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Agnieszka Zakrzewska-Bielawska
Iwona Staniec *Editors*

Contemporary Challenges in Cooperation and Coopetition in the Age of Industry 4.0

10th Conference on Management of Organizations' Development (MOD)

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Preface

Industry 4.0 is a concept relating to the use of automation in industries, data processing and data exchange. The concept also encompasses artificial intelligence, the digitalization of the production process and introducing new technologies. Nowadays, workforce, digitally controlled machines connected to the Internet and information technology, is all integrated and this new setting poses new challenges for the management of organizations and for their development. One of these challenges involves the necessity of cooperation with many stakeholders and business partners. However, thanks to networking and data exchange, businesses are also able to make goods in a more economical way. What is more, they can adapt quickly to their clients' individual needs and integrate each other in the value networks which enable them to gain a competitive advantage. As a consequence, the conditions created by Industry 4.0 are both an opportunity and a threat to successful cooperation and coopetition.

The challenges posed by Industry 4.0 are the focus of this proceedings volume. They will be analysed in terms of their impact on present-day organizations and the changes that occur in cooperation and coopetition between companies. Other selected problems relating to the development of organizations based on new conditions will also be addressed. The approach the authors used when writing this proceeding volume was both theoretical and empirical. The work consists of three parts.

In Part I, general guidelines pertaining to Industry 4.0 are considered. To start with, Anna Adamik and Michał Nowicki offer their critical literature review on the subject and an account of the research in consulting firms. Based on their findings, they identified key barriers and potential pitfalls in the process of building a competitive advantage in the age of Industry 4.0. They also provided solutions to overcome them. Afterwards, Michał Młody and Adam Weinert also analysed the literature, but they provided an overview of the current knowledge level about Industry 4.0 in Poland and indicated the direction of further research in this field. Moreover, Edyta Gwarda-Gruszczyńska pointed out theoretical and research gaps in the 'Valleys of Death' concerning creating, commercializing and diffusion of Key Enabling Technologies (KETs). Another contributor, Edyta Bielińska-Dusza

identified the changes occurring in the functioning of organizations caused by ground-breaking technologies. Furthermore, Aleksandra Rudawska pointed out that the phenomenon of Industry 4.0 enables the transfer of knowledge between the workforce. It contributes to overall knowledge building in an organization and, as a consequence, positively influences the creativity of individual employees as well as the creativity of an organization as a whole. Despite this fact, the author argued that sharing knowledge is not a straightforward process. She explained that proactive and reactive knowledge sharing involves employing different mechanisms on an individual and organizational level. Finally, another contributor—Katarzyna Szymańska—identified the main directions of change in the organizational culture of companies that adapt to the new conditions of Industry 4.0.

Part II is devoted to analysing cooperation and coopetition between organizations in the light the challenges that Industry 4.0 brings. This section opens with an article by Jerzy Niemczyk and Rafał Trzaska. The authors studied the network approach in Industry 4.0 in the context of coopetition. According to them, the competitive advantage of an organization can be established by entering the network with certain coopetition features as these organizations will take advantage of all efficiency sources and therefore increase their competitiveness and market value. Next, Dagmara Lewicka and Agnieszka Zakrzewska-Bielawska analysed how trust impacts the cooperation and coopetition between various market stakeholders. According to their research, if the level of trust to a particular group of market partners (e.g. suppliers, customers and other non-competitive partners) increases, the partnership cooperation with particular group is greater, and similarly, if the level of trust in competitors increases, the inclination to coopetition is greater. The authors Łukasz Sułkowski, Robert Seliga and Andrzej Woźniak focused on the complexity of mergers and acquisitions in the specific context of tertiary education. They identified the process of coopetition, cooperation and consolidation of universities in Poland based on their qualitative research. Furthermore, Magdalena Grębosz-Krawczyk and Sławomir Milczarek dealt with the issue of communication between companies and Polish research institutions. The authors strived to establish what expectations the companies have from the research institutions. The results confirmed that interpersonal communication is the most sought-after form of contact between them. It is also demonstrated that the most convenient means of information exchange is electronic media. What is more, Iwona Staniec and Yochanan Shachmurove showed that opportunism is the key obstacle in establishing cooperation regardless of the type of business or the industry it operates in. The authors demonstrated how the perception of the risks influenced the opportunistic approach to cooperation with small- and medium-size technological companies. Meanwhile, Waldemar Glabiszewski, Agata Sudolska, Joanna Górka and Angelika Pańka assessed the extent to which absorption capacity had an impact on the level of innovation in financial companies in Poland. The research confirmed that the ability to make the use of external technologies and the ability to develop existing ones had a positive impact on the level of innovation of the financial companies. Another author, Patrycja Klimas, also highlighted the fact that the proximity in strategic management may be perceived as a significant factor

leveraging effectiveness and performance of both cooperating (or coopeting) organizations and inter-organizational networks. The author stressed the importance of close cooperation and networking and helped the reader appreciate various aspects of such close collaboration. In Part II, Dagmara Wójcik, Patrycja Klimas, Katarzyna Czernek-Marszałek and Patrycja Juszczyk also examined the impact of the development of the tourist sector on the cooperation between various other sectors. The authors pointed out that the rapid development of the tourist sector, due to the popularization of the sharing economy, had a positive effect overall. Furthermore, Aleksandra Hauke-Lopes, Krzysztof Fonfara and Milena Ratajczak-Mrozek postulated various causes of conflicts in foreign inter-organizational relationships of multinational enterprises and determined the impact of such conflicts on the functioning of these companies. The authors mentioned the formal and informal tactics that managers employed in order to deal with the conflicts and mitigate their adverse effects. Aleksandra Sus and Michał Organa took up the problem of how the strategy dynamics and the dynamism of inter-organizational network strategies influenced the general development of network systems. The authors conducted a detailed analysis of relations between the strategy dynamics of inter-organizational networks (centralized or decentralized) and network development in the sense of increasing the effectiveness of activities within the considered systems. The last article in Part II was written by Katarzyna Liczmańska-Kopcewicz and Maciej Zastempowski. The article is an analysis of the relationship between a proactive responding to client's needs and the creation of innovative products in the fast-moving consumer goods industry.

In Part III, the contributing authors proposed that the conditions brought by Industry 4.0 make up a specific work and development environment. Here, Cezary Suszyński focused on outlining the main trends in the evolution of a company from the perspective of industrial revolutions to date. He highlighted the challenges and the changes introduced in how the business is done due to Industry 4.0. Afterwards, Mariusz Bratnicki and Wojciech Dyduch described the way our irrational perception of reality has an effect on the strategic decision-making in companies, which in turn determines how the values in organizations are created and captured. Another author, Andrzej Lis, identified new research areas in the context of the management of the development of organizations. Later, Dagna Siuda described the issue of co-creating the value of a brand in social media, whereas Agnieszka Izabela Baruk focused her attention on selected aspects of how the image of an employer is created by employees who are also prosumers. Automation in the context of Industry 4.0 was dealt with by Andrzej Kamiński. The author described an original concept of cooperation between heterogenic information systems in production by means of the integrated platform. The authors, Aldona Glińska-Neweś, Paweł Brzustewicz, Iwona Escher, Yulia Fomina, Barbara Józefowicz, Irina Katunin, Joanna Petrykowska and Dawid Szostek, pointed out in their article that the idea of corporate social responsibility (CSR) is being questioned nowadays, mainly due to its doubtful significance and its alleged lack of implementation in companies. In the authors' view, the basic requirement that needs to be met in order to make CSR work is to engage the workforce in projects that promote sustainable development.

The authors pointed out that such projects have the potential to introduce a positive social change within the organization and bring about many other benefits. Finally, Monika Kulikowska-Pawlak discussed political will in strategic management. The author provided insight into the range of political motivations that support stakeholder management and proposed an integrative model offering the necessary political mechanism for an organization's value creation.

Papers included in this proceedings volume have been written by scientists, researchers and practitioners, and they were presented during the 10th Conference on Management of Organizations' Development (MOD) organized by Department of Management of Lodz University of Technology in Poland. This proceedings volume highlights the complexity and diversity problems of organizations' development in the age of Industry 4.0 and the underlying challenges. It will cover a wide range of key areas from essence, determinants and forms of cooperation and coopetition, to networks creating and organization managing, and also culture and social problems connected with conditions of Industry 4.0. Combining the newest theory and practice, the book will provide a realistic outlook on the network economy in the age of Industry 4.0 and interdependencies between sectors and within them. That is why the proceedings will be a valuable source of knowledge for researchers in universities and research institutions, graduate students and practitioners in management in both private and public institutions.

Łódź, Poland

Agnieszka Zakrzewska-Bielawska
Iwona Staniec

Contents

Part I
Challenges of Industry 4.0

Chapter 1
Barriers of Creating Competitive Advantage in the Age of Industry 4.0: Conclusions from International Experience

Anna Adamik and Michał Nowicki

Abstract Industry Revolution 4.0 generate significant issues to still a large group of enterprises and often even barriers to the processes of their further growth or improving market competitiveness. Unfortunately, awareness among the businesses regarding their specificity, prevalence and real consequences is limited. This is why identification of major problems of effective shaping of enterprises' competitiveness in the Industry 4.0 era is the research problem. Consequently, the main goal of the paper is to identify and map the key barriers and potential sources of failure in processes of building competitive advantage of enterprises operating in the age of Industry 4.0, the so-called Black Points and creation of a specific "Road Map", which is a path/algorithm of actions illustrating how organisations can better prepare themselves to overcome these key barriers. The research was based on a review of the literature on strategic management, competitiveness of businesses, theory on competitive advantage or describing requirements that organisations face in the age of IR 4.0. The collected data was compared with the empirical results of research by global management consultancies who assessed the problems and degree of implementation of IR 4.0 solutions and preparation of enterprises from various countries to the requirements of IR 4.0.

Keywords Organisation competitiveness · Competitive advantage · Company development · Industry 4.0 revolution · Black Points Industry 4.0

JEL L29 · O31 · O32 · O33

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1.1 Introduction

Industry Revolution 4.0, IR 4.0, brings not only chances and opportunities to contemporary organisations,[1] but also difficult challenges.[2] Many of those challenges generate significant issues to still a large group of enterprises and often even barriers to the processes of their further growth or creating market competitiveness.[3] Unfortunately, the awareness among the businesses regarding their prevalence and real consequences is limited. This brings surprises, discouragement and resistance in relation to the changes required on the path to building competitive advantage typical to the age of IR 4.0, changes and the accompanying investment/implementation processes. Seemingly, the occurrence of such situations can be limited. Support may be given by promoting, among businesses, academic lecturers and students the so-called good business practices for the discussed subject and signalling the key, most common issues, called "Black Points". Regrettably, the latter ones are rarely described in the literature on the subject, even though they may act as significant "warning signs" in the organisational transition processes that are currently conducted in practice.

The **research problem** of the article is identification and help in reducing major problems of effective shaping of enterprises' competitiveness in the Industry 4.0 era. That is why the **main goal** of the paper is to identify and map the key barriers and potential sources of failure in processes of building competitive advantage of enterprises operating in the age of Industry 4.0., the so-called Black Points (Black Points of Competitive Advantages IR 4.0—BPCA 4.0), and propose a specific "Road Map", which is a path/algorithm for actions that will make it possible to avoid them or prepare for them.

In the theoretical part (Sect. 1.2) of the paper, research was based on a systematic review of world literature on strategic management, competitiveness of businesses, theory on competitive advantage and describing requirements and organisational issues in the age of IR 4.0. The bibliometric analyses were conducted on **Web of Science Core Collection** and **Scopus** databases. The research resulted in collecting the data showing the current state and growth in the interest in the problems of Industry 4.0, which also allows for indicating some theoretical/empirical gaps. Given the above, in Sect. 1.3, the authors focused on presenting a (prototype) of a model concept for the process of achieving competitive advantage in the age of Industry 4.0. The key CA IR 4.0 barriers and inhibitors, as well as catalysts and accelerators for this process, were separately presented in blocks.

After methodical Sect. 1.4, in the empirical part of the paper (Sect. 1.5, Results and Discussion), the model presentation was compared to results of research published in various scientific articles about "Industry 4.0" (see the references), as well as published by global management consultancies attempting to assess the degree of implementation of IR 4.0 solutions in various industries and the degree to which businesses from various countries are prepared for the requirements of IR 4.0. The

[1] See, i.e. [9, 21, 22, 47].

[2] See, i.e. [32, 40, 42, 58].

[3] See, i.e. [2, 3, 4, 7, 8, 12, 33, 49].

following reports were analysed: [16, 31, 41, 55]. Empirical research showing and verifying the validity of the proposed model was carried out. Verification of the hypotheses formulated in the paper and an attempt to assess how commonly in the economic practice the key "Barriers of CA IR 4.0" occur using the individual platforms then acted as a basis for formulating the "Map of Black Points of CA IR 4.0 creation" and proposing the recommendation on how to circumvent or defeat those barriers. The study is summarised with the conclusions from the conducted research.

1.2 Literature Review

In order to identify the key drivers for the processes of building competitive advantage of enterprises operating in the age of Industry 4.0, the literature on the subject was researched. Bibliometric research is the first part of conducted desk research. It aimed to confirm the existence and assess the size of identified research gap related to the problems and barriers of building a competitive advantage of enterprises in the Industry 4.0 era. In-depth (systematic) literature review is the second part of conducted desk research. Its purpose was to systematise and prioritise negative determinants (barriers) of effective building a competitive advantage in the Industry 4.0 era.

The bibliometric research was conducted using the method of a systematic review of the literature on "Industry 4.0" available in two international databases—WoS CC and Scopus. It was supported with in-depth bibliometric research.

The analytical work was focused on studying the **selected data sets**, taking account of "type of publication"[4] and "scientific field/research area".[5] Such approach is a certain novelty as compared to the bibliometric analyses of the subject of "Industry 4.0" performed by other researchers.[6] Secondary research of the selected papers showed that in most of such publications, reviews and comparisons used full aggregation, i.e. selection of data was knowingly given up, i.e. the research field/specialisation was disregarded. Therefore, the results obtained in the above cases may be considered to be low reliability and not fully valid if the objective is to recognise and analyse the output of the literature on "Industry 4.0" within the discipline of management and related sciences.

[4]Only the following types of publications were taken into account: articles, proceedings, reports, book chapters. Therefore, publications excluded included, e.g. reviews, news items/notes, or editorial materials, etc.

[5]In the case of analyses based on WoS CC resources, only the publications indexed in at least one of the following Web of Science Categories were taken into account: business/business finance/economics/management/operations research management science/planning development/engineering manufacturing. When selecting the data sets to be obtained from Scopus database, filters were used, which caused further analyses to be conducted on publications indexed in at least one of the following categories (Scopus): Business, Management and Accounting/Computer Science/Decision Sciences/Economics, Econometrics and Finance/Engineering/Environmental Science/Social Sciences.

[6]See: [6, 30, 43].

The work started by preparing the bibliometric map. To do that, **VOSviewer** software was used,[7] to which the data obtained from WoS CC database was input (obviously, taking account of only the literature in the field/discipline of management and related sciences) reflecting the volume of indexed publications containing in the title the keywords {*Industry 4.0*,[8] *competitiveness*,[9] *competitive advantage*,[10] *open resources*,[11] *open culture*,[12] *open knowledge*[13]}.

In the era of Industry 4.0 "open culture", "open knowledge" and "open resources" are the basic sources of enterprises competitive advantage. If they are successfully developed in a conscious and long-term manner, they have a chance to generate their

[7] It is a software tool for constructing and visualizing bibliometric networks.

[8] **Industry 4.0** → The concept of Industry 4.0 appeared in the literature in the year 2011 [27, 50]. It helped entrepreneurs to realise key developmental directions for the near future that determine the possibilities of gaining and maintaining competitive advantages. The Industry 4.0 challenges encompassed several areas such as: Autonomous Robots, Simulations, Vertical/Horizontal Software Integration, Machine-to-Machine Communication (M2M), Industrial Internet of Things, Internet of Services, Big Data and Analytics, Clouds, Additive Manufacturing, Augmented Reality, Virtual Reality, Cyber-Physical Systems, Digital Twin, Artificial Intelligence, Neural Networks, Cybersecurity and Mass Customisation. At the same time, considerations accompanying the concept pointed to a need to respect six key principles of effective competition under the conditions of Industry 4.0. These principles are: (1) inter-organisational cooperation, (2) virtualisation of business activities, (3) decentralisation of management processes, (4) real-time assessment of all kinds of organisational capabilities (e.g. production, sales, transport, warehousing capabilities, etc.), (5) service orientation, and (6) modularity of the proposed products, services and other types of solutions Hermann et al. (2015).

[9] **Competitiveness** → The organisation's competitiveness is the state of the organisation's dynamic balance, developed due to its strategic fit. It is a relatively permanent system of relations between the organisation and its environment, as well as within the organisation itself, which allows it to comply with the requirements of the organisation's environment and members (in the material and technical, as well as political and social sense).

[10] **Competitive advantage** → It is the ability of a given organisation to consciously identify, implement, develop, protect and obtain benefits of unique resources and skills (encompassing all the organisation's value chain links) which, being desired and valued by the market, are not available to the same extent to other competitors. Such an advantage appears when resources are configured and exploited in a proper manner. It leads to a situation in which a company has something that distinguishes it in the market out of the ranks of its competitors, i.e. special assets that allow it to do something better or differently from its competitors, and consequently achieves better results that lead to a specific superiority over other.

[11] **Open resources** → This openness should apply to an enterprise's resources as well as resources of its customers, suppliers and competitors. In fact, it should encompass entities that have complementary skills and do not hesitate to use them in relationships of co-creation with other sectors.

[12] **Open culture** → It is the type of culture characterized by the so-called openness to space, which means openness to change, openness to uncertainty and openness to flexibility. Such culture should be characterized by openness to learning as well as promoting and encouraging flexibility and creativity.

[13] **Open knowledge** → It is a common good from which everyone can benefit, a staff member and an organization itself or its business partners. Moreover, everyone can participate in its development. Knowledge is open if everyone has free access to it, can use, modify and share it with others, subject to the requirements of, at most, the determination of the sources of its origin or maintaining its openness.

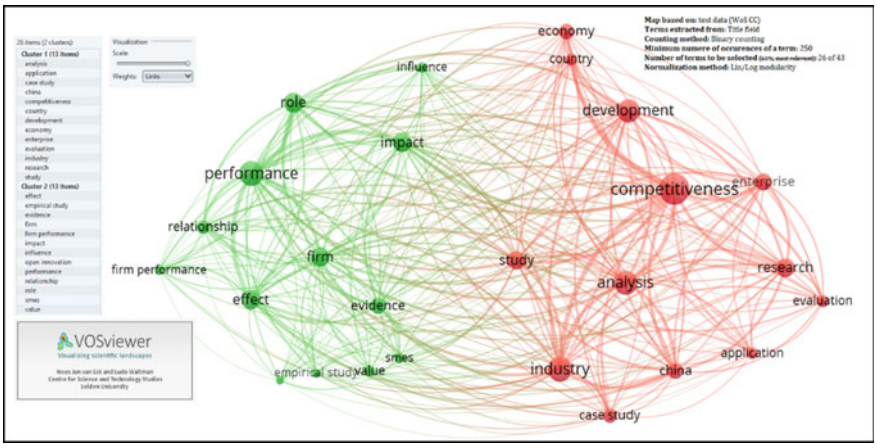


Fig. 1.1 Bibliometric map of keyword associations. *Source* Own elaboration

high competitiveness. The reason "why it is as it is" is quite simple. Due to enterprises' openness in different areas of their business activity, they can dynamically respond to changes in a volatile environment and reduce its complexity. Therefore, openness of enterprises should be seen as a key factor in raising the competitiveness of the European economy [5].

The map in Fig. 1.1 shows the subject of Industry 4.0 is closely related to competitiveness (cluster: "competitiveness"), development (cluster: "development"), enterprises/entrepreneurship (cluster: "enterprise" and "SMEs") and performance (cluster: "performance"). Contrary to the expectations, there was no statistically significant connection between the subjects: "Industry 4.0" and "barriers of creating competitive advantage in the age of industry 4.0".

This result encouraged us to explore the case closer. To that goal, detailed analyses were performed, consisting of several stages, using the principle "from the general to the specific". Working on WoS CC database, first we prepared a comparison of bibliometric data including publications containing the keyword "Industry 4.0", which described the character of the article (filter: "topic"), then limiting them to those containing the keyword "Industry 4.0" in the title (filter: "title"). To achieve a deeper analysis, then data sets were created containing publications containing in their titles the combination of keywords: "Industry 4.0 and barriers", "Industry 4.0 and competitiveness", "Industry 4.0 and competitive advantage", "Industry 4.0 and open resources", "Industry 4.0 and open culture" and "Industry 4.0 and open knowledge". A similar approach was applied to the analyses of Scopus database. First, for the keyword "Industry 4.0", a set was filtered using "article title, abstract, keywords",[14] and then using the filter "article title".[15] The deepened analyses used the filter which allowed us to pick up the articles with given subjects (again filter

[14]Equivalent of filter "topic" used with WoS CC.

[15]Equivalent of filter "title" used with WoS CC.

"article title, abstract, keywords"). The achieved data was then subjected to detailed analyses.[16]

Next, a ranking of "**Top publishing**" **countries** was created, and **histograms** showing the increments in publishing articles containing a given keyword/keywords in the title (or specifying the subject matter). The results of the above work are presented in Table 1.1 (WoS CC database bibliometric data), Table 1.2 (Scopus database bibliometric data) and Fig. 1.2 (WoS CC and Scopus data about disproportion between articles about Industry 4.0 and articles about barriers of Industry 4.0) and Fig. 1.3 (WoS CC and Scopus data about top publishing countries).

After analysis of the data shown in Table 1.1 (WoS CC database bibliometric data) and 2 (Scopus database bibliometric data) and those shown in Fig. 1.2 (WoS CC and Scopus data about disproportion between articles about Industry 4.0 and articles about barriers of Industry 4.0) and 3 (WoS CC and Scopus data about top publishing countries), it can be concluded that:

1. The subject of Industry 4.0 is relatively often discussed in articles representing the subject matter (discipline) of management and related sciences. The database WoS CC indexed $n = 711$ and 224 (filter: "topic" and "title") articles containing keyword "Industry 4.0". For Scopus database, it was, respectively, $n = 2732$ and 820 publications.
2. **There is a high disproportion between the volume of articles** "**generally**" **discussing the subject matter of Industry 4.0** ($n = 711$ and 224 for WoS CC and $n = 2732$ and 820 for Scopus), **and the volume of articles focusing on the specialised aspects, i.e.** "**the barriers for implementing solutions related to Industry 4.0**" ($n = 13$ and 34—see Fig. 1.1), "competitiveness" ($n = 49$ and 77) and "creating competitive advantages" (35 and 49) in the reality of Industry 4.0 revolution, or relations to the use of "open resources" ($n = 17$ and 24), "open culture" (4 and 4) and "open knowledge" planes (17 and 23).
3. The most often cited publications related to Industry 4.0 are cited much more often than others—those with "average" citations (WoS CC: h-index = 23 and

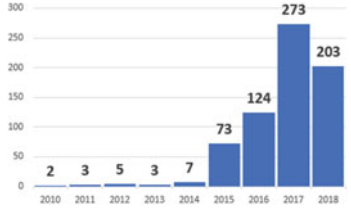
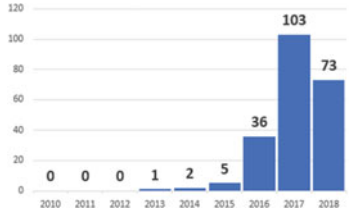
[16] Based on the data obtained from **WoS CC, the following were determined**:

1. n = number of articles indexed in the Web of Science Core Collection database that contain a given keyword;
2. h = h – index for all articles;
3. C = sum of times cited (without self-citations);
4. WoS "X" = highest citation value;
5. ACR = average citations per item;

Based on the data obtained from **Scopus, the following were determined**:

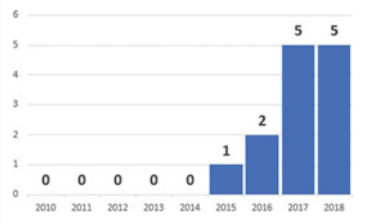
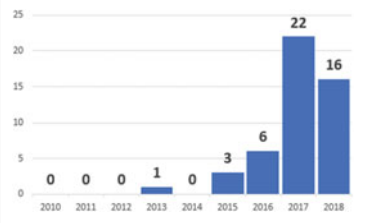
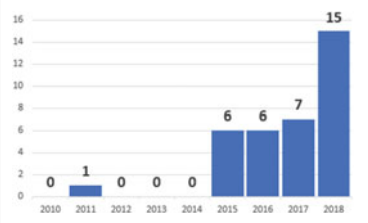
1. n = number of articles indexed in the Scopus database that contain a given keyword;
2. C = sum of times cited;
3. HCV = highest citation value for an article;
4. "*X*/*Y*/*Z*/…" = number of citations of article with highest citation value (descending order);
5. FWCI = Field-Weighted Citation Impact.

Table 1.1 WoS CC database bibliometric data

Keyword	Web of science core collection data				Publications by year: 2010–2018
Industry 4.0 (*filter: "topic"*)	Number of articles indexed in the Web of Science Core Collection database that contain a given keyword [N = number of articles/h—index for all articles/C = sum of times cited (without self-citations)/WoS X = highest citation value/ACR = average citations per item]	$n = 711$ h–index = 23 $C = 2063$ WoS A = 192 ACR = 338	Countries with the largest number of publications indexed in the Web of Science Core Collection database that contains a given keyword	1. Germany (156/21.94%) 2. Italy (55/7.74%) 3. USA (51/7.17%) 4. England (49/6.89%) 5. China (48/6.75%) … 13. Poland (23/3.23%)	
Industry 4.0 (*filter: "title"*)		$n = 224$ h–index = 11 $C = 623$ WoS B = 60 ACR = 3.29		1. Germany (41/18.30%) 2. Czech Republic (24/10.71%) 3. England (18/8.04%) 4. Brazil (15/6.70%) 5. Italy (15/6.70%) … 10. Poland (11/4.91%)	

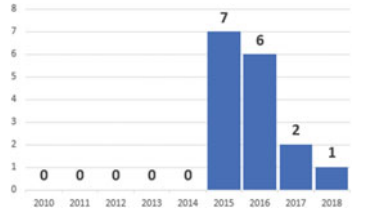
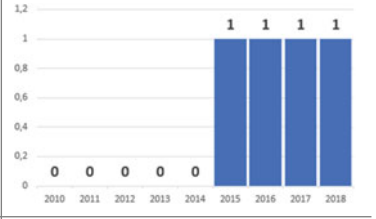
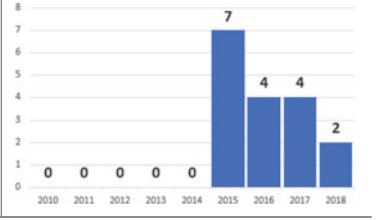
(continued)

Table 1.1 (continued)

Keyword	Web of science core collection data				Publications by year: 2010–2018
Industry 4.0 and barriers (*filter: "title"*)		$n = 13$ h–index = 3 C, ART. 63 WoS C = 26 ACR = 4.85		1. England (3) 2. Germany (3) 3. Brazil (2) 4. USA (2) 5. Czech Republic (1) … 10. Poland (1)	
Industry 4.0 and competitiveness (*filter: "title"*)		$n = 49$ h–index = 6 $C = 99$ WoS D = 25 ACR = 2.08		1. Czech Republic (8) 2. Germany (6) 3. England (4) 4. Poland (4) 5. Lithuania (3)	
Industry 4.0 and competitive advantage (*filter: "title"*)		$n = 35$ h–index = 4 $C = 66$ WoS E = 13 ACR = 1.89		1. Malaysia (7) 2. Germany (4) 3. Czech Republic (3) 4. Denmark (3) 5. Turkey (3) … 9. Poland (2)	

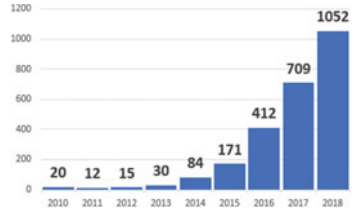
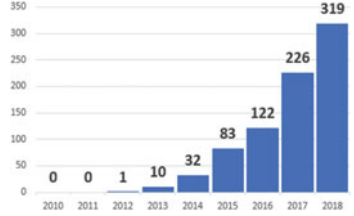
(continued)

Table 1.1 (continued)

Keyword	Web of science core collection data				Publications by year: 2010–2018
Industry 4.0 and open resources (*filter: "title"*)		$n = 17$ h–index = 5 $C = 68$ WoS F = 19 ACR = 4		1. USA (4) 2. Germany (3) 3. Malaysia (3) 4. England (2) 5. Russia (2) … X. Poland (0)	
Industry 4.0 and open culture (*filter: "title"*)		$n = 4$ h–index = 2 $C = 10$ WoS G = 6 ACR = 2.50		1. England (1) 2. Malaysia (1) 3. Russia (1) 4. South Africa (1) 5. USA (1) … X. Poland (0)	
Industry 4.0 and open knowledge (*filter: "title"*)		$n = 17$ h–index = 6 $C = 95$ WoS H = 29 ACR = 5.59		1. England (3) 2. Germany (3) 3. Spain (3) 4. Italy (2) 5. Sweden (2) … X. Poland (0)	

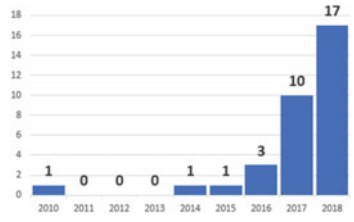
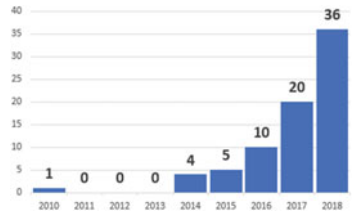
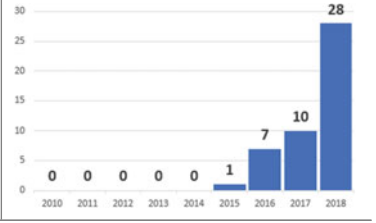
Source Own elaboration

Table 1.2 Scopus database bibliometric data

Keyword	Scopus data				Publications by year
Industry 4.0**	Number of articles indexed in the **Scopus** database that contain a given keyword [n = number of articles/C = sum of times cited/ HCV = highest citation value for an article/number of citations of article with highest citation value (descending order: 2018–2015) FWCI = Field-Weighted Citation Impact]	$n = 2732$ $C =$ - NA - SCOP A = 692 2018: 335 2017: 222 2016: 116 2015: 19 FWCI = 8697	Countries with the largest number of publications indexed in the **Scopus** database that contain a given keyword	1. GER (777/28.44%) 2. Italy (233/8.53%) 3. USA (195/7.14%) 4. CHPR (182/6.66%) 5. Spain (131/4.80%) … 14. Poland (63/2.31%)	
Industry 4.0*		$n = 820$ $C = 3049$ SCOP B = 692 2018: 335 2017: 222 2016: 116 2015: 19 FWCI = 8697		1. GER (285/34.76%) 2. Italy (66/8.05%) 3. UK (42/5.12%) 4. Spain (40/4.88%) 5. USA (37/4.51%) … 12. Poland (23/2.80%)	

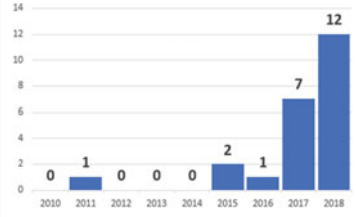
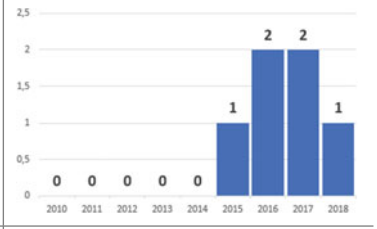
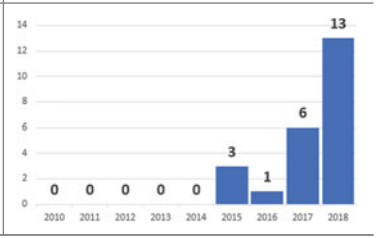
(continued)

Table 1.2 (continued)

Keyword	Scopus data				Publications by year
Industry 4.0 and barriers		$n = 34$ C = 80 SCOP C = 33 2018: 26 2017: 6 2016: 1 FWCI = 5.72		1. Germany (8) 2. USA (7) 3. Italy (5) 4. Brazil (4) 5. UK (3) … 14. Poland (1)	
Industry 4.0 and competitiveness		$n = 77$ $C = 253$ SCOP D = 66 2018: 31 2017: 20 2016: 11 2015: 3 FWCI = 22.52		1. Germany (20) 2. Italy (10) 3. UK (7) 4. Spain (6) 5. USA (6) … 33. Poland (1)	
Industry 4.0 and competitive advantage*		$n = 49$ $C = 49$ SCOP E = 8 2018: 6 2017: 2 FWCI = 2.14		1. Germany (6) 2. UK (4) 3. Denmark (3) 4. Italy (3) 5. Austria (2) … 10. Poland (2)	

(continued)

Table 1.2 (continued)

Keyword	Scopus data				Publications by year
Industry 4.0 and open resources*		$n = 24$ $C = 29$ SCOP F = 10 2018: 10 FWCI = 3.02		1. Italy (5) 2. USA (4) 3. China (3) 4. Austria (2) 5. Germany (2) … X. Poland (0)	
Industry 4.0 and open culture *		$n = 4$ $C = 0$ SCOP G = 0 FWCI = - NA -		1. China (2) 2. Austria (1) 3. Bangladesh (1) 4. Ethiopia (1) 5. Greece (1) … X. Poland (0)	
Industry 4.0 and open knowledge*		$n = 23$ $C = 32$ SCOP H = 17 2018: 16 2017: 1 FWCI = 6.49		1. China (3) 2. Germany (3) 3. Spain (3) 4. Norway (2) 5. UK (2) … X. Poland (0)	

Source *Own elaboration*

* query in the Scopus database with parameter "topic"

** query in the Scopus database with parameter "title"

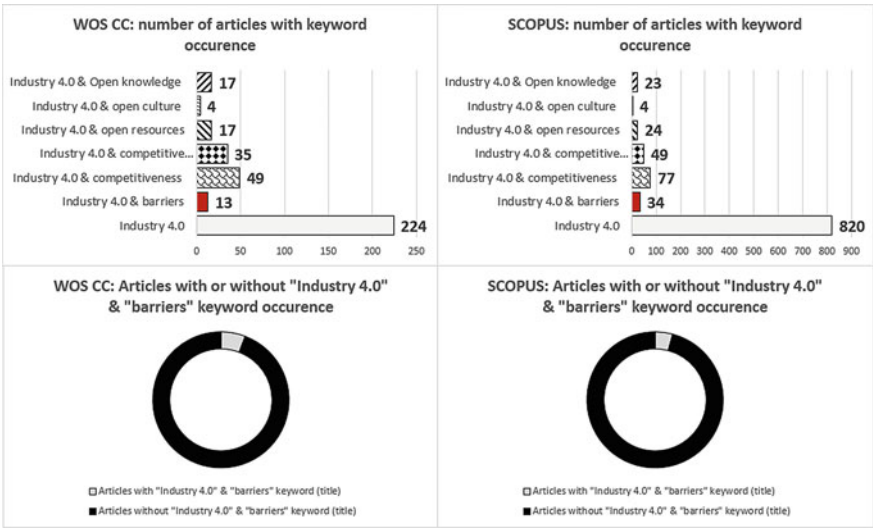


Fig. 1.2 WoS CC and Scopus data about disproportion between articles about Industry 4.0 and articles about barriers of Industry 4.0. *Source* Own elaboration

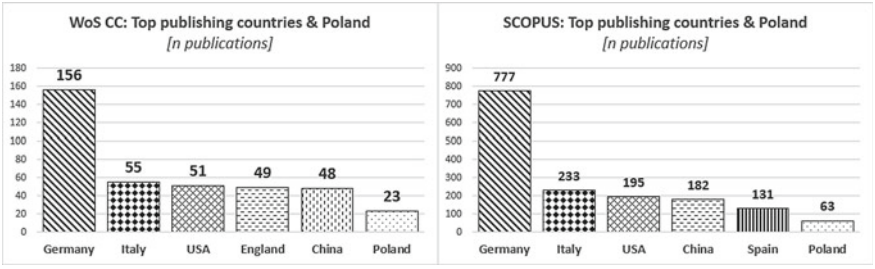


Fig. 1.3 Top publishing countries about Industry 4.0 (WoS CC and Scopus data). *Source* Own elaboration

ACR = 3.38 and h-index = 11 and ACR = 3.29; Scopus: FWCI for the most often cited article = 6.97!).

4. In terms of publications, the top centres are from Germany, Italy, and the USA, given the number of publications indexed in WoS CC/Scopus, for which the keyword "Industry 4.0" described the subject matter (filter "topic"). It is respectively $n = 156$ and 777 for publications from Germany, $n = 55$ and 233 for publications from Italy and $n = 51$ and 195 for publications from the USA.
5. In terms of the volume of articles published, for which the keyword "Industry 4.0" is included in the title, the most publications are from centres in Germany, Czech Republic, England (WoS CC: $n = 41/24/18$) or Germany, Italy and England (Scopus: $n = 285/66/42$).

6. Both databases indexed publications from Poland, however, their share at best ranks "us" at the end of the top ten most active publication "centres".
7. The three (3) articles generally dealing with the subject matter of Industry 4.0 with highest number of citations containing a given keyword/keywords:
   - WOS CC[17]: [37]/(Times Cited = 226)]; [35], (Times Cited = 197)]; [56]/(Times Cited = 122)];
   - Scopus[18]: [36]/Citations in Scopus = 709; FWCI = 86.97]; [37]/Citations in Scopus = 328; FWCI = 113.95]; [35]/Citations in Scopus = 310; FWCI = 21.26].
8. The three (3) most often cited articles dealing with the subject of the benefits (advantages) of implementing Industry 4.0 are:
   - WOS CC: [34]/(Times Cited = 8)]; [54]/(Times Cited = 3)]; [21]/(Times Cited = 1)];
   - Scopus: [34]/Citations in Scopus = 17; FWCI = 7.51]; [19]/Citations in Scopus = 5; FWCI = 0.79]; [22]/Citations in Scopus = 3; FWCI = 0.38].
9. The three (3) most often cited articles dealing with the subject of barriers and issues in implementing Industry 4.0 are[19]:
   - WOS CC: [29]/Times Cited = 3]; [11]/Times Cited = 2]; [58]/Times Cited = 2];
   - Scopus: [42]/Citations in Scopus = 2; FWCI = 1]; [40]/Citations in Scopus = 1; FWCI = 1,12]; [32]/Citations in Scopus = 0; FWCI = 0.00].

The general and detailed bibliometric analyses conducted clearly showed that even though the subject of barriers to building competitive advantage in the age of Industry 4.0 is developing, the publication volume on that subject[20] is relatively low as compared to the publication volume of articles on the general subject of "Industry 4.0"[21] (see Tables 1.1 and 1.2). Due to the fact that the essence of IR 4.0 is most often considered in practice to be skilful implementation of a combination of new IT technologies, Internet of things mainly and new production, transport and handling technologies plus new materials and related processes, contemporary organisations must learn to live and function in networks of various types of relationships not only in the real but also in the virtual/cyber plane of activity (in the virtual reality). In order to meet this challenge, they unfortunately must undergo changes related to:

(1) technologies they use,
(2) their organisational solutions, but also the
(3) relationships they use and develop and their social competencies.

[17] The search used the filter "title".

[18] The search used the filter "article title" (equivalent of "title" in WoS CC).

[19] As an exception, filter "topic" was used, as the filter "title" yielded very little valuable results.

[20] During the last 5 years for WoS CC:0/1/2/5/5 and for Scopus: 1/1/3/10/17.

[21] During the last 5 years for WoS CC:2/5/36/103/73) and for Scopus: 32/83/122/226/319.

New technologies [23, 48] must be supported by concepts and models that are appropriate for IR 4.0 [10], as well as appropriate strategies of both development and competition of businesses [2, 1], functional strategies [13], structural solutions [15, 44] and their supporting relationships, competencies and social attitudes of employees and managers [39]. Due to the fact that such solutions concern so many different areas, business practitioners often find it difficult to formulate consistent, well-directed and highly effective programs that prepare their companies to the age of Industry 4.0.

This observation inspired us to work on "Determinants of achieving competitive advantage in the age of Industry 4.0 → CA IR 4.0" (stimulating and blocking factors), on three special blocks/platforms: **Technological Platform, Knowledge Platform and Human Resource Platform**.

It should be noted that the in-depth literature review has provided convincing evidence that when describing the **most important CA IR 4.0 barriers one should focus on: Technological Platform, Knowledge Platform and Human Resource Platform** [1–4, 11, 13, 15, 23, 29, 32, 40, 39, 42, 44, 48]. That is why authors decided to define and try to validate the following main hypothesis:

- **MH**: Barriers of creating Competitive Advantage in the age of Industry 4.0 (Black Points CA IR 4.0) are present on many related to each other planes (platforms) of competitive potential of contemporary organisations.

In order to be able to better verify the above main hypothesis, detailed hypotheses were formulated:

- **H1**: Barriers and shortages occurring on Human Resource Platform block the contemporary companies' readiness to effectively use the Knowledge Platform resources;
- **H2**: Barriers and shortages occurring on Knowledge Platform block the contemporary companies' readiness to effectively use the Technological Platform resources;
- **H3**: Barriers and shortages occurring on Technological Platform block the contemporary companies' readiness to obtain various Competitive Advantages associated with Industry Revolution 4.0. (CA IR 4.0) and thus build strong (high) competitiveness.

1.3 Determinants of Achieving Competitive Advantage in the Age of Industry 4.0—Framework of Conception

The performed review of the literature allowed us to identify two problem areas that are a key for the processes of building advantage: the plane of factors blocking the readiness companies to creating CA IR 4.0 (Black Points) and the plane of stimulating factors, fostering the real creation of CA IR 4.0 (Lighthouses). Those planes are interconnected and compatible. They are connected by the plane of transitory and adjustment actions to IR 4.0. Research showed that similarly to the mythical "tree

of life",[22] or the model cycle of organisation's life by Greiner[23] [25] organisations reach readiness to creating CA IR 4.0 by skilfully coping with crisis situations typical to IR 4.0. They do this by overcoming Black Points generated by their competitive potential [17, 28, 53]. It is only the knowledge and experience acquired in these actions that give them the skills necessary to create, stimulate and utilise the sources of competitive advantage effective in IR 4.0 (Lighthouses), as shown in the research, currently mainly inherent in the ability to create the so-called: Open Culture, Open Knowledge and Open Resources [4, 5, 46, 57]. These observations were shown in the original concept of the model "Tree of Life of CA IR 4.0".

The model shows the role of quick and effective identification and elimination of key Black Points that may occur in each of the three, hierarchically interconnected platforms (HR/Knowledge/Technological Platform). By eliminating the Black Points, organisations gradually increase the level of their readiness to create competitiveness in the conditions of IR 4.0 by which they get closer to "PLANE 2—READINESS TO CREATING CA IR 4.0". In order to go further and transit to PLANE 3, they must be able to effectively implement and use methods, techniques, tools, strategies and other solutions that are key to the age of IR 4.0, which should support efficient creation of Open Culture, Open Knowledge and Open Resources that are present in IR 4.0.

Due to the objectives of the paper, further analyses focus on PLANE 1—Black Points of CA IR 4.0. Those barriers occur in many planes of the organisation (HG), however, most often in Human Resource Platform, Knowledge Platform and Technological Platform. What is important, the factors from the first platform are the source of multiplying Black Points, in the next two platforms. At the same time, the barriers occurring in the second one (Knowledge Platform) initiate new issues in the third (Technological Platform). This way, each of the platforms causes blocking of the READINESS OF MODERN ORGANISATIONS TO CREATE CA IR 4.0 (H1, H2, H3). Similarly, effective overcoming Black Points related to Human Resource Platform reduces issues in the Knowledge Platform and coping in that platform weakens barriers them may occur in the Technological Platform.

Therefore, the key to ensure effective competitiveness of enterprises in IR 4.0 seemed to be identifying the most common barriers to competitiveness on the base platforms listed above, therefore the real Black Points of CA IR 4.0. This was attempted in the empirical part of the paper.

[22]The Tree of Life perceived as a cultural pattern, symbolised the perpetual rebirth of nature and had the gift of giving immortality (in Jewish, Christian, Muslim, Buddhist traditions, the Greek myth of Heracles); it is also a bridge between two worlds—the lower, problematic one (roots, earth) and the ideal, dream one (crown, heaven) [24, 38].

[23]History shows that the same organizational practices are not maintained throughout a long-life span. This demonstrates a most basic point: management problems and principles are rooted in time.

1.4 Methodology

In order to identify the key real Black Points of CA IR 4.0 for the three base platforms in the concept of platforms described above, breakdowns of[24] "Key Parameters of Readiness to CA IR 4.0" and the resulting "Potentially Black Points of CA IR 4.0" were prepared based on the in-depth (systematic) review of the literature. "Key Parameters" constituted certain benchmarks, meaning reference points for further analyses, and even example sources of CA IR 4.0, i.e. the so-called Lighthouses. Specific operating activities, related to them, which are the most difficult and the most problematic for the contemporary enterprises, and the tools, competencies and attitudes necessary to deliver them were considered to be "Potentially Black Points". Their elements or symptoms were looked for in the reports with up-to-date results of research by global management consultancies attempting to assess the degree of implementation of IR 4.0 solutions in various industries and the degree to which businesses from various countries are prepared for the requirements of IR 4.0. The following reports were analysed: [31],[25] [16][26]; [41][27]; [55].[28] The identified barriers were assessed and classified. The assessment took account of how commonly[29] a

[24] See, i.e. [3, 14, 18, 26, 45, 51].

[25] The report is based on data from 300 manufacturing industry CEOs. This data was part of the 2018 CEO Outlook, a survey of 1300 CEOs in 11 countries, conducted in early 2018 by Forbes Insights on behalf of KPMG International. To support the data, KPMG International conducted a series of interviews with executives at manufacturers around the world. Their experience, combined with the views of KPMG professionals and sector leaders, provides valuable insights for today's manufacturers.

[26] This research is based on a survey of 1603 global executives conducted by Forbes Insights in the second half of 2017. Survey respondents represented 19 countries from the Americas, Asia and Europe and came from all major industry sectors. All survey respondents were C-level executives, including CEOs/presidents (16%), with the rest evenly divided among COOs, CFOs, CMOs, CIOs and CTOs. All executives represented organizations with revenue of $1 billion or more, with more than half (53%) coming from organisations with more than $5 billion in revenue. Additionally, Forbes Insights and Deloitte conducted one-on-one interviews with global industry leaders and academics.

[27] The report is based on data from over 700 qualified respondents from companies with more than 50 employees and over USD 10 million in revenues, spanning a range of industry sectors from automotive to chemicals to transport and logistics for seven key markets (Brazil, China, France, Germany, India, Japan and the USA).

[28] Report gives expertise in developing supply chain maturity assessment tools, and the assessment is designed around four readiness levels (beginner, intermediate, experienced and expert). They have explicit statements of what needs to be achieved to reach that particular level of readiness for each sub-dimension. This report has been designed to enable complete a self-assessment of your company's current Industry 4.0 readiness, providing a benchmark across a group of 53 companies from 22 countries—74% of respondents were senior management or executives.

[29] A barrier was identified in:

- 0–19% of the tested sample = score 1 = barrier very low;
- 20–39% of the tested sample = score 2 = barrier low;
- 40–59% of the tested sample = score 3 = barrier average;
- 60–79% of the tested sample = score 4 = barrier high;

given barrier occurred, and it was scored based on that. Expert classification allowed to assign the identified symptom to one of 12 types of barriers separated in the empirical research of Black Points of CA IR 4.0. The database created this way was used to prepare the "Map of Black Points of Creating CA IR 4.0" and propose recommendations on how to overcome these barriers.

1.5 Results and Discussion

During the analyses, 64 Real Black Points of CA IR 4.0 were identified (see in Appendix Table 1.3). In the "Human Resource Platform" symptoms of 15 were diagnosed, in "Knowledge Platform" 23 and in "Technological Platform" 26. In each of them, the average rating of the diagnosed barriers was at average level. Relatively highest average = 3.2 points (out of 5) was diagnosed in the "HR Platform". For the "Knowledge Platform", the average rating of "Black Points" was at 3.1 points, and for "Technological Platform" was at 3.0. When preparing to compete, the tested enterprises therefore have relatively most difficulties with adjusting their human resources to the requirements of the age of Industry 4.0.

In the "**HR Platform**", the prevailing barriers were related to the areas of "**Leadership**" (6 symptoms), as well as "**Education**" (3) and "**Skills**" (3) that were unadjusted to the requirements of IR 4.0. Barriers related to the areas of "**other type**" were also noticed (3). The highest barrier in this platform (5/5) was the Black Point—Leadership resulting from incorrect management of human resources in the examined organisations, and especially the "Talents" necessary in the era of digital transformation. This problem was found in as many as 83% of the companies examined in 2017 by Deloitte and 69% respondents of McKinsey. It seems to be the strategic problem from which others stem, especially those related to "Lack of right workforce composition and the skill sets needed for the future" (Black Point—Skills, diagnosed in 75% of Deloitte's respondents) and "Retooling the capabilities of workers and educate them on new roles introduced through digital transformation" (Black Point—Education, diagnosed in 64% of KPMG's respondents).

In the "**Knowledge Platform**", the prevailing barriers were related to the areas of "**Management**" (10 symptoms) and "**Cooperation**" (5) that were unadjusted to the requirements of IR 4.0. Barriers related to the areas of "**other type**" were also noticed (8). The highest barriers in this platform were related to:

- Black Point in **Management** aspect:
  - **Planning and organisation**: Organisations are not highly capable of planning for and addressing the effects that technology-driven Industry 4.0 changes have on their organisational structures and employees (such issue was found in 93% of Deloitte's respondents). It generates "organisational inertia", which occurs as

- 80–100% of the tested sample = score 5 = barrier very high.

a group remains fixated on its past accomplishments to protect its current state, while unknowingly blind to changes taking place within the marketplace.
  - **Innovativeness**: Organisations are not ready to fully harness the opportunities associated with Industry 4.0 (86% of Deloitte's respondents have this issue). Many executives continue to focus on traditional business operations, as opposed to focusing on opportunities to create new value for their direct and indirect stakeholders.

- Black Point in **Cooperation** aspect:
  - **Interdependence**: The growth of global business networks changes the risk landscape and makes companies more vulnerable to external shocks. Companies are becoming more interdependent. The biggest barrier to extracting value from third parties is the difficulty of sharing data securely, so top-tier manufacturers are becoming more selective about which companies they partner with (this issue was diagnosed in 94% of KPMG's respondents).

When analysing the character of the remaining Black Points identified, similarly to the previously described platform, most of them seem to be caused by the above.

In the "**Technological Platform**", the most common were the barriers related to the abilities of effective implementing "**New Technologies**" (7 symptoms) and "**IT/ICT solutions**" (6). A large problem was also elements of "**Management**" (5). Barriers of "**other type**" were also noticed (8). Highest Black Points in this platform were related to gaps with regard to IT/ICT. In 80% of McKinsey's respondents a "Lack of setting up a data lake across network in more than 50% of their plants" was diagnosed, in 75% of them "Lack of use an advanced analytics platform at scale" and in 70% "Lack of adopting specific Digital Manufacturing rollout-relevant solutions company-wide". It seems, however, they are a consequence of Black Points for non-technology areas, such as:

- "**Knowledge**"→ Executives not ready for new delivery models or blurred lines between industries (75% of Deloitte's respondents);
- "**Time**" → Agility is the new currency of business if we're too slow, we will be bankrupt (70% of KPMG's respondents);
- "**Management**"→ Lack of ROI as a major obstacle when implementing Digital Manufacturing solutions at scale (61% of Mc Kinsey's respondents);
- "**Leadership**" → Manufacturing CEOs don't think they will need to improve the way that they monitor market disruption over the next 3 years (60% of KPMG's respondents).

The above observations confirm the correctness of the model's assumptions, in which it was indicated that unsolved Black Points from lower platforms of "Tree of Life CA IR 4.0" generate problems in the following, higher platforms, by which they make it difficult, or even block the READINESS TO CREATE CA IR 4.0 (PLANE 2). It is also a premise to positively verify the detailed hypotheses formulated in the last part of literature review section of the article:

- **H1**: Barriers and shortages occurring on Human Resource Platform [Black Points of Human Resource Platform] block the contemporary companies' readiness to effectively use the Knowledge Platform resources;
- **H2**: Barriers and shortages occurring on Knowledge Platform [Black Points of Knowledge Platform] block the contemporary companies' readiness to effectively use the Technological Platform resources;
- **H3**: Barriers and shortages occurring on Technological Platform [Black Points of Technological Platform] block the contemporary companies' readiness to obtain various Competitive Advantages associated with Industry Revolution 4.0. (CA IR 4.0) and thus build strong (high) competitiveness;

and consequently, also the main hypothesis:

- MH: Barriers of creating Competitive Advantage in the age of Industry 4.0 (Black Points CA IR 4.0) are present on many related to each other planes (platforms) of competitive potential of contemporary organisations.

It is worth mentioning that systematic review of the literature (in-depth literature review/second part of desk research) also provided evidence for the validity of the hypotheses—other researchers included similar conclusions and observations in their papers.

For example, Saniuk and Saniuk [52] indicate that "*Implementing the concept of Industry 4.0 poses new challenges to companies, related to the need of building cyber-physical systems and use them to conduct network cooperation. This requires material investments in the area of automation, robotics, and computerisation […] the future also requires significant investments in the area of preparing engineers to apply (implement) those technologies […] an employee's knowledge and experience will definitely be of the highest importance, and this requires preparing new content and methods of professional training in the areas of production engineering, mechatronics, automation, robotics, information technology or logistics*".

Our observation is also consistent with the one of Basl [9], who researched enterprises operating in the Czech Republic in terms of readiness to implement technologies related to Industry 4.0. As he noticed "*Czech companies still lack own Industry 4.0 strategy and they don't have assigned responsible persons who would take care of further deepening of principles of Industry 4.0. […] The investigation has shown that there is a large space for improvement in terms of delivery of available information on Industry 4.0 to the employees. Most companies (56%) stated that their employees are not yet aware of what this new trend means. Only about 8% of companies reported that Industry 4.0"*.

Similar observations were noted by researchers dealing with the issue of Industry 4.0 barriers in the case of the *manufacturing sector in* Republic of China. Feng et al. [20] came to the conclusion that "*What Chinese manufacturing sector needs to do now is to overcome the problems and gradually move towards industrial 4.0 […] China's manufacturing sector can build the platform consist of government, industry, university, research unit, and customer to promote technological innovation in an all-round way […] The industry 4.0 era will make the relationship between countries*

and the world becoming more and more closely linked, and their inter-dependence is strengthening. Therefore, it is important to establish the manufacturing technological standards in line with the world's standards […] In industry 4.0 era, the requirement for the network is higher. So, China must build network infrastructure to meet the requirement […] Ultimately, all competition depends on the talent competition, so talent in manufacturing industry occupies an important position absolutely. China's manufacturing sector must build the Personnel-Training system to cultivate intelligences who meet the needs of industry 4.0".

Moreover, great inspiration in the creation of this article and the formulation of hypotheses were the results of research carried out by Kamblea et al. [32] which are published in "Computers in Industry" in article titled: "Analysis of the driving and dependence power of barriers to adopt industry 4.0 in Indian manufacturing industry". Scholars postulate that "*Industry 4.0 is a revolution in manufacturing, and it brings a whole new perspective to the industry on how manufacturing can be collaborated with the latest technologies to get maximum output with minimum resource utilization […] In this study, the '**Barriers to adoption of industry 4.0' (BTA)** is identified based on extant literature review and opinions of experts from industry and academia […] The present study identifies **twelve barriers** for Industry 4.0 adoption: **BTA1:** Employment Disruptions, **BTA2:** High Implementation Cost, **BTA3:** Organizational and Process Changes, **BTA4:** Need for Enhanced Skills, **BTA5:** Lack of knowledge management systems, **BTA6:** Lack of clear comprehension about IoT benefits, **BTA7:** Lack of Standards and Reference Architecture, **BTA8:** Lack of Internet coverage and IT facilities, **BTA9:** Security and Privacy Issues, **BTA10:** Seamless integration and compatibility issues, **BTA11:** Regulatory Compliance issues, **BTA12:** Legal and Contractual Uncertainty*".

In the above context, it is also worth quoting the conclusions of Pluciński and Mularczyk [47] regarding the situation in Poland. They indicate that "*Currently, Poland has no homogeneous ecosystem for introducing solutions resulting from the idea of Industry 4.0. Creating it will require a bottom-up initiative of the enterprises themselves […] requires on-going investments in automation, robotics, and human resources (operators and engineers) […] it will also be necessary to introduce changes in business models, methods of planning long-term strategies or human resources management*".

Lastly, Fonseca [21] also takes a similar position regarding the Industry 4.0 barriers, claiming that "*However, Industry 4.0 is still in the early stages for most companies and the digital transformation will require a strong leadership, the right human competences and to overcome the several barriers identified for its successful implementation. Although the literature indicates that the adoption of Industry 4.0 improves companies' performance, there are still many organizations that do not apply and don´t feel comfortable about doing it. This leads to opportunities to further investigate the areas where companies should prioritize the adoption of Industry 4.0 and to consider not only the technical aspects, but also the management, organizational and human dimensions, including what types of novel business models and people skills are required for the future, and what are the change processes to make it happen*".

Bearing in mind the fragments quoted above (selected from many of the analysed publications), it seems that the hypotheses put in this article fit fairly into the current research on the impact of Industry 4.0 barriers. In our opinion, an attempt to verify them provides valuable cognitive material that develops knowledge of management sciences.

1.6 Conclusion

The process of building competitive advantage of enterprises in IR 4.0 conditions should be detailed and considered throughout multiple layers. This is related to many requirements posed to modern organisations by the accompanying "digital transformation" and net economy. In order to be successful in the market, the grassroots work is necessary, i.e. preparing relevant structure and quality of the "Competitive Potential". For many organisations, this task brings significant barriers in the process of reaching "Readiness to CA IR 4.0", and in the bottom line to achieving the "Desired (high) level of competitiveness → CA IR 4.0". Although it might seem that the key to success are new technologies, the reality is slightly different. Much more is needed in order to be able to collect, implement and use such solutions. The complete view of the necessary actions is quite clearly shown in the "Tree of Life CA IR 4.0" (Fig. 1.4), and its details are provided in "The Map of Black Points of Creating CA IR 4.0"[30] (Appendix), and operationalised by the "**Pointer of Readiness to Competitiveness in IR 4.0**", which is a summary of the research described above (Fig. 1.5).

As the above tools suggest, the progress of works on developing and strengthening an organisation's ability to build and achieve CA IR 4.0 should be monitored in a specific way. Firstly, attention should be paid to "HR Platform" of organisational Competitive Potential. It is because it provides the key Black Points in the process of building CA IR 4.0. They are usually related to the issues related to Leadership (1), Education (2) and Skills (3). The absence of management competencies and talents required in IR 4.0 very often blocks the creation of the training system specific to IR 4.0 and the related incentive system, which in turn makes development difficult, or causes a backlog with regard to knowledge, skills and attitudes typical to IR 4.0, among employees and managers. Unfortunately, the effects of those gaps impact the next of those platforms Competitive Potential—"Knowledge Platform" and bring (cause) Black Points in processes of Management and Cooperation (both internal and external) which usually are a consequences of lack of efficiently implemented strategies, structures, or other tools typical to IR 4.0, as well as broadly understood network cooperation. Those barriers block the use of the resources of the "Technological Platform", resulting in having no significant ability to design, acquire, develop or implement not only new technologies, but also digitise their activities. What is important, those issues intensify when a given organisation fail to effectively

[30] See in Appendix Table 1.3.

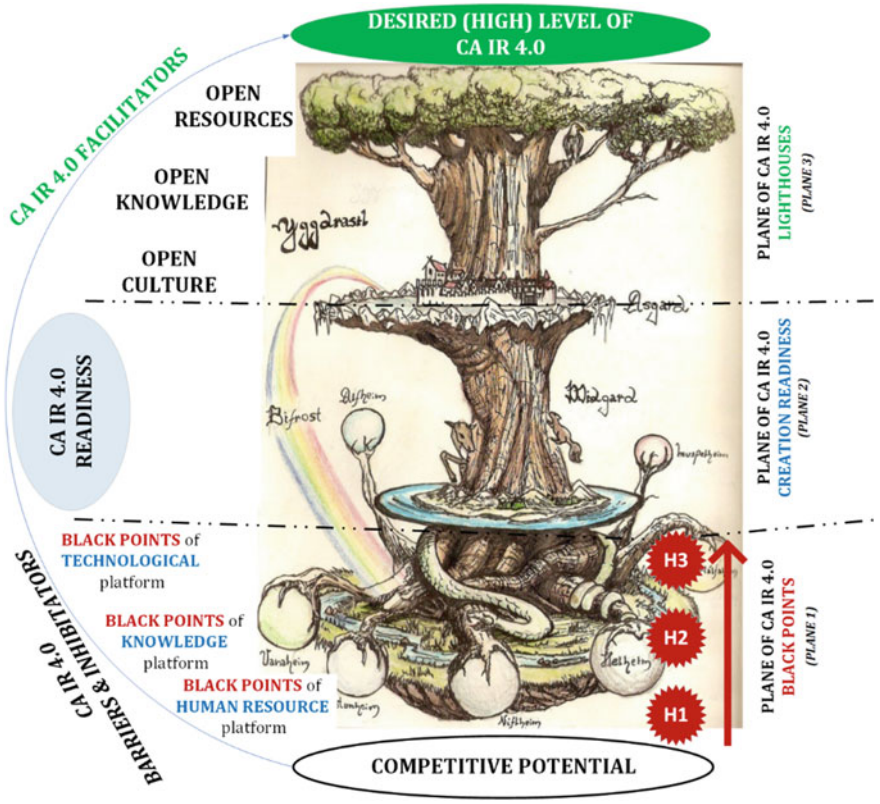


Fig. 1.4 Framework of conception of Tree of Life of CA IR 4.0. *Source* Own elaboration

overcome or even reduce the Black Points on "HR and Knowledge Platform". All of the above leads to "Lack of readiness to create CA IR 4.0".

The method to overcome the above deadlock is for enterprises to develop mechanisms to monitor and respond to the diagnosed Black Points. The most effective solution is a systematic work on developing the seven strategic factors listed in Fig. 1.4, with special focus on management competencies and talents necessary in IR 4.0. Case analysis clearly shows that actions aiming to prepare workers to navigate the age of Industry 4.0 by creating a culture of learning and collaboration and creating training opportunities—both within the organisation as well as in underserved communities should be a priority. Organisations need to invest in people and create an innovative mindset, involving training and enablement. These elements are more important than implementing the technologies. **If people don't get excited about transformation, it won't be successful**. Their knowledge can help to take a holistic approach to strategic planning, exploring how core capabilities can be enhanced by new ones to develop new products and services, and create new value for a broader range of stakeholders. It will also help to see that technology is the most powerful

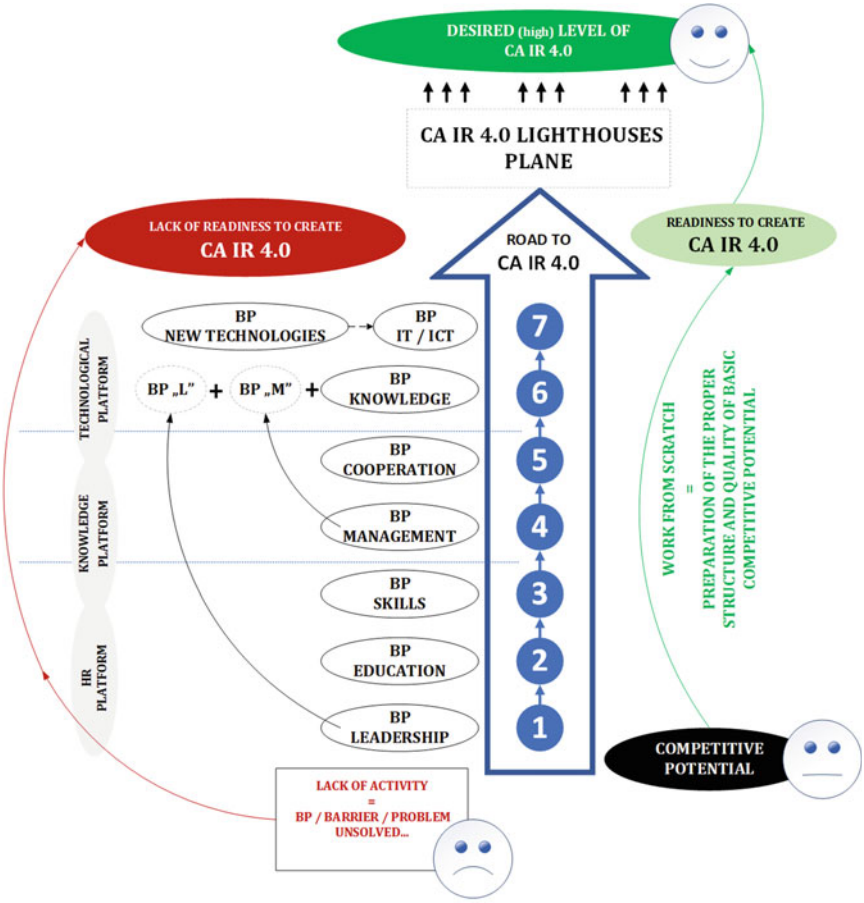


Fig. 1.5 Pointer of Readiness to Competitiveness in IR 4.0. *Source* Own elaboration

differentiator in an Industry 4.0 world, and it is valuable to invest in integrating new applications that can support new business models. And, most importantly, it should allow to understand that Industry 4.0 technologies shouldn't be limited to just one part of the organisation; **they should be integrated across the organisation** to better support a broad spectrum of responsibilities and stakeholders necessary to thrive in an Industry 4.0 world. Successful manufacturers will be those that blend artificial and human intelligence most effectively. The Black Points CA IR 4.0 eliminated this way will accelerate the "organisational readiness to create CA IR 4.0".

Appendix

See Table 1.3.

Table 1.3 The Map of Black Points of Creating CA IR 4.0

Key parameters of readiness to CA IR 4.0		Potentially black points CA IR 4.0	Found/real black points CA IR 4.0 (%)	Type of barrier	Level of the barrier[a]
Technological platform)	• Operational quality and effectiveness • Development of production methods • Effective interorganizational cooperation • IT infrastructure and ICT technologies • Software integrations • Innovativeness Economies of scale of operation • *Digital transformation* • *Virtualization of organizational life* • Development and implementation of new technologies	IR 4.0 ICT technologies 1. Digitalisation 2. Simulation and forecasting techniques 3. Integrated software 4. Techniques of direct communication between the machines (M2M) 5. Innovative methods of collecting and processing large amounts of data (Big Data) 6. Operations in the cloud (Clouds) 7 Cyber-physical systems (CPS) 8. Internet of Things (IoT) 9. Internet of Services (IoS) 10. Cybersecurity *IR 4.0 modern technologies* 1. Augmented Reality (AR) 2. Virtual Reality (VR) 3. Digital twins 4. Artificial Intelligence (AI) 5. Neural Networks (NN) 6. Mass customization 7. Autonomic Robots (AR)	*KPMG (N = 300)*		
			Agility is "the new currency of business"; "if we're too slow, we will be bankrupt" (70%) Building digital connectivity is a must to improve transparency and better manage the ever-increasing complexity of global supply chains	Time	4
			Struggling to keep pace with the high rate of technological innovation in manufacturing (more than 30%). You need to achieve a high level of industrial readiness before even having a conversation with a prime contractor. Organizations will be asked about their cyber readiness, ERP maturity and whether they have the systems in place to work in an integrated fashion. This level of maturity is not only required by the prime contractors, but is also being stipulated by governments	Technologies	2
			The most of technology investments are tactical. If CEOs choose the wrong technology, it can be costly from the perspective of both time and money (almost 50%)	Technologies	3

(continued)

Table 1.3 (continued)

Key parameters of readiness to CA IR 4.0		Potentially black points CA IR 4.0	Found/real black points CA IR 4.0 (%)	Type of barrier	Level of the barrier[a]
			Some of the technologies are essential components of modernization. IoT and augmented reality are among the top forces driving the digital transformation of manufacturing. Advances in operational technology create a 'sensor net of things' in which operational decisions can be made independently of humans. It generates Cyber security risk (37%)	Technologies	3
			Lack of preparedness to identify new cyber threats (51% manufacturing companies) Lack of preparedness to contain the impact of a cyberattack on our strategic operations (53% manufacturing companies)	IT/ICT	3
			Manufacturing CEOs don't think they will need to improve the way that they monitor market disruption over the next 3 years (60%)	Leadership	4
			Manufacturing CEOs don't plan to increase investment in processes to detect disruption and promote innovation (50%). With the incredible pace that business disruption is moving, to be caught it could be a death sentence	Leadership	3
			Deloitte (N = 1603)		
			Lack of internal alignment about which technologies to follow (43%)	Knowledge	3
			Lack of collaboration with external partners (38%)	Cooperation	2

(continued)

Table 1.3 (continued)

Key parameters of readiness to CA IR 4.0		Potentially black points CA IR 4.0	Found/real black points CA IR 4.0 (%)	Type of barrier	Level of the barrier[a]
			Lack of adequate technologies (36%)	Technologies	2
			Lack of rank-and-file adoption (32%)	Management	2
			Lack of technology know-how (29%)	Technologies	2
			Budgetary issues (29%)	Finance	2
			Executives don't ready for new delivery models or blurred lines between industries (75%)	Knowledge	4
			Mc Kinsey & Company (N = 700)		
			Lack of adopting specific Digital Manufacturing rollout-relevant solutions company-wide (70%) (adopting: connectivity 23%; intelligence 29%; flexible automation 24%)	Management	4
			Lack of ROI as a major obstacle when implementing Digital Manufacturing solutions at scale (61%)	Management	4
			IT deficiencies as a main challenge in successfully implementing digital transformation initiatives (44%)	IT/ICT	3
			Lack of set up a data lake across network in more than 50% of their plants (80%)	IT/ICT	5
			Lack of use an advanced analytics platform at scale (75%)	IT/ICT	4
			Warwick, Crimson & Co, Pinsent Masons (N = 53)		
			Contracting processes are linear and unchanged (50%)	Management	3
			Self-optimisation processes are not in use (38%)	Management	2

(continued)

Table 1.3 (continued)

Key parameters of readiness to CA IR 4.0		Potentially black points CA IR 4.0	Found/real black points CA IR 4.0 (%)	Type of barrier	Level of the barrier[a]
			Autonomously guided workpieces are not in use (38%)	Technologies	2
			Cloud solutions not in use (35%)	IT/ICT	2
			Poor equipment readiness for Industry 4—Significant overhaul required to meet Industry 4.0 model (25%); Machines and systems have no M2M capability (22%); Few machines can be controlled through automation (22%)	Technologies	2
			Data-driven services account for an initial share of revenue (<2.5%) (42%)	IT/ICT	3
			Products show only physical value (38%)	Digitization	2

(continued)

Table 1.3 (continued)

Key parameters of readiness to CA IR 4.0		Potentially black points CA IR 4.0	Found/real black points CA IR 4.0 (%)	Type of barrier	Level of the barrier[a]
Knowledge platform	• Effective knowledge management • Employee skills development • Interorganizational knowledge partnering • Effective knowledge sharing *(Sharing Economy)* • Effective process approach to management • Effective competitive strategies • Competitive advantage • Organizational growth and development • Design management (design thinking) • Co-creation values	*IR 4.0 structural solutions leading solutions* Organic model of organisation; Cultural openness; Decentralization of power; Empowerment; flat, flexible organisational structures; work in creative task forces or project teams; mainly horizontal communication; fast decision-making process; Short communication channels, inter-department knowledge sharing; *IR 4.0 strategies* *key IR 4.0 resources* Employees, knowledge, relationships, dynamic abilities, modern technologies *Strategies for development and competitiveness* Eclectic, flexible, agile, dynamic, innovative, novel, proactive; *Strategies for building IR 4.0 advantage* Based on qualitative, dispersed, non-material, unreal, unstable, synergistic advantages; *Modern IR 4.0 functional strategies* ZZL, logistic, marketing, production, financial, etc.; *key IR 4.0 solutions* **– Relationship strategies** based on cooperation, alliances and coopetition, strategic partnership, network cooperation, sharing economy (C2C, B2C, B2B), co-creation, ambidexterity; **– Openness of management strategy**: Knowledge (Knowledge Partnering, Open Knowledge), innovations (Open Innovation), resources (Open Resources); **– Orientation to services;** **– Orientation to client;** **- Social responsibility of the organisation**	*KPMG (N = 300)*		
			Pressure from stakeholders to demonstrate the value of the investment quickly; the board of directors has an unreasonable expectation for a return on the investment in digital transformation (more than 50%)	Time	3
			Times on significant digital transformation projects often seem "overwhelming". A lot of CEOs struggle to maintain the course, often moving from strategic plans to tactical and limited execution (nearly 75%)	Time	4
			CEOs express scepticism about the ability of data analytics to forecast business trends; they won't be increasing use of predictive models or analytics (Almost 50%); CEOs have a low regard for the accuracy of predictive analytics (50%). CEOs often have no idea how to align a digitalized front office with the rest of the business	IT/ICT	3
			Strategic alliances are the most problematic strategy for achieving growth objectives over the next 3 years (More than 60%) The most critical elements will be creating digital supply chain networks based on complex strategic alliances	Cooperation	4

(continued)

Table 1.3 (continued)

Key parameters of readiness to CA IR 4.0		Potentially black points CA IR 4.0	Found/real black points CA IR 4.0 (%)	Type of barrier	Level of the barrier[a]
			With connectivity comes risk. The growth of global business networks changes the risk landscape and makes companies more vulnerable to external shocks (94%). Companies are becoming more interdependent. The biggest barrier to extracting value from third parties is the difficulty of sharing data securely, so top-tier manufacturers are becoming more selective about which companies they partner with. Growth will be heavily reliant on strategic alliances, so determine which companies are important to work with. Only 6 percent have achieved full supply chain visibility, despite acknowledging its growing importance	Cooperation	5
			Deloitte (N = 1603)		
			Lack of internal alignment (43%)	Management	3
			Lack of collaboration with external partners (38%)	Cooperation	2
			Focus on the short-term investments, Short-termism (37%)	Management	2
			Lack of vision by the leaders (29%)	Management	2
			Organizations are not ready to fully harness the opportunities associated with Industry 4.0 (86%). Many executives continue to focus on traditional business operations, as opposed to focusing on opportunities to create new value for their direct and indirect stakeholders	Management	5

(continued)

Table 1.3 (continued)

Key parameters of readiness to CA IR 4.0		Potentially black points CA IR 4.0	Found/real black points CA IR 4.0 (%)	Type of barrier	Level of the barrier[a]
			Organizations are not highly capable of planning for and addressing the effects that technology-driven Industry 4.0 changes have on their organizational structures and employees (93%). It generates "organizational inertia", which occurs as a group remains fixated on its past accomplishments to protect its current state, while unknowingly blind to changes taking place within the marketplace	Management	5
			Mc Kinsey & Company (N = 700)		
			Lack of vision as a significant obstacle digital transformation (60%)	Management	4
			Lack of set up Digital Manufacturing integrated pilots as showcases to train and inspire the organization (75%)	Digitization	4
			Lack of robust road map for implementation digital transformation (clear definition of the size and nature of the business opportunity and a precise understanding of the IT and operational technology (OT) architecture and resourcing requirements) (42%)	Digitization	3
			Lack of a globally coordinated Digital Manufacturing strategy (75%)	Management	4
			No integration with suppliers or customers (35%), lack of supply chain visibility	Cooperation	2

(continued)

Table 1.3 (continued)

Key parameters of readiness to CA IR 4.0		Potentially black points CA IR 4.0	Found/real black points CA IR 4.0 (%)	Type of barrier	Level of the barrier[a]
			Warwick, Crimson & Co, Pinsent Masons (N = 53)		
			New risks not identified or assessed (50%)	Management	3
			No awareness 'As a service' business model (25%)	Management	2
			No sizeable Industry 4.0 investment (30%)	Finance	2
			Initial Industry 4.0 investments in only one business area (35%)	Finance	2
			KPIs are not focused around Industry 4.0 (55%)	Finance	3
			Industry 4.0 is recognised at departmental level but is not integrated into the strategy (40%)	Management	3
			Only basic communication and data sharing are required with suppliers and customers (35%)	Cooperation	2

(continued)

Table 1.3 (continued)

Key parameters of readiness to CA IR 4.0		Potentially black points CA IR 4.0	Found/real black points CA IR 4.0 (%)	Type of barrier	Level of the barrier[a]
Human resources platform	• Effective modern leadership • Trust and integrity • Effective interpersonal communications • Effective interpersonal relations • Effective motivation system • Effective structure and decision rights • Core values: values, believes, norms • Enthusiasm • Effective team work • Learning and development opportunities	*IR 4.0 competencies* 1. Subject-matter knowledge 2. Ability to learn 3. Teamwork 4. Ability to work in multicultural environment; 5. Ability to provide remote work 6. Knowledge of foreign languages 7. IT knowledge 8. Ability to share knowledge *IR 4.0 attitudes* 1. Will to constantly grow 2. Orientation to goals 3. Openness to new experiences 4. Creativity, flexible thinking, agility, high tolerance of uncertainty 5. Social responsibility	*KPMG (N = 300)*		
			Retooling the capabilities of workers and educate them on new roles introduced through digital transformation. Many organizations are struggling with it. 64%will create more jobs than it eliminates	Education	4
			The struggle for attract the talent need to accelerate organization digitalization strategies. Data scientists will be the most-needed type of worker for future growth (70%)	Motivation	4

(continued)

Table 1.3 (continued)

Key parameters of readiness to CA IR 4.0		Potentially black points CA IR 4.0	Found/real black points CA IR 4.0 (%)	Type of barrier	Level of the barrier[a]
			CEOs aren't prepared to take charge of the process of reshaping the corporation and to set out a vision of what the organization should be aimin1g for. Personally, are not prepared to lead [their] organization through a radical transformation of its operating model to maintain competitiveness." (30%)	Leadership	2
			Workers will need extensive retraining, though, if they are to move into new jobs that robots cannot perform. 36% organizations will eliminate more jobs than it creates	Education	2
			CEOs don't feel that AI's focus should be in the reduction of operational costs (more than 70% don't feel it yet)	Education	4
			Deloitte (N = 1603)		
			Organizations' workforces will trend more toward contractual, temporary and/or ad hoc employees (More than 61%) This is supported by a larger economic trend that suggests one of the fastest- growing segments of the workforce is those engaged in alternative workforce arrangements with more workers working off campus and off-balance sheets	Time	4
			Lack of right workforce composition and the skill sets needed for the future (75%)	Skills	4

(continued)

Table 1.3 (continued)

Key parameters of readiness to CA IR 4.0		Potentially black points CA IR 4.0	Found/real black points CA IR 4.0 (%)	Type of barrier	Level of the barrier[a]
			Lack of believe that organizations hold significant influence over societal key factors such as education, sustainability and social mobility (75%)	Leadership	4
			Reformation strategies of Talent and HR are a relatively low priority during Digital transformation (83%)	Leadership	5
			Mc Kinsey & Company (N = 700)		
			Lack of appointed a C-level individual responsible for driving their Digital Manufacturing efforts (64%). Ensuring a sufficient pace and widespread adoption of Digital Manufacturing also requires the commitment of P&L owners	Leadership	4
			Talent issues are the main Digital Manufacturing challenge for 69% of manufacturers	Motivation	4

(continued)

Table 1.3 (continued)

Key parameters of readiness to CA IR 4.0		Potentially black points CA IR 4.0	Found/real black points CA IR 4.0 (%)	Type of barrier	Level of the barrier[a]
			Organizations don't see attraction, management, and the retention of top talent as the main challenge about Digital Manufacturing implementation (yet 30%)	Leadership	2
			Warwick, Crimson & Co, Pinsent Masons (N = 53)		
			Employees have little or no experience with digital technologies (20%)	Skills	2
			Technology focused areas of the business have employees with only some digital skills (35%)	Skills	2
			Leadership team are still investigating potential Industry 4.0 benefits (30%)	Leadership	2

Source Own elaboration

[a] 1: 0–19% of the tested sample—very low barrier; 2: 20–39% low barrier; 3: 40–59% average barrier; 4: 60–79% high barrier; 5: 80–100% very high barrier

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Chapter 2
Industry 4.0 in Poland: A Systematic Literature Review and Future Research Directions

Michał Młody and Adam Weinert

Abstract The interest in Industry 4.0 has been gaining popularity, which is confirmed by the dynamically growing number of publications. The popular yet relatively poorly recognized scientific concept revolutionizes production strategies of enterprises. This prompts many researchers to analyze the real status of knowledge using a systematic literature review. In contrast to the available foreign publications, the existing analysis shows the lack of an analogous outcome on the domestic market. A systematic review of the literature made it possible to answer the following questions: (1) How widespread is the concept of Industry 4.0 in the Polish literature? (2) Which of the mentioned areas of the Industry 4.0 concept are particularly eagerly explored by researchers in Poland? (3) What research directions should the scientists focus on in the future? The conducted research resulted in findings regarding the current state of knowledge about Industry 4.0 in Polish conditions and indication of future research directions.

Keywords Industry 4.0 · Fourth Industrial Revolution · Systematic literature review

2.1 Introduction

Industry 4.0 is more and more frequently mentioned among the most important current and future trends in the global and national economy. The concept of Industry 4.0 was started in Germany, and in principle, it was a program related to the allocation of resources in the economy, promoting computerization and digitization of manufacturing processes. The German federal government announced "Industrie 4.0" as the key initiatives of its high-tech strategy [1–4]. The fact is that the very popular

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yet relatively poorly recognized concept revolutionizes manufacturing strategies of enterprises [5]. This prompts many researchers to analyze the real state of knowledge. To this end, the systematic literature review (SLR) method is used, which allows to summarize the current state of knowledge, informing about gaps in the literature and the need to conduct new research [6]. In contrast to the numerous foreign articles, the literature analysis showed the lack of a similar outcome on the national level (in Poland). As part of the completed review, three key questions were addressed:

- How widespread is the concept of Industry 4.0 in the Polish literature?
- Which of the mentioned areas of the Industry 4.0 concept are particularly eagerly explored by researchers in Poland?
- What research directions should the scientists focus on in the future?

The originality of the following study consists in determining the current state of knowledge in the field of Industry 4.0 in Poland. We used the SLR procedure proposed by Czakon [7], considering it the most adequate from the point of view of achieving the goal of the article. To cover relevant publications in the analysis, we used two databases: CEON Library of Science and Google Scholar (in Polish). The research description obtained in this way is to help in understanding, conducting, and comparing research results in the years to come, and thus it will support the current analysis of the development of the Industry 4.0 issues in Polish conditions. Recognition of its range can also be used to identify cognitive research gaps that can be filled in the future. The conducted analysis is part of the exposed trend devoted to the methods of secondary data analysis and evidence-based practice.

2.2 Industry 4.0—The Importance of the Concept and Theoretical Background

Throughout the history of industry, technologies have been subjected to three fundamental changes (i.e., mechanization, electrification, and digitization). Scientific and technological progress supporting the development of industrialization around the world has contributed to give this term more specific and clear meanings to reflect the influence of many factors. These primarily include: universal access to the Internet and ICT, widespread digitization, lower storage costs for large amounts of data, increased computing capabilities of computers, the ability to use big data, artificial intelligence, building cognitive systems, providing data protection and cyber security, advanced data analytics, machine-to-machine communication technologies, additive and spatial printing, 3D scanning, augmented reality, blockchain, digital twin, device mobility, RFID technology, advanced robotics (incl. cobotics—when people and robots collaborate), intelligent sensors and wireless transmitters, agent technology, automation of repeatable processes, extended business intelligence solutions [8–10].

The idea of Industry 4.0 is fascinating for both scientists and practitioners. This is due to two reasons. First, an a priori Industrial Revolution is predicted, unobserved ex-post, which provides companies and research institutes with many opportunities

to actively shape the future. Secondly, the enormous economic impact of the ongoing Industrial Revolution is assumed. It is forecasted that operational efficiency will be significantly improved, along with the development of new business models, services and products as well as customer access channels [1, p. 3]. Industry 4.0's impact on whole industries will change the way of designing, manufacturing, delivery, and payment methods [11, p. 23].

The general illustration of interest in the topic of Industry 4.0 is based on the Google Trends methods of popularity assessment (including interest in a given topic by Internet users in terms of time and geography and phrases which have been gaining popularity). The Google Trends search engine indicates a parallel increase in interest in the word Industrie 4.0 (German) and Industry 4.0 (English), with the larger increase in the popularity of translation in English (Fig. 2.1) and the variety of phrases that are gaining popularity on the Internet (Table 2.1). Based on what users enter in the search engine, it can be seen that interest in the concept of Industry 4.0 started to be noticeable only after 2011. This is understandable because the term was introduced and presented to the wider public at the time when the initiative was taken to promote a new idea of an approach to strengthening the competitiveness of the German manufacturing industry [8].

Initially, most scientific articles were published only by German research groups [12, p. 261]. It is worth pointing out that the concept first spread in European countries, and only then around the world, although its popularity in different parts of the world

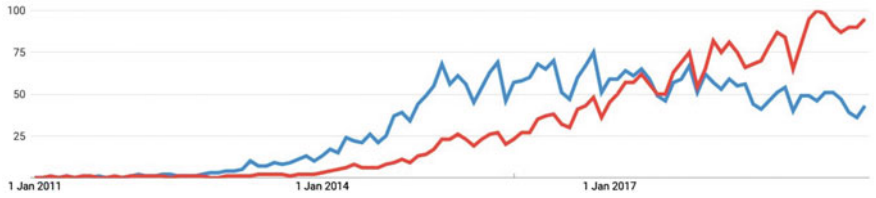

Fig. 2.1 Popularity of the terms "Industrie 4.0" (red) and "Industry 4.0" (blue)—Google Trends (from 2011 to 2018). *Source* Google Trends (www.google.com/trends) (as at 28.11.2018)

Table 2.1 List of phrases gaining popularity

Phrases (21 most gaining)		
Manufacturing 4.0	Industry Revolution 4.0	Industry 4.0 ppt
Industrial	Industry 4.0 Malaysia	Industrie 4.0
Industrial 4.0	Factory 4.0	Smart factory
Industrie 4.0	Industry 4.0 India	Industrial Revolution
Smart Industry 4.0	Industry 4.0 S	Industry 4.0 meaning
Internet of things (IoT)	Industry 4.0 definition	Bosch Industry 4.0
Industry 4.0 pdf	Industry 4.0 Germany	PwC's Industry 4.0

Source Google Trends (www.google.com/trends) (as at November 28, 2018)

Fig. 2.2 Popularity of "Industrie 4.0" (red) and "Industry 4.0" (blue) in the world—Google Trends (from 2011 to 2018). *Source* Google Trends (www.google.com/trends) (as at 28.11.2018)

is at different levels (Fig. 2.2). Industry 4.0 has been listed as a main topic on the 2016 World Economic Forum's agenda [11, p. 23], and it has become a key element of further debates, e.g., regarding Globalization 4.0 [13].

Since 2013, the number of conferences and scientific papers related to the concept of Industry 4.0 has gradually increased [14, p. 2]. Researchers note that most scientific articles are included in conference materials, and the available literature is dominated by technical content. Economic, strategic, and organizational aspects are described less frequently [15, p. 3]. It should be noted that, with time, the literature on the concept of Industry 4.0 becomes more and more diverse and rich. This is evidenced by the fact that the largest electronic database of books in the world—Google Books—already displays over 28,900 literature items containing the term "Industrie 4.0" and 61 400 regarding the term "Industry 4.0" (as at 28.11.2018).[1]

Nowadays, Industry 4.0 is described as a new paradigm and convergence of the most modern ICT with production [3, p. 125]. The concept of Industry 4.0 is also perceived in the literature as a synonym combining a set of new technologies and the

[1] It is worth noting that the Polish language equivalent allows to search for much fewer of them—748 results (as at November 28, 2018).

organization of the value chain [1, p. 7]. Researchers note that the literature lacks a clear, precise, and common definition of the concept of Industry 4.0 among scientists [6].

A closer look at the existing ways of Industry 4.0 understanding by different authors is presented in Table 2.2. Researchers identified different categories of definitions, focusing on, e.g., the components of Industry 4.0, value creation and the structure of the value chain, the definition of Industry 4.0 as linked to the "smart factory" concept or the concept of competitiveness.

Industry 4.0 scientific content is present, inter alia, in the literature on economics and management sciences. This problem is described and explained by scientists from various sub-disciplines. The theoretical background, depending on the issues studied, can involve many concepts and theories. The question arises, what framework should be used for further analysis. It is impossible to overestimate the importance of the acquis in the field of economic models, organization and management theory, and strategic management. Research work on them is still being extended, mainly due to the use of modern methods of the literature analysis [16, p. 930]. It is extremely difficult to indicate all the theoretical perspectives that can be taken into account in the research work; however, indicated theories, useful in the context of Industry 4.0 analysis, are depicted in Table 2.3.

The concepts and theories listed in Table 2.3 are those most frequently referred to in articles on Industry 4.0. The usefulness of individual theoretical approaches depends on the macro-/meso-/microanalysis and the area the authors focus on. Nevertheless, it should be noted that the implementation of Industry 4.0 is a very interdisciplinary and multifaceted problem. With this in mind, it will probably be necessary to modify or integrate the current conceptual framework to illustrate the functioning of enterprises, sectors, and economies in new technological, political, economic, and social conditions.

Some attempts have been made in the academic literature to conduct SLRs regarding Industry 4.0, based on various databases (e.g., EBSCO, Scopus, ScienceDirect, Emerald, Web of Science, Google Scholar). Due to the wide scope of the concept of Industry 4.0, journals from many fields are subjected to analysis (e.g., [1, 2, 4, 6, 9, 10, 16]). The conclusions from the previous systematic reviews on the Industry 4.0 literature suggest that the majority of publications were written in English, most articles focus on the theoretical approach, and there is a lack of research providing data and analyses regarding the application of specific concepts, methods, and tools in the field of Industry 4.0.

2.3 The Procedure of a Systematic Literature Review in Polish Conditions

In the methodology of a systematic literature review, one can distinguish various phases and stages that do not appear in the traditional literature approach. This

Table 2.2 Definitions of Industry 4.0 in foreign studies

Author(s)	Definitions (descriptions in the literature)	Category of definitions
Alekseev et al. (2018)	"Industry 4.0 is the totality of the spheres of economy in which the fully automatic production processes are based on the artificial intellect and the Internet create new machines without human participation" (p. 3)	Examining in depth the details of the components of Industry 4.0 and/or some technical peculiarities linked to this topic, sometimes also describing some key concepts related to Industry 4.0 (e.g., IoT, ICT, cyber-physical systems)
Kovacs & Kot (2016)	"The essence of Industry 4.0 conception is the introduction of network-linked intelligent systems, which realize self-regulating production: people, machines, equipment and products will communicate to one another" (p. 122)	
Prause & Atari (2017)	"Industry 4.0 represents nothing less than the fourth industrial revolution, comprising 3D printing, Big data, Internet of Things, and Internet of Services, i.e., all the ingredients needed to facilitate smart manufacturing and Logistics processes" (p. 423)	
Kinzel (2017)	"Industry 4.0 is the new buzzword in the manufacturing industry. It comprises the entire value chain process in manufacturing goods and providing services" (p. 70)	Focuses on value creation and the structure of the value chain
Preuveneers & Ilie-Zudor (2017)	"These technological revolutions will transform production and logistic processes into smart factory environments that will increase productivity and efficiency" (p. 1)	Introduces the definition of Industry 4.0 as linked to the "smart factory" concept
Navickas et al. (2017)	Industry 4.0 as a necessary tool to maintain the competitiveness of firms; they seem to suggest that Industry 4.0 is a must, just to maintain competitiveness	Introduces the concept of competitiveness
Müller et al. (2018)	Industry 4.0 allows safeguarding the competitiveness of firms in the long term	Explicitly puts the formulation of strategy, even if at a governmental level, at its core and not only considers the long-term perspective necessary to understand the implications of Industry 4.0

(continued)

Table 2.2 (continued)

Author(s)	Definitions (descriptions in the literature)	Category of definitions
Johansson et al. (2017)	"a current example of the technological development is presented in Industry 4.0, a strategy shaped by the German government in 2013" (p. 282)	
Strange & Zucchella (2017)	"is a term reputedly first used to describe a high-technology strategy proposed by the German government, and is now commonly used to refer to the development of cyber-physical systems and dynamic data processes that use massive amounts of data to drive smart machines" (p. 154)	
Kiel et al. (2016)	"Industry 4.0, which is internationally also known as the Industrial Internet of Things, refers to the integration of Internet of Things technologies into industrial value creation enabling manufacturers to harness entirely digitized, connected, smart, and decentralized value chains" (p. 2)	Specific attention to single terms used as synonyms of Industry 4.0 and encompasses only papers on "Internet of things," the most frequently used synonym for Industry 4.0

Source Own elaboration based on [6, pp. 10–13]

Table 2.3 Concepts and theories most frequently related to Industry 4.0

Theory	Main author(s)	The usefulness of the theory
Organizational intelligence	Williams & Williams, Lonnqvist & Pirttimaki	Technological intelligence—the ability to introduce and use various techniques, tools, and methods (in particular, IT solutions, robots/cobots), making changes in the organization to improve its operations and achieve higher efficiency than other organizations
Value co-creation	Prahalad & Ramaswamy, Jansen & Pieters	In order to correctly guess the expectations, tastes, and needs of potential customers (stakeholders), companies must find an effective way to quickly and effectively acquire and process "external" information, data, knowledge, ideas, opinions, suggestions, proposed solutions
Resource-based view	Wernerfelt, Prahalad & Hamel, Barney, Grant	Integration of resources, their creation, reconfiguration, to generate new solutions to strategic problems (e.g., integration of data, machines, and people in order to build key competencies)
Competitiveness and competitive advantages	Porter	Modern technologies that fit into the concept of Industry 4.0 have a big impact on three generic strategies for achieving above average performance in an industry: cost leadership, differentiation, and focus
OLI paradigm	Dunning	Ownership-specific advantages, internalization specific advantages, and location-specific advantages undergo significant modifications as a result of the implementation of technologies 4.0

(continued)

Table 2.3 (continued)

Theory	Main author(s)	The usefulness of the theory
Value chain	Porter	As a result of the implementation of Industry 4.0 technologies, are gradually changing Supplier-Related Value Chains, Company Value Chains and Forward Channel Value Chains
Global value chains	Gereffi	Due to Industry 4.0, countries need to carefully assess the pros and cons of GVC participation and the costs and benefits of proactive policies to promote GVCs
Knowledge management	Nonaka & Takeuchi	Ownership, development, and appropriate use of knowledge resources affect the implementation process of Industry 4.0 technology
System approach	Ackoff	Organizations as open systems undergo changes and evolve, which is reflected in the process of adapting to the environment, including new technologies
Organizational Learning	Argyris & Schön	Industry 4.0 technologies affect the process of creating, retaining, and transferring knowledge within an organization

Source Own elaboration

article uses a procedure comprising three phases and six stages, adopted by Czakon [7] (Table 2.4).

The first phase of the review was related to the determination of the purpose of the study. The reconnaissance character was adopted; i.e., it was conducted around predetermined subject slogans, which included terms and issues related to the generally perceived Industry 4.0. The aim of the study was to check the state of knowledge in this area in the literature in Polish conditions.

This next phase included three stages: selection of the basic literature, selection of publications, and preparation of a database of publications. Therefore, it was a set of technical operations on selected databases, which ensured a smooth transition from determining the entire literature available digitally, toward the set that best suited the achievement of the research objective.

Table 2.4 Phases and stages of the systematic literature review

Phase	Stage
1. Determining the purpose of the study	1. Industry 4.0 in Poland (the national literature)
2. Selecting the literature of the subject	2. CEON database (BazEkon and BazTech) and Google Scholar (in Polish)
	3. Keywords: "Przemysł 4.0" and "Czwarta rewolucja przemysłowa"
	4. Research period—8 years (from 2011 to 2018)
3. Bibliometric analysis and content analysis	5. Analysis of the number of scientific publications
	6. Keywords analysis

Source Own elaboration

The selection of the subject of the study consisted in determining a set of publications that will be subjected to analysis. The selection of the basic literature was based solely on digital databases. The CEON database was used (public base at: http://bibliotekanauki.ceon.pl/yadda) due to the character of the study. The dedicated search engine application Google Scholar was also used due to the research area in Polish. As a result, it was possible to use all major journals, peer-reviewed and published in the Polish and national literature (occasional studies in English).

The next step of the review focused on the selection of relevant keywords related to the subject of the study. At this stage, the keyword list has been limited to two basic ones. The keywords "Przemysł 4.0" and "Czwarta rewolucja przemysłowa" were used for the given initial set of texts. A three-step selection was applied: identification of articles dealing with (Industry 4.0), and the (Fourth Industrial Revolution); full-text, peer-reviewed, and non-duplicating studies; and described considerations over the concept, with a division directly related to Industry 4.0 and the Fourth Industrial Revolution, partly related to and poorly related to the studied area.

Details of the course of creating the literature database for the undertaken research are included in Table 2.5. The search criterion was: title, abstract, or keywords. The collection of articles containing given search criteria was limited to full-text and peer-reviewed works published after 2011. The study covered the period of 8 years (from January 2011 to November 2018). The frequency of characteristics appearing in the studied literature—e.g., keywords—is determined by frequency analysis. Their absolute frequency was verified. The research did not concern books and popular science articles. Verification of abstracts and deletion of duplicate items allowed to narrow the database to a total of 92 publications (list of all publications is included in Annex 2.6).

Due to the scope of the study, we decided to analyze the content of all articles found in databases, which allowed for the qualification of articles fitting into the subject scope. Thanks to the applied sequence, a base was obtained, which can be subjected to further bibliometric and content analyses.

Table 2.5 Course of creating a literature database

Search criteria	CEON	Google scholar (PL)
"Przemysł 4.0"—title, abstract, or keywords	169	199
"Czwarta rewolucja przemysłowa"—title, abstract, or keywords	50	113
Full-text reviewed articles	70	59
After verifying the abstracts	66	57
Together	123	
After verifying the content of all articles (duplicate removal included)	92	

Source Own elaboration

2.4 The Results of the Systematic Literature Review

While analyzing the number of publications on Industry 4.0, it can be noticed that scientific explorations treating it as a leading research subject are growing in an accumulative way (Fig. 2.3).

The number of publications summarizing and analyzing particular years allows to assess the activity of scientists in Poland and show which stage of development the given research area it occupies.

All keywords used to create a keyword (tag) cloud (Fig. 2.4) have been singled out from articles that make up the database of publications on the concept of Industry 4.0 in Poland. In total, 189 different keywords were identified. The most common terms are: Industry 4.0; Internet of things; Fourth Industrial Revolution; cyber-physical systems; and big data. The indicated words provide quantitative information about the views of Polish researchers (Fig. 2.4). The size of the letters in the cloud of keywords represents the frequency of their occurrence in all articles of the review.

A certain problem that occurred in the process of analyzing articles was to specify the type of research and the research method used, which in most studies were not clearly indicated by the authors in their content. Nevertheless, the obvious conclusion from the data presented in Fig. 2.5 is that most articles are of a conceptual or descriptive nature. Articles in which questionnaire survey results or case studies

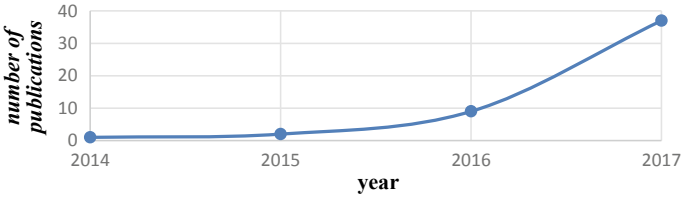

Fig. 2.3 Increase in the number of scientific publications in the field of Industry 4.0 in Poland. *Source* Own elaboration

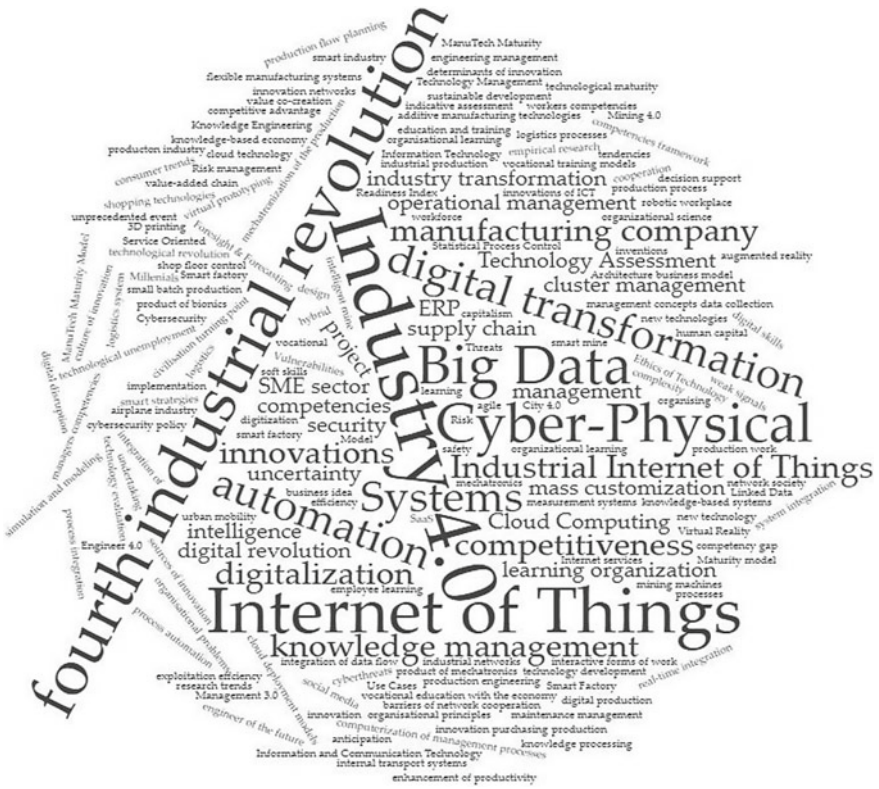

Fig. 2.4 An example of a word cloud (based on keywords frequency)—attributes of Industry 4.0. *Source* Own elaboration

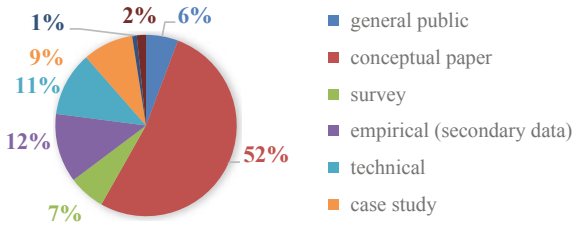

Fig. 2.5 Research type/methods. *Source* Own elaboration

were used (including practical examples) constitute only 16% of all articles that were analyzed.

Some doubts arose also during the identification of the issues raised in individual articles. Most of the authors demonstrated a holistic approach to the analysis of the concept of Industry 4.0 in Poland, in particular in the case of conceptual articles that simultaneously addressed a broad spectrum of issues related to technological transformation (Fig. 2.6). Nevertheless, the scope of research can be considered as

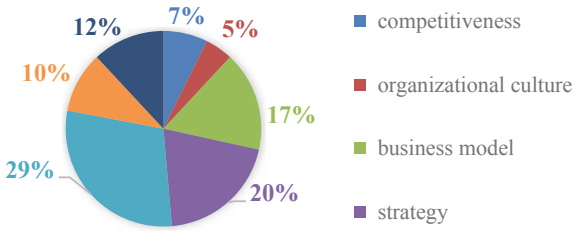

Fig. 2.6 Key aspects. *Source* Own elaboration

quite wide and generally convergent to the achievements of the world literature.

Summing up the bibliometric analysis, it can be concluded that the scope of the articles considered is a good platform for further research, but the methodology should be more diversified so that they could be referred to research carried out in countries where the concept is more popular.

2.4.1 Selected Empirical Research—Scientific Papers

As part of the systematic review of the literature, relatively few articles were identified that used quantitative research methods and qualitative methods such as case study. Nevertheless, the spectrum of authors' interest is broad and covers many issues.

Table 2.6 contains the literature items essentially related to the economic and management aspects of technological transformation, while the articles of a strictly technical nature have been intentionally omitted.

A review of selected empirical studies indicates a deep deficiency of both quantitative and qualitative studies carried out in academic environments. The results allow in particular to recognize the need to adapt and properly organize enterprises to new conditions at almost all of the levels. In particular, attention was paid to the adjustment/rebuilding of strategies, the reorganization of supply chains, and the significance of employees with Competence 4.0. In addition, the review indicates the need to strengthen soft and design skills, the importance of which in the production sector has not been appreciated so far. Values that require further empirical verification also include model concepts (e.g., [17–19]). The review only to a small extent indicated the benefits resulting from the technological transformation, although the possibility of product personalization and improving the data flow in enterprises were emphasized.

Table 2.6 Selected empirical research—scientific papers

Author(s)	Method	Sample	Key aspects	Main conclusions/identified research gaps
Adamik, Nowicki (2018)	Practical examples	10	Business competitiveness, business model, value co-creation	– The authors developed a model of "co-creation as a value generator for companies' operating in the age of IR 4.0," which is a contribution to the process of raising awareness about the possibilities of companies to compete in the era of Industry 4.0 – The authors suggest the initiation of broader research on consumer involvement in the process of creating value and recommend exploring the possibilities and conditions for implementing co-creation in different sectors using various technologies 4.0
Antosz (2018)	Interview	50	Corporate culture, Competence 4.0, competence assessment	– The authors developed a comprehensive model of the competency assessment of maintenance workers; application of a properly selected method of competence assessment allows for identification of the current level of competence and identification of training needs, in order to improve the efficiency of the maintenance process – Future work should support the employee evaluation process using data collected in CMMS systems
Chamier-Gliszczyński, Staniuk, Staniuk (2018)	Practical examples	3	Logistics/supply chain	– An indicative assessment of logistics systems in enterprises operating in the logistics area is an important element of the activity – The authors of the article presented the original method Logistic Audit 9A in terms of indicators and logistic measures in the area of Economy 4.0
Gudanowska, Alonso, Törmänen (2018)	Survey questionnaire	95	Corporate culture, Competence 4.0	– The article presents competencies depending on of five analyzed manufacturing sectors – The analysis showed that employees should have better professional knowledge and technical skills, highly developed communication skills, be committed to the exact performance of tasks, be open to exchange and sharing knowledge and experience – Future research should focus on the measurement of competencies and their proper assessment, which should enable the identification of key points in the area of employee development

(continued)

Table 2.6 (continued)

Author(s)	Method	Sample	Key aspects	Main conclusions/identified research gaps
Saniuk, S., Saniuk, A. (2017)	Survey questionnaire	50	Enterprise strategy, meso-/macro-perspective	– Low level of automation and computerization of Polish enterprises may result from a short adaptation period of Polish enterprises after economic transformation, lack of climate for investments in new technologies, still low level of employment of qualified engineering staff, low wages of employees, or a high of concentration on the area of marketing and sales
Sąsiadek, Basl (2018)	Survey questionnaire	42	Enterprise strategy, meso-/macro-perspective	– Building a company's readiness to effectively achieve the goals of Industry 4.0 strategy is not based only on technological aspects, but also on having the right strategy and developing measurable indicators allowing efficient testing of the effectiveness of the implementation of this concept
Spałek (2016)	Survey questionnaire	121	Competitiveness of enterprises, enterprise strategy	– The research has verified to what extent Polish enterprises are prepared for the challenges of the upcoming Industry 4.0 in the area of project management – The authors indicate that the knowledge of the concept 4.0 in Polish organizations is far from sufficient, and the level of its application significantly differs from the level recorded in foreign enterprises
Stadnicka, Litwin, Antosz, Safin, Perłowski, Rzucidło (2018)	Case study/practical example	1	Competitiveness, business model, enterprise strategy, planning process	– The authors, based on real examples of problems, indicate how elements of the Industry 4.0 concept can be used to improve production planning – Implementation of lean tools in process analysis and process improvement can bring real benefits to the enterprise
Szozda (2017)	Survey questionnaire /case study	1	Logistics/supply chain	– Industry 4.0 concept is not unfamiliar to modern enterprises and has an impact on the organization of physical flows and information in supply chains – Managers are aware of the ongoing changes in the organization of production processes, in provision and distribution throughout the supply chain – Concerns refer to the transfer of processes into the virtual world due to data security and the capacity of long-range wireless networks

Source Own elaboration

2.4.2 Selected Empirical Research—Industry-Level Studies

The research carried out by independent research centers, institutions, and consulting companies is definitely more empirical; hence, we decided to extend this part of the analysis beyond the studies included in the systematic review of the literature.

Table 2.7 shows the most important studies carried out in 2016–2018 regarding the implementation of the concept of Industry 4.0 in Poland. Both large enterprises and those belonging to the SME sector (mainly manufacturing companies) constituted a research sample, and the spectrum of issues covered included mostly the broadly understood conditions of the digital transformation of Polish enterprises. Most of the industry research was aimed at verifying the level of familiarity and the degree of implementation of technology 4.0 in enterprises as well as identification of barriers affecting the relatively slow pace of technological transformation.

The conclusions from the research suggest that large enterprises, in particular those with foreign capital, perform much better. However, one can notice a gradual improvement in moods also among enterprises from the SME sector, which positively perceive the ongoing Industrial Revolution. The results obtained indicate at the same time that capital constraints associated with the implemented investments and a clear competence gap are the main barriers. In most reports—based on interviews with experts—a remedy was sought for staff shortages, paying particular attention to the need to educate employees in accordance with the requirements of the Fourth Industrial Revolution.

2.5 Conclusions and Future Research Areas

Despite the significant increase in the amount of research, knowledge about the Industry 4.0 concept is still incoherent and fragmented. To a certain degree, it results from the fact that various theories are the basis for its design, and it includes many elements that are tested separately. The main conclusions resulting from the carried out systematic literature review are as follows:

- Industry 4.0 enjoys rising interest within the Polish academics, and the thematic scope of the analyzed articles is broadly consistent with the research efforts of scientists carrying out research in relation to Industry 4.0 abroad.
- Most studies are based on descriptive research, not empirical research, which results in realistically low possibilities for building conclusions.
- There are no studies providing data and analyses regarding the application of specific concepts, methods, and tools in the field of Industry 4.0, as well as the real effects of the implementation of technology 4.0 at the micro-, meso-, and macro-level.

Industry 4.0 is a complex, multidimensional, and multidisciplinary concept, and it is difficult to create a universally accepted definition that includes all its possible

Table 2.7 Selected empirical research—industry-level studies

Research institution: title	Method	Sample	Main conclusions
BCG: Industry 4.0 PL—An opportunity or a threat to an innovative economy? (2016)	–	–	– 81% of managers in Poland believe that Industry 4.0 is important for their company, while only 5% think that it will not have any impact in the future – The main challenges for a company implementing technologies 4.0 are: high investment needs, difficulty in attracting qualified staff, and concerns about data security
Astor: Engineers of Industry 4.0—(Un) ready for change? (2017)	–	114	– The employees' involvement is one of the main factors enabling the development of the company – The pessimistic picture of employers' approach to developing engineering staff emerges from the research results; Engineer 4.0, in addition to permanently significant technical competence, must be aware of the importance of "soft" competencies that enable collaboration and facilitate the process of change management
PWC: Industry 4.0—the challenges of modern production (2017)	Survey questionnaire	50—PL 1950—other countries	– Polish entrepreneurs look optimistically at the chances of Industry 4.0; the respondents highly assessed the level of advancement of digital transformation in their enterprises – The main obstacles to deeper metamorphosis are the high costs of its introduction and the lack of necessary infrastructure
Siemens, Millward Brown: Smart Industry Polska (2017)	CATI	251	– According to the surveyed companies, the automation and robotization of production are the technologies with the biggest competitive advantages; modern technologies visibly contribute to the improvement of the functioning of companies (quality of products or services offered, efficiency and effectiveness of production) – Barriers to introducing new technologies in manufacturing companies from the micro-sector and SMEs include, first and foremost, formal and official obstacles (i.e., bureaucracy or lack of incentives) and internal difficulties of companies: limited funding opportunities, lack of access to qualified personnel, or fear of investment non-return

(continued)

Table 2.7 (continued)

Research institution: title	Method	Sample	Main conclusions
Siemens, Millward Brown: Smart Industry Polska (2018)	CATI	200	– 60% of entrepreneurs have not heard of the Industry 4.0 concept—but this is not synonymous with the nonuse of modern technologies by these companies – Automation of production lines (52% of indications), data analytics (51%), and software supporting the reduction of prototyping costs of new products (32%) are the most frequently used technologies by SMEs – 15.5% of enterprises included the idea of Industry 4.0 in their strategy. Innovative technological solutions were implemented in these enterprises, primarily to reduce production costs and gain a competitive advantage
ASD Consulting: Challenges of Polish enterprises in the era of Industry 4.0 (2018)	Survey questionnaire	137	– The research focused on issues related to the management and organization of work on the basis of data collected and processed in the company – The level of computerization of Polish enterprises is at a low level, with large and medium-sized enterprises as leaders in the level of automation of data collection; 9/10 companies use data to optimize at least one of the production stages
Magazyn gospodarczy: Polish Industry 4.0 – special report (2018)	–	–	– Polish industry is positioned between reality 3.0 and 4.0; specific solutions are introduced "locally" – The main barriers for Industry 4.0 include significant investment costs and availability of qualified staff; changes are not facilitated by traditional organizational culture, infrastructural barriers, and unfavorable and complicated legal regulations – It is easier to introduce technology 4.0 in a completely new plant than change 3.0 for the 4.0 in the existing one

Source Own elaboration

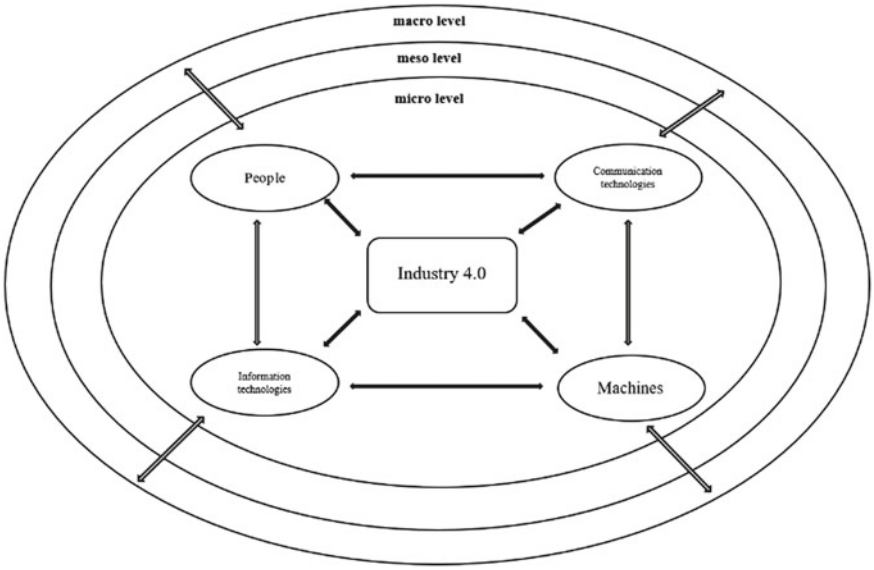

Fig. 2.7 Industry 4.0—micro-, meso-, and macro-levels. *Source* Own elaboration

aspects mentioned by theoreticians and practitioners. The review of the literature allows for the conclusion that the concept of Industry 4.0 can be described and explained at micro-level—within the enterprise, -meso-level—within the sector, or macro-level—the whole economy, in which the integration of people, machines, and advanced communication technologies and information technologies is observed, enabling real-time interaction between key components of a manufacturing or service enterprise, sector, and economy (Fig. 2.7).

In light of the above, it seems crucial to define a demarcation line in the business management process, crossing which would confirm that the assumptions of the Industry 4.0 concept have been implemented. The set of the elements disseminated within its framework is open due to the combination of solutions and their derivatives developed by producers and users. The constant development of technologies suggests that their implementation should be seen as a continuous process. Therefore, it is important to determine the degree of their integration. The implementation of the Industry 4.0 concept enforces changes at all levels of business management, including strategic management, but no empirical research on their dynamics and real scope is available.

The macroeconomic perspective poses a noticeable difficulty in determining at what stage of the "Industrial Revolution" the economy is located, because its assessment through the prism of all industries with the use of uniform measures may lead to inference errors.

While the articles identified in the SLR cover a wide range of issues, they show relatively little research gaps. Based on content analysis, we identified four basic areas

the research efforts should be concentrated on, in particular, taking into account the significant deficiency of both qualitative and quantitative research results.

Future research should allow a detailed answer to the question what companies implement technologies 4.0. While research (mainly industry-level) indicates some differences in the size of enterprises and the scale of operations, as well as the source of capital and some industry characteristics, the key aspects of problem analysis such as company experience or type of productive activity (labor vs. capital-intensive) have been omitted.

Another area of research concerns the real reasons for implementing the 4.0 concept, in particular in the context of the importance of individual internal and external factors related to costs, flexibility, infrastructure, supply chain risk, quality, technical and technological aspects, and relations with the company's stakeholders (in particular, suppliers and customers).

Research to date on Industry 4.0 in Polish conditions to a limited extent has also enabled the diagnosis of the degree of technology integration, analysis and evaluation of the decision mechanism, the process of adaptation of enterprises, and broadly understood behavioral aspects related to technological transformation. A question about differences on these planes between enterprises with various levels of experience and the origin of capital also needs to be answered.

Finally, due to the presence of technology 4.0 in many enterprises, it would be worth trying to assess the actual impact on enterprises from the perspective of not only financial and production indicators, but also, e.g., the image, innovation, or the ability to create value.

Our systematic review of the literature has some limitations. The inclusion of only two databases in the review (CEON and Google Scholar PL) and the literature search criteria used during the review may have caused that some of the existing studies were omitted. We realize that the degree of digitization of Polish journals on economic sciences is relatively low compared to foreign databases. Therefore, the representativeness of the conducted research is limited. In the future—as the popularity of research on Industry 4.0 in Poland increases—the review can be extended with new keywords, the use of additional databases or the use of the "snowball" procedure, which consists in taking into account the articles presented in the reference literature. The limited number of articles and their dispersion from the point of view of the place of publication and the studied issues made it impossible to draw conclusions in some areas. However, we hope that the future update of the review will identify the leading academic centers in Poland dealing with the issues of Industry 4.0, their division according to the issues studied, as well as the identification of journals in which research is published most often.

Annex

See Annex Table 2.8.

Table 2.8 List of selected publications (CEON, Google Scholar PL)

Author(s)	Title of the article	Source (journal/book)
Adamczak A., Nowicki M. (2018)	Zrobotyzowane stanowisko kabinowe typu Plug and Produce w koncepcji Przemysłu 4.0	Pomiary automatyka robotyka
Adamik A. (2018)	Inteligencja organizacji w erze IR 4.0	Studia i Prace Kolegium Zarządzania i Finansów
Adamik A., Nowicki M. (2018)	Co-creating Value in the Era of Industry 4.0	Przedsiębiorczość i Zarządzanie
Antonowicz M., Gonsior T. (2017)	Współczesne zakupy w obliczu nowoczesnych technologii e-biznesowych	Przedsiębiorczość i Zarządzanie
Antosz K. (2018)	Maintenance—identification and analysis of the competency gap	Eksploatacja i Niezawodność
Badurek J. (2014)	System ERP dla wytwórczości nowej generacji	Przedsiębiorstwo we współczesnej gospodarce – teoria i praktyka
Bembenek B. (2017)	Klastry przemysłu 4.0 w zrównoważonej gospodarce opartej na wiedzy	Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu
Bendkowski J. (2017)	Zmiany w pracy produkcyjnej w perspektywie koncepcji "Przemysł 4.0"	Zeszyty Naukowe. Organizacja i Zarządzanie
Bentyn Z. (2017)	Adaptacja łańcuchów dostaw do potrzeb Przemysłu 4.0	Autobusy: technika, eksploatacja, systemy transportowe
Brach J. (2017)	Mobilność 4.0, pojazd użytkowy 4.0 oraz transport 4.0 – kwestie definicyjne i praktyczne	Zeszyty Naukowe Wydziału Ekonomicznego Uniwersytetu Gdańskiego: Ekonomika Transportu i Logistyka
Brzozowska M. (2016)	Industry 4.0—Impact on Logistics Processes Management	Przedsiębiorczość i Zarządzanie
Bujak A. (2017)	Rewolucja Przemysłowa - 4.0" i jej wpływ na logistykę XXI wieku	Autobusy: technika, eksploatacja, systemy transportowe
Chamier-Gliszczyński N., Staniuk W., Staniuk M. (2018)	Problematyka wskaźnikowej oceny systemu logistycznego w aspekcie koncepcji audytu logistycznego 9a	Prace naukowe Politechniki Warszawskiej

(continued)

Table 2.8 (continued)

Author(s)	Title of the article	Source (journal/book)
Ćwikła G., Grabowik C., Kalinowski K., Krenczyk D. (2015)	Case study of application of OPC technology in integration of laboratory equipment and software	Selected engineering problems
Francik K., Pudło M. (2017)	Znaczenie cyfryzacji MSP w różnych sektorach przedsiębiorstw przemysłowych	Przegląd nauk ekonomicznych
Frankowska M., Malinowska M., Rzeczycki A. (2017)	Kształtowanie modeli biznesu w erze Industry 4.0	Przedsiębiorczość i Zarządzanie
Gierej S. (2017)	Big Data in the industry—overview of selected issues	Management Systems in Production Engineering
Gliń W., Stasiak-Betlejewska R. (2017)	Analysis of the production processes automation level in Poland	Zeszyty naukowe. Quality. Production. Improvement
Götz M., Bartosik-Purgat M., Jankowska B. (2018)	International Aspects and Challenges of Digital Transformation	Gospodarka Narodowa
Götz M., Gracel J. (2017)	Przemysł czwartej generacji (Industry 4.0) – wyzwania dla badań w kontekście międzynarodowym	Kwartalnik Naukowy Uczelni Vistula
Górski F. (2017)	Building virtual reality applications for engineering with knowledge-based approach	Management and Production Engineering Review
Gracel J., Łebkowski P. (2018)	Analiza stopnia integracji procesów i systemów w modelu dojrzałości technologicznej firmy produkcyjnej manutech maturity model (mtmm) w Przemyśle 4.0	Innowacje w zarządzaniu i inżynierii produkcji
Gracel J., Makowiec M. (2017)	Kluczowe kompetencje menedżera w dobie czwartej rewolucji przemysłowej – Przemysłu 4.0	Acta Universitatis Nicolai Copernici. Zarządzanie
Grzyb K. (2017)	Cyfryzacja przedsiębiorstw produkcyjnych w Unii Europejskiej w perspektywie koncepcji Przemysłu 4.0	Prace Naukowe Wyższej Szkoły Zarządzania i Przedsiębiorczości z siedzibą w Wałbrzychu

(continued)

Table 2.8 (continued)

Author(s)	Title of the article	Source (journal/book)
Gudanowska A.E. (2017)	Transformation toward Industry 4.0—Identification of research trends and aspect of necessary competences in the light of selected publications	Research in Logistics & Production
Gudanowska A.E., Alonso J.P., Törmänen A. (2018)	What Competencies Are Needed in the Production Industry? The Case of the Podlaskie Region	Engineering Management in Production and Services
Hochuł A. (2017)	Identyfikacja źródeł innowacyjnych możliwości przedsiębiorstwa 4.0	Prace Naukowe Wyższej Szkoły Zarządzania i Przedsiębiorczości z siedzibą w Wałbrzychu
Iwański T. (2017)	Przemysł 4.0 i wszystko jasne	Napędy i Sterowanie
Janikowski R. (2017)	Zrównoważony i odpowiedzialny rozwój a miasto mobilnej produktywności	Optimum. Studia ekonomiczne
Jurczyk-Bunkowska M., Pawełoszek I., Wieczorkowski J. (2017)	Big Data w zarządzaniu działalnością operacyjną przedsiębiorstw produkcyjnych	Zeszyty Naukowe Politechniki Częstochowskiej Zarządzanie
Jurczyk-Bunkowska M., Pawełoszek I. (2016)	Big Data w zarządzaniu działalnością operacyjną przedsiębiorstw produkcyjnych	Zeszyty Naukowe Politechniki Częstochowskiej Zarządzanie
Jurdziak L., Błażej R., Bajda M. (2018)	Monitorowanie stanu taśm i połączeń szansą na zwiększenie zawodności pracy transportu ciągłego w kopalniach	Monografia Węgiel brunatny – dziś
Kiepas A. (2017)	Ewolucja wartościowania techniki w obliczu różnych wyzwań – od zwrotu normatywnego do Przemysłu 4.0	Zeszyty Naukowe. Organizacja i Zarządzanie /Politechnika Śląska
Kiraga K. (2016)	Przemysł 4.0: Rewolucja przemysłowa według Festo	Autobus: technika, eksploatacja, systemy transportowe
Kopp R. (2014)	Przemysł 4.0 i jego wpływ na przemysł kuźniczy	Obróbka plastyczna metali
Kovacs G., Kot S. (2016)	New logistics and production trends as the effect of global economy changes	Polish Journal of Management Studies

(continued)

Table 2.8 (continued)

Author(s)	Title of the article	Source (journal/book)
Kozłowski A., Wojtas P. (2017)	Systemowe podejście do cyfryzacji w procesach technologicznych w górnictwie	Zeszyty Naukowe Instytutu Gospodarki Surowcami Mineralnymi i Energią Polskiej Akademii Nauk
Krenczyk D. (2018)	Planowanie przepływu produkcji z uwzględnieniem ograniczeń systemu transportu wewnętrznego wspomagane systemami symulacyjnymi	Konferencja Innowacje w Zarządzaniu i Inżynierii Produkcji
Krystek J., Alszer S. (2018)	Komputerowe wspomaganie procesu sekwencjonowania – koncepcja Paint Shop 4.0	Mechanik
Kubicka A. (2017)	Wpływ nowych trendów konsumenckich na cyfrową transformację biznesu	Przedsiębiorczość i Zarządzanie
Łapuńka I., Marek-Kołodziej K., Wittbrodt P. (2017)	Zarządzanie 3.0 w Przemyśle 4.0	Innowacje w zarządzaniu i inżynierii produkcji (konferencja)
Łapuńka I., Marek-Kołodziej K. (2017)	Elastyczne systemy wytwórcze – rozwój w kierunku cyfrowej produkcji	Przedsiębiorczość i Zarządzanie
Łapuńka I., Pisz I. (2016)	Systemowy wymiar inżynierii zarządzania procesami, projektami i innowacjami	Zeszyty Naukowe Politechniki Śląskiej
Łobejko S. (2018)	Strategie cyfryzacji przedsiębiorstw	Innowacje w zarządzaniu i inżynierii produkcji (konferencja)
Magruk A. (2017)	Minimalizacja pewności w systemie Przemysłu 4.0 poprzez antycypację zdarzeń bezprecedensowych	Zeszyty Naukowe. Organizacja i Zarządzanie /Politechnika Śląska
Magruk A. (2016)	Wild Card as a Phenomenon Cushioning Uncertain Events—Example of Industry 4.0	Logistics and Transport
Magruk A. (2016)	Uncertainty in the sphere of the Industry 4.0—potential areas to research	Business, Management and Education
Gracel J., Makowiec M. (2017)	Zarządzanie wiedzą w modelu oceny dojrzałości technologicznej manutech maturity model (mtmm) w Przemyśle 4.0	Przedsiębiorczość a źródła przewagi konkurencyjnej w gospodarce opartej na wiedzy

(continued)

Table 2.8 (continued)

Author(s)	Title of the article	Source (journal/book)
Mączyńska E. (2018)	Państwo i rynek w warunkach rewolucji cyfrowej i przesilenia cywilizacyjnego	Studia i Prace Kolegium Zarządzania i Finansów
Michalski K. (2017)	Autonomizacja techniki i pożądane skutki eliminowania człowieka jako źródła błędów	Filo-Sofija
Nowicka K. (2017)	Rozwój świata wirtualnego i jego wpływ na e-mobilność	E-mobilność: wizje i scenariusze rozwoju
Oborski P., Bielicki B. (2017)	System przetwarzania danych pomiarowych wykorzystujący SPC do obróbki krótkich serii zgodny z ideą Przemysłu 4.0	Pomiary automatyka robotyka
Odważny F., Szymańska O., Cyplik P. (2018)	Smart Factory: the Requirements for Implementation of the Industry 4.0 Solutions in FMCG Environment—Case Study	Logforum
Olszewski M. (2016)	Mechatronizacja produktu i produkcji – Przemysł 4.0	Pomiary automatyka robotyka
Palka D., Stecuła K. (2018)	Postęp technologiczny – dobrodziejstwo czy zagrożenie?	Innowacje w zarządzaniu i inżynierii produkcji (konferencja)
Paprocki W. (2016)	Koncepcja Przemysł 4.0 i jej zastosowanie w warunkach gospodarki cyfrowej	Cyfryzacja gospodarki i społeczeństwa
Patalas-Maliszewska J., Skrzeszewska M. (2017)	Model rozwoju przedsiębiorstwa produkcyjnego w kontekście koncepcji Industry 4.0	Przedsiębiorczość i Zarządzanie
Pieriegud J. (2016)	Cyfryzacja gospodarki i społeczeństwa – wymiar globalny, europejski i krajowy	Cyfryzacja gospodarki i społeczeństwa szanse i wyzwania dla sektorów infrastrukturalnych
Pieriegud J. (2017)	E-mobilność jako koncepcja rozwoju sektorów infrastrukturalnych	E-moblinność: wizje i scenariusze rozwoju
Pluciński M., Mularczyk K. (2016)	Przemysł 4.0 w polskich przedsiębiorstwach produkcyjnych – szanse i zagrożenia	Przedsiębiorczość i Zarządzanie

(continued)

Table 2.8 (continued)

Author(s)	Title of the article	Source (journal/book)
Rot A., Blaicke B. (2017)	Bezpieczeństwo Internetu rzeczy. Wybrane zagrożenia i sposoby zabezpieczeń na przykładzie systemów produkcyjnych	Zeszyty Naukowe Politechniki Częstochowskiej Zarządzanie
Rozkwitalska M. (2017)	Miejsce uczenia się w naukach o zarządzaniu	Studia Ekonomiczne Regionu Łódzkiego
Rozkwitalska M., Slavik J. (2018)	Around learning and Industry 4.0 in management theory	International Journal of Contemporary Management
Rudowski M. (2017)	Współczesne rozwiązania i trendy IT a aktualne wyzwania w PKP	Problemy Kolejnictwa
Rudowski M. (2017)	Cloud computing w transporcie szynowym. Chmura – ale jaka?	Najnowsze technologie w transporcie szynowym, (materiały konferencyjne)
Sakowicz M. (2017)	Znaczenie obiegu danych w produkcji, czyli Przemysł 4.0	Napędy i Sterowanie
Saniuk S., Saniuk A. (2017)	Analiza sytuacji polskich przedsiębiorstw w sieciach przemysłowych w dobie Industry 4.0	Nauki o Zarządzaniu /Uniwersytet Ekonomiczny we Wrocławiu
Sąsiadek M., Basl J. (2018)	Świadomość i poziom wdrożenia koncepcji przemysł 4.0 w wybranych polskich i czeskich przedsiębiorstwach	Innowacje w zarządzaniu i inżynierii produkcji (konferencja)
Schulze R. (2017)	Czwarta rewolucja przemysłowa: wyzwania dla sektora produkcyjnego	Napędy i Sterowanie
Skala A., Gieżyńska K. (2016)	Translating Digital into High-Tech Economy	Scientific Editor Katarzyna Śledziewska, Smart Economy and Innovation
Spałek S. (2016)	Rozpoznawalność i stosowa zwinnego zarządzania projektami w polskich przedsiębiorstwach w świetle badań empirycznych	Zeszyty Naukowe „Studia i Prace Kolegium Zarządzania i Finansów
Stadnicka P., Litwin K., Antosz D., Safin D., Perłowski R., Rzucidło A. (2018)	Doskonale procesu planowania produkcji z wykorzystam elementów koncepcji Lean Manufacturing i Przemysł 4.0	Innowacje w zarządzaniu i inżynierii produkcji (konferencja)

(continued)

Table 2.8 (continued)

Author(s)	Title of the article	Source (journal/book)
Stasiuk-Piekarska A. (2017)	Zarządzanie ryzykiem w kontekście nauk o organizowaniu	Innowacje w polskiej nauce obszarze nauk ekonomicznych. Przegląd aktualnej tematyki badawczej
Stasiuk-Piekarska A. K., Wyrwicka M.K. (2015)	Organising—Still an Important Function of Production Management	Research in Logistics & Production
Stecuła K., Brodny J., Puzik K. (2018)	Stan i perspektywy zastosowania osiągnięć idei czwartej rewolucji przemysłowej w branży górniczej	Innowacje w zarządzaniu i inżynierii produkcji (konferencja)
Stefianiuk T. (2017)	New Dimensions of Information and Knowledge Security in Reality of Industry 4.0	Knowledge–economy–society selected problems of dynamically developing areas of economy
Stolarczyk A. (2017)	Kapitał ludzki – szanse i wyzwania w kontekście rozwoju koncepcji Industrie 4.0	Nierówności społeczne a wzrost gospodarczy
Szozda N. (2017)	Industry 4.0 and its impact on the functioning of supply chains	Logforum
Szterlik P. (2018)	The Fourth Industrial Revolution and Workforce—a Chance or a Threat?	Przedsiębiorczość i Zarządzanie
Szulewski P. (2017)	The concepts and components of the smart factory	Mechanik
Ślusarczyk B. (2018)	Industry 4.0: Are we ready?	Polish Journal of Management Studies
Świątkowska J. (2017)	Bezpieczeństwo fundamentem sukcesu czwartej rewolucji przemysłowej	Napędy i Sterowanie
Torbacki W. (2018)	Metodyka wyboru i wdrożenia systemu ERP w dobie rozwoju przemysłu 4.0	Innowacje w zarządzaniu i inżynierii produkcji (konferencja)
Torbacki W. (2018)	Transformacja logistyki w dobie koncepcji Przemysł 4.0	Autobusy: technika, eksploatacja, systemy
Wieczorkowski J., Jurczyk-Bunkowska M. (2017)	Big Data jako Źródło Innowacji w Zarządzaniu i Inżynierii Produkcji	Innowacje w Zarządzaniu i Inżynierii Produkcji

(continued)

Table 2.8 (continued)

Author(s)	Title of the article	Source (journal/book)
Wittbrodt P., Łapuńka I. (2017)	Przemysł 4.0 – wyzwania dla współczesnych przedsiębiorstw produkcyjnych	Innowacje w Zarządzaniu i Inżynierii Produkcji
Wojtas P., Kozłowski A., Wojtas M. (2017)	Cyfryzacja polskiego górnictwa metodą obniżenia kosztów i podniesienia bezpieczeństwa oraz jakości produktu końcowego	Mining—Informatics, Automation and Electrical Engineering
Wojtas P., Kozłowski A., Wojtas M. (2017)	Digitization of Polish mining industry by reducing costs and improving safety and quality of finished product	Mining—Informatics, Automation and Electrical Engineering
Wronka A. (2017)	Systemy ekspertowe jako narzędzie wspomagające zarządzanie logistyką produkcji	Przedsiębiorczość i Zarządzanie
Zaręba T. (2016)	Self-aware networks—cechy techniczne i implikacje technologiczne	Cyfryzacja gospodarki
Zawadzki P., Żywicki K. (2016)	Smart product design and production control for effective mass customization in the Industry 4.0 concept	Management and Production Engineering Review
Zawłocki I., Niewiadomski K. (2017)	Kształcenie i doskonalenie kadr pracowniczych w dobie czwartej rewolucji przemysłowej	Edukacja-technika-informatyka

Source Own elaboration (as at November 28, 2018)

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Chapter 3
"Valleys of Death" in Creating, Commercializing, and Diffusion of Key Enabling Technologies

Edyta Gwarda-Gruszczyńska

Abstract New technologies have been recognized as key drivers for corporate profitability and growth in today's fast-changing environment. Technical and technological progress has made innovations and new technologies a tool used by developed and emerging economies to achieve growth and improve competitiveness. Not all companies, R&D institutes, and universities creating new technologies are successful in their commercialization. In most cases, the reason is a "valley of death." Some new technologies are enablers. Their diffusion allows to create innovative products, processes, services in different industries. Not all technologies of this type, even if commercialized, spread to different industries. Some, more than others, influence the economy's development and innovativeness of different industries. A group of such technologies, recognized by the European Union as pivotal for increasing Europe's competitiveness, is known as Key Enabling Technologies (KET's). The aim of this article was to identify the theoretical and research gaps in the area of "valleys of death" in creating, commercializing, and diffusion of KETs. Examples of different approaches to KET's research and the "valley of death" problem are mentioned in this article. The methodology used was the literature review and desk research. The result of the conducted analyses is the identification of new research areas in technology commercialization and diffusion.

Keywords Valley of death · Technology commercialization · Technology diffusion · Key Enabling Technologies

3.1 Introduction

New technologies have been recognized as key drivers for corporate profitability and growth in today's fast-changing environment. Technical and technological progress has made innovations and new technologies a tool used by developed and emerging economies to achieve growth and improve competitiveness [37]. New technologies

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and innovations are ubiquitous both in the economic and social spheres. Market leaders build their competitive positions thanks to them and their efficient commercialization [6, 20, 35].

Rapid progress in the development of new technologies means that technologies and innovations reach their maturity faster and get old [7]. The awareness of inventors, entrepreneurs, and scientists of the need to efficiently commercialize the results of scientific research is growing [13, 18, 38]. More and more universities and research institutes are commercializing solutions or technologies created by research teams [31, 36]. The scale of commercialization is still too small to visibly increase the innovativeness of some economies, though.

Not all companies, R&D institutes, and universities creating new technologies are successful in their commercialization. In most cases, the reason is a "valley of death."[1] Many new technologies fail because of different barriers they meet in the process of transformation from being an idea to getting introduced to the market (e.g., market barriers, financial barriers, lack of resources). They fail at different stages of this process. Many entities are unable to bring new technology from an early-stage laboratory research to a proof-of-concept prototype and on to a full commercial scale. This leads to two market gaps that nips too many promising new technologies in the bud. These gaps are known as the early-stage "technological valley of death" and the later-stage "commercialization valley of death" [19, p. 3]. This pair of barriers is endemic to the most innovative technologies. As a result, many innovative prototypes never make it to the marketplace and never have a chance to compete with already established technologies. These "valleys of death" particularly plague capital-starved start-ups and entrepreneurial small- and medium-sized companies but also R&D institutes and scientific research at universities.

Time, knowledge about the processes of commercialization as well as the ability to build technological competitiveness and knowing how to overcome the "valley of death" is the basis for achieving success both by enterprises and scientific units creating new technologies [17, pp. 389–399]. However, even if they successfully commercialize new technologies, they may meet another problem. Some new technologies are enablers. Their diffusion allows to create innovative products, processes, and services in different industries. Nowadays, technology diffusion plays an important role [32]. Not all technologies of this type, even if commercialized, spread to different industries. It is not defined or described in the modern literature, but the reason may be a "technology diffusion valley of death."

Some technologies, more than others, influence the economy's development and the innovativeness of different industries. A group of such technologies, recognized by the European Union as pivotal for increasing Europe's competitiveness, is known as Key Enabling Technologies (KETs). They are an important part of Horizon 2020 and are considered to be a weapon aimed to increase Europe's productivity and competitiveness.

[1] The term is used as a metaphor to describe a relative lack of resources and expertise in the area of technology development and its commercialization.

Following the literature, one can observe that there were many articles and research on technology transfer and commercialization, some on technology diffusion, some on the "valley of death," and much fewer on Key Enabling Technologies as a group. All these problems are vital, and research in these areas is important for the EU and its members. There are still some gaps in literature and research that may be covered to improve the recognition of the aforementioned problems. Therefore, the aim of this article is to identify those theoretical and research gaps in the area of "valleys of death" in creating, commercializing, and diffusion of Key Enabling Technologies. The methodology used is literature review and desk research (analyses of articles, data, reports, projects, etc.).

3.2 Methodology

The major part of the literature review was carried out in 2012–2013 during the research about the processes of new technology commercialization in Polish and foreign companies. The literature review (about 200 articles) and quantitative research (208 Polish companies and 73 foreign companies) conducted at that time allowed to identify problems that companies commercializing new technologies face trying to implement at the market their technologies or technology-based products or services. That research helped to identify "the market for technologies and the market for ideas" concepts as well as the "valleys of death" in commercialization process.

Further research was conducted in 2015–2017. The research objective was to identify innovation diffusion idea, process, and problems. It had a form of desk research review and covered about 30 items. Articles, books, and doctoral dissertations were analyzed. It helped to identify "technology diffusion" and "innovation diffusion" terms and the differences between them and their analysis.

Next research was conducted in 2017–2018, and its aim was to identify KETs and their situation in Europe. The reason was to prepare the project proposal for national authorities. Several EU-financed projects about KETs were examined (projects financed in programs Horizon 2020 and Interreg), also European Commission reports and reports prepared by scientific institutes (e.g., ZEW), national agencies (AIRI, The Polish Chamber Of Commerce in Advanced Technologies), and data statistics of World Intellectual Property Organization (WIPO), European Patent Office (EPO), Polish Patent Office.

In 2018, the other literature review was conducted to recognize new articles, books' reports, and data in the analyzed area of interest.

The literature review is based on a selection of about 40 papers, which were collected and analyzed using the "theoretical saturation point method." Materials from different papers, reports, data statistics, previous research were reported using a frame with different items to fill:

– market for ideas concept;
– technology commercialization process;

– the "valley of death" concept;
– technology diffusion;
– Key Enabling Technologies.

Many papers and information selected dealing with the topic of KETs were written as of 2011 onwards, which reflects the fact that it is very recent area to explore. Older publications mentioned in the bibliography provide complementary information on topics related to the market for idea concept, commercialization, innovation, and technology diffusion, which are not new but of a significant importance nowadays.

It should also be emphasized that the area described and analyzed in this article is very current. It suggests many research limitations. Nowadays, science and new technologies are developing very quickly. A lot of research is done every year in different scientific institutions; the commercialization practice may overtake the research. There are more and more research projects financed by EU provided in the described area. The discipline is very dynamic, so it is easy to overlook some new information and publications.

3.3 Technology Commercialization, Technology Diffusion, and a "Valley of Death"

3.3.1 The Context

"Technology commercialization" and "technology diffusion" are terms used in a wider scientific area called "market for technologies and market for ideas." The market for technologies and ideas' concept enables a person to describe the decision issues in the knowledge flow from universities and research institutes to and within the industry for open innovation [4]. This knowledge flow is enabled by a complex set of contextual and cultural elements [34] composing of innovation, political and organizational systems, each of whom also enables research funding. Open innovation happening on the market goes beyond the commercialization of underutilized ideas, knowledge, technologies, or capabilities by companies, since it encompasses the development of a reliable business model and cooperation (strategic alliances, acquisitions, and mergers between organizations for resource complementarity). Research on the market for ideas focuses on the transaction process, competition, negotiation, the effect of the market safety configuration and trust [1]. The market for ideas is described by its specific elements and components: ideas, knowledge owners and seekers, and market realization modes [2]. Although not necessarily included in the open innovation context, IP protection is usually discussed. The promotion of free knowledge dissemination is also essential for economic contributions (especially in public research institutions) and calls attention to project knowledge spillovers as essential for effective entrepreneurship. New and incipient research objects and concepts comprise actors such as patent aggregators and topics

such as market efficiency for the IP marketplace, idea dissemination without monetary exchange, and the relevance of certain factors for innovation in this market [11]. The relevance of external or intermediary administered markets for ideas to generate more active markets to match the demand with the supply is argued. The technology intermediaries minimize the risk, not just by technology assessment and marketing but also by creating or enhancing the value of ideas as a result of organizations' ability to combine complementary assets, thereby allowing potential users to benefit from a new technology [12]. For this reason, in the practical domain, several incentives to establish technology and knowledge intermediaries are observed to support economic development by creating a market for underutilized inventions [25]. As intermediaries are still emerging as a concept and are not yet well explored, agents in the innovation system must yet discuss their efficiency and find better configurations for them. The intermediators' format fluctuates, comprising public, non-governmental, or private institutions. Several agents may act as intermediaries, including Technology Transfer Offices, students and employees, spin-offs, venture capitalists or business angel investors, and surrogate entrepreneurs [28, 30]. Spin-offs (or a supporting organization or entrepreneur) are intermediaries as they need to convince venture capitalists, angel investors, or surrogate entrepreneurs to act on or invest in their idea. In some industries, R&D processes are specialized and segmented across several companies by stage, and therefore, the R&D process in an innovation chain is fragmented. The market for ideas enables high-tech firms to commercialize ideas instead of products. In the same manner that specialized and innovative companies present diversified business models for technology commercialization [27], the intermediation process is also diversified. Some of the business models that are possible in this context include prototyping services; development stage biosciences; highly specialized component suppliers; specialized subcontractors; product and service solutions providers; highly specialized equipment; contract research, consulting, and product development based on strong internal system integration skills and capabilities; original equipment manufacturers; and co-design. The traditional view considers all new technology business to pursue product orientation and considers other modes complementary until the main goal is achieved.

3.3.2 Technology Commercialization

Technology commercialization itself is not a new area both in literature and research projects [5, 20, 35]. It started to become very popular especially in mid-1990s and since that time the trend continues. In Poland, the problem started to be popular in scientific literature on management in the early 2000s and is still important and vital. Technology commercialization is analyzed from the public policy point of view as far as the enterprises' point of view or scientific-research units' point of view [15, 31]. Authors in different publications describe problems like innovation system and triple helix, technology transfer, commercialization processes, intellectual property and financing aspects (both on the macro and micro level), technology transfer

and conditions of technology commercialization, technology evaluation, technology readiness, and other problems. There are many publications about the role of Technology Transfer Centers, Innovation Centers, Incubators, Technology brokers, etc. There are also numerous articles and books on technological entrepreneurship. Three mostly described problems in the "idea to market" process are financing, technology transfer, and business academic cooperation. In the worldwide literature, commercialization is very often connected with new technologies and this process is willingly analyzed by the government agendas.

3.3.3 The "Valley of Death"

The term "valley of death" is used in different articles and books on technology commercialization. The phase "valley of death" was employed by Bruce Merrifield in 1995 to refer to the challenges of transferring agricultural technologies to Third World countries. The phase was subsequently applied to describe the resource gap between R&D laboratories or units and the commercialization within organizations. Since then, the term has been further extended to describe the funding handoff from governmental to private sources of renewable energy technologies [29]. In the worldwide literature, "valley of death" was not used or seldom used so far as a tool for identifying and understanding a critical area of development that has not been adequately addressed. There are not so many case studies available on the "valley of death" in Polish entities creating and commercializing new technologies. Seldom, the "valley of death" is divided into an early-stage problem and a later-stage problem (technological and commercialization "valley of death").

3.3.4 Technology Diffusion

There are also not many publications and research on technology diffusion processes of technologies commercialized by companies or research institutes [14, 23] and no identified publications on "technology diffusion valley of death." Most of the theory is connected with technology diffusion to different countries. Analyzing the literature, one can notice that during the past several decades, the number of diffusion models for examining the diffusion of products and technologies has been on the increase. The domain literature related to this area can be divided into two parts: diffusion theory and models, technology diffusion, and patent citation.

The Rogers Innovation Diffusion Theory is often used to analyze the process. Diffusion theory is centered on the processes, whereby an innovation "is communicated through certain channels over time among the members of a social system" [33]. There are four main components: innovation, communication channels, time, and social system to determine the features of the diffusion process of an innovation. The innovation process spread through society in a way that is reflected by the S-shape

curve, with early adopters selecting the technology first, followed by the majority, until a technology or innovation is considered common.

One of the most popular models is the Bass diffusion model. This model has been successfully used in various fields, such as industry, agriculture, education, marketing, in order to measure the growth rate, penetration level, and potential adoption rate [26]. Bass analyzed the diffusion process through consumers' behavior under the basic assumption that the probability of initial purchase is related linearly to the number of previous buyers. Buyers or adopters may be innovator or imitators. While the number of previous buyers does not influence innovators in the timing of their initial purchase, imitators are strongly affected by the number of adopters. Bass's model has been successfully used in various fields in order to forecast growth rate and usage of numerous new and innovative technologies with an emphasis on predicting the ultimate level of penetration and the rate of potential adoption. Bass model implies exponential growth of initial purchases to a peak and then exponential decay. The shape of the diffusion curve is therefore a function of the rate at which awareness of the new product develops, as well as of the product's appeal. The model can predict how many customers will eventually adopt the new product and when they will adopt.

When we talk about the technology diffusion model, the main difference from the above models is that the diffusion object changes from product to technology. There are many approaches to technology diffusion in the industries. In practice, technology conferences, product exhibitions, and technology licensing and transfers are possible ways to diffuse technologies [3]. However, the diffusion effect of the above methods cannot be observed or measured clearly. A patent is a medium for disclosure of a technology. There are more and more studies focusing on the technology diffusion or knowledge spillover among industries through patent data [26].

3.4 Key Enabling Technologies

3.4.1 Key Enabling Technologies—EU Perspective

The KET's concept is seen by the European Commission as a non-sectoral and broad approach to industrial innovation: "KETs are knowledge intensive and associated with high R&D intensity, rapid innovation cycles, high capital expenditure and highly-skilled employment. They enable process, goods and services innovation throughout the economy and are of systemic relevance. They are multidisciplinary, cutting across many technology areas with a trend towards convergence and integration." KETs aim at the re-industrialization of Europe, which is about industry participation.

The KET's concept originated during discussions within the Information and Communication Technology (ICT) community and semiconductor industry. A policy to strengthen the European ICT industry was needed in order to strengthen the

industrial base. But this proved to be relevant to other industries as well, and a non-sectoral approach using technologies as enablers crystallized. The following five KETs were regarded as strategically the most relevant:

– nanotechnology;
– micro- and nanoelectronics, including semiconductors;
– photonics;
– advanced materials;
– biotechnology.

A sixth, more overarching, KET was added to include the manufacturing side of the industry: advanced manufacturing technologies.

In addition to the six individual KETs, the combination of KETs is also considered to be of importance. Within the Horizon 2020 program, cross-cutting KETs are therefore seen as pivotal to innovation: "The cross-fertilisation of different KETs is vital, in particular for the transition from R&D to pilot and industrial scale production."

Increasing efficiency and effectiveness in innovation policy was the starting point for the KET's strategy. One of the key aspects of the KET's strategy is addressing Europe's major weakness: the translation of its knowledge base into goods and services. With the final report of High-Level Group on KETs [21], the first evoked the concept of the "valley of death":

– "technological valley of death," in which further capital is needed to develop a commercial product and prove its basic market viability.
– and the "commercialization valley of death," where entrepreneurs seek capital to fund first-of-a-kind commercial-scale projects or manufacturing facilities. The implication is that support to cross the valley of death is not only about technology (product/manufacturing), but it should also address organizational and market issues.

The desk research shows that there are not many articles on KETs. More interest in the topic show scientists and international project teams applying for the EU financing (e.g., Horizon 2020, Interreg). KETs are often analyzed as individual technologies. KET industries and competitiveness of companies operating in these industries are analyzed as far as commercialization processes (mostly commercialization of biotechnology and nanotechnology). KETs are also discussed in connection with regional development problems and intelligent specializations [9, pp. 273–289]. There is little research on technological competitiveness of KETs in different countries and their importance to raise the economic growth and European value chain. More focus is on technological competitiveness of KETs as technologies than on technological competitiveness of entities commercializing KETs and technology diffusion. To analyze KETs, researchers more willingly choose qualitative research (case study examples) than quantitative research [24].

3.4.2 Key Enabling Technologies—Importance for European Development

KETs are a core part of Horizon 2020. They are considered pivotal to foster innovation and market growth of future high-tech goods and services in a variety of industrial sectors, such as automotive, foods, chemicals, electronics, textiles, energy, environment, pharmaceuticals, construction, aerospace, and telecommunication. An estimate of the overall global market related to the six KETs provided a figure of some 650 billion euros in 2008, expected to rise to more than 1 trillion euros by 2018. In terms of R&D on KETs, Europe is leading (it holds some 30% of the global patent share, export from EU countries accounts for 23% of world exports in KET-based products), but is lagging behind to other competing economies, such as the USA, in translating this knowledge into marketable products [16]. European Commission expects KETs to play an increasing role for R&D and innovation in Europe, with remarkable funding to support it and market opportunities expected in a short–medium terms.

KETs are very important for European countries and Poland among them. KETs have two specific characteristics that separate them from other "enabling technologies":

– They are embedded at the core of innovative products.
– They underpin strategic European value chains.

Combinations of KETs are embedded at the core of most advanced products. Mastering of KETs is absolutely required to ensure that we can produce within Europe, future innovative products, and is therefore a strategic priority to ensure the competitiveness of the European industry [21]. It is these KET-enabled products that subsequently allow Europe to address its grand societal challenges such as "de-carbonization of transport" which requires the development of radically new "energy-efficient vehicles" enabled by advanced KET's capabilities and capacities.

KETs underpin innovation in many strategic sectors and play a key role in making new products and services affordable for the population at large. They contribute to the development of disruptive technologies across sectors such as:

- energy (e.g., renewable energies, bio-fuel, solar energy);
- transport (e.g., lighter, safer, and energy-efficient transport vehicles);
- manufacturing (e.g., reduced material and process rates, energy saving);
- chemistry (e.g., green processing);
- environment (e.g., sensors for environmental monitoring);
  - information and communication (e.g., chips for nomadic, multimedia convergence, and cloud computing);
- medicine (e.g., gene therapy and genetic testing);
- consumer goods (e.g., mobile phones, lighting).

They also contribute to the build-out of a more productive, competitive, energy, and resource-efficient economy. Products with enhanced features have the potential to

bear high economic value as well as ensure a more comfortable, healthy, and safe life for European consumers and workers in a clean environment.

The mastering and deployment of KETs in Europe are expected to provide significant economic benefits, offering a widening variety of uses in an increasing number of application areas and industries, as well as contributing to energy and resource efficiency, through innovative materials, processes, technologies, and applications. Europe's biggest competitors in KETs are North America (the USA, Canada, Mexico) and East Asia (Japan, China including Hong Kong, South Korea, Singapore, India, Taiwan). In general, the results for all six KETs show that both the share of patents and the share in total export have increased for Asia, decreased for North America and remained rather constant for the EU-28 throughout the last 3 years [21].

3.4.3 Key Enabling Technologies—Measuring and Monitoring

Some attempts are taken to identify the KETs potential within the EU. The number of patents in KETs was identified for the EU member countries based on the European Patent Office (EPO) and the World Intellectual Property Organization (WIPO) statistics. The patent activity in KETs is comparable to the Innovation Scoreboard classification of innovativeness of different European countries.

Some attempts are taken to measure and monitor the performance and development of KETs in Europe both among the EU-28 member states and vis-à-vis its main competitors in other world regions.

In order to monitor EU performance in a comprehensive way, a set of indicators is used to capture performance at different stages of the value chain [21]. The analysis rests on two complementary approaches, the technology generation and exploitation approach and the technology diffusion approach. While the technology generation and exploitation approach look at the ability of countries to generate and commercialize new knowledge, the technology diffusion approach investigates the likely impacts of KETs on the wider economy [14].

The chosen indicator framework also addresses the well-known "valley of death" when commercializing a new technology. While technology indicators report the production of new technology, production and trade indicators help to identify the extent of successful commercialization of this new technology and hence indicate whether the "valley of death" could be passed. The technology diffusion approach even goes beyond this perspective and looks at the potential of successfully commercialized new technology to trigger innovation and competitiveness across many industries.

Besides the research and measurements done by the European Commission on KETs [16, 21], there are several projects financed by the EU, national governments, or national organizations analyzing different aspects of KETs. A comprehensive understanding of the situation on KETs (such as the existing competencies, clusters,

technology readiness, market development, etc.) in comparison to the EU countries is essential to identify challenges and opportunities that the EU approach to KETs will offer to the national industrial and R&D players.

The Center for European Economic Research (ZEW) completed the research on "European Competitiveness in Key Enabling Technologies" [10]. The purpose of this study was to analyze the technological competitiveness of Europe in six KETs. In addition to analyzing the state of technological competitiveness, they explored the challenges and weaknesses that may affect future prospects of these KETs in Europe and discussed the policy actions that may be needed to strengthen technology performance and advance commercial applications. In particular, the study investigated, for each KET: the performance of actors from Europe (both enterprises and public institutions) in producing new technology compared to the main competing regions (North America, East Asia); the industrial sectors and fields of applications that are most affected by a certain KET; the likely medium-term market potentials and application prospects; the factors that are likely to drive technological and commercial success; the market and system failures and other barriers that may impede technological progress, and how these failures are tackled by policy activities; the role of governments for the development of each KET, focusing on public funding of R&D, fiscal incentives, public procurement and lead markets. Based on these findings, they derived policy conclusions on how to strengthen the EU's technological competitiveness in these KETs. The project team concluded that the magnitude of macroeconomic productivity effects from KETs will depend on:

- the speed of diffusion of KETs;
- the breadth of diffusion across many sectors and user groups;
- the occurrence of network effects when using a certain KET;
- the maturation of a KET in terms of the variety of technological applications and innovative solutions that have been developed over time.

3.4.4 Key Enabling Technologies—Italian and Polish Approaches to the Opportunity

Some attempts are taken to identify the KETs potential within the EU. The number of patents in KETs was identified for the EU member countries based on the European Patent Office (EPO) and the World Intellectual Property Organization (WIPO) statistics. Picture 1 shows the results. The patent activity in KETs is comparable to the Innovation Scoreboard classification of innovativeness of different European countries.

Some European countries, more than others, see the opportunity in the development and promotion of KETs. The difference may be the result of the innovativeness level of the country. According to the European Innovation Scoreboard, Italy and Poland are representatives of different groups of innovators. Italy is a more innovative country than Poland who is at the fourth place at the end of the EU members

in the ranking. According to the data of the EU in 2011, Italian inventors presented much more patent applications in Key Enabling Technologies (5314 applications) than the Polish inventors (505 applications). Such a big difference in patent activity was an important reason to choose the countries for the comparison. Both countries represent different innovativeness level which translates into a state of KETs and national level activities to recognize and support these technologies.

Italy may be a good example of KET recognition and analysis activities at the national level. The Italian Association for Industrial Research (AIRI), with the support of the National Research Council (CNR), established in 2012 the Working Group on "Key Enabling Technologies," aiming to assess their impact and define a vision on KETs at the national level. The Working Group was composed of experts from the industry and academia, used as background information on priority technologies for the Italian industry prepared on a regular basis by AIRI since the 1990s. One of the expected outcomes of the work was to help to bridge objectives and needs of the industrial research players with competencies and skills of academia, toward technologies and sectors relevant to the economy of the country [22].

As a conclusion for the Italian study, the Working Group found out that KETs contribute to all the eight Priority Technologies for the industrial sectors; more than 80% of the Priority Technologies include at least one KET; more than 50% of the Priority Technologies include at least three KETs. This shows the remarkable contribution given by KETs to the R&D activities of the Italian industry. In all these areas, KETs contribute and are often enabling to develop components, devices, and systems along the value chain of the technology processes or product considered.

There is still not much local research and activities conducted to recognize the Key Enabling Technologies (KETs) in Poland. There is no research on technological and commercialization "valleys of death" or technology diffusion processes and mechanisms in KETs as far as KET's diffusion value chain is concerned. At the national level, the opportunity seems not to be of high importance. There is only one KET platform, but it is not providing much knowledge about technological competitiveness of the Polish KETs and other interesting aspects in terms of the project objective [Baza KET]. There are also some projects oriented to KETs as individual technologies or KETs in SME.

The Polish Chamber of Commerce of Advanced Technologies (Polska Izba Gospodarcza Zaawansowanych Technologii) in the project "Baza KET" identifies five KETs that are developed in Poland (biotechnology, nanotechnology, photonics, advanced materials, and micro and nanoelectronics). Despite the increasing expenditure on R&D (according to GUS in 2017 in biotechnology increased by 8,5% and in nanotechnology by 8,9% comparing to 2016) and an increase in the quantity of entities (e.g., from 71 nanotechnology enterprises in 2013 to 88 in 2017; from 44 biotechnology enterprises in 2011 to 188 in 2017), the "technological valley of death" and the "commercialization valley of death" still seem to be a huge problem for the Polish entities creating KETs. Technologies developed within KETs in Poland do not contribute enough to increasing the Polish innovativeness which is still at a low level [8]. Developed technologies do not spectacularly contribute to a raise in the quantity of new innovative products in Poland and other countries. According to

EUROSTAT, the export of high-tech products and technologies is still at a low level. Most often Polish companies export electronic products (89%), computer equipment (95%), and pharmaceuticals (91%). It may suggest that Polish entities developing and commercializing KETs also face the "technology diffusion valley of death."

In Poland, most information, case studies, and statistics are shown in the fields of biotechnology and nanotechnology, and the other KETs seem to be less recognized. There is no integrated knowledge about KETs, their "valleys of death," and their technology diffusion processes and models.

3.5 Conclusions

The literature review and desk research allowed to identify some theoretical and research gaps that may be covered by further research projects and implicate some new research discussions and research areas. They may also have some implications for practice.

Gap 1 is connected with the "valley of death." The research shows that there is a limited number of publications and research on the "valley of death" phenomenon. It may suggest that most of the authors of current publications concentrate more on the commercialization process itself but not on the reasons for failures within this process what can have a big importance for the practice.

One can observe the limited use of the "valley of death" concept as a tool for identifying and understanding a critical area of development that has not been adequately addressed. The tool and developing the diagnostic methodology may be a valuable input for companies and research institutes commercializing their research results, technologies, and innovations.

There is also limited research on technological and commercialization "valley of death" in KETs. There are also a limited number of in-depth case studies on "valley of death" in KETs, what opens new research area for scientists and creates cognitive limitations to these companies or research institutes who create KETs and want to implement them in their products. Case studies are examples of real situations that can help to understand commercialization processes.

Gap 2 concerns the technology diffusion. The author of the article has mentioned the limited number of publications and research on technology diffusion processes as a next step over the commercialization stage. There is also a limited number of publications and research on technology diffusion of KETs. There are no publications on "technology diffusion valley of death." However, the term is hypothetical and the research in this area may bring interesting results.

Technology diffusion is important for both technology inventors and technology users. This topic has strong practical implications. Many new, valuable technologies when they are getting old in the industry for which they were created could be used in different industry and bring value and money to other companies but nobody knows about their utility for the certain industry. It opens new research area.

Gap 3 is related to KETs as a research object. Commonly in literature and research, KETs are often analyzed as individual technologies. There are a limited number of projects doing complex analysis of KETs. There is a limited research on technological competitiveness of KETs and their importance to raise the economic growth and European value chain. There is little research on technological competitiveness of entities commercializing KETs. Especially in low innovative countries like Poland, there is limited local research and activities to recognize Key Enabling Technologies (KETs) and there is no complex approach to the problem. The research in this area may contribute to show the problem to the national and local authorities and companies and contribute to the raise of national, local innovativeness and competitiveness of companies. New technologies, especially KETs, may increase productivity what is important especially for European countries and companies operating in Europe.

Gap 4 is connected to the methodology of research on KETs and "valley of death." To analyze KETs and "valley of death," researchers more willingly choose qualitative research (case study examples) than quantitative research. However, the literature review and desk research show that there is an unsatisfactory quantity of case studies and very few quantitative studies in this area. It opens new possibilities for researchers. The research and created case studies may help managers of companies to understand the reasons for failures and the reasons for successes in commercializing KETs.

The identified gaps are of interest to the project started at the University of Łódź but may also be an inspiration for other researchers interested in this field. Better understanding and recognition of the "valleys of death" in creating, commercializing, and diffusion of Key Enabling Technologies may help companies, universities, and R&D institutes to recognize and bridge them and, as a result, increase their competitiveness.

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Chapter 4
Analysis of Ground-Breaking Technologies and Their Effect on the Functioning of Enterprises

Edyta Bielińska-Dusza

Abstract The primary goal of this paper has been an attempt to present breakthrough periods in the functioning of an enterprise, conditioned by ground-breaking technologies. In this study, two approaches to analyzing the notion of technology have been indicated in an original way, and five prisms have been distinguished through which it can be constructed. In addition, key inventions in the history of humanity have been identified together with their effect on the enterprise. Importantly, three main periods of the breakthrough have been indicated in the functioning of an enterprise. The research method used to solve the scientific problem is structural analysis and causal analysis. The first has enabled the identification of ground-breaking technologies, and the second one has identified changes taking place in the functioning of enterprises.

Keywords Technology · Definition of technology · Ground-breaking technologies · Technological change · Innovation · Invention · Enterprise

4.1 Introduction

Technology creates new challenges for enterprises, plays an increasing role in business operations, and over the centuries has often revolutionized their principles of functioning. On the one hand, it allows improvement in operating effectiveness, while on the other hand contributes to hazards and unpredictable events, inhibiting efficient management. Technology can be a result of discoveries, inventions, and innovation, but also often they are just technology themselves, which creates changes, progress, economic growth, or revolutions. It is important to remember that the relation is bilateral and highly correlated, and rigid differentiation of this problem is extremely complex, subject to the context of examination, time and seems unjustified. However, over the centuries technology has undoubtedly undergone massive transformations from a simple method, skill of manufacturing, treating it as a model, influence on

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relations between social, psycho-socio-cultural phenomena, up to its autonomy and possibilities of improvement of an enterprise.

Though these problems are an interesting area of scientific examinations, it seems that it is marginalized by the subject literature. That is why the purpose of this study is to present breakthrough periods in the functioning of an enterprise, conditioned by ground-breaking technologies. In this study, two approaches to analyzing the notion of technology have been indicated in an original way, and five prisms have been distinguished through which it can be construed. In addition, key inventions in the history of humanity have been identified together with their effect on the enterprise. The original analysis included in this study has allowed inventions to be indicated along with identification of a series of various devices and laws of physics, contributing to its creation. This task was particularly difficult, since, along with the degree of complexity of the technologies the difficulty grows in answering the question of how different technologies contributes to creating the subsequent one. Significant is also the fact that changes in technology happen very slowly and, while it is relatively easy to indicate key inventions from a few hundred years ago. Now, due to incomplete knowledge, regarding the development of a particular technology in the future, it is quite difficult. The method allowing achievement of the aforementioned research intentions is analysis and classification.

According to T. Pszczołowski, analysis is a method of action consisting of receiving the output through a division of a certain whole into smaller elements [1]. The use of analysis as a key research process usually can be narrowed down to the implementation of its two basic objectives.

The first one is called structural analysis and consists of determining the structure of the object by indicating the elements constituting it, determining the characteristics of the whole as well as individual parts and identifying and clarifying the relationships that occur between the elements of the whole and describing their nature. This structural analysis enables the identification of technological breakthroughs.

The second one, identified with causal analysis, seeks to understand the mechanisms of functioning of the examined whole by identifying the changes that occur in it, determining the factors affecting the whole, as well as the strength, direction, and intensity of the influence of these factors on the changes of the whole. This sort of analysis identifies the breakthrough changes taking place in the organizations under their influence.

While generally understood classification is a process of dividing and combining, which, through multi-purpose transformation of the structure of an object or a set is to lead to putting the elements of the structure or a set in order [2]. The task of classification itself may assume different forms of grading, taxonomic ranking, and ordering. The pursuit of classificatory solutions is intended to determine the direction and the scope of systematization and hierarchization. Systematization is an "activity consisting in listing—in a single-stage or a multi-stage system—the components of the given whole, basing on the type classificatory criterion." Whereas, hierarchization "is an ordering activity referring to simple elements of single classes of similarity (division) in a given classificatory rank or to classificatory ranks, and it consists of their placement according to the section of validity, the temporal sequence

(chronology of occurrence) or also because of causality relation" [3]. Another name for the multi-level classificatory system is the "hierarchical classification" where the word "hierarchy" indicates superiority from the point of view of the conceptual scope of the set divided in relation to subsets introduced, as a result of classification.

Apart from the above, this study is based on a literature review, in particular, the principles of a classical review and a narrative review method which was used as a subsidiary method. Moreover, it was the starting point for further analysis.

4.2 Characteristics of the Notion of Technology

Technology plays a significant role for the man, organization, world economy as well as is a significant element of the society's culture. Often it is the reason for radical changes, contributes to the pace and directions of development, shapes competitiveness and according to J. A. Schumpeter, is a source of economic growth; however, it can be noted that this increase contributes to the development of technology. As justifiably noted by A. Zakrzewska-Bielawska today, technology is a key factor in building value for the client, investors and other stakeholders [4]. It should also be noted that it brings along a number of hazards, both macroeconomic and microeconomic ones.

We can note that there is no unified approach to determining the term technology (see [5–10]) and unambiguous opinions about its essence. The diversity in interpretation results among others from its complexity [11], the context of examination of the given problem area, or passage of time. This proves do the omnipresence of technology and challenges related to understanding it. Already at the very beginning, we come across the problem related to distinguishing the notions' technique and technology. The authors, such as P. Lowe or E. Agazzi, justifiably remark that there is a certain type of continuity between these terms, consisting in that technology remains within technique and is in a way its new branch, which can be understood as "applied science" [12, 13].

On the other hand, other distinguished scientists W. E. Bijker, T. P. Hughes, and T. J. Pinch believe that "technology" is a sensitive term, and the notions such as "technological change" and "technological development" often carry vast interpretational burdens along and devotion of too much effort does not pay off [14].[1]

Analysis of the subject literature has made it possible for us to distinguish two approaches to the examined problem area:

[1] In the subject literature one can observe replacement application of the terms technique and technology, with the prevailing use of the latter one. This disproportion results, among others, from incorrect translation from English as well as suggesting the scientific nature or at least the theoretical dimension of the particle -logy in the word 'technology' which is typical of names of various scientific disciplines. It also seems that this kind of neosemantism is very difficult to overcome and with time these terms will become increasingly equivalent. That is why, taking account of the above, both the notions are treated interchangeably in this paper.

- **narrow** (traditional)—focusing on technology as hardware, machines, and devices (the so-called hardware) used by people in the work process.
- **wide**—including general tasks, material assets as well as manufacturing methods and techniques used in business operations or even social-technological phenomena.

The representatives of the first approach are, among others: Bain [15], Woodward [16], Blau et al. [17], and Barley [18]. However, limitations related to such perception of technology have induced researchers to propose a broader approach, undoubtedly being a supplement of the first one. This allows treating technology as an important variable in different types of organizations as well as pays attention to its non-organizational aspect. Key researchers involved in this problem area are Thompson [19], Pierow [20], Eveland [21], Pearson and Young [22], and Szatkowski and Mitchem [23] it should be noted that the latter approach, unfortunately, creates interpretational ambiguity.

Additionally, technology can be perceived through the prism of:

- **knowledge, science**—this approach interprets technology as a scientific discipline, independent from other disciplines, perceived more broadly than just theoretical knowledge [24]. Other known researchers who have seen technology in this way were Burgelman et al. [25], Gudanowska [26];
- **product**—shows that technology is a specific product of the man, to create which technical knowledge has been used in the first place [27], inseparably related to the functioning of the man. Researchers such as Smitha and Sharif [28], Hatch [29], and W. B. Arthur define technology in a similar manner.
- **resources of an enterprise**—being its key, strategic element. This has been indicated among others by Stonehouse et al. [30] or A. Zakrzewska-Bielawska.
- **methods and technique**—it is probably the most frequent method of defining technology, pointing to a set of methods and techniques used by the man for manufacturing and action. In this meaning, technology is also a general tool for improving competitiveness, depending on many other factors [31, 32]
- **process**—within which technology is a focused process of manufacturing products based on theoretical and practical knowledge, incorporating various activities, performed in a strictly defined way and in proper order. The researchers seeing the problem in this way are among others C. Christensen, Raynor [33], Karpiński [34], Santarek [35].

In connection with the above, for the purpose of this study the following definition has been adopted:

> collection of mutually supplementary methods, tools and algorithms for preparation, performance, maintenance and assessment (analysis) of the process of processing or manufacturing a specific material good, energy or information that uses available knowledge, machines and equipment.

It seems that the proposed definition fulfills the assumptions adopted in this part of the study. However, it should be emphasized that to understand the essence of the

contemporary technology, one should also take account of the external conditions the complex nature of which requires the technologies to also be complex in this area.

4.3 Identification of Ground-Breaking Technologies

The above-made characterization of the technology notion shows that this term is highly diversified and difficult to be unambiguously determined. That is why in this part, we would like to focus on showing the evolution of technology and indicating the primary, ground-breaking technologies which had an effect on business functioning and were the basis for identification of breakthroughs characterized in the last part of the study.

The basic question allowing for specifying the technological breakthroughs was the problem of indicating the causes for their formation which we see in the evolution of technology and breakthrough inventions, originating from one or many scientific achievements in the past. Those being the foundation for further solutions, and innovations which established changes in agriculture, industry and services, triggering further variations in economy and business, culture, society, and technology. It can be noted that an invention replaces a recognized technology, a product which contributes to creating a totally new product. It is revolutionary enough to allow for ceasing the application of the previous ways of conduct and replace a recognized technology. Simultaneously, being flexible enough, it gives new opportunities for its use. Passage from one to the second method of manufacturing, functioning in the world, also results in revaluing, changing the standards, principles of action in science, practice, with particular focus on changes in the functioning of the enterprise. The process of evolutionary-revolutionary technological changes does not proceed in a linear way but is characterized by non-continuous technological changes, related to a single moment of discoveries and significant development over the period from the Industrial Revolution with the peak in the period of the scientific and technical revolution from the 1950s until the end of the twentieth century. A summary has been presented in Table 4.1.

A basic problem we have encountered in our research was identification of the mere primary inventions (e.g., practical application of electricity or telecommunication infrastructure was possible by inventing a series of various devices and laws of physics), as well as specifying the date of key effect (not always the moment of inventing, patenting or the first definition meant this significant effect on the humanity, organization. It should be treated rather as an estimate than unambiguous decision) and the discoverer. However, it seems that from the point of view of the development of science, the pursuit of the answer seems unfounded. In addition, technological changes happen very slowly. Sometimes slowly enough to be difficult for their contemporary observers to notice.

In the paper, an attempt has been made to indicate significant inventions, innovations, which contributed to the formation of breakthrough technologies, or were

Table 4.1 Historical evolution of ground-breaking technologies

Period	Dates and general characteristics	Meaning
Antiquity (approx. mid thirty-fifth century BCE to 476)	9000 BCE–7000 BCE—agrarian and agricultural revolution—domesticating plants and animals	*Process—cultivation of plants and animal breeding* Revolutionary economic and social changes, settled life and creation of more complex social forms, development of culture as well as adjusting nature to the needs of the man
Neolithic revolution (10,000–40,000 BCE)	4000 BCE—inventing the wheel is an undoubtful breakthrough in the history of humanity also having a great symbolic meaning	*Product—wheel* Development of civilization and culture, transport, trade, and industry
	3500 BCE–3300 BCE inventing the letter is one of the most important inventions of the humanity making it possible to record information	*Process—writing* Possibility of recording, using symbols, possibility of coding, keeping documentation, cooperation, trade
	3300 BCE—480/450 years BCE—smelted ore, bronze and iron	*Process—smelting metals* Possibility of obtaining tools, weapons, machines and equipment, development of civilization
Middle Ages (476–1453)	approx. 1439—development of print (J. Gutenberg)	*Process—print* Possibility of making faithful copies in shorter time, spreading information, development of knowledge, education, science and technology, social, cultural, political transformations

(continued)

Table 4.1 (continued)

Period	Dates and general characteristics	Meaning
Modern times (1453–1914	– **1712**—Inventing steam engine and 1732 steam machine to drive rotary machines (T. Newcomen) – 1976—Beginning sale of engines improved by J. Watt, of T. Newcomen. From the point of view of development of the organization, we can not ignore other areas of mechanization of production processes: – 1733—Inventing the mechanical shuttle (J. Kay) – 1764—Inventing the mechanical spinning frame (J. Hargreaves) – 1784—H. Cort, 1797—H. Maudslay—Change in the method of plastic iron processing affecting transformation of metal manufactories into machine factories	*Product—steam engine transition from agriculture-based economy, manufactory or craftsmanlike production to mechanized factory production; it is a process of business, social, economic, technological and cultural changes. Industrial Revolution*
Industrial Revolution 18th century	Practical application of electricity was possible by inventing a series of various devices and laws of physics. We can indicate among others: – approx. 1600—Using the Latin word *electrcus* to refer to the power created as a result of friction of objects (W. Gilbert) – approx. 1600—Using the term electricity for the first time (T. Browne)- approx. – 1663—Flow of electric charge (O. Guericke) – **1753—**Discovery of electric induction (J. Canton) – 1780—Discovery of the presence of electric phenomena (L. Galvani) – 1800—Inventing the galvanic cell (A. Volta)	*Product—electricity electrification, economic, social, economic, technological and cultural changes*
	The invention of electricity meant a new age in telecommunications techniques and resulted in creation and development of telecommunication infrastructure. It is related to a number of inventions but undoubtedly a key role was played by: – **1792–1794**—Inventing the first optical telegraph line (C. Chappe) – 1839—Creating electric telegraph (Ch. Wheatstone, W. Fothergill Cooke) – 1848—Building the first telephone (A. Meucci) – 1876—Patenting the first electromagnetic telephone (G. Bell)	*Product—telegraph, phone* Possibility of distance transmitting of information using means of communication; development of telegraphic telecommunications, business and economic, social, technological and cultural changes
Second Industrial Revolution nineteenth/twentieth century	*Developing the transport infrastructure*: *maritime transport* **– 1783**—Inventing the steamer (M. C. de Jouffroy) *Rail transport* – 1801—Designing diesel engine and 1804 building rail steam locomotive (R. Trevithick) – **1830**—The first railway line (G. Stephenson) *Road transport* – approx. 1859—Inventing the first commercial internal combustion engine (E. Lenoir); – 1876—First modern internal combustion engine (N. Otto) – **1883**—Car with a gasoline engine (G. Daimler, C. Benz) *Air transport* – 1903—Inventing airplane (Wright brothers)	*Product—steam engine, diesel engine, internal combustion engine, steamer, steam locomotive, car, aircraft* Development of economy, transport, trade and national, international tourism, business and economic, social, technological and cultural changes

(continued)

Table 4.1 (continued)

Period	Dates and general characteristics	Meaning
	– 1913—Manufacturing line—mobile vehicle manufacturing line—(H. Ford)	*Product—production line development of the economy, transport, trade and tourism, business and economic, social, technological and cultural changes*
	– 1926—Mass production (the notion popularized in Encyclopedia Britannica, after an article which was written based on correspondence with Ford Motor Company)	*Process—mass production possibility of producing large quantities of standard products, improvement in productivity, economic growth, increase in total production, emergence of a homogeneous group of consumers*
20th century	*Development of communication infrastructure* *Computer* – 1945—Electronic computational machine ENIAC (Electronic Numerical Integrator and Computer), (chief J. P. Eckert and J. W. Mauchly), new era in the development of the civilization and beginning of the digital revolution. Creation is related to such inventions as among others: – 1800—Building the first mechanical logical machine (Ch. Stanhope) – 1854—Creating two-element algebra logic, until now the foundation for operations of computer elements (G. Boole) – 1948—Building the transistor (J. Bardeen)	*Product—computer* Transition from the mechanical and analog technology to digital electronics, digitization, and implementation of IT solutions in the operations of the man, common availability of information, distance transmission of information, changes and economic and commercial, scientific—technological, social, cultural development
Third Industrial Revolution (scientific-technical the 1950s—today)	*Artificial intelligence—demonstration of intelligence by machines such as people's intelligence (Artificial Intelligence)* – **1950—**First artificial intelligence laboratories Carnegie Mellon University, (A. Newella, H. Simona as well as Massachusetts Institute of Technology J. McCarthy – 1956—Computers learning checkers strategy (Dartmouth College)- 1980—expert systems as a form of programming artificial intelligence	*Process—automation of areas of the company's operations. Creation of smart factories and limiting the participation of people in enterprises to a necessary minimum. A new business model will be created, based on flexibility, efficiency, and speed*

(continued)

Table 4.1 (continued)

Period	Dates and general characteristics	Meaning
	Cellular telephony: – 1917—Patenting a hand-held foldable phone with a very thin carbon microphone (E. Tigerstedt)- – 1947—The idea of cordless telephony based on cells (Bell Labs)-1956—introduction of a mobile terminal (Ericson) – **1973**—Radio telephony system (M. Cooper) – 1965—Sending a commercial telecommunication satellite Early Bird (Intelsat 1) (Space and Communications Group)	*Product—mobile phone* Distance transmission of information *Product—Internet access, electronic mail, mobile device with Internet connectivity* Revolutionary changes in traditional business models, electronic business, development of international trade, revolutionized distribution channels, crowdsourcing, social networks, common access to knowledge and information, exchange of information, information war, "e-revolution" in communication, multimedia connections. Creation of ICT conditioning the functioning of contemporary enterprises, societies
Digital revolution	– 1988—Second-generation cellular systems (2G) system GSM (CEPT); 1997—Third-generation cellular systems (3G) (IMT—2000/UMTS) (ETSI—European Telecommunications Standards Institute); fourth-generation cellular systems LTE standard (Long Term Evolution). New generations are introduced on average every decade – 1992—Smartphone—portable device combining functions of a mobile phone and a portable computer (PDA—Personal Digital Assistant). Introduction to the market in 1993	*Product—instant messenger use of computer network to send instant messages between two or more computers, video conferences*
	Internet – 1955—Inventing the optical fiber—(Kapan) and 1988—placement of transoceanic fiber optic cable TAT-8 (consortium of enterprises led by AT & T Corporation, France Télécom and British Telecom. Laboratories AT & T Bell) – 1960—Design of a global chain of computers (J. Licklider), – **1969**—First connection between computers in ARPANET—DARPA Web (Defense Advanced Research Project Agency) – 1965—Electronic mail, e-mail—(sending information between users of the same computer (L. Pouzin, G. Schroeder, P. Crisman) – 1971—Sending text information between computers (R. Tomlinson) – 1989—Project of creating a network of hypertext documents, named World Wide Web—(T. Berners-Lee, R. Cailliau) – 1990—Creating the basics of HTML and the first Web site (T. Berners-Lee); – 1993—First graphic web browser—Mosaic (NCSA (National Center for Supercomputing Applications)-broadband access to the Internet (Broadband Internet Access) – 1997—Registering google.com domain – 1997—First mobile device with Internet Nokia 9000i Communicator	

(continued)

Table 4.1 (continued)

Period	Dates and general characteristics	Meaning
	Instant messenger (Instant Messenger—IM) a program making it possible to send fast text, audio or video messages, based on cloud data processing technology – 1970—Creation of the first instant messenger prototype (UNIX system) – 1988—IRC (Internet Relay Chat) created by J. Oikarin – 1996—ICQ first instant messenger—by Mirabilis	
	Nanotechnology production with the use of technology in order to achieve very high accuracy and exceptionally small dimensions (precision 1 nm). Becomes the carrier of access to and development of technology – *1931—Building the electron microscope-first device making it possible to see nanoparticle structure, at the atomic level—M. Knoll, E.* Ruska – 1959—Vision of engineering at the atomic level R. Feynman – **1974**—introduction of the term "nanotechnology." N. Taniguchi	*Process—incomparable possibilities of achieving revolutionary progress in education, technology, and production, which may also have an enormous social effect.* Leads to new linkages affecting the enterprise, the economy
	Virtual organization – 1980—First use of "virtual office"—P. Littmann, S.A. Jansen or V. E Giuliano?? check!! **– 1986**—Introduction of the term "virtual organisations" A. Mowshowitz – 1993—Ground-breaking publications by W. H. Davidow, M. S. Malone popularizing and harmonizing the term	*Process—virtual organization* Remote use of resources, particular form cooperative networks, flexibility, smaller costs of operations. New business model for enterprises
	Computational clouds (Cloud Computing) – 1996—First application of the term—G. Favaloro – 2006—Presentation of the term on an industry conference—G. E. Schmidt – **2007**—Promoting activities by companies Amazon, Microsoft and IBM	*Process—possibility of using resources remotely.* Complete change in the approach to performing IT infrastructure-based business processes. Possibility to focus on the basic functions of the operations
	Internet of things, objects, (Internet of things–IOT), Internet of Everything (Internet of Everything–IoE) – 1999—First use of the term K. Ashton to describe a network combining objects in the physical world with the Internet – Beginning of 2009—creation of integrated mobile applications	*Process—communication with the Internet and ability to independently broadcast data.* Automatic generation, exchange and use of data with minimum intervention of the man, resulting in change of the model of interaction of things with the Internet. Almost unlimited use of smart devices in the sector, the enterprise. New business model for enterprises

(continued)

Table 4.1 (continued)

Period	Dates and general characteristics	Meaning
	Modern biotechnology—Methods from the scope of the biotechnology are used for thousands of years, but the modern biotechnology uses genetically modified enzymes, proteins, organisms unlike the classic one that uses organisms naturally present in nature or substances produced by them 1919—First use of the word biotechnology (Károly Ereky) 1996—Cloning Dolly lamb—seems to be the largest breakthrough in this domain of science	*Process—provision of goods and services using biological methods.* Implementation of technical and economic solutions, allowing problems of biotechnological processes to be solved on the industrial scale. It is design of devices, technologies, manufacturing possibilities
	Integrated ERP systems (Enterprise Resource Planning) computer system for supporting resources management in an enterprise. It allows performing managerial function in all the functional areas of the company (production, sales, and others), however, the main area for support and the basis for functioning and processing in these systems is the broadly understood area of finance **– 1960s**—First applications supporting business management—IC programs (Inventory Control—inventory control), – First use of ERP abbreviation in the 1990s—Gartner Group	*Process—improvement in operations of areas of the enterprise, higher effectiveness of the processes, better use of resources*
21st 2002 beginning of the digital era	*Big Data—advanced techniques of analysis of large data collections* – late 1920s—IBM redesigns Basile Bouchon's invented perforated card – 1997—First definition (M. Cox M., D. Ellsworth) – 2000—Formulation of the definition of large data collections as three dimensions (D. Laney) **– 2002–2003—**creating Nutch engine used for searching and indexing content of pages (D. Cutting, M. Cafarella)	*Process—parallel processing of large quantities of diverse data from various information sources and departure from the classical data storage scheme*
	Block chain—decentralized transaction platform in scattered network infrastructure – 1991—First works on cryptographically protected block chain were-S. Haber, W. Scott Stornett – **2008**—First blockchain conceptualized by a person (or group of persons) known as Satoshi Nakamoto	
Revolution digital	*Technological singularity (singularity)—alleged point in the development of the civilization, when any human predictions will become invalid due to fast technological progress* – 1958—First use of the term (S. Ulam). – 60. XX—Deliberations on the consequence of creating machines that are more intelligent than men (I. J. Good) – 1980—Popularization of theory of I. J. Good (V. Vernor) – 2045—Final product	

Source prepared by the author

such technologies and on the basis of which further technologies inventions were developed. In addition, from the point of view of the subject of the publication, attention was concentrated on those technologies which had or have a key effect on the development of enterprises and have significantly affected the principles of their functioning.

4.4 An Attempt to Determine the Breakthrough Periods in the Development of Enterprise

Technology development results in the need for changes in business management. On the one hand, they should flexibly adjust their operations, functions and methods of work organization, and management to the radically changing operational conditions. On the other hand, it is often just themselves who are the carrier of technology and determine directions and ways of business operations. The company's development thus depends on both internal and external technological factors determining business functioning. On the other hand, the ability to adjust to the conditions, and in particular, determination of technological trends largely determines the effects of the operations, competitiveness, and development opportunities.

The analysis performed above undoubtedly indicates that under the effect of technological changes conditioned by inventions, innovations over the centuries, enterprises have undergone a number of transformations that we can present in the form of certain breakthrough periods. As justifiably noted by M. Lisiński, M. Szarucki, period of a breakthrough is a specific critical point, a turning point, and a fundamental change, which creates a new, original, and important quality [36]. T. S. Khun, on the contrary, shows that the special achievements, with adequate originality and attractiveness, able to turn the attention of a fixed group of enthusiasts of a given theory and characterized by openness, leaving various problems to be solved, become a revolution [37].

Therefore, an effect of our research approach was distinguishing of breakthrough periods that are not hermetic, unambiguously identified events in the given place and time but are affiliated with each other and function within a certain structure and interdependence over the particular time span. Thus, examining them as independent, isolated beings is a certain artificiality, on the contrary, they should be interpreted as a certainly closed whole after being matched with certain facts. In addition, we will want to solve this complex research approach to the evolution of changes in the functioning of enterprises as a result of technology development, assuming a different research perspective than previously, namely through the prism of considering revolutions identified in science. Indicating their effect on the enterprise as well as a perception of technology over this period. The problem area of revolution is the subject of interest of numerous researchers and can be differently classified. However, our research procedure will be focused around three main periods the boundaries of which are the ground-breaking discoveries or inventions:

- **I—related to the Agrarian Revolution** (duration from 9000 BC–approx. 1700)
- **II—related to the Industrial Revolution** (duration 1732–approx. 1950)
- **III—related to the scientific and technical revolution** (duration 1950–today).

Below we will present a brief analysis of each period, indicating significant, in our opinion, transformations in the functioning of enterprises, determined by primary inventions or innovations.

The first period related to the agrarian revolution longest one, lasting several thousand years, resulted in changing the lifestyle from nomadic to settle. This has contributed to the formation of more complex social forms, development of culture, first communication methods and formation of first non-agrarian professions being a result of increased productivity. Although we can date back the development of a professional enterprise and management to the period of the Industrial Revolution (II period we have distinguished), the following inventions have been intentionally included in the paper—e.g., wheel, writing, printing, or smelted ore, bronze and iron—preceding this period, since we believe that from the very beginning, they have revolutionized the life of humanity throughout the whole period of its duration and had an enormous effect both on the society's culture and the further development of businesses as well as match the assumptions of this study. From the point of view of business operations, this period can be characterized by the presence of manufactories and craft organizations.

In this period, technology is perceived as art, ability, or craft. It is the basis for knowledge about the world and is the man's basic ability. It is also knowledge about the proper implementation and is the source for solving problems of the man and improvement in its life. As professional management or classic forms of business are not present in this period, we can not also speak about technology management.

The second period is linked with the Industrial Revolution and inventing the steam machine, as well as inventing the mechanical shuttle of the mechanical spinning frame, or the production line. They have become the reason for deep business, social, economic, technological, and cultural changes. Physical work automation led to an expansion of business resulting in a concentration of the industrial production processes, improvement in productivity, ability to produce large quantities of standard products, emergence of economy scale, centralization of factories but also demand for professional management. This period is characterized by significant technology development, resulting in the breakthrough discovery of electricity, which allowed the development of telecommunications and its infrastructure, the electric engine, or information technology. This invention meant a new age in the history of humanity and business management. The discovery of telephone and telegraph allowed for distance broadcasting of information using means of communication, thereby shortening time and distance. In addition, inventing internal combustion, diesel engine, or steamer results in a dynamic development of the transport infrastructure. It is possible to travel by sea, air, and railway and is also booming. All this results in new, so far unknown opportunities both for businesses and the whole economy, which, after periods of war, is dynamically developing already not only on the national but also international scale.

Undoubtedly, these factors contribute to very large production growth, but also to the emergence of negative phenomena, e.g., breakdown of public finances, higher inflation, increase in the regulatory role of the state, or creation of financial institutions [38]. This period marks the formation of industrial society and explosion of the Industrial Revolution in England, then in the USA and Western Europe. It also means drastic changes in the mentality of manufacturers, employees, and customers. As justifiably noted by M. Lisiński, M. Szarucki very important become, so far hardly significant, demographic phenomena, for example, the pace of growth of the world's population as well as the phenomenon of migration. The year 1955 is also the unprecedented situation of the number of administrative employees becoming higher than the number of blue-collar workers. Business functioning in this period involves a number of intraorganizational as well as external changes.

Technology of this time is perceived through the prism of tools, methods, machinery, devices and industrial processes. R. J. Tulley even concludes that it almost systematic industrial knowledge, of the most important industrial areas, e.g., spinning, weaving, and metallurgy [39]. To a certain extent, this is a personification due to considering machines and industrial processes (engineer as an example of coding sex). It takes account of many skills, methods of performing the activities. This becomes important from the point of view of competitiveness; however, nevertheless, it is treated more as a factor making intraorganizational development easier, contributing to improvement in productivity, increase in total production, and expansion to international markets.

The third period is linked to the scientific-technological revolution where the main role is played by science and intellectual capital. Epochal achievements of this period can be observed in almost all sciences. From the point of view of our deliberations, particularly essential is the development of IT tools, such as automation of work processes, integrated management systems, development of the communication infrastructure, further improvement in means of transport and communication, and development of nanotechnology. It also means passage from the mechanical and analog technology to digital electronics, digitization and implementation of IT solutions, common availability of information, virtualization and digitization of businesses, or finally artificial intelligence. The inventions of this period and their development contribute to changes in all spheres of life of humanity, and thus also affect enterprises and force a new code of behavior. Undoubtedly the most important invention of this time was the computer, which initiated the digital revolution, development of information and communication technologies (ICT). These technologies are regarded as the main causal factor in the development of the modern world. Virtualization of businesses, computational clouds, Internet of things, use of big data, or blockchain completely changes approaches to performing IT infrastructure-based business processes. Allowing, on the one hand, better focus on the basic functions of the operations, on the other hand, contributing to creation of a new business model. On the other hand, the intensified development of artificial intelligence contributes to the creation of smart factories and limits the participation of people in enterprises to a necessary minimum. A business model based on flexibility, efficiency, and speed is emerging. Scientists', futurologists' theories can be also found, saying

that machines will autonomously make decisions, act concurrently by communicating between themselves, not involving the man. Let's hope that the concept of technological personality (singularity) will never come true since it would mean the last invention of the man in history.

In the third period, technology is treated as an independent and determinist strength shaping the reality, development of which cannot be stopped and it is out of any control. We are approaching a technology being dependent on strength, which we can moderate and which is something more than a collection of machinery, devices, methods, or processes. Perceived broader than the collection of theoretical knowledge, it can be considered as an independent scientific discipline having a significant effect on the formation of social, cultural, and psychological phenomena. On the other hand, these phenomena can form the technology itself, contributing to new inventions, innovations, often being just such an invention or innovation. It gradually becomes adapted to the needs of a particular enterprise. Its new possibilities of application are often discovered and often different from the creators' primary intentions. This also means analysis of mutual linkages between education, technique, and business. More and more often attention is focused on using it as a source of competitive advantage. Enterprises improve ways and methods of technology transfer as well as cooperation going beyond the sector of their operations. New organizational forms are created, e.g., technology transfer centers, broker systems, facilitating an acquisition of technology and cooperation. We can say that such an approach focuses on a mutual improvement of the enterprise and technical solutions correlated with the psycho-socio-cultural aspect from the point of view of the common achieving of the goal. There are opinions that technology becomes too autonomous and is not subject to human control. Its development is spontaneous and cannot be stopped.

The above-made identification of breakthrough periods in the development of enterprises and their synthetic assessment from the point of view of primary inventions, technologies, does not resolve all matters. However, it seems that it indicates a number of material phenomena that determine the development of this research area and must be treated more as problem areas that require further discussion than final determinations.

4.5 Summary and Conclusions

We have underlined above that the problem area related to the definition of technology, as well as identification of the main key inventions for humanity and thus for businesses, is not easy. The definition of technology itself in its complexity is extremely difficult, and this analysis is complicated by the diversity of views on this subject in the literature, its essence, lapse of time as well as the prism of perception. We are also aware that the above-presented summary does not exhaust all possible definitions as technology is connected with almost every aspect of a functioning of the state, enterprise, society, and every activity of the man, and it can be understood both in the context of knowledge, science, methods, tangible items, or processes.

However, it is important, regardless of the context, to take account of its multidimensionality. We have tried to propose a certain way of thinking about technology, technological changes, inventions that are able to or have ground-breaking importance and effect on the principles of functioning of the enterprise. On the contrary, the presented ground-breaking periods, resulting from technology development, or emerging inventions, innovations, should be the starting point for further discussion and broader research in this area. We are aware that the primary inventions we have specified are not the final determinations. They can rather be an inspiration or indications for further research on this complex problem.

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Chapter 5
Knowledge Sharing and Creativity: Individual and Organizational Perspective

Aleksandra Rudawska

Abstract The flow of knowledge between employees contributes to the knowledge development which in turn influences individual and organizational creativity. However, knowledge sharing by employees is not a simplistic and homogeneous behaviour. Basing on the literature review in the area of intraorganizational knowledge sharing and creativity, the author aims to explain the relation between giving knowledge and individual (giver) creativity and organizational creativity. The knowledge sharing is analysed from the knowledge giver perspective. Author has distinguished two forms of knowledge giving—proactive and reactive—that are situation depended. This conceptual article indicates that proactive and reactive knowledge sharing relates differently with creativity and that sharing knowledge with others is not always positive to the giver's creativity, while it is influential for organizational creativity. The theoretical deliberations are summarized in nine propositions. They indicate that managers need to take into account the likelihood of individual creativity loss as a cost of reactive knowledge sharing; otherwise, the quality of sharing could be harmed by knowledge manipulation by the sharer, with a negative influence on organizational creativity.

Keywords Proactive and reactive knowledge sharing · Individual creativity · Organizational creativity

5.1 Introduction

The capability of developing and implementing innovation is a major source of competitive advantage. Innovations are the effect of both incremental modifications and also completely novel and original approaches to the problems resulting from creativity. The concept of individual, group and organizational creativity has become an important and popular research subject. Scholars in different fields are trying to

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answer the question of enhancing and stimulating individual, group and organizational creativity.

Creativity in organizations is a multilevel concept which includes individual, group and organizational levels [1], and it is assumed that lower-level creativity (i.e. individual creativity) influences that in the upper levels (i.e. group and organizational) [2, p. 295]. To this end, the individual level was chosen as the key point of this analysis with some respect to the organizational level.

One of the important antecedents of individual creativity is knowledge dissemination among individuals [3], mainly in the form of direct interactions [4 pp. 125–130]. The behaviours of knowledge seeking, receiving and assimilating contribute to creative behaviours of employees. Though the relations between knowledge transfer (receiving knowledge) and creativity or innovation have been studied and indicate a positive connection [5, 6], the relations between giving knowledge and creativity or innovation have also been analysed but to a lesser extent, with the results not being consistent [7–10].

This article argues that the perspective of knowledge giving (supplying) should not be underestimated, because, in order to obtain and absorb knowledge by one individual, the other one has to supply it while assuring a proper quality of transfer. Having in mind, on the one hand, the importance of creativity (on the individual level), and on the other hand, the individual costs of sharing (giving) knowledge [11], the question is about the relationship between giving knowledge and the creativity of the giver. Moreover, the perceived individual outcomes of the behaviour will influence the future attitudes and behaviour of an individual [12]. This would mean that if sharing knowledge harms individual creativity, it is more likely that an individual will be more hostile to sharing in the future, so managerial intervention will be necessary to prevent that opportunistic behaviour. The author also argues that knowledge sharing behaviour takes place through different mechanisms [13] like giving knowledge in reply to an inquiry or giving knowledge resulting from the sole knowledge owner initiative. This implies the question, whether the form of knowledge sharing behaviours relates to different consequences regarding the individual creativity of the giver and organizational creativity.

The main purpose of this conceptual article is to explain the relations between giving knowledge by an individual to others and his/her individual creativity, as well as the creativity at the organizational level. The deliberations are conducted from the knowledge supplier perspective, taking into account the two forms of knowledge sharing behaviour—reactive and proactive—identified using the criteria of the individual that initiates the knowledge sharing interaction. By differentiating individual and organizational creativity, the author aims to show that sharing knowledge has different outcomes at individual and organizational levels, which indicates the necessity for managerial interventions.

Drawing on the literature on knowledge behaviours of individuals and individual, team and organizational creativity, the author aims to contribute to better understanding of the phenomenon of knowledge sharing behaviours of individuals and the possible barriers of sharing that result from the perceived consequences of sharing on the individual performance of knowledge givers.

5.2 Method

The conceptual propositions presented in the article have been drawn on the literature from the growing field of knowledge sharing by individuals in organizations and individual, team and organizational creativity.

The initial review of the literature started with the examination of a concept of knowledge sharing by analysing literature available in the electronic databases (basic search knowledge sharing) and was narrowed to the knowledge sharing by individuals in organizations that consequently let to such constructs as knowledge transfer, knowledge collecting, knowledge donating, knowledge sharing intention, knowledge sharing behaviour, knowledge hiding, knowledge hoarding, knowledge manipulation. One of the conclusions on this stage was that knowledge sharing is a complex behaviour, and on this level of field development, there is need to separate the knowledge donor's perspective from the broader perspective of the participant in the process of sharing (giver and receiver together). This part of the study has led to the concentration on the sharing from the knowledge donor's perspective and analysing the situational influence on the giver's behaviour.

The second group of literature considered creativity of individuals, teams and organizations and relation with the knowledge sharing. In this part of the literature review and analysis, the main emphasis was placed on the field and experimental studies that examined the knowledge sharing and creativity/innovation relations. What the author was looking for were any inconsistencies in the relations or counter-intuitive results. The effects of analysis and synthesis are collected in the propositions in the article. The article includes, due to the limited space, only some main works found in the field that were the building blocks of the deliberations presented.

5.3 Knowledge Sharing by Individuals

Knowledge sharing is a social interaction that takes place between two or more persons during which knowledge is transmitted by one and subsequently received and absorbed by the other(s) through a variety of information transmission methods [14, p. 873]. It is worth mentioning that face-to-face contact and communication enable the richest information transfer, while electronic or paper messages make the poorest transfer (phone communication is in between) [15, p. 124]. Additionally, face-to-face interactions are particularly important when it comes to tacit knowledge sharing. Knowledge sharing success takes place when shared "packages of knowledge" are received and internalized by the recipient. The results of sharing should be noticed in changes in the recipient's cognition and behaviour.

In the situation of sharing, especially tacit knowledge, positive effects of sharing for the knowledge giver can also occur. During the process of communicating knowledge, in the mind of the donor knowledge re-creation may emerge. Sharing involves self-observation, reflection, analysis of one's activities, thinking patterns

and suggested solutions, in order to prepare the knowledge package for the recipient [16, pp. 373–374].

There is a complementary condition of successful knowledge sharing (internalizing and recreating knowledge)—that is the individual's interest in the knowledge domain. The interest influences individual motivations to participate in the sharing process and determines knowledge development. This interest in the knowledge domain depends on the level of possessed knowledge (expertise), past experience and the tasks in hand [4, pp. 213–223].

In the process of sharing, the knowledge giver plays an important role, as without that participation there is no sharing. Besides personal factors (personality traits, intrinsic motivation), the decision of the knowledge giver to share the knowledge depends on the perceived costs and benefits of sharing. From this, knowledge sharing is a situational and episodic behaviour, stimulated by the interaction between the giver and the recipient [17, p. 278] and other organizational conditions. Sharing knowledge then is not a simple homogeneous (of one form) behaviour and in various situations (of interaction) may have a different course with distinct factors conditioning it.

Applying the interactionist perspective, according to which "the behaviour of an organism at any point in time is a complex interaction of the situation and the nature of the organism" [12, pp. 279–280], the author proposes to distinguish two forms of knowledge sharing behaviour, by specifying the situation of deciding about sharing or not. There are two situations: (1) the knowledge sharer is provoked (solicited, induced, inquired) to give knowledge; (2) the knowledge sharer gives knowledge voluntary, spontaneously. In the former situation there is a reactive (directed) knowledge sharing and in the latter there is a proactive (unrestrained) knowledge sharing [18, 19]. Each of these two situations influences the course of sharing and causes different outcomes (for the giver and recipient) because of the differences (between giver and recipient) between interest in the process of sharing and in the domain of the shared knowledge.

Reactive (directed) knowledge sharing is transferring knowledge to a recipient as a result of some form of inquiry and can involve passing information, sharing experiences, giving instruction or expertise, showing specific solutions or way of action, or helping the recipient in the current task [17, 19, 20]. The knowledge recipient defines the knowledge package needed; when it is needed; and how it should be transmitted. The knowledge donor needs to decide (sometimes immediately) how to respond to the inquiry (if at all)—timing, the scope of knowledge, language and form of transfer. Reactive knowledge sharing is hard to plan for a knowledge donor, as the person would not know when somebody is going to ask for knowledge and with what expectations (considering the time of response). In this situation, the potential knowledge sharer, when deciding about sharing or not, needs to have regard to the social consequences of the behaviour chosen (giving knowledge—full, partial, manipulation; not giving knowledge—hiding knowledge, refusal). Moreover, that knowledge request could be within their expertise domain but not in the domain of their current interest.

Proactive (unrestrained) knowledge sharing is initiated and directed by the knowledge donor. In this situation, the initial scope of the knowledge, aim, time and way

of sharing can be planned by the knowledge donor. The shared knowledge could involve insights, ideas, opinions, concepts and skills or expertise that the knowledge donor is willing to externalise and to voluntarily share from the observed needs of the other individuals. In this case, when the initiative of sharing is on the donor side, the sharing is more favourable for the sharer. The transfer will concern the knowledge domain within the interest of the knowledge donor, the timing will be more appropriate (not interrupting any important activities), and the knowledge receiver will be suitably selected (within the interest of the sharer).

5.4 Individual and Organizational Creativity

Creativity is a process that leads to the production of an original (novel—different from what has been done before) and useful (appropriate to the problem or opportunity presented) product (idea, product, process or solution) [21, 22, pp. 17–19]. Woodman and Schoenfeldt [12] state that creativity is the complex product of an individual's behaviour in a given situation that is characterized in terms of contextual (e.g. physical environment, task and time constraints) and social (e.g. social facilitation, norms, social rewards) influences, which either facilitate or inhibit the creative accomplishment of that individual. This perspective points out that creativity is not only an individual dependent behaviour, but it is also influenced by various antecedent conditions. Creative behaviours of employees are not only assigned to the engineers or R&D employees. The creativity can occur at almost every position in the organization, because it is the behaviour that leads to developing a new and applicable way of solving a problem, realizing the task, etc. There are areas in organizations where creativity is more expected and desirable; nevertheless, it may occur everywhere.

Amabile [23], in her componential theory of individual creativity, has also identified situational conditions (social environment) that influence creativity [23, pp. 9–10]. That external component of creativity can influence each of the three intra-individual components of creativity, namely (1) domain-relevant knowledge and skills (expertise), (2) creative thinking skills, and (3) intrinsic task motivation. Her theory suggests that creativity will be greater, the higher the level of each of the three intra-individual components [21, pp. 42–46], and none of the intra-individual components can be completely absent if creativity is to result.

Woodman et al. [2, p. 301] claim that knowledge plays a crucial role in individual creativity, as new solutions are "little more than a new combination" of what was already known or experienced by the individual and stored in the memory. Perry-Smith [3, p. 86] states that when an individual has more domain-relevant knowledge, the incidence of creative performance is higher. Also, with expertise, knowledge increases the likelihood that the potential solution is validated as useful. In this line, Gilson et al. [5] analysed that the explicit knowledge possessed by individuals positively influences their creativity, and knowledge sharing positively moderates the relation between team tenure diversity and the individual knowledge of the peers.

Similar conclusions can be drawn from Dong et al. [24], as they found the positive relation between the individual skills' development and creativity that is moderated by the knowledge sharing in the team. Here, the sharing knowledge compensated low level of individuals' skill development in the team. This means that knowledge sharing enables access to the diversified knowledge of team members and by this improves individual creativity [25]. The relation between knowledge giving and creativity at the individual level was studied in only few works, among which is the article of Park et al. [9]. They have found that knowledge giving does not directly influence individual donator's creativity, but it is related indirectly by knowledge creation. This implies a question when knowledge sharing contributes to creating knowledge and when it does not.

According to Bratnicka [1, p. 34], organizational creativity is the ability of organizations to generate new and useful ideas. And referring to the individual creativity concept, organizational creativity is a function of the creativity of individuals and groups and contextual influences (also those that come from the external environment) [2, p. 308]. Organizational creativity is not just a simple aggregate of the creativity of individuals and groups, as between them there is a continuous interaction where the creative behaviour of individuals contributes to the creative behaviour of groups and the creative performance of the organization. From the other side, the organization creates the context and social conditions of the individuals' behaviour.

From the perspective of creating new knowledge in organizations, Nonaka stated the importance of frequent communication, dialogue, tacit and explicit knowledge transfer, as important conditions of producing novel and useful products [26]. Woodman et al. [2, p. 314] also claim that information flow and open communication channels are important for organizational creativity.

In empirical research, Darroch [27] (studying Australian companies) found at the organizational level that processes of knowledge dissemination are connected with innovation (with innovation the successful implementation of organizational creative products). Similarly, in analysing Taiwanese organizations, Lin [8] concluded that employees' willingness to donate and collect knowledge positively influences innovation capability. In Italian companies, Giustiniano et al. [6] found a relation between collecting knowledge by individuals and organizational creativity. On the opposite side, Fong et al. [28] found that knowledge hiding influences negatively team creativity as it weakens team absorptive capacity. Kamaşak and Bulutlar [7] analysed knowledge flow at the individual level and group exploratory and exploitative innovation and found that knowledge collecting is important for every kind of group innovation, while knowledge donating—only for exploitative purposes. This study revealed differences between donating and collecting knowledge in relation to group creativity.

Considering the above-listed arguments, it can be stated that access to knowledge in an organization, gaining and learning from others positively influences individual creativity when looking from the perspective of receiving (absorbing) knowledge [29]. However, it is not so obvious when looking from the knowledge giver side (see in example [9, 30]). In the following section, author is taking an attempt to explain why the relation knowledge donating individual creativity is not clear.

5.5 Sharing Knowledge and Creativity—Perspective of the Knowledge Giver

Knowledge sharing is connected with the social dilemma, where individual rationality (trying to maximize the individual payoff) leads to collective irrationality. Cabrera and Cabrera describe that an individual when contributing knowledge to others in the organization bears the individual costs of sharing (time, disturbance at work, losing exclusive information advantage) while the benefits are rather collective (positive image, better team performance) [31, pp. 692–694] or even individual but postponed in time (possibility of gaining compensation in the form of knowledge from others—reciprocity).

Research on individual creativity has revealed that exposing individuals to receiving and absorbing knowledge, within the domain that the individual is working in, influences his/her creativity [3, p. 86], because it improves the understanding of that knowledge domain and facilitates creating new approaches for solving problems and doing tasks. It is assumed that searching for knowledge, support or help and receiving it is related to creativity, as it facilitates the production of novel ideas (with new, different perspectives of the issue at hand) and fosters evaluation of their appropriateness. As it comes to the relation between giving knowledge and creativity, the influence is not clear-cut.

In the subsequent sections, the relation between reactive and proactive knowledge sharing and creativity at the individual and organizational levels will be analysed as it is presented in Fig. 5.1.

The analysis is conducted with the perspective of three situational factors related to sharing knowledge: (1) the opportunities of sharing (time pressure); (2) the scope of knowledge and level of interest; (3) the insistence on giving knowledge to somebody (not hiding).

5.5.1 Reactive Knowledge Sharing and Individual Creativity

Reactive knowledge sharing is strongly directed towards the needs of the knowledge recipient. In reactive knowledge sharing, the knowledge recipient (who is asking

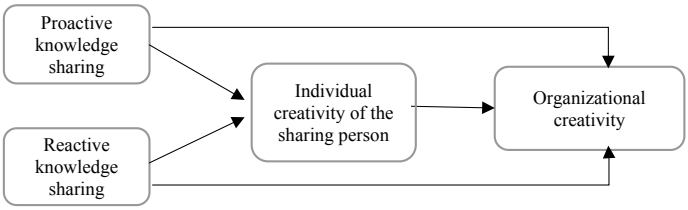

Fig. 5.1 Framework of the conceptualized knowledge sharing and creativity relations

for knowledge) initiates the episode of sharing and determines (or suggests) the time, place and way of the sharing interaction. Addressing the knowledge inquiry, especially in the form of face-to-face interaction, causes disturbance for the potential knowledge sharer. It can derail the task activities, creative cognition processes or solving problem processes. For the potential knowledge donor it is perceived as the cost of interaction, because probably it will be hard to resume work or thinking processes from the point that it was dropped. Frequent interruptions cause deconcentration, absent-mindedness and frustration, which is stronger if the person has something important and meaningful to do. It is worth noticing that transferring knowledge itself also costs the time and attention of the knowledge giver. All of those factors determine the perceived time pressure as a stressor and will possibly cause the individual to feel as if on a treadmill [31, p. 56]. Consequently, the likelihood of creative thinking (developing novel ideas) decreases [31]. Mueller and Kamdar [20] observed that helping others (investing time and attention) in solving their creative problems is negatively related with the individual creativity of the helpers (while looking for help and receiving is related positively).

In reactive knowledge sharing, the package of knowledge to be shared is defined by the interest of the recipient. In a situation where inquiries and requests for information and expertise come from the outside the department or workgroup, the content of the sharing might not be connected with the knowledge domain that the knowledge donor is working within. This causes a low interest in the donor for developing and improving this part of knowledge. Therefore, there is little likelihood of knowledge re-creation (in the mind of the donor) during externalization and transfer [16, p. 374]. In this circumstance, sharing would not develop the knowledge base nor facilitate the creativity of the sharer. The necessity of switching from one task (knowledge) to another can decrease the other components of individual creativity (motivation or creativity-relevant processes).

The above-mentioned consequences will be minimized if the reactive knowledge sharing takes place within the workgroup, where the individuals work on the same or a similar issue. Sharing knowledge, expertise and insights within the same scope of interest would be beneficial for sharers and recipients, as their individual knowledge could grow.

The last aspect analysed here is the insistence to respond to knowledge inquiries. In reactive knowledge sharing, a person addresses an inquiry to the individual that in their perception possesses the needed knowledge or, at least, knows how to find it. This circumstance put the potential knowledge donor in a difficult situation. Deciding not to share knowledge would probably be perceived negatively—as hiding knowledge. On the other hand, deciding to give knowledge brings all the costs mentioned before. One of the consequences of not giving knowledge (or hiding it) could be explained by the theory of social exchange and the reciprocity phenomenon.

In the study by Černe et al. [32], different forms of knowledge hiding by the potential knowledge sharer related negatively to the individual creativity of the (not) giver. This was explained by the emerging reciprocal distrust loop between the individuals in that potential sharing interaction. If a person is asking for knowledge needed in creative work and is not receiving it and additionally perceives that the

other individual is hiding that knowledge and is unwilling to help, a distrust between those individuals will emerge and cause reciprocal knowledge hiding [32, p. 174]. Therefore, the constricted access (in the future) to the knowledge held by others is the cost of knowledge hiding and will negativity influence that individual's creativity [32, pp. 181–182]. Similarly, Rhee and Choi [10] found negative consequences of not giving knowledge. Interestingly, they found that knowledge manipulation has positive relations with individual creativity. A knowledge giver manipulates the knowledge during transfer and shares the necessary minimum in order to fulfil the reciprocity need and maintain the status of an expert (while not spending too much time, effort and not revealing too much) [10, pp. 825–827].

The author has developed the following propositions:

Proposition 1 *Reactive knowledge sharing negatively influences the individual creativity of the giver as it disturbs the creative process, produces time pressure, and only incidentally contributes to the individual's knowledge development.*

Proposition 2 *The relation between reactive knowledge sharing and creativity of the knowledge giver will be more negative if the giver works under high time pressure and there is a greater misalignment in the knowledge domain interests between the giver and the recipient.*

Proposition 3 *In a reactive knowledge sharing situation, the time pressure and misalignment in the knowledge domain interests between the giver and recipient, and the high expectation of reciprocity prompts the knowledge giver to manipulate the knowledge while sharing in order to preserve individual creativity.*

5.5.2 Reactive Knowledge Sharing and Organizational Creativity

In analysing relations between knowledge sharing and organizational creativity, we also need to regard the effects on the knowledge recipient. On a higher organizational level, the results of successful reactive knowledge sharing are important. For the knowledge recipient, knowledge gained from the expert (giver) enables explaining and learning the rules, mechanisms and processes connected with the specific task that the recipient is currently working on, where knowledge expertise is broadened or deepened, and consequently, the creative ability increases. Ruscio and Amabile found that obtaining heuristic instructions (instruction emphasizing conceptual understanding) is connected with producing novel solutions. But it is worth mentioning that getting very specific algorithmic instructions (showing step-by-step how to do the task, solve the problem) can cause a functional fixation effect that may hinder the ability to develop novel solutions [33, pp. 261–264]. Moreover, receiving a response to the inquiry (for information, instruction or help) may positively influence the motivation to solve the creative problem.

Some studies on the relations between obtaining knowledge by employees (as a result of reactive knowledge sharing) and organizational creativity support this line of thinking [6, 8]. These positive relations could also be explained by the quality of knowledge sharing in the perception of the recipient. The quality of knowledge sharing was operationalized by Lee as timeliness, reliability, completeness, accurateness, understandability and relevance to the topic [34, p. 13]. The reactive knowledge sharing (not manipulating) meets those quality requirements because here the recipient is the person that articulates the knowledge needs. The reactive knowledge sharing may influence the creativity of the recipient or recipients and through this—of the organization. It is worth to mention that the opportunistic behaviour of the knowledge giver, like knowledge manipulation, reduces the positive effects of reactive knowledge sharing on organizational creativity, as it may impair the quality of sharing.

Proposition 4 *Reactive knowledge sharing is positively related to organizational creativity by enabling knowledge recipients to obtain good quality knowledge and to produce novel and applicable ideas.*

Proposition 5 *The knowledge manipulation in reactive knowledge sharing decreases the benefits of sharing to knowledge recipient's creativity and organizational creativity.*

5.5.3 Proactive Knowledge Sharing and Individual Creativity

Proactive knowledge sharing has a different nature than a reactive one. It is based, to a greater extent, on the willingness of the knowledge giver, and is more prosocial behaviour. In this form of sharing, a positive aspect is that the knowledge giver does not feel an immediate pressure to share (there is no request for knowledge). The sharing takes place because the knowledge sharer feels like doing this, wants to do this and has the opportunity to do this [19]. But it also makes proactive knowledge sharing harder to facilitate and enhance.

The social and contextual conditions determine proactive knowledge sharing (time availability; recipient characteristic; the way of sharing) [17]. In the situation of time pressure (little available time), the knowledge sharer has the freedom (is not under social pressure) of deciding whether to share or not. The donor can concentrate more on their own benefits of sharing, like receiving feedback on the ideas they share, the entrenchment of the ideas (the understanding) by externalizing it. When time is a constraint during creative work, an individual will decide to share proactively only if it is relevant, valuable and does not disturb the thinking process [31, p. 59].

In proactive knowledge sharing, the giver is selecting the recipient, taking into account the expected benefits related to the individual's knowledge development or receiving some feedback. Zhang and Jiang found that proactive knowledge sharers look at the professional competence of the recipients and their personal relations with them [17, pp. 286–287]. The greater an expert the recipient is, the more willingly

the giver will be to share their knowledge because they assume that it would be more fruitful. For example, as a result of voicing ideas about work or the organization, the knowledge sharer may receive some tips considering the novelty or usefulness of the presented idea [31, p. 59], even just in observing the reaction of the knowledge recipients.

The next issue is the interest of the knowledge donor in the package of knowledge that is shared. In proactive knowledge sharing, the giver decides about the content of sharing, which is consistent with their contemporary task (work) interest. Even in the case of helping others, selling ideas to others or just giving information, the giver is willing to initiate the sharing interaction because they are interested in the subject and it could help to extend his/her expertise.

Proposition 6 *Proactive knowledge sharing is positively related with the individual creativity of the knowledge giver because it increases their individual creativity and the benefits connected with knowledge development and limits sharing costs by adjusting the time, recipient and knowledge scope to the giver's needs and situation.*

Proposition 7 *In the situation of proactive knowledge sharing, when the perceived benefits connected with creativity do not exceed the costs of sharing, the potential knowledge giver will choose not to share.*

5.5.4 Proactive Knowledge Sharing and Organizational Capability

While reactive knowledge sharing is useful for the individual creativity of the recipient, proactive knowledge sharing may also (or in the first place) facilitate collective creativity. In proactive sharing, the reason for sharing is not only to fill the knowledge gap, but also to broaden the perspective of the recipient (voicing ideas, selling tips). An individual passing on his/her ideas, explaining them, showing examples not only gives information to the recipient, but also extends and enriches the language, or shows a different point of view. It brings the development of common (mutual) knowledge between the individuals that participate in such an interaction [4].

In the short term, knowledge recipients might not be interested in obtaining knowledge (not needed at that present time), especially if they face contextual constraints to their creativity (like time pressure). But exposing them to new (for them) knowledge may help in the future to cross the knowledge boundaries that exist between specialized domains. Carlile writes about syntactic, semantic and pragmatic boundaries and indicates that those boundaries may become barriers to innovation [35]. Creating common knowledge (between specific knowledge domains) may help in overcoming this problem by developing a common lexicon, common meaning for identifying novel ideas and common interest for making a trade-off and implementing novelty at the organizational level.

Only two studies were found that analysed the relationship between proactive knowledge sharing and the creativity of the organization. While Lin [8] found a positive relationship at the organizational level, Kamaşak and Bulutlar [7] studied sharing within and outside the department and observed that proactive sharing to employees outside the department had no significant relation to innovation, but proactive sharing within the department had a positive impact on innovation.

Proposition 8 *Proactive knowledge sharing is positively related to organizational creativity by broadening the knowledge of the recipients and developing common knowledge at the organizational level in the long term.*

Proposition 9 *Proactive knowledge sharing positively influences organizational creativity by facilitating the creative performance of the knowledge giver.*

5.6 Conclusions and Implications

In the presented conceptualization of the knowledge sharing antecedents of creativity, knowledge giving by employees can bring both positive and negative effects in terms of their individual creativity. This could explain why Rhee and Choi found no significant relationship between sharing and creativity [10]. The author proposes that relations between knowledge sharing and creativity are not isomorphic among the organizational levels (individual versus organizational)—to the advantage of the organization. An organization (as a complex system) benefits from any form of knowledge sharing, while for individuals, reactive knowledge sharing can limit their creativity and move them towards opportunistic behaviours (like knowledge manipulation). This could be harmful to highly knowledgeable and creative individuals to whom other employees turn to get knowledge, information or help. If they are not protected by the organization against numerous requests for sharing, their creativity (and satisfaction) will decrease, or they will learn how to protect themselves by sharing only small packages of knowledge. Both situations will negatively impact organizational creativity in the long term.

Although the presented conceptualization of the relation between knowledge sharing and creativity is based on several empirical studies, there is considerable need of multilevel and longitudinal studies to capture the long-term individual and organizational creative consequences of behaviours connected to sharing knowledge. The developed propositions could become the starting point for developing testable hypotheses. Moreover, there also is a problem with the causality as the creativity could be both antecedent and an outcome of the sharing knowledge—the individual creativity can build the individual self-efficacy, an important antecedent of giving knowledge. The suggested long-term, repetitive studies could help to capture it.

There are several organizational factors that were not taken into consideration when analysing knowledge giving and creativity relation. First is the team and organizational culture the knowledge giver works in and the balance between an orientation towards goals' fulfilment and learning. It seems to be needed to take into

consideration how culture moderates the possible individual and organizational creative outcomes of giving. Secondly, the proposed conceptualization does not indicate the attitude and behaviour of the knowledge receiver, which also could moderate the relation. The reaction of the knowledge receivers to the knowledge they are exposed to influences the re-creation of knowledge on the side of the knowledge giver and the future willingness to share knowledge again [36]. These limitations of the presented conceptualization could also be ideas for future research.

There are some managerial implications that derive from the propositions. Managers need to understand and acknowledge the social dilemmas the individuals have considering sharing knowledge (especially in the reactive form) and the importance of sharing in terms of creativity and innovation. Building the culture "if you do not know, ask and you will get an answer" creates pressure for individuals, especially those who have strong individual expectations towards their creativity that could lead to individual strain hindering creativity and their productivity [37]. Therefore, managers should concentrate on the social and contextual conditions of sharing and creativity. Those conditions should aim at decreasing the costs of sharing and emphasizing the benefits (both individual and collective). The supervisors' support seems to play an important role here [6, p. 1480].

In the case of widely observed high working demands (time pressure and multitasking), one of the propositions to protect creativity while sustaining good quality sharing is introducing protection of the individual and/or group creativity time, especially in those areas where creativity is desirable. Perlow [38] and Amabile et al. [31] suggest introducing an organizational norm of "uninterrupted quiet time" when specified hours are booked for creative work. This could create the opportunity for knowledgeable experts to completely engage in the creative work without regular and frustrating interruptions and during the "not protected hours" to share their valuable expertise.

Another idea of decreasing the costs of sharing is designing workplace architecture. Allen suggests that the workplace architecture and physical location of employees influence the likelihood of chance encounters, which mainly facilitate proactive knowledge sharing [39]. Coradi et al. [40] found that co-locating individuals facilitates face-to-face communication and decreases the knowledge barriers between those employees (syntactic, semantic and pragmatic). Consequently, this broadens the knowledge domain of the recipient's and donor's common interest [40, 41].

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Chapter 6
Organisational Culture in the Industry 4.0 Era: Introduction to Research

Katarzyna Szymańska

Abstract The aim of the paper was to identify the main directions of changes in the organisational culture of enterprises associated with the process of adaptation to functioning in the face of challenges of the Industry 4.0 concept. Thus, formulated goal was accomplished by presenting the main assumptions of the development of the Industry 4.0 era, indicating the Industry 4.0 era desired directions of changes in the organisational culture based on the results and conclusions from the empirical research conducted in 2018. In order to carry out the research, quantitative methods were used, and the research tool was an original questionnaire. As evidenced, the profile of the organisational culture of the studied group of enterprises in reference to the Industry 4.0 era requires profound changes associated with more comprehensive modelling that would strictly correspond to the requirements of the described concept.

Keywords Organisational culture · Industry4.0 era · Cultural profile in the IR 4.0 era

6.1 Introduction

A dynamically changing environment as well as progressing globalisation has resulted in the creation of the Fourth Industrial Revolution (Industry 4.0, Fourth Revolution, Internet of Things or SMART, Industry Revolution 4.0 (IR 4.0)).[1] Industry 4.0 is understood as a common term, combining engineering, information technology, and management knowledge. In addition, it assumes the existence of smart systems that are networked, i.e. they are connected with other processes occurring inside the enterprise which in turn are associated with value-creating networks. Two realities intersect in the new environment in which enterprises operate: physical reality (PR) and virtual reality (VR) [2]. This process encompasses the development

[1] In the paper, the terms Industry 4.0, IR 4.0, etc., will be used interchangeably.

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of various types of inter-organisational cooperation networks (network cooperation, virtual network), new technologies based on, among others, computerisation, digitalisation, and robotics(cyber-physical systems—CPS),dynamic processing of large amounts of data in real time(big data Analytics—BDA), Internet connections (Internet of things—IoT; Internet of services—IoS), close, partnering interpersonal relations (cooperation, partnering, team working), inter-organisational relations (strategic partnering—SP, knowledge partnering—KP; coopetition), and inter-machine relations (machine to machine communications—M2M; artificial intelligence; neural networks) [1]. Under such conditions, management becomes a challenge for managers who are used to a hard analytical approach focused on hard competition and not on extensive cooperation. In this context, management must rely on a specific model that will be used by managers in this process. The assumptions of Industry 4.0 are currently quite often a subject of research, but the technological approach is usually taken into account. There is a lack of research conducted in relation to the other so-called soft elements important in the management process determining the success of Industry 4.0 [6, 15, 17], i.e. organisational culture, which prompts to conducting research in this area [16].

To ensure success in the new work environment created by the Industry 4.0 era, an organisational culture that must be characterised by openness to various fields of activity becomes crucial. A new type of culture requires a new, open system of values, standards, thinking patterns, and actions that will be perpetuated in the social environment of the organisation, contributing to the achievement of its goals. The organisational culture in the era of Industry 4.0 is primarily open to the environment, supports extensive cooperation with it, provides freedom of relations, uses not only the potential of employees but also external partners, and is open to new knowledge, changes, and sometimes to the resulting mistakes. In addition, it is focused on implementing unique visions and strategies, while ensuring discipline, and successfully integrates participants of described relationships around new activities [28, 30]. The question then arises: are Polish enterprises ready to adopt the assumptions of the Industry 4.0 era and does their organisational culture foster their functioning under these new conditions? The answer to this question corresponds with the purpose of the paper, which was to identify the main directions of changes in the organisational culture of enterprises associated with the process of adaptation to functioning in the face of challenges of the Industry 4.0 concept. The paper is a contribution to the literature on management in the context of changes caused by the new IR4 era analysing its impact on the organisational culture of enterprises. Therefore, the subsequent sections of the paper discuss issues related to the requirements of IR 4.0 in the context of changes in the organisational culture of enterprises. Next, the research method, research results, conclusions, and further research recommendations are described.

6.2 Industry4.0—What Does It Mean?

Over the years, the development of new technologies has caused the world to go through new eras of the industry which has fundamentally changed the rules of the game important for the functioning of various types of enterprises. Water and steam propulsion was used in the First Revolution, electricity in the second, and innovations in the field of microelectronics, and IT supporting automation were introduced in the third revolution.

Industry 4.0 (or German Industrie 4.0) is a collective term for technical innovation and a new concept (era) of value chain organisation that enable a revolutionary change in industrial production [3]. The term Industry 4.0 is understood as the unification of the real world of production machines with the virtual world of the Internet and information technology [14, 17]. In this process, i.e. in the course of production, there is an automatic exchange of information between people, machines, and IT systems, as well as between separate factories and various IT systems operating in different branches of industry. Thus, the diverse nature of production systems operating in various industries does not allow for the generalisation of the term Industry 4.0 [11, 13, 27]. This means that the scope of definitions should be considered individually for different areas of functioning of a given enterprise. This concept describes a decentralised production chain that extends from the design to the supply chain, production, distribution, and eventually to the final customer service [18, 19]. Therefore, Industry 4.0 refers to the entire value chain, i.e. from placing an order and delivering components for ongoing production, until sending the goods to final customers, and after-sales services. Innovative software and devices connected to the Internet are used in this process, thanks to which real-time errors can be prevented from occurring at different levels of management [22]. Due to this network, the enterprise can become faster, more flexible, effective, and competitive. As a result, managers are constantly looking for new and innovative production systems that motivate to create new business models focused on the exploitation of a high degree of economic benefits, while improving existing models. The research conducted by Arnold, Kiel, and Voigt identifies only some of the most important areas directly related and relevant to business activity conducted in accordance with the concept of Industry 4.0. According to the authors, these areas include proposals for creating data-based value, the process of switching from a product to system offer, improved personalisation, intensified customer relations, IT and software know-how as key resources, and increasing interconnectivity, as well as cooperation with key partners [4, 9, 23].

Based on these studies, it can be seen that the phenomenon of socio-economic development defined in the literature as the "Fourth Industrial Revolution" is associated with the following three phenomena [7]:

– universal digitalisation and ensuring constant communication between people, between people and machines, as well as between machines,
– implemented disruptive innovations which allow for a rapid increase in the efficiency and effectiveness of the socio-economic system,

– achieving such development of machines that they gain the ability to display autonomous behaviour through the use of "artificial intelligence" in the process of control.

Unlike the previous revolutions, Industry 4.0 creates the so-called Industry 4.0 environment which is to support the team in creating extensive value networks that allow for exchange and access to virtually any useful information, anytime, from anywhere. This enables the economic production of customised products for the needs of a specific customer and the so-called short batches (mass customisation). Thus, Industry 4.0 is not intended to create mechanised factories in which man's place is occupied by robots but factories in which an employee is the most valuable asset of an enterprise. In this system, man, machine, and process are closely integrated with one another. The basis for all this is the cooperation of separate control units that are capable of autonomous decision making, managing the assigned technological unit, and in particular of becoming an independent and full member of comprehensive production units. Therefore, this concept requires continuous innovation and education depending not only on the skills of people but also on the organisational culture of the company. For this purpose, it is necessary to understand the internal and external changes in order to adapt the strategy, structures, and processes, as well as people and technologies to the requirements of the "new wave" of the IR 4.0 concept. An appropriate managerial approach therefore plays an important role in creating such measures that will foster the development of the described concept in all types of enterprises. Existing studies, however, draw attention to the higher probability of evolution and changes occurring in small and medium-sized enterprises in particular, as they often operate in the area of high technologies and to a large extent seek innovation, create and develop new areas of manufacturing, as well as new sectors and industries based on the assumptions of the new era [8, 11, 29].

An appropriate managerial approach plays an important role in generating such activities that will be conducive to the development of the described concept. There is still growing interest around Industry 4.0, but there is a lack of systematic reviews of research concerning various development determinants of this concept. Most existing studies discuss only the technological approach to this concept without paying attention to the importance of other factors determining success of this process [6, 15, 17]. This is confirmed by the research conducted by Lu and Cecil, who, based on a literature review, attempted to identify the state of research on the concept of Industry 4.0. They indicate that most studies discuss technological aspects, not taking into account the importance of soft management aspects, i.e. organisational culture, which motivates researchers to conduct studies in this area [16].

6.3 Organisational Culture and IR 4.0

Attempts to proactively predict the main directions of changes related to the implementation of determinants of the Industry 4.0 era in enterprises lead to the conclusion that to implement new solutions determining their development, enterprises will have to adopt new organisational models based on new open relations with various stakeholders [12]. The effectiveness of these activities requires not only continuous innovation and education but also depends on the skills of people and is determined by the new organisational culture. This culture is a "social bond" and creates a sense of community that counteracts the processes of diversification which is an unavoidable part of the organisation's life, in particular, in the context of determinants of the development of Industry 4.0. Organisational culture, offering a common system of meanings, forms the basis for communication and mutual understanding. That is why managers who implement new principles emphasise the relationship between the success of the organisation and its organisational culture.

In the face of a large variety of interpretations defining the term organisational culture, the definition given by one of the classics and experts of culture E. H. Schein seems important. The author interpreted it as "a pattern of external adaptation and internal integration that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those" [26].

The adopted, general definition allows for a comprehensive reference to organisational culture without valuing its individual elements, which means that the attitudes, values, and behaviour patterns of the organisation's employees can be treated equally. In addition, it can be assumed that the above-presented definition of culture to some extent combines other definitions given by researchers, as it results from the assumption that each organisation builds certain specific behaviours of people that correspond to formal organisational solutions present in it, creating an organisational culture that integrates employees around the adopted organisation's purpose and allows it to function in the environment [10, 20, 21].

In the new IR 4.0 work environment, an organisational culture which is characterised by openness becomes crucial, as thanks to this culture, employees demonstrate an entrepreneurial and innovative attitude, using a wide range of competences and skills. This understanding of culture will enable the development of technologically advanced algorithms, and then skilful reading of data from various sources to improve the quality of production, flexibility, performance, etc. [5, 15].

The culture of a new type compatible with IR 4.0 requires therefore the development of a new system of values, standards, thinking patterns, and actions that will be consolidated in the social environment of the organisation, contributing to the achievement of its goals. Organisational culture in the era of Industry 4.0 must be open to the environment, support cooperation, ensure the freedom of various relationships, using not only the potential of employees but also external partners, be wide open to new knowledge, changes, and sometimes the resulting errors. In addition, it is focused on implementing unique visions and strategies, while ensuring discipline and

successfully integrates participants of described relationships around new activities. For the purpose of the research, it has been assumed that the organisational culture of enterprises in the Industry 4.0 era is one that is open space, open to change, open innovation, and open to flexibility [30]. Openness in this case should refer not only to customers, suppliers, or competitors but in fact simply to many stakeholders who have complementary capabilities and do not hesitate to use them in cooperation with other sectors to implement the IR 4.0. Readiness for innovative changes is related to the ability of the enterprise to consider and organise activities related to the occurrence of new factors in its environment in order to reduce the risk of errors and to take advantage of emerging opportunities when introducing a new concept. A high degree of tolerance of uncertainty is related to the fact that managers and employees have adequate knowledge explaining a given phenomenon which requires undertaking an action or solution. Flexibility in operation will be an important feature/property of a modern enterprise, knowingly and successfully coping in the Industry 4.0 era. As it can be seen, the proposed definition of open culture closely corresponds to the assumptions of Industry 4.0. In this concept, the processes related to changes leading to an open organisational culture are becoming particularly important. This culture is characterised by the following traits: it supports cooperation, provides freedom, is open to the environment, exploits the potential of employees, is open to errors, is focused on visions and strategy, while ensuring discipline, and integrates business participants, owners, managers, and employees around new activities (see Fig. 6.1).

In order to develop values related to the dimensions given in this definition, specific processes should be designed to promote openness, innovation, creativity, flexibility, and change. However, the most important is to understand that these activities must become an element of the organisation's functioning in the Industry 4.0 era. They must be part of its philosophy, as only then will they cease to be only ephemeral constructs and will begin to exert a real influence on the enterprise. Otherwise, they will remain only impressively sounding words that have no effect. In addition, it should be noted that the provided definition is "open" and can be supplemented with other new dimensions relevant to the development of the IR era.

The confirmation of significant dependencies between IR 4.0 and other elements can be found in the research conducted by Bahrin et al. who have identified various

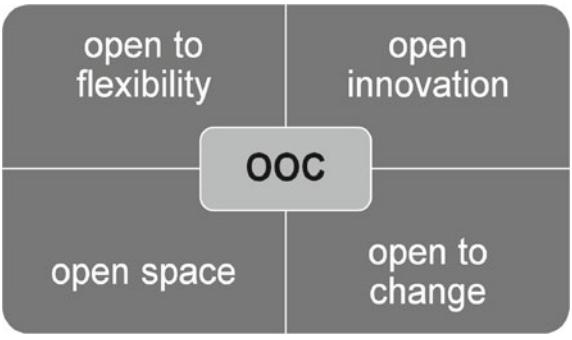

Fig. 6.1 Proposal of the dimensions of an open organisational culture. *Source* The author's own elaboration

interrelationships, including organisational culture and other organisational systems that lead to the dynamic development of components designated by the new era [5]. The authors, though not conducting in-depth research in this area, confirm that continuous learning and innovative development depend not only on the enterprise's capabilities but mainly on people who create its organisational culture. In turn, Pfeiffer, questioning the view that man can be replaced by robots, has confirmed that only different types of knowledge that employees have allow the company to carry out interactive activities in various work processes in order to ensure their high quality and efficiency. The organisational culture of enterprises is therefore one of the composites that integrate people with cyberspace which is a key for the development of the era of Industry 4.0 [31]. Therefore, researching the issue of the relationship between the organisational culture of enterprises and the assumptions consistent with the Industry 4.0 concept seems to be reasonable. This issue is particularly important when supporting enterprises by strengthening their cooperation with entities in their environment, especially cooperation with the sphere of science, public administration and business (e.g.: as part of clusters), and activities carried out in the framework of open innovation (OI). Sackey identifies the problem related to the necessity and ability to manage these relationships in order to meet the Industry 4.0 assumptions and indicates that it is possible to build an industrial ecosystem based on an organisational culture that offers practical infrastructure for teaching and learning [25]. The profile of such an organisational culture must therefore refer to the pillars set by the Industry 4.0 era. The accuracy of interpreting such assumptions will result in the ability to take action in a technologically developing market. Under such conditions, organisational culture, thanks to the related processes, will foster absorption, understanding, teaching, problem solving and communication, creating the basis for adaptation to the requirements of IR 4.0. This means that such culture will support the broadly understood ability of enterprises to operate in two realities—real and virtual, under changing environmental conditions and in cooperation with various types of partners, and thus, the company will be ready for the systematic and consciously created dynamics of changes in many business processes, including the building of its competitive advantage. This will also refer to a certain kind of transparency that is perceived in the context of access to information (e.g.: open resources of knowledge) [21, 24].

The question arises—are Polish enterprises ready to accept the concept of Industry 4.0 and does their organisational culture foster their functioning under these new conditions? As a consequence of these considerations, the following hypothesis was proposed:

H: The Industry 4.0 era affects the change of the organisational culture of enterprises due to the fact that the more open the organisational culture, the more it strengthens the possibilities of developing IR 4.0 in the enterprise.

In order to verify the formulated hypothesis, the research described in the next part of the paper was carried out.

6.4 Research Methodology

In order to achieve the aim of the paper, which was to identify the main directions of changes in the organisational culture of enterprises associated with the process of adaptation to functioning in the face of challenges of the Industry 4.0 concept, empirical research was carried out. The study was conducted from March to November 2018 as part of the first stage of the author's own research on organisational culture in the Industry 4.0 era. In order to carry out the research, quantitative methods were used, including the survey method using the mix mode technique and the combination of CAPI and CATI research, and the research tool was an original questionnaire.

The sampling of enterprises was stratified randomly based on the following criteria: the enterprise size measured by the number of employees, the industry (according to the Polish Classification of Activity, enterprises from various industries were examined), the level of innovativeness (screening question, companies characterised by different levels of innovativeness were examined), the company's development phase (screening question, companies characterised by various development stages were examined). The sampling frame was the database of the REGON National Official Register of national economy entities from which the so-called gross sample was obtained, i.e. a list of entities exceeding the size of the sample several times, and the draw was made by the company called "ASM—Centrum Badań i Analiz Rynku" (ASM—Market Research and Analysis Centre) from Kutno. The size of the random sample was set with a large excess, taking into account that with the applied technique it would be possible to obtain completed surveys only from some of the randomly selected entities. Respondents were owners (38%) and/or managers (62%) of the surveyed companies. The research covered a group of 139 enterprises including 21 medium-sized enterprises (i.e. employing 50–249 people) and 118 small enterprises (i.e. employing between 10 and 49 people). The most innovative companies (i.e. with the highest level of innovativeness according to the scale adopted by the researchers) were included in the study. The surveyed enterprises represented various industries, but the majority were manufacturing enterprises (88 out of 139 surveyed enterprises). They operated in the local market (44 entities), national market (76 entities), as well as international market covering several countries (17 entities), and two enterprises had a global reach (many countries, often on different continents). The vast majority had only Polish capital (72 out of 139 surveyed entities). The dominant companies were those operating for more than 10 years (71 entities).

The results presented in the paper are only a small part of the wider analysis of the interrelations between organisational culture and the assumptions of the Industry 4.0 era.

6.5 Effects of Adapting the Organisational Culture of Enterprises to Function in the Face of Challenges of the Industry 4.0 Concept—Research Results

The definition of organisational culture adopted in the paper provided the opportunity to diagnose key activities for the desired organisational culture in the perspective of the development of the Industry 4.0 era in the analysed enterprises. First, the surveyed respondents were asked to assess their level of knowledge about the assumptions of the IR 4.0 era. For this purpose, four areas of activities related to actions specified in the adopted definition of organisational culture related to the ability to create a network of cooperation with the environment (open space), the propensity for creating innovative activities in the surveyed enterprises (open innovation), activities undertaken in the situation of dynamic changes in the environment (openness to change), and flexibility (openness to flexibility) were assessed [31]. It was assumed that the given areas would be assessed in small and medium-sized enterprises. Table 6.1 presents the assessment of the respondents possessed on the 4.0 industry.

The conducted research shows that the vast majority of respondents are familiar with the assumptions important for the era of Industry 4.0 at the low level (medium-sized enterprises—20.0% of responses, small enterprises—25.9% of responses), medium level (medium-sized enterprises—37.0% of responses, small enterprises—53.3% of responses), and high level (medium-sized enterprises—23.3% of responses, small enterprises—9.3% of responses). A total lack of knowledge of this topic in the group of respondents was confirmed by 18.2% of small and 3.3% of medium-sized enterprises. However, it should be noted that the responses referred solely to the confirmation of the knowledge and the actual functioning in accordance with the Industry 4.0 rules was confirmed by only two medium-sized enterprises and one small enterprise operating in the high-tech industry. Such a distribution of responses is most probably influenced by the fact that the concept of a new era forces the introduction of changes into traditional, and even innovative, business models. However, this change will be taking place in an evolutionary manner over the next decades, which will result in the gradual implementation of new assumptions in enterprises.

Table 6.1 Assessment of the level of knowledge possessed on the Industry 4.0 era (%)

Knowledge of the assumptions of the IR 4.0 era	Total	Small	Medium
Lack of knowledge	15.2	18.5	3.3
Low level of knowledge	24.6	25.9	20.0
Medium level of knowledge	40.6	37.0	53.3
High level of knowledge	12.3	9.3	23.3
Key level of knowledge	2.2	2.8	3.0
I don't know/hard to say	5.1	6.5	1.0

Source The author's elaboration based on the research conducted
Note Respondents could provide more than one answer

Subsequently, the activity of the surveyed enterprises in the area of networking with various entities (open space) was assessed.

As the research indicates, in the areas of designing new products, conducting joint research and development activity, taking active participation in conferences/meetings/seminars, establishing business contacts, designing new products, purchasing licences/patents and new technologies, they rarely cooperate with customers, competitors, suppliers, and strategic allies (small enterprises at the level of 10.2% of responses and medium-sized enterprises 15.0% of responses). The worst was the assessment of the cooperation with R&D research units and intermediate institutions (small enterprises—0.0% of responses and medium-sized enterprises—3.0% of responses).

The propensity of enterprises in the field of innovative development (open innovation) was assessed in terms of conducting activities related to creating new ideas, changes in production processes, product development, changes in marketing processes, as well as knowledge and technology management (Table 6.2).

As the conducted research has shown, all initiatives in the field of innovative development are undertaken more often in small companies. These activities are related to creating new ideas (86.0% of small enterprises and 13.5% of medium-sized enterprises), changes introduced in production processes (52.5% of small enterprises and 47.2% of medium-sized enterprises), activities connected with product development (70.6% of small enterprises and 47.6% of medium-sized enterprises), changes introduced in marketing processes (87.9% of small enterprises and 12.1% of medium-sized enterprises), as well as initiatives in the field of knowledge and technology management (81.2% of small enterprises and 18.2% of medium-sized enterprises).

This may be a result of the specificity of the functioning and management of this group of enterprises (the scale of operations, industry, innovations, etc.) as well as the managing person (the number of managers, their professional experience, profile of education, etc.). In the course of the interviews, the surveyed respondents also indicated that to increase their competitive position in the market, enterprises introduced product and process innovations (29.6% of small enterprises and 40.0% of medium-sized enterprises). Next, the actions taken by the surveyed enterprises in the situation of dynamic changes in the environment were assessed (openness to change) (Table 6.3).

Table 6.2 Initiatives in the field of innovative development undertaken in the surveyed enterprises over the last 5 years (%)

Type of activity	Small enterprises	Medium-sized enterprises
Creating new ideas	86.0	13.5
Changes in production processes	52.5	47.2
Product development	70.6	47.6
Changes in marketing processes	87.9	12.1
Knowledge and technology management	81.2	18.2

Source The author's own elaboration based on the research conducted

Table 6.3 Actions taken by the management in the situation of changes in the environment

Actions taken by the management team in the situation of changes in the environment	Total	Small companies	Medium-sized companies
Financial restructuring (debt restructuring)	8.6	6.5	25.0
Reduction of employment in the group of administration employees	8.6	9.7	0.0
Reduction of employment in the group of production employees	8.6	9.7	0.0
Withdrawal from some markets	11.4	9.7	25.0
Cessation of new investments	11.4	12.9	0.0
Reduction of operating costs	11.4	3.2	7.5
No such actions taken as no need seen	45.7	51.6	0.0

Source The author's own elaboration based on the research conducted

As indicated by the surveyed respondents, the analysed enterprises undertake various activities that are a result of dynamic changes taking place in the environment in which they operate. Among the actions listed, limitations were indicated rather than activities related to implementing IR 4.0. Entrepreneurs most often reduce the costs of their operations (small enterprises 3.2% of responses and medium-sized enterprises 75.0% of responses). Actions related to withdrawal from some markets, cessation of new investments, reduction of employment in the group of administration and production employees, or debt restructuring were assessed to at a similar level in the examined group, which confirms not very high frequency of these activities. Respondents from small enterprises indicate that they have not introduced any changes in the indicated areas, as they claim they have had no such need (small enterprises 51.6% of responses). The distribution of the answers obtained also refers to the flexibility of the surveyed enterprises in different situations (openness to flexibility).As the conducted research has shown, restrictive measures which are a direct response to changes occurring in the environment are the ones taken more often in the surveyed enterprises.

On the basis of the conducted deliberations as well as the research results obtained, many generalisations and conclusions can be formulated at this point. In response to the question posed in the Introduction whether Polish enterprises are ready to adopt the assumptions of the Industry 4.0 era and whether their organisational culture fosters the functioning under the new conditions, it can be concluded that the surveyed enterprises (although the respondents confirmed the basic knowledge of the IR 4.0 framework) are characterised by a certain degree of cultural closure which blocks the development of this concept. According to the surveyed respondents, it can be said that this stems from a lack of activities in the area of creating a network of cooperation with the environment (open space), low frequency of carrying

out even basic innovation-related activities in the surveyed enterprises (open innovation), rare/limited actions undertaken in the situation of dynamic changes in the environment (openness to change), and a lack of flexibility (openness to flexibility). This approach results from the underestimation and failure of the owners and managers to see key cultural determinants supporting the IR 4.0 era. Due to the limited research sample, one can only formulate the following hypothesis: "*The Industry 4.0 era affects the change of the organisational culture of enterprises due to the fact that the more open the organisational culture, the more it strengthens the possibilities of developing IR 4.0 in the enterprise*". The conducted deliberations indicate that the Industry 4.0 implementation in enterprises causes many changes, including changes in the methods of communication, implementation of tasks, methods of solving problems, personal practices, the organisational structure, etc. Cultural changes are therefore necessary, as the system of beliefs, values and opinions of employees influences their attitudes and behaviours. Cultural openness is enforced not only by internal changes resulting from the implementation of new IR 4.0 assumptions but also changes taking place in the environment, e.g.: the fast development of technology and the need for its absorption, the multi-directional knowledge development, changing customer requirements, competition intensity, sociocultural determinants (education of society, values, and attitudes conducive to building the knowledge-based economy), and increasing cooperation, especially within inter-organisational networks, etc.

Therefore, entrepreneurs should strive to initiate all activities that stimulate the creation of the desired organisational culture which can become a strategic factor of success in the IR 4.0 era.

6.6 Conclusions

As it has been shown, the general profile of the studied group of enterprises in reference to the Industry 4.0 era requires profound changes associated with more comprehensive modelling that would strictly correspond to the requirements of the described concept.

The author of the paper is aware of the limitations of the presented research, which result, among others, from the selection of the sample, the research methods, and the research tool. These limitations also influence the level of caution in regard to the interpretation of the research results obtained and the possibilities of generalising the findings. One of the additional objectives of the paper, however, is the initiating of the discussion on the importance of soft aspects, i.e. organisational culture, in the IR 4.0 era.

If activities related to the implementation of IR 4.0 are a strategic and economic part of enterprises' operations, then in general organisational culture should support them in all the indicated areas. Improper management can become a burden and a source of strategic weakness of the enterprise.

The obtained results inspire to conduct further research in this area. First of all, due to the lack of representativeness of the sample, as all formulated applications concern only the examined group of enterprises. An interesting challenge would be to identify and assess the analysed relationships on a representative sample of enterprises from various industries and sectors that have implemented and operate in accordance with the IR 4.0 assumptions.

Secondly, most enterprises in Poland are only at the initial stage of the implementation of the Industry 4.0 concept (for many this is only the early period), therefore it is inspiring to develop an organisational culture model that will indicate general determinants of success and support for the exploitation of the 4.0 strategy. The key is therefore to build an organisational culture model that supports: cooperation, management (planning, organising, motivating, and controlling), and optimisation of processes taking place in the entire enterprise through close human interaction with real and virtual reality.

A need for a more accurate understanding of the mechanisms and processes occurring in the dyad—the development of the IR 4.0 era—organisational culture motivates to conduct in-depth research in this field. The considerations presented in the paper should therefore be treated as a contribution to further research.

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Part II
Cooperation and Coopetition

Chapter 7
Network Approach in Industry 4.0: Perspective of Coopetition

Jerzy Niemczyk and Rafał Trzaska

Abstract There is a challenge before manufacturing, trading, and service companies, in the form of competitiveness in Industry 4.0 conditions. Classic passive matching strategies will be ineffective here. The winners will be those who actively anticipate the solutions of the new economy and those who are the first to actively support the implementation and internalization of new solutions. The problem the authors of the article are facing is the indication how companies behave in an attempt to actively influence the acceleration of the Industry 4.0 implementation process and thus to take a privileged position in the area of the value chain appropriate for the new economy. According to the authors of the article, the solution to this problem lies in the entrance of companies into the network with features of coopetition. Companies can then use such networks from all sources of efficiency of the co-opting network and thus increase their competitiveness and value on the market. The aim of the article is to build a network model with the features of coopetition dedicated to activities supporting the company taking a privileged position in new areas of economic activities on the example of the Industry 4.0 Revolution.

Keywords Industry 4.0 · Company competitiveness · Network · Coopetition

JEL M1 · M10 · D41

7.1 Introduction

The end of World War I, the industrial might of the USA was unleashed for domestic, peaceful purposes. Within a few short years, an economic shift took place as the economy transitioned from wartime production to peacetime production. New technologies like the automobile, household appliances, and other mass-produced

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products led to vibrant consumer culture, stimulating economic growth [1]. The 1920s brought another breakthrough in the global economy. The economy, commonly known as 4.0, has been developing more and more strongly. We see the demand for solutions 4.0 in developed countries, but also in developing countries. Industry 4.0 is the development of the economy in the areas of cloud computing, mobile technologies, technologies machine to machine, advanced robotics, big data, Internet of things, cognitive computing, and cybersecurity. In practice, every aspect of our private and public life is going to change. The development of the economy in these areas sets the pace of development of the global economy. At the same time, it is going to force new ways of competing for companies, resulting from the need to quickly adapt to new conditions.

Therefore, there is a challenge in the form of meeting competitiveness in the conditions of Industry 4.0 before the production, trade, and service companies. Classic passive matching strategies will be ineffective here. The winners will be those who actively anticipate the solutions of the new economy and those who are the first to actively support the implementation and internalization of new solutions.

The problem the authors of the article are facing is the indication how companies behave in an attempt to actively influence the acceleration of the Industry 4.0 implementation process and thus to take a privileged position in the area of the value chain appropriate for the new economy.

According to the authors of the article, the solution to this problem lies in the entrance of companies into the network with features of coopetition. Companies can then use all sources of efficiency of the coopetitive network and thus increase their competitiveness and value on the market. Companies that want to enter the Industry 4.0 conditions more quickly can use various organizational forms of cooperation offered by Management Sciences. Thanks to this form is possible faster convergence and implementation of new solutions.

In the conducted research, there was adopted a deductive-empirical approach. The research process consisted of literature research on Industry 4.0, network theory in strategic management [5, 12], the theory of coopetition [10, 17, 24], and strategies in the area of innovation. The second part of the research concerned the identification and critical analysis of selected examples of coopetition networks already operating in highly developed countries. These studies allowed to formulate the assumptions of the coopetition network model appropriate for companies actively wishing to participate in Industry 4.0. These assumptions, mainly related to network rents, will be explained in detail in Chap. 3.

The article uses a deductive approach in the part concerning the selection of a model solution for enterprises that want to accelerate their adjustment to the Industry 4.0 conditions. The second part of the article is the result of empirical research focused on the analysis of foreign experiences related to coopetition networks supporting the implementation of solutions 4.0 by interested enterprises.

7.2 The Industry 4.0 Revolution. Dynamics of Change as Well as Opportunities and Risks

The analysis of reports of international business agencies and research results of scientists in the areas of economic activities related to Industry 4.0 indicate exceptional dynamics in this area.

The importance of these challenges is indicated by the Roland Berger report "The Digital Transformation of industry", in which the authors of the report, in the context of Europe only, claim that "the digital transformation of industry is creating tremendous opportunities for Europe (…). By 2025, Europe could see its manufacturing industry add gross value worth 1.25 trillion euros—or suffer the loss of 605 billion euros in foregone value added. The digital transformation of industry is also driving a radical structural transition in Europe's economies. New data, connectivity, automation and the digital customer interface are challenging existing value chains. (…). At the same time, a powerful, no-gaps information and communications infrastructure is needed if European industry is to remain competitive" [19].

In this context, it is worth noting the reports describing the degree of preparation of companies and managerial staff for the Revolution 4.0. The report entitled "The 4th industrial revolution: a primer for manufacturers" [18] presents the results of research on the expectations of enterprises related to changes in Industry 4.0. 96% of manufacturers agree that the Fourth Industrial Revolution will be about connectivity and communication, while 99% of manufacturers agree that the Fourth Industrial Revolution will be about getting actionable insights into data. Furthermore, it should be noted that 74% of companies say the Fourth Industrial Revolution will fundamentally change customers' expectations. This fact, in the opinion of the authors of the article, will significantly affect competition in the sectors and may lead to the change of sector leaders. In addition, the report shows that as many as 80% of the surveyed manufacturers say it will be a business reality by 2025.

Another report, prepared by Deloitte and titled "The Fourth Industrial Revolution is here—are you ready?" [20] contains the results of a senior management survey on readiness for Industry 4.0 in four areas: social impact, strategy, talent and the workforce, technology.

"In social impact:

- Executives overwhelmingly (87%) believe Industry 4.0 will lead to more social and economic equality and stability, and two out of three say business will have much more influence than governments and other entities shaping this future.
- However, less than a quarter believe their own organizations hold significant influence over societal key factors such as education, sustainability, and social mobility.

In strategy:

- Only one-third of the executives surveyed are highly confident that they are capable of acting as stewards for their organization during this time of change. Further, just 14% are highly confident that their organizations are ready to fully harness the changes associated with Industry 4.0.

- Yet, many executives continue to focus on traditional business operations, as opposed to focusing on opportunities to create new value for their direct and indirect stakeholders.

In talent and the workforce:

- Only a quarter of executives are highly confident that they have the right workforce composition and the skill sets needed for the future.
- However, talent and HR are a relatively low priority (17%), despite 86% of executives saying they are doing everything they can to create a better-prepared workforce for this new era.

In technology:

- Executives say their current technology investments are strongly driven by technology that can support new business models, which they say will have one of the greatest impacts on their organizations over the next five years.
- However, very few executives say they have a strong business case for investing in advanced technology. When asked what the hindrances were, executives most often point to a lack of internal alignment (43%), a lack of collaboration with external partners (38%) and a focus on the short term (37%)".

The analysis of these statements points to great concerns of managers regarding the preparation of their organization for the upcoming revolution. At the same time, the low self-esteem regarding the possibilities of their own companies to actively participate in and shape these changes is emphasized. Therefore, it is even more important to look for ways to increase such self-esteem and build the potential to co-create the Revolution 4.0.

The above concerns are fully justified. A special feature of the Industry 4.0 Revolution will be gigantic changes within the existing value chains. They will probably change from the sequential chain towards the extreme network, described across all existing value chains. This will be possible, among others, by using information technology that allows real-time communication of individual elements of the value chain [6] (Fig. 7.1).

The same report cites the expected benefits of implementing a digital supply network. 56% of the respondents in a sample of 186 companies confirm that the introduction of such a chain will change the significant/step change benefit, 29% see incremental benefit, 2% do not know if benefits will occur, and 13% see exponential benefit.

One of the most interesting markets on which the 4.0 Revolution is already being introduced is electromobility. The market itself is growing rapidly. It is worth noting that all radical changes in the organization and management of enterprises that took place in the twentieth century began with the automotive sector, which was rich in funds for research and development. The sales volume of electric and hybrid cars in China in 2018 was about 70% higher than a year before (although from a low base). The share of partially or completely electrified vehicles in all new Chinese registrations exceeded the level of two per cent in 2017. Demand in Germany

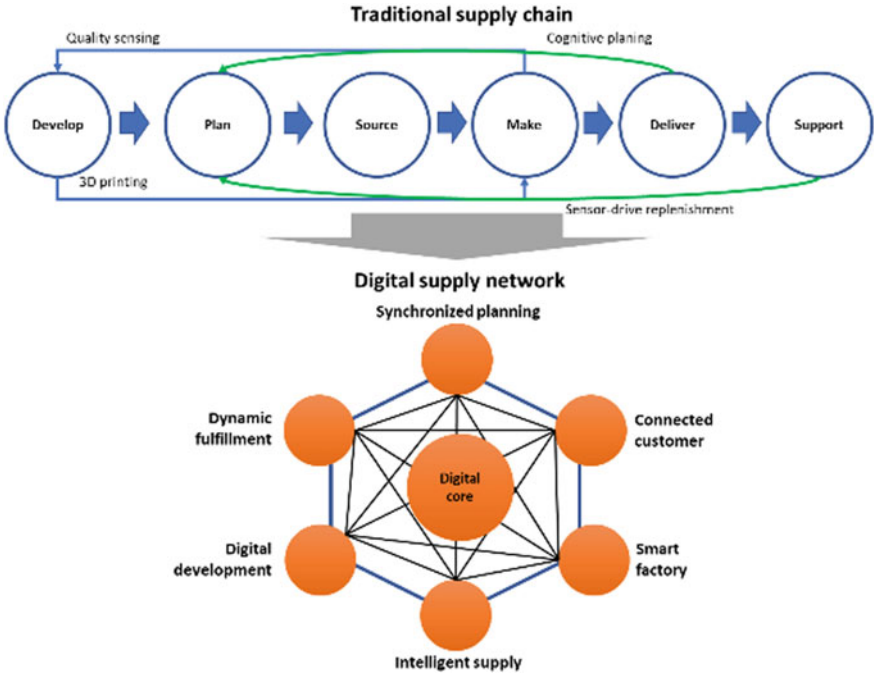

Fig. 7.1 Shift from traditional supply chain to digital supply network. Own based on [6]

increased significantly (over 90%), and about 1.5% of all newly registered vehicles were electric or hybrid ones [7].

The importance of the preparation of companies for Industry 4.0 has been indicated above. Unfortunately, the results of these studies confirm the weaknesses of companies, related to adaptation to the new reality. Therefore, in many countries, we can find governmental strategies supporting the development of Industry 4.0. Quite often these strategies are combined with the activities of commercial and private companies, frequently of competitive nature.

The analysis of these reports only, as well as research, shows that we are dealing with:

- a dynamic growth of industry sectors based on Industry 4.0,
- a real gap in knowledge among the surveyed companies in the Industry 4.0 area,
- the need to develop knowledge and competences related to Industry 4.0,
- the need for financial and substantive support of the state in the implementation of Industry 4.0 solutions.

The subject of the next part of the article will be a model of the coopetition network of companies and environmental organizations as a proposition to speed up the processes of knowledge accumulation, competence and awareness related to Industry 4.0.

7.3 The Model of the Coopetition Network of Companies and Organizations Within the Environment. The Perspective of Efficiency Sources

The areas of Industry 4.0 indicated in the introduction determine the future space for companies to compete. The changes resulting from this revolution will concern every aspect of our lives. The change will pertain not only to technology, but most likely to social structures related to the production and consumption process as well. The eight areas of Industry 4.0 are not independent areas. They are intermingling spaces of innovation in many different dimensions.

An example of combining these dimensions is the big data field. It is based on the idea of using information technologies for mass data processing. It combines the areas of cloud computing, mobile technologies, cybersecurity, big data, and cognitive computing. In practice, this means creating a network of holistically interpenetrating spaces (see Fig. 7.2).

This way, we receive (Fig. 7.2) a value chain built on solutions that constitute Industry 4.0. Currently, despite numerous implementations, this is still a new, costly,

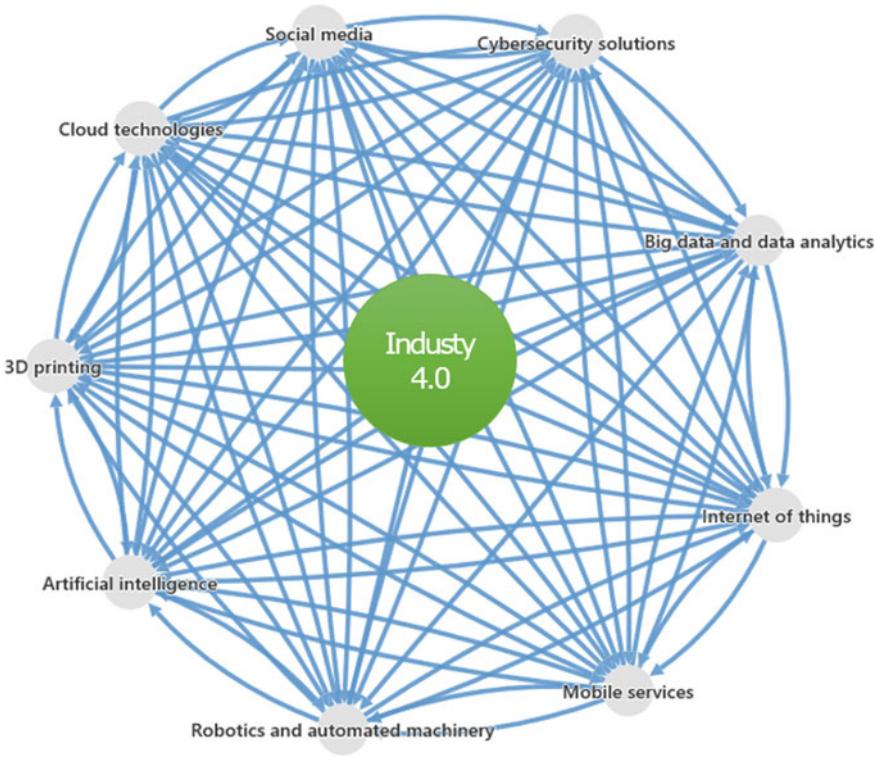

Fig. 7.2 Network structure of Industry 4.0. *Source* Own

and risky sector. It is also a diverse, interdisciplinary field of research in which it is impossible to achieve economies of scale yet. Furthermore, it is an extremely complex value-building chain that requires extensive competence, but also transforming reality into Industry 4.0. Companies interested in the world of 4.0 are therefore forced to cooperate, even if they have previously competed with each other.

In the article, the authors assume that a company interested in entering Industry 4.0, its active transformation and in taking a privileged position measured by the quality of its competence as well as the scope of the value chain covered, must use action models based on building or entering intentional coopetition networks. It cannot do it on its own. According to the authors of the article, such networks should consist of competing companies and various other institutions of the environment, including universities, government agencies, business support institutions, etc. Only then is it possible to leverage the resources and competences of organizations included in the network and to create a faster demand market and the supply of solutions with Industry 4.0 features.

Networks in economics and management literature have already been the subject of numerous studies [5, 12, 21] and so has been the subject of coopetition [10, 17, 24]. Most of these authors understand the network as a set of legally independent entities cooperating in selected areas in order to combine resources and competences (vertical integration), and to a lesser extent the pooling of resources in the context of horizontal integration. Coopetition studies in management are conducted equally often.

According to P. Klimas, coopetition is defined as the interaction of entities remaining at the same time in competitive relations. It is not an expansion or type of cooperation, and it represents completely different inter-organizational dynamics; it is a jointly implemented strategy focused on the processes of joint creation, but also capturing values. Its purpose is to jointly implement the convergent interests of the parties involved, although the mutual benefits of coopetition may or may not be balanced [9].

An interesting issue is the analysis of the sources of network effectiveness and coopetition. In the case of the network, it is worth emphasizing the classic research on minimizing transaction costs achieved in the network [23]. The classic results of works devoted to the synergy achieved in the network are also important. The advantage of the network is, in this case, to achieve synergy at a lower cost of resource accumulation and faster access to them. Another advantage of the network is the use of the convergence effect. Interesting research in this area was conducted by F. Hacklin. He pointed to the possibility of managing the convergence process in such a way as to accelerate the shifting of technological breakthroughs between businesses [10]. In this context, coopetition is a factor that increases the scope of convergence. An important effect of the network's operation, particularly important for cooperating and competing entities at the same time is a faster and more precise diffusion of knowledge between the network entities, but also diffusion directed at other entities of the environment. Network entities depend on such diffusion. In their diffusion studies of knowledge in the networks, S. Breschi and F. Malerba suggest that: "technology-based companies have a wider range of technologies. (…) Its

nature, knowledge, and it is difficult to know what to do in the market. (…) Firms act to create links with other companies. And we see the rise of the networked organization" [4]. The cited research concerns the transfer of knowledge between companies. Other authors, i.e. T. Scherngell and M. J. Barber, have taken the assumptions of the European Union's agencies for verification. "It is widely believed that interaction between firms, universities, and research organizations is a sine-Qua-non condition for successful innovations in the current era of the knowledge-based economy, in particular in knowledge intensive industries" [15]. In this form, networks of companies, universities, and other organizations are the best way to diffuse knowledge in the area of innovation and innovative sectors. Thanks to such diffusion, the market can be quickly transformed into Industry 4.0, thus building favourable development conditions for itself. An important source of network effectiveness is the network effect, rarely emphasized in the literature. By bringing together groups of stakeholders of the coopetition network in one system, it allows to increase the range of the network's impact, and at the same time provides each of the network participants with access to further groups of stakeholders, including potential customers and suppliers at a cost close to zero.

In turn, the advantages of binding competing entities into networks are as follows:

- using heterogeneity and resource uniqueness impossible in the network of non-competing partners [2],
- lower level of risk of opportunistic behaviour and temporary suspension of competitive behaviours weakening cooperation [24],
- the desire to increase the size of the market through the creation of a market niche. This is followed by the "aim to improve resource utilization, mitigate risk, and share costs" [3],
- since coopetitors may gain access to additional resources, but also possibilities to share risks and costs related to different firm activities. Moreover, firms use coopetition to protect market shares and improve firm competitiveness [22],
- the respective firms can keep or improve their own competitive position and mutually fight against strong competitors [14].

The advantage of the coopetition network models, as opposed to the classic sequential solutions, is the possibility of using many sources of efficiency. This allows to implement the required solutions much faster and more effectively. This is due to the network features: lower transaction costs, convergence effects, knowledge diffusion effect, network effect, but also coopetition features: the use of heterogeneity of companies, limitation of opportunism and competitiveness, possible market niche growth, risk division, keeping previous market shares by competing companies, and strengthening forces in the fight against common threats.

The proposed model of the coopetition network should therefore enable companies involved in such a project to reach the goal of achieving a key position in the marketplace 4.0. It seems that the indicated characteristics are conducive to reaching this goal.

Each such coopetition network consists of nodes. The nodes in the proposed model will be:

- companies involved in new technology markets,
- governmental and non-governmental organizations related to the promotion and dissemination of new technologies,
- high schools and higher education institutions,
- research institutes.

In addition to representatives of Industry 4.0, this model also indicates governmental and non-governmental organizations related to the promotion and dissemination of new technologies, organizations responsible for preparing staff (secondary and higher education) and societies for this type of ventures, as well as classical institutes and institutions conducting scientific research. The obvious solution is to include universities, mainly polytechnics and research institutes carrying out research assignments within new governmental technologies and private companies. There is also a group of organizations representing the scale of demand for solutions 4.0. The biggest potential recipients of 4.0 solutions are cities, regions, and governments. These organizations often have the resources of a public nature and can therefore be guided when making decisions not only for a short-term business purpose, but a long-term strategy for sustainable development.

The most important beneficiaries of such coopetition networks are both private and state-owned companies. In the longer term, they will benefit from the effects of such a network. The potential of new technologies developed thanks to the network is a space for building new values in the business and social dimension.

The network has the features of coopetition. Binding competing companies into one organism makes sense only when coopetition creates an additional value, not mere appropriation. This value, in this case, is the generation of a mature rich market space: in the suppliers of products and services 4.0, recipients 4.0, key partners 4.0, companies of technical and social infrastructure.

The element that links the network is relations. In the case of building a network with the features of coopetition, it is worth paying attention to the relations:

- team work,
- competition.

At the same time, it is worth emphasizing the features of such relationships that support the implementation of the strategic goals of the network. They are included in Table 7.1.

The distinguishing features of co-op relations, which are accentuated in numerous publications and which are reflected in the definitions of the concept, include:

- "duality of relations taking place—simultaneous occurrence of relations of cooperation competition, which is possible due to the separation of areas for individual activities, as well as effective coordination of activities in these separated operating zones of cooperating organizations;
- Interdependence—it manifests itself through the mutual dependence of the parties involved, as well as through the sharing of resources that have been brought to co-op in the form of a contribution, and which can take any form (factual, competence, or skills);

Table 7.1 Overview of the features of network interactions proposed in the literature on the subject

Authors	Features of network connections
H. Håkansson (1982)	• closeness • complexity • long-term approach
G. Easton (1992)	• mutual orientation of entities • dependence • mutual obligations • investment in network connections • atmosphere of mutual contacts (originating from conflicts or good cooperation)
D. Ford, H. Håkansson, J. Johanson (1993), M. Holmund, J. Å. Törnroos (1997)	• specificity of connection (dynamics, degree of utilization of the potential, nature of exchange and interaction) • reciprocity (degree of reciprocity, symmetry, possession of power, dependence on resources) • singularity (distinguishing features) • long-term approach • relationships with the environment
D. Ford, L. E. Gadde, H. Håkansson, I. Snehota (2003)	• interaction • interdependence • incomplete organization
H. Håkansson, I. Snehota (1995), D. McLoughlin, C. Horan (2000)	• structural features (continuation, comprehensiveness, symmetry, informality) • process characteristics (adaptations, cooperation and conflict, social interactions, routines)
K. Fonfara (2004)	• continuation of connections • the multilateral nature of the relationship • complexity • directness • informal nature • symmetry
W. Czakon (2005)	• exchange (of information, material and energy) • commitment (deepening and broadening the existing exchange relations) • reciprocity (including information exchange and joint, coordinated decision making on this basis)

Source Own study based on [13]

- long-term relationships—the longer the horizon of cooperation, the more willingly cooperation relations are undertaken; longer cooperation time also affects the quantity and variety of agreements undertaken under the coopetition of agreements and its internal structure;
- openness—cooperation must take part between two or more organizations, but there is no limit for the parties involved; openness also applies to markets that participate in coopetition, as co-operatives do not have to be only direct competitors; the forms and ranges of cooperation may also be of various nature—the decisive factor, in this case, is only the will of the parties and the possibility of achieving jointly defined goals" [16].

The indicated characteristics of network relations are consistent with the assumed objectives of the proposed model.

Therefore, if we create our model from the nodes that generate efficiency characteristic of the network and the efficiency resulting from coopetition, we will add networking features: comprehensiveness, symmetry, informality, adaptability, multilateral character, frequently occurring information exchange, involvement, coordination and reciprocity, and enriching features of coopetitive relations manifested in: duality, interdependence, longevity and openness, and features close to market relations of the right competitors, we will get our model of coopetition network (see Fig. 7.3).

7.4 Results of Own Research. Case Studies of Selected Coopetition Networks

In Europe and Asia, there can be found numerous ideas on networks supporting the development of Industry 4.0. They are usually mixed in character. They are created by government institutions or they are created with the support of state finances and private institutions, mainly enterprises. Their main goal is the creation of knowledge and its diffusion in the field of Industry 4.0. They rarely have the character of production and service centres with the character of an economic cluster.

Below, there are examples of such initiatives operating in European countries:

- France—Alliance pour l'Industrie du Futur
- Germany—Plattform Industrie 4.0
- Netherlands—Smart Industry
- Sweden—Produktion 2030
- Italy—Intelligent Factory Cluster (CFI)
- Spain—Connected Industry 4.0
- United Kingdom—HVM Catapult (HVMC)
- Czech Republic—Průmysl 4.0
- Poland—Fundacja Platforma Przemysłu Przyszłości.

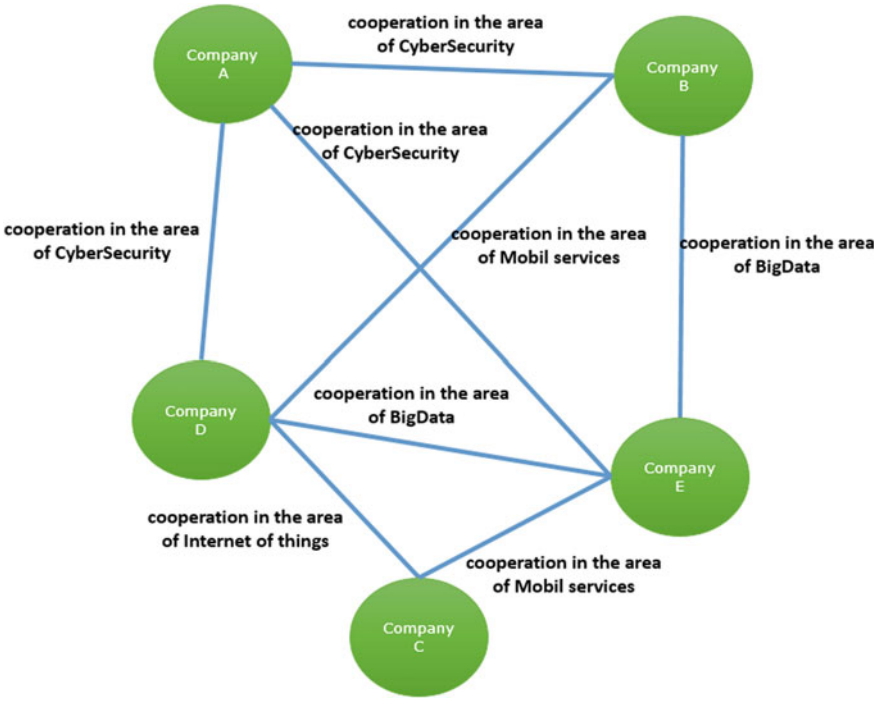

Fig. 7.3 Idea model of network in the Industry 4.0. *Source* Own

The budgets of these initiatives range from several dozen million euro to several billion euro. In Poland, it is a government program called Platform for Industry 4.0 (Fundacja Platforma Przemysłu Przyszłości). The vast majority of these activities are supported by the state budget. More or less, the orientations for technology and skills are distributed in the strategies of these initiatives. Additionally, what is probably obvious in this situation, most of the activities are planned in the top-down system. This results in a clear conclusion that without an external supply, both in the form of finance and management processes, it is difficult to imagine such an initiative as a bottom-up activity of grouped entities. Such a strategy is fully justified. Initiatives related to the future are risky, and their financial effectiveness is distant in time. Without power supply and external control, private companies, especially medium-sized ones, will not be interested. The situation is different in the USA. The government's participation in the economy is very limited there, and it rarely manages such activities. In the US economy, enterprises are accustomed to acting independently in this area. In addition, these companies have a definitely higher level of risk acceptance than companies in Europe and most often do not expect external support. This can be illustrated, for example, by the actions of Elon Musk.

An interesting example could be the emerging cybersecurity cluster in Lower Silesia. It combines cloud computing, mobile technologies, advanced robotics, big data,

Internet of things, cognitive computing, and cybersecurity, i.e. almost all Industry 4.0 branches. Its goal is to support the development of knowledge and public awareness in the area of cybersecurity, education in the area of cybersecurity at the higher level, supporting the development of economic, legal, and technical knowledge in the field of cybersecurity, creating products and services in cybersecurity, lobbying for legal solutions in cybersecurity, scale expansion cybersecurity activities. Within its structure, we find the following entities: universities, private companies, local government units, and state administration, as well as employers' unions. In principle, the coopetition network condition is met, although the weakness of this network is the lack of large business entities. The presence of large organizations which are potential customers of the sector is an advantage. The sources of financing the activities of this network are as follows: funds obtained by the lead entity in government programs, partners' funds engaged in joint and individual ventures, future commercial activities. The network described in this form allows to obtain all of the network effects. It reduces transaction costs by building trust between network participants, and it enables convergence of behaviours, attitudes, legal, technological, and technical systems. It also allows quick and effective diffusion of knowledge. Finally, by joining large, potential customers, it introduces elements of the network effect. It also allows, although limited in this phase of growth, to achieve the effects of the coopetition network, including the use of heterogeneity of companies, limitation of opportunism and competitiveness, risk division, keeping previous market shares by competing companies, and strengthening of forces in the fight against common threats.

The assumptions of the aforementioned coopetition network also raise some critical remarks, which should not appear in the perfect model of the coopetition network. There are no large business entities, producers, or cybersecurity service providers in this network. Therefore, the diversification of funding sources is also missing, despite the presence of large consumer organizations and local government units and state administration. The weakness, at least in this phase of network development, is the limitation of activities to big cities only.

In the indicated model of the coopetition network (Chap. 2), there was mentioned building an area of awareness of the Industry 4.0 products and services, building the fundamentals of the future world of technology, law and the economy of Industry 4.0. The aforementioned cybersecurity network is planning to expand its area of interest to include the widely understood cybersecurity space.

Two other initiatives can be analysed in a similar system: "German Industry 4.0" and "Made in China 2015".

- Sign: "Industrie 4.0"—German manufacturing in the future: suggestions for implementing the strategy of "Industrie 4.0"; Made in China 2025;
- Background: "Industrie 4.0"—post-crisis era; Made in China 2025—China's manufacturing big but not strong;
- Aim: "Industrie 4.0"—to improve the competitiveness of manufacturing industry in Germany; Made in China 2025—to promote from manufacturer to make power;

- Essence: "Industrie 4.0"—re-industrialization strategy; Made in China 2025—transformation and upgrading of manufacturing strategy;
- Primary coverage: "Industrie 4.0"—core, strategy, integration, and measures; Made in China 2025—emphasize innovation drive, quality first, green development, structure optimization, people oriented [11].

The analysis of these two successive networks indicates a strong embedding (placement) in the structure of state programs. In both cases, the reason is to increase the dynamics of Industry 4.0 development and to build a strong competitive economy. The plans of both networks emphasize the process of building structures and processes for space 4.0 by supporting primarily innovative solutions. It seems that the lack of such constituted networks means less emphasis on the educational function and on building public awareness in the area of solutions 4.0.

An interesting proposal going beyond the framework of the coopetition network model is the Polish government proposal of the platform (Act on the Platform for Industry of the Future Foundation). Its formal goal is to support entrepreneurs in the digital transformation towards Industry 4.0 and the recipients of business, science, education, society, and the state. The foundation is also expected to transfer knowledge, train entrepreneurs, and demonstrate solutions that allow increasing the competitiveness of the industry (www.przemysł-40.pl). An interesting role of the foundation will be building a support network for the industry of the future. The initiative lacks only formal and informal members to constitute the coopetition network. In this form, it is merely an organization operating in the legal form of a foundation, whose tasks are of a promotional and educational nature.

The presented solutions do not possess all the features of the coopetition network. They deviate from the model assumptions of the coopetitive network presented in the second chapter. However, these examples are much closer to the idea of this form of building the company's position in the future.

7.5 Conclusion. Discussion of Results

The aim of the article is to propose a network model with the features of coopetition, dedicated to activities supporting the company taking a privileged position in new areas of economic activities on the example of the Industry 4.0 Revolution.

The dominant view in the literature of the subject is the use of the support model by the state or institutions representing it, creating conditions for the development of new technologies. In principle, it is difficult to find models based on the promotion of a liberal policy in this area, which would lead to the use of natural competitiveness of companies. The indicated examples, therefore, include the role of the state as a stimulator of the development of activity in Industry 4.0.

The solution indicated in the article is consistent with current trends in management. One of them is stressing that the horizontal and vertical integration of the value chain and the related interoperability expands firms' traditional boundaries due to the

organization and the stakeholders' network (…). As a consequence, new ways of creating and offering value through ecosystems that go beyond individual value chains are raising (…). Companies feel increasingly compelled to revise their existing business models in response to new competitive dynamics and to tap into those Industry 4.0 inspired opportunities [8]. An interesting comparison is also the proposal of new ecosystems in these models suggested a radical innovation of the actual business model which follows the purpose of focusing on the core business (key or distinctive activities of the firm), sharing the uncertainty with other agents or achieving new required skills and resources from associates, due to the introduction of technologies such as big data, cloud computing, augmented reality, or virtual reality. By this way, the focal firm's value creation process is linked with the stakeholders' processes.

The solution indicated in the article is, in the opinion of the authors, consistent with the currently discussed and implemented models of accelerating the organization's adjustment to the new operating conditions. In general, thanks to this, the convergence of new solutions is much faster, and the potential of the entire ecosystem is growing.

The proposed model of the coopetition network uses the natural entrepreneurship of companies and their readiness to compete, moderated by the cooperation framework imposed by the state or institutions managing such a network. It also uses all the advantages of the network as a specific system of managing and organizing the activities of the entities involved. An important element in the whole process of cooperation is constant communication of the overarching goal of such a coopetition as building, supporting, and promoting the transfer of knowledge, competence, and experience. It is important to educate all—the suppliers, employees of the 4.0 sphere, as well as recipients, in the spirit of understanding the challenges and opportunities of Industry 4.0.

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Chapter 8
Interorganizational Trust in Business Relations: Cooperation and Coopetition

Dagmara Lewicka and Agnieszka Zakrzewska-Bielawska

Abstract This study aims to answer the question: How level and character of interorganizational trust in different groups of partners influences a firm's collaboration expressed by cooperation and coopetition. The literature suggests many factors determining the interorganizational trust, but our results, based on research conducted in 53 companies operating in Poland, grouped them into three different variables: the level of trust in a particular group of partners from the value network, the general trust in a potential partner, and the general trust in collaboration. Our findings also show that if the level of trust in a particular group of partners (i.e., suppliers, customers, other non-competitive partners) increases, the partnership cooperation with particular group is greater, and similarly if the level of trust in competitors increases, the inclination to coopetition is greater. Moreover, the other variables of interorganizational trust are not significant in this context.

Keywords Trust · Interorganizational relations · Cooperation · Coopetition

JEL L14 · L21

8.1 Introduction

The concept of Industry 4.0. is a result of the need for creating the environment in which the digital world and the physical world would be smoothly and fluidly blending [1]. It is caused by the technological progress, role of cyber-physical systems, robotization and digitalization in the network economy [39, 43]. Industry 4.0 is a new industrial stage in which there is an integration between manufacturing operations systems and information and communication technologies (ICT) [19]. Today's

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businesses have to respond to evolving trends through the increasing vertical and horizontal integration of value chains [66]. This, in turn, requires a wide collaboration of enterprises based on cooperation and coopetition. Interfirm collaboration in dyads and networks allows firms to specialize in core businesses, to outsource value-chain stages, to act more quickly than rivals, and finally to achieve a sustained competitive advantage [74]. Cooperation is a kind of collaboration with non-competitive partners, while coopetition is a kind of collaboration with competitive partners by which simultaneous cooperation and competition between enterprises are implied [76]. In general, the need for cooperation and coopetition is explained by technological progress, globalization, shortening life cycles of technologies and products, deeper and faster changes in the environment and its high uncertainty [59] which closely relate to conditions of industry 4.0.

Cooperation and coopetition are determined by many factors, among which trust is one of the most important ones. Trust has been found to reduce conflict and risk by creating goodwill that secures relationships, while at the same time strengthening satisfaction and partners' commitment in the exchange [53]. Existing literature primarily focuses on indicating the important role of trust in the collaboration process and in its outcomes. Among other things, it was shown that trust in partners has a significant impact on the process of knowledge creation and exchange [10], as well as protecting the company against its leakage [35]. A higher level of trust between network participants leads to an increase in its effectiveness [38], contributes to the reduction of the propensity to opportunistic behavior [48, 51], but also increases partners' loyalty and satisfaction with the cooperation [33]. Most research focuses on the role of trust in cooperation (e.g. [20, 22, 62]), less frequently in coopetition (e.g. [16, 18]). In addition, researchers often analyze the impact of trust on cooperation in general and not in relation to a specific group of partners, which, after all, are different.

It is, therefore, a research gap. This study aims to fill this gap by answering the question: How level and nature of interorganizational trust in different groups of partners influences a firm's collaboration expressed by cooperation and coopetition. A relational view perspective [27] and the associated concept of a value network [52] were adopted. Relational View is an approach in which a company builds and develops interorganizational relations with various partners (i.e., suppliers, customers, competitors, partners), and their portfolio is a key factor in the process of gaining competitive advantage expressed by relational rent [28]. In order to create value, the company and its market stakeholders are required to collaborate and constantly adapt to changing external and internal exchange conditions [31]. Collaboration with individual groups of partners in the value network is therefore partnership and long-term, based not only on exchange, but also on commitment and reciprocity [17, 57], as opposed to the logic of the value-chain related to the concept of the economic path [9, 75], which is reflected in short-term transactional cooperation, primarily based on price [65].

This paper contributes to the literature on interfirm collaboration by showing how identified level and character of trust in a particular group of partners from the value network drive firms to coopete or cooperate with them, and what kind of cooperation

that is, transactional or based on partnership. Because of the sample size, the obtained results cannot be generalized, and they only refer to managers' perceptions and the context of companies operating under Polish conditions; however, the study could be a good starting point for further explorations and research.

In the following sections, we discuss trust in interorganizational relations form the perspective of its dimensions and its role in cooperation and coopetition. Next, we present the research methodology used and discuss the findings. Finally, we draw conclusions and outline the limitations of this study and suggest directions for further research.

8.2 Trust in Interorganizational Relations: Literature Review

8.2.1 Interorganizational Trust and Its Dimensions

The literature highlights the importance of trust in interorganizational relations [3, 20, 37, 40, 67]. It is pointed out that establishing and maintaining relations is much easier if partners can trust each other. Mayer with colleagues [47] defines trust as the willingness of one party to accept the actions of the other party, based on the expectation that the partner will behave in a certain way without having to monitor and control its actions. Trust in business relationships therefore reduces uncertainty in the relationship. It is a state including positive expectations about the motives of the other party in risk situations [11]. It is based on the subjective, gradable probability of behavior and actions taken by the other party in a particular situation and the conviction that the other party will not act to the disadvantage of the partner by taking advantage of the partner's weaknesses [48]. The degree of trust is therefore the decisive criterion for choosing between a multitude of business alternatives. Cooperation based on trust generates many benefits for the organization. Among others partners do not have to bear the costs of complex mutual agreements, because they are ready to act in a way that considers the interests of both parties, e.g. in non-standard situations, which leads to lower transaction costs [2, 27].

Trust-building is gradual and consists in providing new premises for consolidating trust. As Dobiegała-Korona [24] points out, trust should be treated as a process that grows thanks to positive experiences, built on the basis of both rational and emotional premises by both parties and with the support of institutional trust.

Trust-building is, therefore, a process based on the history of mutual contacts. Hardwick et al. [32] noted that different types of trust are important at different stages of cooperation development. For the purposes of their research, they have identified two types of trust: trust-based on technical capabilities (convergent with trust in competences) and trust resulting from personal qualities (convergent with trust in honesty and kindness). It turned out that trust based on technical capabilities often initiates cooperation.

In case of lack of knowledge about a potential partner, in order to decide about the collaboration, an initial bond of the relationship—which may be a recommendation from another source—a third party is necessary. This can be trusted in another partner or a related institution. Then there is a transfer of trust from the third party to the relations emerging in the network. In this situation, the third party shall offer to all entering into the relationship evidence of the reliability of each party to the relationship. In this way, a third party acts as a trusted distributor [63]. Research shows that trust in the third party in the relationship is of particular importance in the initial stage of collaboration between partners/companies. Repeated contacts through a third party initiate trust in the organization (but also interpersonal) between representatives of the partners [54].

According to the model by Mayer et al. [47], it is pointed out that trust is based on three components: ability, benevolence, and integrity. The first of them refers to the skills, knowledge, and experience of the partner, important for the implementation of the substantive scope of collaboration. It boils down to the conviction that the partner will be able to carry out the tasks assigned to it in a competent manner. Benevolence means the scope of care for the common good and strengthening the atmosphere conducive to building long-term relationships [50]. Integrity, on the other hand, concerns the extent to which the partner respects the principles of collaboration which are important for both parties, such as quality or timeliness. It also refers to the scope of information provided to the partner. These dimensions build the credibility of the partner, while at the same time being a source of trust in it.

Many authors point out that trust is an essential condition for each type of relationship [29, 42, 61]. At the same time, studies confirm the significant role of trust in interorganizational relations, which helps to reduce conflicts [5], stimulates cooperative behavior [25], increases partners' loyalty and satisfaction with cooperation [33].

8.2.2 Trust in Cooperation

Trust-based cooperation is based on the conviction that it will bring significant benefits to the organization, such as cost reduction, knowledge, innovation potential and many others [36]. Finding a trustworthy and competent partner is crucial for cooperation [37]. It is stressed that cooperation based on trust improves communication and exchange of information between partners [30] and ensures that the implementation of a contract takes place in an atmosphere of mutual understanding, which is particularly important in unpredictable situations [68].

The theory of transaction costs assumes rational actions of players (actors) on the economic market [73]. Transactions conducted by entities are related to incurring transaction costs, which include: partner search, costs of negotiations, contract conclusion, its control, and others. It also points out that, as operators seek to maximize their own interests, they are at the same time exposed to opportunistic action by other operators who do not hesitate to take advantage of favorable opportunities

to maximize their own profits [41]. Therefore, transactional relationships require a number of collaterals, detailed agreements and monitoring activities. Comprehensive contracts that describe in detail the rules of cooperation and the consequences of failure to meet commitments may reduce opportunistic behavior and minimize the risk of conflicts or misunderstandings in the course of cooperation. In line with these assumptions, it is assumed that continued close cooperation reduces transaction costs and increases the benefits to partners.

Many authors point out that relationships based on trust can replace transactional relationships [27, 68]. Researchers also stress that transactional relationships can stifle the development of trust between partners because they base their relationships on detailed rules, making it impossible to naturally build mutual credibility [56]. If a gap in the contract is found, it may be very expensive for one of the parties [46]. Malhotra and Lumineau [45] indicate that contracts based on extensive and detailed provisions aimed at controlling and minimizing the risk of opportunistic behavior reduce the goodwill trust in the relationship and willingness to continue cooperation [48].

The literature on the subject, therefore, perceives relations as one of the most important resources, building the value of the company and its competitive advantage [8, 69]. This resource is the basis for its market power, reducing uncertainty and stabilizing its market position in the . Participation in the network, i.e., a group of actors with strategic links between them, provides access to technology information, faster learning, risk sharing, and cost-sharing. Integration of own resources with partners' resources makes them more unique, which makes it possible, among other things, to generate a greater relational rent. The network theory clearly defines the role of trust in the process of partner selection. The impact of two types of trust on the process is indicated, i.e., knowledge-based trust and deterrence-based trust. In the first case, the network may be a source of information on the potential partner's capabilities and reliability [60]. In the second, it is based on the fear of costly sanctions that can be imposed on a company that shows opportunistic behavior [64]. Damage to reputation may result in the loss of current and future opportunities for cooperation [34].

As a result, it can be concluded that cooperation of a partnership nature is characterized by a higher level of trust in partners, partnership and the overall value of cooperation than in the case of other relationships (e.g. [27]). This study focuses on particular groups of cooperation partners, i.e., customers, suppliers and other non-competing partners, which gave rise to the formulation of the following hypotheses:

H1: Cooperation with suppliers has a partnership character: (a) the higher the level of trust in suppliers, (b) the higher the overall level of trust in cooperation partners, (c) the higher the overall level of trust in the cooperation itself.

H2: Cooperation with customers/clients has a partnership character: (a) the higher the level of trust in the customers/clients, (b) the higher the overall level of trust in the cooperation partners, (c) the higher the overall level of trust in the cooperation itself

H3: Cooperation with other non-competing entities has a partnership character: (a) the higher the level of trust in them, (b) the higher the overall level of trust in cooperation partners, (c) the higher the overall level of trust in the cooperation itself.

On the other hand, in the case of transactional relations, a lower level of trust in partners, partnership and the overall value of cooperation can be expected than in the case of partnership relations (e.g. [45]). This is the basis for the formulation of reverse hypotheses, i.e.:

H4: Cooperation with suppliers has a transactional character: (a) the lower the level of trust in suppliers, (b) the lower overall level of trust in cooperation partners, (c) the lower the overall level of trust in the cooperation itself.

H5: Cooperation with customers/clients has a transactional character: (a) the lower the level of trust in the customers/clients, (b) the lower the overall level of trust in the cooperation partners, (c) the lower the overall level of trust in the cooperation itself.

H6: Cooperation with other non-competing entities has a transactional character: (a) the lower the level of trust in them, (b) the lower the overall level of trust in cooperation partners, (c) the lower the overall level of trust in the cooperation itself.

8.2.3 Trust in Coopetition

Coopetitive relations remain in the circle of growing interest due to the growing uncertainty of the business environment and the growing interdependence of enterprises. The requirements of competition make it necessary for market rivals to cooperate with each other in order to generate more value together [26]. An important condition for coopetition is the continuous development of relations, necessary to maintain cooperation between competitors, as well as to guarantee the sustainability of the organizational network, knowledge transfer and organizational efficiency [15, 44]. Many authors emphasize the important role of trust as a factor supporting coopetitive relations [13, 23]. This is due, among other things, to the fact that trust is an essential building block of voluntary cooperation, and coopetition consists of two elements: competition and cooperation. However, in this system trust is only one of the factors that may explain the tendency to establish coopetitive relations.

So far, however, little research has been devoted to the mechanism of trust emergence in coopetition. The research findings to date definitely confirm the positive effects of trust in relations between companies [21]. It is stressed that trust reduces opportunism [14, 70], improves interactions between partners and develops identifications around shared values [13]. Trust can partially replace formal agreements and reduce the costs of activities. Where there is a high level of trust, the parties will rely more on oral commitments and promises. In addition, some activities can be initiated horizontally by line managers who are in direct contact with their counterparts in the other company. Research also shows that trust in coopetitive relations is developing on the basis of monitoring the other party's behavior and open communication, which leads to better mutual understanding [4, 7].

Bouncken and Fredrich [12] showed that the strength of trust affects the likelihood and effects of coopetition. These studies tested trust in four alternative combinations, demonstrating that coopetition leads to the best results in case of high trust and high dependency.

To sum up, it is worth emphasizing that research results indicate that trust is an extremely desirable, and even a necessary condition for effective coopetition. Therefore, it can be assumed that the propensity to voluntary coopetition and coopetition at the request of customers is related to the level of trust in partners, partnership and the value of cooperation in general. The above gives rise to the following hypotheses:

H7: The propensity for voluntary coopetition is higher: (a) the higher the level of trust in competitors, (b) the higher the overall level of trust in cooperation partners, (c) the higher the overall level of trust in the cooperation itself.

H8: The propensity for coopetition on demand is higher: (a) the higher the level of trust in competitors, (b) the higher the overall level of trust in cooperation partners, (c) the higher the overall level of trust in the cooperation itself.

Based on the assumptions of the role of interorganizational trust in cooperation and coopetition and the hypotheses set, we built a research model as shown in Fig. 8.1. In order to test these hypotheses, research was conducted in Polish companies in 2018.

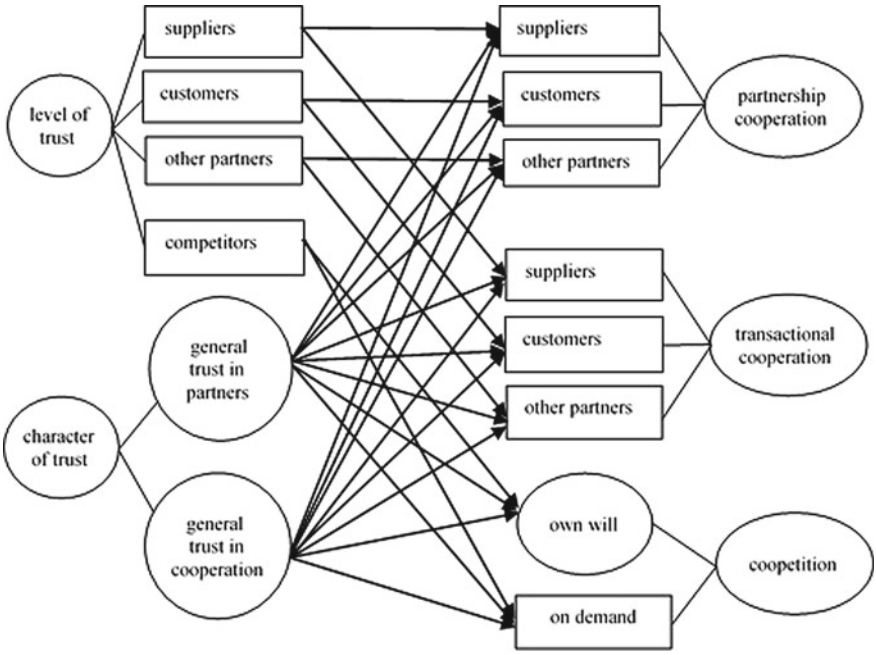

Fig. 8.1 Research model

8.3 Methodology

8.3.1 Sample and Data Collection

The research subject was medium-sized companies (i.e., with 50–249 employees) operating in Poland. Companies of this size were chosen specifically, as they are characterized by a high level of diversity. In this group, there are entities with qualities ascribed to small companies, as well as those whose characteristics are closer to those of large companies. We used a questionnaire survey to collect the primary data for this study.

The research presented here is part of a broader project devoted to the study of the content, characteristics and effects of relational strategy of enterprises. The impact of trust on taking up coopetition and cooperation was one of the partial issues. The research was carried out in three stages. In the first one, field research was carried out using the method of semi-structured interviews on a sample of 53 medium-sized companies selected deliberately according to the number of employees. A selection of that 21 companies was assumed with employment from 50 to 70 people and 32 companies with employment from 71 to 249 people, of which at least 16 with employment of more than 200 people, but less than 250, were selected. The sampling frame was the database of the National Economy Register (REGON), from which the so-called gross sample was obtained, i.e., the list of entities several times exceeding the number of the assumed sample. Ultimately, 53 companies agreed to participate in the study. Respondents were owners or top management. The research was conducted from November 2016 until the end of July 2017. The results allowed to create a standardized tool for examining the relational strategy, its features, effects and conditions, which were subject to expert evaluation. Hence, the second stage of research was expert research. It was carried out from May to June 2018. Experts were a group of 20 people who were representatives of the Polish scientific community. Their selection was purposeful, and the criterion for selection was significant scientific achievements in the scope of strategic management and/or issues related to interorganizational relations or networks, which was verified by the number of publications and their subject matter on the basis of data from the Google Scholar database. Each of the experts was asked to give an opinion on the items describing the variables under examination from the perspective of their validity and theoretical relevance, as well as the degree of understanding by economic practitioners. Among them there were variables related to trust (its level and character) and those related to the nature of cooperation and coopetition. The results of expert research allowed us to develop and refine the research tool that was used in the third stage of research. At this stage, respondents from the first stage (i.e., 53 medium-sized companies) were again asked to complete a standardized questionnaire this time.

The studied population was mainly mature entities, i.e., entities operating on the market for over 20 years. Therefore, having appropriate experience in creating, developing or withdrawing from interorganizational relations. The majority of them

were manufacturing companies (28 companies) and those which were active on the domestic market (31 companies).

8.3.2 Variables Measures

We consulted the existing literature to compile measurement items. Next, the items were modified after the expert research. All constructs were measured on a seven-point Likert scale from strongly Disagree (1) to strongly Agree (7).

Trust was measured by its level and nature. The level of trust was determined by respondents in relation to selected groups of partners, i.e., suppliers, customers/clients, competitors and other key entities with which the company cooperates. The nature of trust was defined by eight items. In order to check whether the items determining the nature of trust are one factor, we conducted an Exploratory Factor Analysis (EFA), which was facilitated by the value of Kaiser-Meyer-Olkin's statistics of 0.829. According to the screen plot criterion, the nature of trust should be determined by two factors that explain 80.54% of the output variance, of which the Eigenvalue is higher than 1. We conducted EFA on the scale items by principal component analysis rotated with varimax rotation. From this extraction, we obtained two components: (1) overall trust in cooperation partners and (2) trust in cooperation itself. The factor loadings are significantly above the requisite 0.7, except for the item of we trust that as a result of the cooperation we will obtain benefits exceeding the outlays with a factor loading of 0.60, but it is still acceptable. Table 8.1 displays the EFA results. Next, we ran reliability analyses for these two variables. The Cronbach's α value for the first variable is 0.97, and for second is 0.66 (Table 8.1). Thus, these two variables demonstrate adequate reliability and convergent validity.

Cooperation was measured separately in relation to particular groups of partners (i.e., suppliers, customers/clients, other non-competitors), and was determined through the prism of transactional cooperation based primarily on exchange and price [65] and through the prism of partnership cooperation, based on long-term relations, characterized by commitment and reciprocity [17]. To this end, respondents were asked to respond to two items: (1) "Our cooperation with suppliers/customers/other non-competitors is primarily transactional", (2) "Our cooperation with suppliers/customers/other non-competitors is primarily partnership-based".

Coopetition, in turn, meaning simultaneous cooperation and competition, was measured by identifying this type of relationship and the propensity for it. For this purpose, we proposed 4 items (Table 8.2) and carried out an exploratory factor analysis, which was made possible by the value of Kaiser-Meyer-Olkin's statistics amounting to 0.841. According to the scree plot criterion, coopetition and propensity to it should be determined by two factors: (1) voluntary coopetition and (2) coopetition on demand, which together explain 95.56% of the output variance, of which the Eigenvalue is higher than 1. In this case, we also conducted EFA by principal component analysis rotated with varimax rotation. The factor loadings are significantly greater than 0.7. We checked reliability and validity of the first variable calculating

Table 8.1 EFA results and coefficient alpha for the nature of interorganizational trust

Variable	Item	Factor loading	Validity and reliability—Cronbach's α
Overall trust in cooperation partners (OTP)	We trust that the partner, based on its competences, is able to meet the conditions of cooperation	0.90	0.97
	We trust that our partner pursues common goals	0.96	
	We perceive our key partners as predictable/operating on the basis of specific principles	0.96	
	We see our key partners as fair	0.94	
	Our current experience with key partners is positive	0.86	
Trust in cooperation itself (TCI)	We trust that as a result of cooperation we will obtain benefits exceeding the outlays	0.60	0.66
	We trust that in case of disputes we will find a solution together (with a partner)	0.77	
	If an entity (company, institution), in which we trust, recognizes another entity as reliable, we also trust it in case of potential cooperation	0.86	

Extraction method: Principal component analysis. Rotation method: Varimax with Kaiser normalization. Accumulate explained variance = 80.54%

the Cronbach's α value, which is 0.88. The second variable consists of the only one item, thus we did not calculate the Cronbach's α for it. Results are presented in Table 8.2.

Because we collected data from owners and managers using a single questionnaire, any relationships observed may be susceptible to common method bias. We followed the procedures recommended by Podsakoff et al. [55] for limiting the potential for common method variance. Specifically, we assured respondents that there were no

Table 8.2 EFA results and coefficient alpha for coopetition

Variable	Item	Factor loading	Validity and reliability—Cronbach's α
Voluntary coopetition (VC)	We actively and systematically develop cooperation relations with selected competitors	0.91	0.88
	If competitors offer cooperation, we accept it (if it is legal and advantageous)	0.89	
	We cooperate with competitors on our own initiative	0.90	
Coopetition on demand (DC)	We cooperate with competitors on request/demand of customers	0.98	–

Extraction method: Principal component analysis. Rotation method: Varimax with Kaiser normalization. Accumulate explained variance = 92.56%

right or wrong answers, encouraged them to respond as honestly as possible, grouped construct items in sections and not in variables, and employed multi-response formats.

8.4 Findings

Next, we tested our research model and corresponding hypotheses. Firstly, we present the means, standard deviations, and bivariate correlations for the variables (Table 8.3). We used following symbols:

1. LTS—level of trust in suppliers
2. LTC—level of trust in customers/clients
3. LTOP—level of trust in other partners
4. LTCp—level of trust in competitors
5. OTP—overall trust in cooperation partners
6. TCI—trust in cooperation itself
7. PCS—partnership cooperation with suppliers
8. PCC—partnership cooperation with customers/clients
9. PCOP—partnership cooperation with other partners
10. TCS—transactional cooperation with suppliers
11. TCC—transactional cooperation with customers/clients

Table 8.3 Descriptive statistics and correlation matrix

Variables	*M*	*X*	Sd	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. LTS	6	5.24	0.92	1.00													
2. LTC	6	5.41	1.00	**0.41**	1.00												
3. LTOP	5	4.84	1.08	−0.02	0.02	1.00											
4. LTCp	3	3.73	1.00	0.15	0.15	**0.33**	1.00										
5. OTP	6	5.67	0.64	**0.47**	**0.46**	0.01	0.21	1.00									
6. TCI	5	5.18	0.62	**0.44**	**0.54**	0.08	0.25	**0.43**	1.00								
7. PCS	6	4.49	1.77	**0.83**	0.26	−0.11	0.09	**0.38**	**0.28**	1.00							
8. PCC	6	4.79	1.69	**0.47**	**0.49**	**0.33**	**0.38**	**0.43**	**0.47**	**0.28**	1.00						
9. PCOP	3	3.90	1.82	0.25	**0.34**	**0.40**	**0.47**	**0.29**	**0.37**	0.08	**0.43**	1.00					
10. TCS	3	3.83	1.74	**−0.82**	**−0.29**	0.14	−0.06	**−0.31**	**−0.33**	**−0.93**	−0.25	−0.03	1.00				
11. TCC	3	3.60	1.57	**−0.41**	**−0.44**	**−0.34**	**−0.42**	**−0.39**	**−0.47**	−0.22	**−0.94**	**−0.46**	0.20	1.00			
12. TCOP	5	4.35	1.79	−0.21	−0.25	**−0.42**	**−0.49**	**−0.28**	**−0.28**	−0.08	**−0.39**	**−0.93**	0.01	**0.41**	1.00		
13. VC	3	3.29	1.11	0.19	0.25	**0.32**	**0.72**	0.22	0.18	0.07	**0.36**	**0.46**	−0.04	**−0.36**	**−0.45**	1.00	
14. DC	3	3.21	0.96	0.18	0.15	−0.02	0.03	−0.04	0.12	0.23	0.14	0.00	−0.26	−0.20	0.01	−0.13	1.00

$n = 53$ business entities, *M*—median; *X*—mean, SD—standard deviation; Bold value signifies the correlation is statistically significant for $|r| \geq 0.28$ with min. $p < 0.05$

12. TCOP—transactional cooperation with other partners
13. VC—voluntary coopetition
14. DC—coopetition on demand.

The results confirm that the surveyed companies cooperate primarily with partners from the economic path, i.e., suppliers and customers, and this cooperation has a partnership character, as evidenced by the median value of 6. In relation to these groups of partners, they also show the highest level of trust. In relation to the complementors, the level of trust is high ($M = 5$), however, the surveyed companies maintain primarily transactional relations with these entities. Coopetition was the least popular due to the limited level of trust in competitors ($M = 3$). It should also be noted that the overall level of trust in cooperation partners, related to their perception, is quite high ($M = 6$), as is the overall level of trust in cooperation itself ($M = 5$).

Taking into account the correlations between individual variables in the context of the hypotheses, a significant part of the dependencies is statistically significant. The hypothesis H1 should be confirmed, because cooperation with suppliers is a partnership (PCS), the higher the level of trust in suppliers ($r = 0.83$), the higher the overall level of trust in cooperation partners ($r = 0.38$), and the higher the level of trust in the cooperation itself ($r = 0.28$), while in relation to the last two factors these dependencies are weaker.

Similarly, hypotheses H2 and H3 should be confirmed on the basis of the results obtained, with correlations with particular factors determining the level and nature of trust in the case of partnership with customers/clients being on the similar level (from $r = 0.49$ for LTC to $r = 0.43$ for OTP). In the case of partnership cooperation with other entities (LTOP), on the other hand, relations are stronger in relation to the level of trust in them ($r = 0.40$) and trust in cooperation itself ($r = 0.37$) than overall trust in cooperation partners ($r = 0.29$).

At the same time, hypotheses H4, H5, and H6 turned out to be true, based on correlation analysis. All dependencies are negative, which proves that cooperation with suppliers/customers/other entities, respectively, is transactional, the lower the level of trust in a given group of partners, a lower overall level of trust in cooperation partners, as well as the cooperation itself.

In relation to coopetition, only one relation turned out to be statistically significant, i.e., the higher the level of trust in competitors ($r = 0.72$), the higher the propensity for voluntary coopetition. Therefore, only hypothesis H7a is true. Other factors determining the nature of trust, i.e., overall trust in cooperation partners as well as trust in cooperation itself turned out to be irrelevant from the perspective of establishing and developing coopetition relations.

A linear regression was carried out by performing deeper analyses and checking the combined influence of particular factors determining trust on cooperation and coopetition. Its results are presented in Tables 8.4 and 8.5.

When considering cooperation with suppliers, it should be noted that its partnership or transactional nature depends primarily on the level of trust in suppliers (model 3a with variation of PCS of 70.6% and model 6a with variation of PCS of

Table 8.4 Regression analysis for cooperation

(a) With suppliers

Independent variable: interorganizational trust	Dependent variable: PCS			Dependent variable: TCS		
	Model 1a	Model 2a	Model 3a	Model 4a	Model 5a	Model 6a
LTS			0.878*** (0.092)			−0.865*** (0.097)
OTP		0.314** (0.143)	0.007 (0.091)		−0.208 (0.145)	0.094 (0.096)
TCI	0.280** (0.134)	0.145 (0.143)	−0.107 (0.089)	−0.328** (0.132)	−0.239 (0.145)	0.010 (0.094)
R^2	0.078	0.159	0.706	0.107	0.143	0.673
F	4.344	4.725	39.292	6.141	4.160	33.697

(b) With customers/clients

Independent variable: interorganizational trust	Dependent variable: PCC			Dependent variable: TCC		
	Model 1b	Model 2b	Model 3b	Model 4b	Model 5b	Model 6b
LTC			0.268* (0.145)			−0.207 (0.149)
OTP		0.278** (0.132)	0.205 (0.135)		−0.237* (0.134)	−0.180 (0.139)
TCI	0.474*** (0.123)	0.355*** (0.132)	0.242* (0.143)	−0.469*** (0.124)	−0.367*** (0.134)	−0.281* (0.147)
R^2	0.225	0.288	0.334	0.220	0.266	0.249
F	14.792	10.112	8.211	14.404	9.066	6.798

(c) With other partners (non-competitive)

Independent variable: interorganizational trust	Dependent variable: PCOP			Dependent variable: TCOP		
	Model 1c	Model 2c	Model 3c	Model 4c	Model 5c	Model 6c
LTOP			0.378*** (0.120)			−0.404*** (0.122)
OTP		0.160 (0.143)	0.171 (0.132)		−0.205 (0.147)	−0.217 (0.135)
TCI	0.368** (0.130)	0.230** (0.143)	0.262* (0.133)	−0.277** (0.134)	−0.189 (0.147)	−0.149 (0.135)
R^2	0.136	0.157	0.230	0.077	0.111	0.273
F	8.011	6.643	6.953	4.249	3.128	6.133

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

Table 8.5 Regression analysis for coopetition

Independent variable: interorganizational trust	Dependent variable: VC		
	Model 1	Model 2	Model 3
LTS			0.715*** (0.102)
OTP		0.176 (0.151)	0.084 (0.109)
TCI	0.185 (0.137)	0.110 (0.151)	−0.032 (0.110)
R^2	0.034	0.059	0.531
F	1.809	1.582	18.515

*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

67.3%). This factor is crucial and when compared with other factors determining the nature of trust (OTP and TCI), the latter are no longer significant. Considering only the nature of trust, overall trust in cooperation partners is more important for partnership cooperation with suppliers than trust in cooperation itself (model 2a), and in the case of transactional cooperation these factors have proved to be insignificant (model 5a). Trust in cooperation itself (TCI) is only relevant if its impact on partnership or transactional cooperation is considered in isolation from other factors (models 1a and 4a).

Trust in cooperation itself (TCI), especially in the context of transactional cooperation (models 4b, 5b, and 6b), is of the greatest importance for cooperation with customers. In the case of partnership cooperation, the level of trust in the customers is also an important factor, which, together with the level of trust in cooperation itself, has a significant impact on its nature (model 3b).

Similarly, partnership cooperation with other non-competing entities depends on TCI (models 1c and 2c), but when compared it to the level of trust in this group's partners (LTOP), the latter having a stronger impact on it (model 3c). Meanwhile, in the case of transactional cooperation with this group of partners, it depends primarily on trust in them (model 6c), while TCI is important when considered on its own (model 4c).

On the other hand, coopetition is only affected by the trust if it is undertaken voluntarily (Table 8.5) and depends only on the level of trust in competitors (model 3). The factors determining the nature of trust (OTP and TCI) are irrelevant in this case.

The results indicate that trust affects the type of cooperation with different groups of partners, i.e., suppliers, customers, and other non-competitors. Trust in competitors has an impact on coopetition undertaken by the company on its own initiative.

8.5 Discussion and Conclusion

Competitive advantage for contemporary companies results more and more frequently from the ability to collaborate with others in order to obtain relational rent [77]. This creates the need for research on factors influencing it. One of them is the interorganizational trust [3, 37, 67, 71], but its impact on collaboration with different group of partners has not been clearly defined. The research results presented here made it possible to answer the research question: how level and nature of interorganizational trust in different groups of partners influences a firm's collaboration expressed by cooperation and coopetition.

The literature indicates that the level of trust in a partner influences the relations between them [2, 13, 48]. However, undertaking cooperation with others is also influenced by the nature of this trust, expressed, among others, through trust in the competence of the partner [32], trust in the willingness to achieve common goals [49], trust in the predictability of the partner's actions [58], its honesty [48] or positive experience of cooperation to date [24]. As a result of our analyses, these factors can be defined as a single construct expressing overall trust in cooperation partners when making decisions about cooperation. On the other hand, this decision is also influenced by trust in obtaining benefits from cooperation exceeding the outlays [6], trust in the willingness to jointly solve disputable issues [5], or acceptance of an intermediary distributing trust [63]. Our research has confirmed that these factors also constitute a single construct, which can be described as trust in cooperation itself.

Taking into account the combined level of trust in a specific group of partners, as well as overall trust in cooperation partners, and trust in cooperation itself, the results of our research indicate that the key element influencing cooperation based on exchange, involvement, and reciprocity [17], and thus influencing partnership cooperation and coopetition, is the level of trust in a specific group of partners from the value network rather than the overall trust in cooperation partners or the cooperation itself. Thus, this paper contributes to: (1) the understanding of how trust drives firms to coopete or cooperate, (2) identifies three different variables of interorganizational trust, (3) provides a direction for further examination of trust related to a particular group of partners, because this kind of trust is the most important for collaboration.

Limitations that result from the research methods used (subjectivity in the respondents' statements, a relatively small research sample size, limited to only medium-sized firms), may inspire further research conducted on a representative sample. Another interesting direction for scientific exploration may be comparison of the level of trust in particular groups of partners with the level of distrust towards them and their impact on the decision to collaborate, because total trust is rather rare. People usually partly trust their partners, but also partly do not trust them [72]. Therefore, it is necessary to assume the existence of distrust (as the opposite of trust) in interorganizational relations, what will be a subject of our further scientific explorations.

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Chapter 9
From Coopetition by Cooperation to Consolidation. Contemporary Challenges of University Mergers and Acquisitions

Łukasz Sułkowski, Robert Seliga and Andrzej Woźniak

Abstract Consolidations, acquisitions, and mergers of entities are very widespread managerial practices in the business sectors. They usually lead to increased efficiency and competitiveness of business entities, although they may also be aimed at limiting competitiveness through monopolization or oligopolisation. In the case of higher education institutions, mergers in most countries take place on the basis of an autonomous decision of the merger partners, often with the involvement of central and local authorities, employees of the universities themselves and other stakeholders. Universities are also subject to consolidation processes, both in the private and public sectors—in recent decades the number of mergers between universities around the world has increased significantly. The aim of the article is to identify the processes of coopetition, cooperation, and consolidation of universities in Poland. The article focuses on the complexity of mergers and acquisitions in the higher education sector. The research methodology is based on qualitative research—a comparative analysis of a case study of universities.

Keywords University management · Mergers and acquisitions · Consolidation · Coopetition · Cooperation

9.1 Introduction

So far, there is no extensive base theory in the merger and acquisition processes in the university sector, the existing ones are based on broad literature on the subject of mergers and acquisitions in organizations [1–12].

The progressing consolidation of the university sector in the world is associated with a profound transformation of the universities themselves and their relationship with the environment. The formula of the entrepreneurial university is more and

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more clearly beginning to supplant the traditional university based on the Humboldtian model. This means focusing on commercialization of research results, competition, and at the same time intensive cooperation between universities and the socio-economic environment. A manifestation of the creation of extensive coopetition networks can be the progressive internationalization and even globalization of the activities of universities that compete for students and researchers around the world, also through the development of international cooperation. The development of international rankings and global indexes allowing for the measurement and comparison of scientific achievements (e.g., Web of Science, Scopus, Google Scholar, Hirsch index, etc.) is the illustration and catalyst for globalization processes among universities. There has also been far-reaching commercialization of education, closely related to the empowerment and commodification of higher education. The consequence is a departure from the model of education of intellectuals, oriented towards common goods and universal ideals, to educating specialists who obtain "competence packages", constituting intellectual capital in the labor market [13].

Relations between organizations on the market are complex, although it seems that they can be classified on the basis of the competition and cooperation criterion [14]. It would be possible to create a continuum—from competition, through coopetition and cooperation to integration. Competitive, inter-organizational relations would be dominated by competition, with a generally limited sphere of shared interest awareness and limited communication between competitors [15]. Coopetition would be a breakthrough as strategic aspects of cooperation appear alongside the area of competition between organizations [16].

The aim of the article is to identify the processes of coopetition, cooperation, and consolidation of universities. The article focuses on the complexity of mergers and acquisitions in the higher education sector. The research methodology is based on qualitative research—a comparative analysis of a case study of universities.

9.2 Literature Review

Divisions of consolidation processes are adopted according to various criteria, including the strategy and goals of the merger, the structure of the target organization, the organizational culture after the merger, changes in the ownership and founding structures and others. The basic forms of the organizations' merging processes are:

- concentration of activities,
- integration of activities,
- coordination of the organizations' activities [17].

The most common division is due to the consolidation strategy: horizontal and vertical mergers. Horizontal mergers occur when merging business entities produce similar products in the same sector. The motives of organizations merging horizontally are often: willingness to reduce costs, increase efficiency, economies of scale and increase economic security. The effects of this type of mergers are increased

concentration, market share and increased market power of the company. Among horizontal mergers, there are mergers expanding the market and mergers that expand the offer. In higher education consolidations, we usually deal with horizontal mergers, because the entities that undergo the process are most often universities.

Vertical mergers occur when organizations dealing with various phases of production or distribution of the same product are integrated. The motive for merging companies in vertical mergers is often to strive to increase control over the component stages of their operations. Vertical mergers take the form of a bottom-up vertical merger and top-down vertical merger, depending on whether the entity merges with its supplier or its recipient. In the education sector, vertical mergers occur when the university is merged with a different type of entity, e.g., a research institute, a post-secondary school or a hospital [18].

Piotr Szczepankowski, apart from horizontal and vertical mergers, distinguishes conglomerate, product and geographic (market) mergers. Forms and types of acquisitions can be threefold. One-by-one merger occurs when organizations that are close in size and structure absorb each other. One-at-a-time merger is a situation when organizations combine in the face of threats coming from the environment or when a larger enterprise takes over smaller ones. Lastly, many-at-once merger is a merger in which several organizations of diverse character are merging with another organization or seeking to purchase it in order to support their activity in the industry.

The form of the merger is influenced by the organization's goal and the manner of making the acquisition. We can talk about close cooperation, additive and complementary mergers. Close cooperation occurs when the partners of the merger use shared resources and devices, but each of them produces its own products. In the case of additive mergers, resources of the same type are used, and joint products are also created and sold. Finally, complementary mergers occur when common and jointly manufactured products are sold, based on resources that operate on the top-up basis [17].

In the case of organizations that cooperate with each other economically, e.g., are clients or suppliers, coopetition is natural and develops as a part of the unforced relationship. It is different in the case of relations between competitors in the sector or substitute sectors where competition is the primary form of relationship. Coopetition in such relations is often developed through contacts in industry organizations, employers, and business associations in which contacts are intensified and awareness of common interests and values increases. In the case of the university sector, coopetition is the most often developed relationship between universities operating in a similar market [19]. The dominant logic of cooperation is the strategic cooperation between organizations, which enables the implementation of significant, long-term joint projects, taking the form of, for example, consortia, strategic alliances, and joint ventures. Integration is a move towards merging the organizations that will allow participants of the process to benefit. Integration is in many cases the effect of tightening cooperation ties and many years of experience in the implementation of joint projects (Table 9.1).

It is worth noting that the proposed continuum, although it has a wide range, does not exhaust the entire complexity of inter-organizational relations. For example,

Table 9.1 Types of relationships between organizations

Relationship type criterion	Competition	Coopetition	Cooperation	Integration
The dominant logic of the relationship	Competition, competition driving the development of market organization	Competition in certain aspects, cooperation in others	Cooperation and cooperation in strategic aspects of the activity	Merging organizations that bring benefits
Common interests and values	Usually limited awareness of common interests and values	Increased awareness of common interests and values	High awareness of common interests and values	High awareness of common interests and values
Cooperation strategies	Marginal, competition dominates	Strategic elements of cooperation	Cooperation is a key component of the strategy	Consolidation and integration strategies
Inter-organizational communication	Limited, often stereotypical perception of a competitor	Developing, expanding communication channel and range	Developed, associated with the coordination of joint ventures	Developed, fixed, formalized and informal
Types of connections	Benchmarking, imitation, learning from a competitor	Cooperation in selected shared areas	Implementation of joint strategic projects	Purchase of shares, exchange of shares, structural connections
Forms of interdependence	Competition similar to the perfect model, oligopolistic, duopolistic, similar to monopoly, intense and extensive competition	Associations, sector unions, employers' organizations	Strategic alliance Joint venture Cartel Consortium Economic union Associations Industry associations	Consolidations, mergers, and acquisitions
Examples of structures and markets	Competitors in the sector	Cooperators in the cluster, competitors in the sector	Cooperators in the cluster, competitors in the sector	Cooperators in the cluster, competitors in the sector

Source Author's own study

acquisition processes that are hostile or top-down may not match the proposed scheme because they integrate the organization without the awareness of a community of interests and values, and communication openness.

Merging organizations is often preceded by the development of various forms of cooperation that can lead to integration. Such developmental form of transition from cooperation to integration allows testing various forms of cooperation, potential synergy, and economies of scale. In the case of universities, this is a tendency to create a network of scientific and didactic cooperation, taking on very diverse forms. Presenting these forms of cooperation as a string, at the end of which there is full integration of the organizations, the following models of university cooperation can be identified: informal cooperation, affiliation, consortium, common unit, federal structure, unitary structure.

While analyzing the relations between universities, it should be noted that quite rarely we deal only with competitive relationships even between entities in the same, higher education sector. It results from the essence of scientific ventures and education, which—according to the description of Robert Merton's CUDOS ethos—are community-based, require cooperation between the research community and effective communication [20]. Therefore, the mission of the university is obviously based on cooperation, and not only competition between the sector entities and the environment. It seems then that although competition for rare effects and resources, such as prestige, scientific results, outstanding students and researchers, plays an important role in the activities of universities, the different forms of cooperation have the key meaning. G. Harman and K. Harman proposed diversification of models of university cooperation according to the integration criterion. The cooperation includes informal cooperation and affiliation, which are often forms of bottom-up cooperation in the field of scientific activity between researchers. Informal cooperation in the case of universities means the implementation of research or teaching projects with the participation of employees of both units, without signing contracts. It is also mutual support of universities in scientific improvement, education, and realization of implementations by universities or other entities surrounding universities. Affiliation belongs to the forms of cooperation when relatively stable cooperation between collective entities is established. Cooperation includes the implementation of selected objectives, with the simultaneous independence and organizational and program independence of entities in achieving the remaining objectives [21]. It is good practice to stimulate and develop such cooperation without creating organizational and legal barriers to the implementation of cooperation between researchers from various scientific centers. Cooperation with a higher degree of integration, which requires decisions at managerial level, is the coordination of activities in the form of a consortium or joint entity. Formation of formalized networks in the form of consortia is an example of coordinated and formalized cooperation that enables implementation of joint strategic projects. The next step towards integration is the creation of a common unit, for example, technology centers, design units, incubators, spin-offs, split-offs, and split-ups (Table 9.2).

Most researchers propose a clear distinction between cooperation and connection. Cooperation between business entities may cover various forms of alliances and joint

Table 9.2 University cooperation models

University cooperation models according to the integration criterion					
Informal cooperation	Affiliation	Consortium	Joint entity	Federational structure	Unitary structure
Cooperation coordination merger					

Source [21]

Table 9.3 Connections between organizations

Types of connections		
Cooperation	Connection	
	Acquisition (takeover)	Merger
Strategic alliance Joint venture Cartel Constortsium Economic union Employer associations	Share takeover Property takeover Other—contractual—arrangements	Merger by absorption Merger by creating a new organization Merger as a result of individual contracts

Source [13]

ventures of two or more entities, such as strategic alliances, joint ventures, cartels, consortia, economic unions, and others. Connections can be divided into acquisitions and mergers. Acquisitions will include share takeovers, property takeovers and other contractual arrangements. In terms of mergers, there will be merger by absorption, merger by creating a new organization and merger as a result of individual contracts (listed in Table 9.3).

Cooperation and consolidation of enterprises can be embedded in the axis of coordination, i.e., coordination of organizational activities. Coordination is based on the fact that organizations make joint economic and market decisions so that their impact on the environment is greater. Coordination is related to similar problems as the merger and concerns financial, technical, strategic and organizational issues.

Coordination tasks include setting goals for implementation, standardizing actions and correcting the actions of the other party. There may be interdependencies adding up—in the case of organizations independent of each other, whose maintenance depends on the actions taken by each of them. Branches can remain independent, but their activities are always coordinated within the whole organization. Sequential interdependence means that one organization has the task to take action before the other can take part in the venture. The third type of interdependence is reciprocal interdependence—here the cooperation of companies has a very wide scope.

The typology of interdependence of goals may be a useful cognitive model, allowing for a description of the increase in the degree of coordination of cooperating universities (or other organizations). The growth of cooperation is usually followed by the development of its complexity. For example, universities, starting from the formalized cooperation to joint scientific and didactic projects, creating consortia and

joint entities, start to operate in a multifaceted manner, which requires the development of forms of coordination. Cooperation begins with the standardization of goals that are aggregated and implemented together. Gradually, as the advancement of cooperation increases, joint planning and coordination appear in the form of sequential implementation of partners' tasks. The third stage of interdependence is mutual coordination and corrections, which take the form of feedback. Such a fairly universal model of interdependence can describe both cooperation, coordination, and integration from the concepts of Harman and Harman [21].

9.3 Materials and Methods

The methodology of research is qualitative. The unstructured nature of the problem needs a deeper analysis, possibly with qualitative methodology. The method of the research is qualitative case study comparative analysis based on data from interviews, observations and documentation analysis. The sample is non-random and heterogenic to find commonalities between very differentiated cases of mergers of HEI's. There are 3 cases of mergers of universities (two Polish cases and one French):

1. Merger of Cracow Medical University with the Jagiellonian University.

The case of a conservative merger indicating that the organizational identity is slowly changing. The values, culture, and identity are a huge intellectual and emotional capital that can be launched in the consolidation process of the universities.

2. Merger of the Medical Academy in Łódź with the Military Medical Academy

The merger, thanks to which the two academies became a university. There were, however, numerous barriers—of financial, organizational, cultural and social nature.

3. Merger of Université Joseph Fourier with Université Pierre Mendès France and Université Stendhal

Federal merger with a higher degree of integration of individuals than in the case of consolidation of the Jagiellonian University. In this case, all support structures have been designed and implemented by the universities and integrated entities.

9.4 Results and Discussion

The comparative analysis leads to several conclusions from which good practices can be derived (Table 9.4). At the planning stage, the most important good practices related to the effectiveness of the analysis of the effects of the merger, due diligence and planning a strategy for conducting the merger. At the implementation stage, communication and flexibility are of key importance allowing to make adjustments.

Table 9.4 Comparative analysis of university mergers

Merger areas	Indicators	Jagiellonian University	Medical University	University Grenoble Alpes
Consolidation strategy	Decision of the merger	Rectors and senates of both universities, without the participation of the authorities *"the decision was made by the rectors—Koj and Szczeklik" (K1)*	Rectors and Senates of the universities, at the initiative of Military Medical Academy, under the influence of changes in the regulations of central financing from the Ministry of National Defense *"the decision was made at the top, as in a military school, at the order […] politicians stated that they would not finance the training of military doctors" (L3)*	Rectors, senates, with the active participation of local authorities and representatives of the Ministry *"the decision was political, the rectors negotiated, in agreement with the regional authorities and the participation of the ministry" (G1)*
	Goals of the merger	1. Reunification of the Jagiellonian University 2. Increase in the scientific position *"reunification of the Jagiellonian University" (K1)*	1. Maintaining the educational achievements of military doctors 2. Strengthening the scientific potential of the Medical University *"absorption of Military Medical Academy by Medical University […], "supposed" reduction of education costs" (L3)*	1. "Critical mass" in the area of science 2. Position in international rankings 3. Rationalization of education networks *"Shanghai shock, but also the feeling that fragmentation is irrational" (G1)*

(continued)

Table 9.4 (continued)

Merger areas	Indicators	Jagiellonian University	Medical University	University Grenoble Alpes
	Strategic analysis	None *"there were no analyses, the reunification was treated as quite obvious, there was only a sharp negotiation process" (K1)*	None *"nobody analyzed anything, just a political decision" (L3)*	Strategic analysis and due diligence *"strategic analyses were still conducted at the stage of alliance and establishing a university connection, then it was also taken into account in the negotiation process" (G2)*
	Strategic management process	None *"there were no formal strategies, after the negotiations legal documents and a new structure were prepared, which evolved anyway" (K1)*	None *"there was no effective strategic management, the decision to absorb, and to try to get along" (L3)*	1. Formal merger strategy 2. Strategic plan 3. Strategic controlling *"extensive strategic analysis process, which consisted in estimating the value of the merger, due diligence and maximizing potential benefits … obviously after the negotiation process" (G1)*
Stakeholders' opinion of the merger	Before the merger	Positive on both sides *"positive opinions prevailed in general, the more so that the soft option of the merger has effected" (K1)*	Many critical voices, merger treated as "forced" *"rather negative, in particular from Military Medical Academy employees, but opponents of the merger were also among MU professors" (L3)*	1. Staff: ambivalent opinions 2. Administration: concern 3. Students: weak participation *"mostly, cautious but positive opinions, students did not have a special opinion" (G1)*
	During the merger	Positive on both sides	Many critical voices, merger treated as "forced"	1. Training programs 2. Satisfaction improvement

(continued)

Table 9.4 (continued)

Merger areas	Indicators	Jagiellonian University	Medical University	University Grenoble Alpes
	After the merger	Positive on both sides	Many critical voices, merger treated as "forced"	1. Generally positive opinions of the faculty, students and administration.
Merger barriers	Merger barriers	Loss of former Military Medical Academy positions *"the key obstacle was the threat of losing jobs at Military Medical Academy" (K1)*	The fear of losing jobs, fear of conflicts and chaos *"above all, animosities, loss of positions by people, struggles for locations, clinics and money" (L3)*	1. Human fears, inertia of structures 2. Political negotiations 3. Decision-makers' ambitions *"politics, they had to settle down in terms of position, … this is one of the reasons why the Polytechnic has left the merger" (G1)*
	Overcoming barriers	Creation of Collegium Medicum and ensuring its autonomy, management positions in the Jagiellonian University *"maintaining the autonomy of Collegium Medicum as former Cracow Medical Academy, with new positions: Vice-Chancellor, Chancellor, Rector's Plenipotentiaries" (K1)*	Simultaneous top-down by the rectors Attempts at central conflict resolution. Establishment of separate military medical department *"the first commissioner, rector, and the next one did not touch on internal tensions outside […] in the middle it boiled, hence these structures of departments […] the military-medical one" (L3)*	1. A lot of meetings, discussions and trainings 2. Leadership, indicating the sense of change *"as in France, the process of reaching out with the participation of the Ministry and provincial authorities, discussions, negotiations, until compromises were made" (G1)*

(continued)

Table 9.4 (continued)

Merger areas	Indicators	Jagiellonian University	Medical University	University Grenoble Alpes
Restructuring	Restructuring methods	Change of structure by joining Collegium Medicum, headed by the new Vice-Rector, lack of deeper restructuring *"the restructuring consisted in the incorporation of the entire structure of Cracow Medical Academy, as a largely autonomous structure" (K1)*	Rector's decisions, regulations limiting the budgets of individual units. Laying off excess teaching and administrative staff. Balancing the university budget *"changes in the structure took place, but in fact it was quite superficial, the division remained […] it is difficult to talk about methods, it was simply the rector's orders" (L3)*	1. Reorganization of the central structure 2. Introduction of integrated university units 3. Implementation of new IT systems *"departments remained unchanged, but supporting units changed significantly", "new funding, a lot of grants … and hard science gained, social sciences lost" (G1)*
	Restructuring results	Expanding the structure with Collegium Medicum *"limited, because the goal was to unite, not far-reaching changes in management" (K1)*	Reduced operating costs Increased scientific efficiency (parameterization 2013) *"at least the university was patched and did not fall apart" (L3)*	1. Effective implementation of new IT systems 2. Faster and more effective financial, documentation and personnel processes *"significant change, it is much more efficient even in terms of IT system and financial settlements" (G1)*

(continued)

Table 9.4 (continued)

Merger areas	Indicators	Jagiellonian University	Medical University	University Grenoble Alpes
Integration process	Integration team	Rectors and vice rectors *"the integration team consists actually the former authorities of both universities" (K1)*	Authorities of both universities, not a specialized team *"there was no such thing, the authorities were just negotiating" (L3)*	1. Integration team 2. Participation of stakeholders 3. Integration plan *"it took a long time, many years, first a consortium and cooperation, then an agreement, information about the merger and many years of cooperation in teams at various levels" (G1)*
	Integration effects	Relative separation of Collegium Medicum and Jagiellonian University *"rather positive, although after almost 25 years the degree of integration could be bigger" (K1)* *"A makeshift that lasts until today" (K2)*	Relative separation of old Military Medical Academy *"rather unstable unity […] the division remained … certainly an important thing that we have become a university, although we could be one without them … maybe a year or two later" (L3)*	1. Gradual integration is progressing 2. Rather positive effects *"we gained a new identification … a bit based on contradictions, we improved in the rankings and organizationally … and teams and students from abroad" (G1)*

Source Author's own study (the respondents' markers are in the brackets)

Assessment of consolidation effects is possible after some time and depends on the assumed merger goals.

Entities joining the merger should have a real will to merge, a perspective of shared values and interests. The strongest integrating mechanisms are organizational culture and identity. The case of the conservative merger of the Jagiellonian University and the Cracow Medical Academy indicates that the organizational identity is changing slowly. The strong ethos and organizational culture of the Jagiellonian University and many centuries of medical science history at the Department of Medicine in Cracow constituted a strong organizational identity. The creation of the Collegium Medicum of the Jagiellonian University was a kind of "return to the matrix", which strengthened the ethos, academic and organizational identity of the Jagiellonian University scientific staff, those of Collegium Medicum in particular. On the other hand, however, a certain minimum of changes in the formula of federal merger allowed Collegium Medicum to remain separate, retain a significant part of autonomy and important prerogatives of the authorities. As a consequence, the organizational system has not changed radically, neither in strategic, structural nor cultural aspects.

The analysis of this merger case suggests that values, culture, and identity are a huge intellectual and emotional capital that can be launched in the university consolidation processes. The natural mechanism of the territorial, value or historical continuity community is the basis for the permanent consolidation of the university.

The example of consolidation from Grenoble, just like the merger of the Jagiellonian University with the Medical Academy indicates that the return to the identity and heritage of the University of Grenoble from over 40 years was a strong integrator. The UGA merger is federal, although the degree of entity integration is slightly greater than in the case of the consolidation of the Jagiellonian University. In this case, all supporting structures have been designed and implemented as integrated, university-based units. We are also dealing with a greater degree of interaction and cooperation within inter-faculty matrix structures.

Through mergers, universities should also implement restructuring processes which lead to a more effective and more effective realization of the mission. This means a change in the organizational structure that will be associated with the consolidation process and with the optimization of management. It is possible to optimize many areas of management that accompany restructuring. UGA experience shows that consolidation restructuring may include, among others: implementation of process management and new IT systems. Consolidations should also develop effective human capital management. This is about the diversity of career paths, which occurred, for example, in UGA during the consolidation. Some employees specialize primarily in scientific activities and another part in didactic activities. Of course, it does not close the possibility of transfers between these groups and allows to combine these two activities, traditionally forming the core of the academic profession. There is also a third group of employees that is gaining in importance, namely academic managers. A good practice that serves the implementation of strategic goals is also the implementation of incentive systems, including assessment, remuneration, and development of employees, which substantially reward employees' achievements, work, and commitment. This leads to an increase in diversity within the academic

staff, but allows more effective assessment and appreciation of the effects of work. An important and integral part of the human capital management system should also be talent management, which applies to both employees and students and is a condition of belonging to the "world-class of universities".

The perspectives of research on the consolidation processes of universities are leading towards large comparative international projects. The conclusions from such studies would refer to the higher education sector, but also to the broader processes of combining public organizations in general. Understanding the organizational and managerial conditions of effective mergers and connections between universities would help to improve the existing practice.

9.5 Summary

The article presents an introduction to the issue of mergers and acquisitions in the university sector. It is followed by a review of the literature on the subject. The types of relationships between organizations, university cooperation models, connections between organizations, typology of interdependencies and coordination of activities have been characterized. The next part of the article presents the material, methods, results, discussion, and summary.

The merger process of the universities involves managerial implications. The due diligence and strategy are crucial in planning and administration of the merger. In addition, clear mission and strategic goals are necessary. Mergers in the university sector are becoming increasingly important. Due to the strengthening of economies of scale and promotion of universities in rankings, public universities tend to consolidate. However, in the case of private universities, this depends on the competitiveness in the sector, the economic situation and the development strategy. The most important issue seems to be the barriers to consolidation of the university, which largely determine the success of the merger [13].

In the case of universities, the processes that should contribute to the success of the merger are as follows: planning of strategic consolidation and cultural integration of the universities. Good knowledge of the sector and universities are variables that increase the probability of successful mergers. Universities most often merge within one country and with similar entities, usually the ones they cooperate with, which means that the conditions of knowledge of the sector and the merger partner are met.

University mergers have become one of the popular strategies and methods of consolidation and restructuring in the sector of science and higher education.

There are several guidelines that can be used to effectively consolidate universities in the public sector:

1. Effective communication of consolidation values in the organization.
2. Exposing potential benefits to all interest groups.
3. Preparation of the strategy for the change process.
4. Selection and preparation of the integration team and change leaders.

5. Providing internal support for the change and overcoming the resistance of the main stakeholders of the university.
6. Organization of support and commitment of the managerial staff.
7. Securing the key resources for the consolidation process.
8. Institutionalization of change.
9. Flexible, entrepreneurial and coordinated implementation of the merger.

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Chapter 10
Communication Between Scientific Units and Companies in the Context of Their Cooperation

Magdalena Gręboszk-Krawczyk and Sławomir Milczarek

Abstract In the article, the problem of the communication of the Polish scientific units in the context of cooperation with companies is discussed. The main objective is to identify the companies' expectations towards scientific units in this area. The research based on a method of indirect communication with respondents with the use of the questionnaire technique was conducted in 2018 among 135 companies representing smart specialisations in Lodz Region. The results show that the model of interpersonal communication with a scientist is the most expected form in business–science contacts. The best channel to provide the information to companies is electronic media, such as the web site of the scientific unit or e-mail. On the web sites of scientific units, companies' representatives usually look for an offer for business. The most important information received from scientific units is an offer of cooperation and a sales offer addressed directly to companies' representatives. The most important feature of the offer of scientific units is its market applicability.

Keywords Scientific units · Communication · Cooperation · Industry 4.0

10.1 Introduction

Collaboration between the world of science and the world of business is a key determinant of innovative economies of the twenty-first century and the basis for the development of the Industry 4.0 potential. Unfortunately, in Poland, which ranks 25th in the group of 28 EU countries in terms of innovation, there are still many barriers that limit or even block this cooperation. These barriers are well known and defined in Polish and foreign literature. As one of the most important, scientists recognise the communication of both environments [15, 17], still, there is a lack of

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in-depth research on marketing communication models used by scientific units in the context of cooperation with the business partners. Therefore, it might be said that we are dealing with a correctly made diagnosis, but at the same time no recommendations to eliminate imperfections in the communication process have been proposed.

In the article, the problem of scientific units' communication in the context of cooperation with companies in Poland is discussed. The main objective is to identify the companies' expectations towards scientific units in the area of communication activities. The research is based on a method of indirect communication with respondents with the use of the questionnaire technique; it was conducted in 2018 among 135 companies representing smart specialisations in Lodz Region.

In this article, the scientific unit is understood—in accordance with Polish law—as an institution that conducts continuous research or development. It can be a basic organisational unit of the university, scientific unit of the Polish Academy of Sciences, research institute, international scientific institute established under separate regulations, operating on the territory of the Republic of Poland, Polish Academy of Skills or other organisational unit having legal personality and registered office in the territory of the Republic of Poland, including entrepreneurs with the status of a research and development centre.

10.2 Theoretical Background

Dynamic science's progress, technologic advances and communication evolution support the development of industrialisation all around the world. In recent years, along with the increased development of the Internet of Things (IoT) [1] and cyber-physical systems (CPS) [13], scientific and business environments have started to announce the fourth industrial revolution, called "Industry 4.0". The term "Industry 4.0" has attracted more and more attention since it was announced for the first time at the Hannover Fair in 2011 [5]. According to Saurabh et al. [24] and Schmidt et al. [23], Industry 4.0 as the fourth industrial revolution is characterised by a combination of new technical components and main principles to design and form this concept, in order to get a horizontal and vertical integration or value networks. Bauer et al. [2] describe Industry 4.0 as a new stage in the organisation and management of the entire value chain over the life cycle of products. According to Pereira et al. [21], the quest of applying Industry 4.0 brings diverse technological challenges, with high influences on many dimensions in today's manufacturing industry. Industry 4.0 brings several benefits for the companies, e.g. increase of flexibility and efficiency, processes' automation, reinforcement of the quality standards, cost savings, increased productivity or faster satisfaction of the customers' demands. However, the majority of companies are hesitant to begin their digital transformation processes due to serious implementation barriers that include uncertainties about financial benefits and a lack of specialist knowledge [20]. The Industry 4.0 processes place companies in a competitive position that obligates them to carry out research and development

(R&D) projects in coordination with universities, the mission of which has evolved in line with the demands of the commercial and production sector [12]. The universities present great potential in knowledge generation which may be effectively exploited to generate local economic growth [3, 4, 10, 25]. However in several countries, like Poland, the cooperation between business and scientific environment is not sufficiently developed.

In the literature concerning the relations of science and business in the context of joint projects and ongoing research, several barriers that prevent the transfer of knowledge between scientific units and companies are described. They can be classified into four basic groups [9, 11, 14, 17–19, 22]:

- a group of psychological factors in which the low level of mutual trust plays a major role, often resulting from common, unproven opinions and lack of sufficient knowledge;
- a group of historical factors, shaped, among others, by words uttered at the beginning of the twentieth century by Einstein [6], "I refuse to make money on science. My laurel wreath is not for sale like cotton bales" that supported the mental isolation of both environments, and their aftermath dominates in economically inefficient economies;
- a group of organisational culture factors such as symbols, key values, interpersonal relations and communication, organisational structure and structure, attitude to regulations, rules and regulations, attitude to terms and goals, desired levels of thinking synthesis and language used, attitude to control and criticism, the importance of the analysis and implementation area;
- a group of legal factors concerning, first of all, intellectual property rights created during the conduct of R&D projects and the possibility of disseminating knowledge through publications that are necessary for the researcher, but are not necessarily conducive to maintaining business secrets in companies.

The functioning of the same obstacles in the following decades is largely due to errors in communication. As the authors of the WEI report [16] note, the reluctance of Polish companies to undertake joint activities with scientists is the result of a negative perception of Polish science and the conviction of its low level of applicability, as well as detachment from business reality. Interestingly, the negative evaluations of science were set to a greater extent by companies who did not have any experience in cooperation with scientific units. This fact unambiguously exposes errors in communication, and in particular in the PR activities of scientific institutions. The authors of the EURAB Working Group's report [7] came to similar conclusions a decade ago, which would mean that the problems are well diagnosed, but there are no effective measures that could eliminate them. The selection of communication tools used by scientific units in the context of the commercialisation of knowledge should be adequate to the content of the message, the situation and the results expected by the sender. This is particularly important because the recipient represents the sphere of business and significantly different from the scientific environment.

When qualifying scientific units as industrial market entities (B2B), they should be expected to use communication instruments characteristic for relationships between

companies. Scientific institutions as a supply-side are expected to actively create relationships and, above all, manage the process of communication with the business environment. The lack of a breakthrough in the relations between science and business environments is largely the result of bad communication. This fact causes some tension in mutual contacts, which is directly attributable to the low level of commercialisation of knowledge. A long-term lack of mutual contacts has contributed to the lack of standards in cooperation.

10.3 Methodology

The scientific problem indicates the following research questions related to the companies' expectations towards scientific units in the area of communication activities:

- Q1: What are the contact forms preferred by companies representatives during cooperation with scientific units?
- Q2: Who should represent the scientific units in the business contacts?
- Q3: Which information channels are preferred by companies' representatives to receive the offer of the scientific units?
- Q4: Which types of information are expected by companies' representatives and which one should be presented on the web sites of scientific units?
- Q5: What are the most important elements of the offer of scientific units dedicated for business?

Recent primary research—pilot studies and the main study—was conducted in 2018 and was looking at companies representing smart specialisations in Lodz Region. "Smart Specialisation is a place-based approach characterised by the identification of strategic areas for intervention based both on the analysis of the strengths and potential of the economy and on an entrepreneurial discovery process (EDP) with wide stakeholder involvement" [8]. The choice of companies to be studied was a deliberate one. The companies that represent regional smart specialisations are extremely predisposed for the innovations development and cooperation with the scientific units. A full list of companies representing smart specialisation in Lodz Region was prepared on the basis of the CDIG and KRS registers. E-mail addresses of companies were acquired from company registration documents in both abovementioned registers. This procedure almost completely guaranteed that the questionnaire would be filled in by the owner or co-owner of the company, and not by a regular employee whose e-mail address does not appear in the registration documents. A method of indirect communication with respondents with the use of the questionnaire technique was utilised. A questionnaire survey was sent to 10% of the total population (3902 companies). As a result, 135 completed questionnaires were received, which amounted to 3.46% of all the companies polled. This result, with a population size of 39,022 entities and a 95% confidence level, gives a maximum statistical error rate of 8%. The final research was conducted with the application

of the techniques of electronic survey. The Statistica and Windows Excel, computer software programs, were used to collect data and make the analysis.

Between 135 studied companies, those representatives took part in the questionnaire survey:

- 32 companies representing the modern textile and fashion industry (including design),
- 10 companies from the area of innovative agriculture and agri-food industry,
- 13 companies representing the energy sector (including renewable energy sources),
- 16 companies from the medical industry, pharmaceuticals and cosmetics,
- 23 companies representing the sector of advanced construction materials,
- 41 companies representing the field of IT and telecommunications.

The analysed companies are characterised by a varied structure of employment and belong to various sectors. The diversity of types of activity, the size of the companies, as well as sector segments in which they operate enable one to carry out an in-depth analysis of the cooperation.

The questionnaire survey contained 22 alternative closed questions and closed cafeteria-style checklist. The questions were both disjunctive and conjunctive in nature. Ordinal, gradual and continuous scales were used. The questions were divided into three categories according to the raised issues. The first part contained 6 general questions, related to the operations of the surveyed companies, whereas 16 questions were closely linked to the communication during the cooperation with scientific units. The questions were related to the overall assessment of the activities within the marketing communication of the scientific units and the expectations of companies' representatives in the area of communication with scientific partners. The results of the second part of this research project, concerning respondents' expectations, are presented in this article.

10.4 Research Results and Discussion

The expectations of respondents concerning the transfer of information about a business offer by scientific units should be the basis for creating the policy of integrated communication in the commercial area. The results of research clearly specify which communication models and marketing communication tools are preferred by potential business partners.

Figure 10.1 presents the contact form preferred by surveyed companies' representatives during cooperation with the scientific units.

Over 80% of respondents prefer direct dialogue, i.e. a model of interpersonal communication. Interestingly, more than 60% want to meet in their own company, not in a scientific unit (Fig. 10.1). There are therefore important analogies with the B2B market, where the interpersonal communication model is dominant and where the supply side usually visits potential clients.

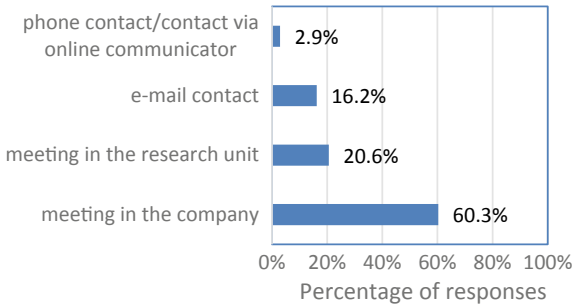

Fig. 10.1 Contact form preferred by respondents during cooperation with scientific units

In this case, there is no correlation between belonging to one of the regional smart specialisations and the preferred form of contacts with the scientific unit (chi2 = 9.658, $p > 0.05$). However, the type of activity carried out by the respondents is statistically significant (chi2 = 13.272, $p < 0.05$). It is worth noting that 80% of the surveyed companies with a production profile were in favour of the meeting in their own headquarters. It can be justified by the desire to show the own facilities.

Most respondents believe that scientific units should initiate business contacts, because they have a predisposition and facilities for that. Admittedly, 42.6% of respondents believe that they should be the initiators of contacts due to their market knowledge. In this case, there is no statistically significant correlation between regional specialisation and preferences regarding the initiators of mutual relations (chi2 = 8.231, $p > 0.05$).

Owners and co-owners of the surveyed companies would most preferably cooperate with a researcher—specialist in the chosen area. This opinion is represented by almost 70% of respondents (Fig. 10.2).

This fact unambiguously confirms the key role of scientists in the process of commercialisation of knowledge. On the other hand, the low level of choice of technology transfer departments may result from either their short history of functioning in Poland and, consequently, low recognition of their competence among companies, or lack of the ability to properly define the needs of companies. It is worth remembering that in the B2B market situation is different. The main burden of initiating, running and finalising business processes rests with the sales department, not at the

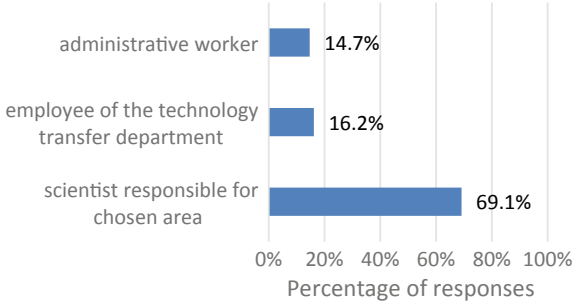

Fig. 10.2 Employees of scientific units required for business contacts by companies representatives

Table 10.1 Information channels preferred by companies' representatives to receive the offer of the scientific units

Information channel	Electronic media	Phone conversation with the unit's representative	Bulletin sent by post	Traditional media	Information point
Nb of received points	301	211	195	166	147
Max nb of points	340	340	340	340	340
Result (%)	89	62	57	49	43

research and development departments. There is no correlation between regional smart specialisation and preferences in choosing a contact person from a scientific unit (chi2 = 10.893, $p > 0.05$).

In order to finalise the commercialisation of knowledge, companies must be informed about the offer of the scientific units. Table 10.1 presents the preferences of the respondents regarding the information channels through which they would like to receive a message.

The research results show that the communication channels favoured by business entities (irrespective of regional specialisation) are the electronic media, including the web site and e-mail (Table 10.1). The second was a phone conversation with an employee of the scientific unit responsible for business contacts, and the third—a cyclic information bulletin sent in traditional, paper form. The smallest number of points was obtained by traditional media such as newspapers, radio and TV, and an information point for companies, located within the scientific unit. What is interesting, however, is the relatively high position of the cyclical information bulletin, sent by traditional post, which may suggest that regular delivery of information, e.g. in printed form, is expected by respondents. In the sectors where the bulletin definitely outranked the conversation with an employee of a scientific unit (textiles and IT), the specialised printed press still has a very strong position. In statistical terms, however, there is no correlation which would confirm the connection of regional smart specialisation with preferences regarding communication channels through which enterprises want to obtain information from scientific institutions (chi2 = 12.010, $p > 0.05$).

Table 10.2 presents the respondents' preferences regarding the type of information received from scientific units. The list clearly shows that the most important and at the same time expected for respondents is information about the possibility of participating in joint projects with scientific institutions. A slightly lower level of importance was obtained by the sales offer intended for commercial entities. The lowest score was received by information about research planned on the horizon of 2 years. The results of research concerning type of information obtained from the

Table 10.2 Types of information expected by companies' representatives

Information expected by companies	Proposition of cooperation (joint project offers)	Sales/services offer for companies	Description of current R&D projects	Information about international innovations	Planned R&D projects (2 years perspective)
Nb of received points	254	245	204	173	144
Max nb of points	340	340	340	340	340
Result (%)	75	72	60	51	42

scientific units show at the same time preferences in cooperation models. Specialisations such as IT or advanced building materials prefer realisation of the joint projects with scientific units, while respondents from other specialisations prefer to purchase knowledge. The fact of assigning low importance to information on innovative solutions in the world is, in turn, an indication for scientific units in the field of promotion of knowledge and education of the business environment.

The result of the chi2 test does not indicate, in this case, a statistically significant relationship between belonging to a specific regional specialisation and the preferences of respondents regarding the validity of the information received from r scientific units (12.626; $p > 0.05$).

Table 10.3 shows what kind of information companies' representatives are looking for on the web sites of scientific units. The main information that respondents search for is an offer addressed to business. The second position included contact with the person responsible for cooperation with companies, and the third—a description of the laboratories owned by the unit. The research results show that awards and distinctions, which often display scientific units on their web sites, are the least searched information by respondents.

Table 10.3 Types of information required by companies' representatives on the web sites of scientific units

Information required by companies on the web site	Offer for business	Contact to the person responsible for cooperation	Description of laboratories	Description of the scientific staff	Prizes and awards
Nb of received points	288	261	228	162	81
Max nb of points	340	340	340	340	340
Result (%)	85	77	67	48	24

Table 10.4 Most important elements of the offer

Elements of the offer	Market applicability	Adaptation to the capabilities of SMEs	Unit support in implementation	Price	The acquisition method
Nb of received points	277	222	186	174	161
Max nb of points	340	340	340	340	340
Result (%)	81	65	55	51	47

The most important feature of the offer addressed to companies should be the assessment of its market use (Table 10.4). This feature gained 81% of indications. This fact might be interpreted in two ways. First of all, the offer should be marketable, and secondly, the language used for its description should be a language of benefits, taking into account primarily market aspects. The respondents also expect the offer to be adapted to the implementation capabilities of the SME segment as well as the scientific units' engagement in its implementation in practice. These two features obtained similar values of ratings, respectively 65% and 55%, and were differentiated by the specialisation to which the respondents belonged.

The acquisition method, i.e. legal aspects related to the transfer of ownership rights, was evaluated at the least position. It is also interesting that the price was in the fourth place (out of five possible options). If the offer is competitive, tailored to the chosen segment and supported at the same time by the help of scientists during the implementation period, the price does not play a primary role. There are the clearly analogies with the industrial market, on which non-price elements of the contract, such as personalisation of the offer or after-sales service are often more important than the price of purchased technological solutions. In statistical terms, in this case, there is no correlation between regional specialisation and the characteristics of the offer addressed to companies by scientific units ($chi2 = 18.196$, $p > 0.05$).

Scientific units, communicating with the business environment, do not use the opportunities offered by modern marketing communication tools, including Internet tools. Scientific units, especially those educating students, are perfectly able to communicate with young people using a whole spectrum of tools, but they cannot create a clear and consistent message for companies. The language used by scientific units in marketing communication addressed to companies is not a language of benefits. The cooperation offer, in addition to scientific statements and technical parameters, usually does not indicate market advantages resulting from its implementation in the SME segment.

The model of interpersonal communication should be the dominant one in science–business relations, but not the only one. The results of the research clearly confirmed that the communication model in the hypermedia environment is highly required. The scope and quality of the message are a determinant of a successful communication process. The research results gave a clear answer to what kind of information the companies representatives expect from the scientific units. It should

not be as a surprise that companies are most interested in the sales and cooperation offer from scientific units, as well as measurable market benefits from the solutions that they can obtain. Polish scientific units should take advantage of good practices of foreign counterparts, especially American ones, which maintain the information proportions between the current offer and the description of R&D projects.

10.5 Conclusions

To reinforce its position and to meet the requirements set by Industry 4.0 concept, companies have to develop the R&D potential. It is possible also thanks to the cooperation between the companies and the scientific units.

The key role in joint contacts is attributed to the skilful use of marketing communication tools by scientific units that are perfectly moving in this area in the context of cooperation with existing and potential students. In the case of reaching the companies, however, they show a lack of knowledge in basic areas, such as descriptions on the web site, using the language of benefits or using PR instruments. Cooperation between both communities is inevitable due to the need to increase the level of innovation in Poland, which is to be assumed by Law 2.0, prepared by the Ministry of Science and High Education, on July 2018, as well as the stimulating role of European funds. It is worth emphasising that scientific units are currently one source in which significant knowledge can be created for the development of the Industry 4.0 concept in practise, especially for the SME segment. Micro, small and medium enterprises do not have the own resources to develop innovative solutions, nor sufficient financial resources to transfer knowledge from abroad. Due to their position and experience, scientific units must assume a leading role in dealing with companies and through a conscious communication process lead to business partnership, characteristic for B2B market.

In the process of shaping the scientific institutions' integrated communication, in the context of cooperation with the business world, good practices of foreign scientific units, especially American ones, should be used as well as the knowledge of experienced specialists from the domestic market.

The analysis of empirical results concerning the expectations of companies' representatives in the field of communication of scientific units allowed to conclude that:

- The model of interpersonal communication is the most expected form of communication in business–science contacts. More than 80% of the respondents were in favour of it;
- For 69.1% of respondents, the most wanted person to conduct business relations from a scientific unit is a scientist whose specialisation is the subject of cooperation. The most appropriate location for conducting dialogue is the companies' own office (60.3% of respondents);

- From the point of view of the respondents, the most important information received from scientific units are an offer of cooperation and a sales offer addressed directly to companies;
- The best channels to provide the information to companies are electronic media, such as the web site of the scientific unit or e-mail (89% of responses). The cyclical information bulletin, delivered in traditional paper form has also a high position;
- On the web sites of scientific units, respondents usually look for an offer for business (85% of responses);
- The most important feature of the offer of scientific units is the market applicability of the proposed solutions (81% of responses).

In conclusion, it should be noted that the analyses confirm that the application of the communication model characteristic for the B2B market is expected by companies during their cooperation with scientific units. Companies, in their relations with scientific partners, want to use intuitive formulas and solutions that they use on a daily basis in contacts with business partners. They want to receive the knowledge transfer offers or propositions of participation in joint projects. These offers should be characterised both by the market aspect and should be adapted to the possibilities of their implementation in the SME segment. Similarly, as in the B2B market, the product should be dedicated to a specific company or business segment. This concretisation manifests itself in both, the technical parameters and the price of the offer, and the after-sales service, which in the case of scientific institutions is a support in implementation. Business entities are mainly interested in the current offer, not the future one, resulting from the R&D works carried out in the unit. In addition, they want that scientific units' use the currently available spectrum of communication tools. The online communication plays a special role. Owners and co-owners of studied companies want to work with modern, dynamic and innovative scientific units that will assist them in solving practical (not imagined) market problems. In business practice, this solution to problems means gaining a competitive advantage in terms of technology, product, design or distribution management based on the Industry 4.0 concept.

The conclusions of this research are presented with the caveat as to the limitations of the sample, which included companies representing Lodz Region. In order to provide a more comprehensive picture of the analysed problem, similar questionnaires should be filled by other groups of companies. It seems particularly interesting to compare the results of the research obtained in the Lodz Region with the results from other regions, including their regional specializations.

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Chapter 11
The Risk Perceptions as Antecedents of Opportunism in Technological Entrepreneurship

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Abstract Opportunism is an obstacle to close collaboration in page relationships. But little is known about what causes it. This study examines how the risk perception perspective influences opportunism in collaboration in small and medium technology enterprises. This paper answers the following research question: Is perception of risk for entrepreneurs in small and medium technology enterprises as an antecedent of opportunism? Using data from 304 responses to an opinion questionnaire survey. The data were analysed with structural equation models (SEM). The results show that the relational risk perceptions and the performance risk perceptions have a positive influence on their tendency to become opportunist. These findings confirm that risk perception is an important perspective to understand why contractors behave opportunistically. This paper focusses on the antecedents of opportunism in managerial decisions and their awareness.

Keywords Opportunism · SMTE · Risk perception

11.1 Introduction

When discussing cooperation among corporations, there is a danger that it may induce opportunistic behaviour, i.e. a tendency towards deceitful conducts leading to an ethical violation of a cooperation agreement or relational norms [41, p. 122]. These opportunistic behaviour and unethical conducts are most common in the small and medium technology enterprise (SMTE) sector. According to Seggie et al. [35], opportunism is an imperceptible state or a motive implying insidious cunning, double standards and deceit by the exchange partner. Gulati and Garguilo [17] claim that opportunistic behaviours are a source of relational risk. This relational risk concerns

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transmission of distorted information, avoidance of keeping promises, late payment of commitments, misappropriation of technology, or delivery of products of lower quality than clearly detailed in a contract.

Nevertheless, despite its widespread danger, the concept of opportunism is addressed by only a few empirical studies, leaving a clear gap between the theory in which opportunism is a key assumption and empirical studies [26, 39, 40]. Research on collaboration focuses on trust because developing trust between partners helps in minimizing opportunistic unethical behaviour [23, 38]. Uzzi [38] maintains that cooperation is built on trust and personal ties, not just formal agreements. Trust and personal ties make partners' expectations more predictable and reduce monitoring costs. The success of cooperation is due to the use of coordination mechanisms that support the exchange of information, reduce information asymmetries and increase their mutual trust. An important element of cooperation success is to anticipate the antecedence of opportunism.

This paper focusses on the antecedents of opportunism in managerial decisions and their awareness. Following Lianying and Qinzhen [26], this paper investigates the following question: *Is opportunism correlates with perception of risk for entrepreneurs in Small and Medium Technology Enterprises*?

11.2 Literature Review

The theory of transaction costs foresees that companies choose a management method that minimizes their exposure to risk and consequently to potential opportunism [41]. Several studies show that companies that are vulnerable to contractual violations by opportunistic entities do not necessarily become opportunistic behaviour [9, 29, 33, 39].

From the point of view of transaction costs economics, occurrence of problems with avoiding and stopping negative events and taking advantage of opportunities in collective undertakings is of major significance [6, 24]. Issues of opportunism are particularly difficult to manage. The way in which cooperation is organized is especially important in the case of unethical behaviour. Weber's bureaucratic models emphasize that the key to structural characteristics of inter-organizational relations leading to minimization of opportunism is: formalization of action, detailed procedures, centralization of power and controls leading to the enforcement of rules and supervision [20]. In the new technology sector, Kapstein [24] sheds light to an additional challenge, which is illegal technology transfer. To counteract illegal technology transfer, in particular, managers are trying to build trust in order to create a sense of collective ownership in addition to engaging in strategic activities to minimize the risk of opportunism. Managers use behavioural economics to create incentives in which the cooperating parties seek to contribute to the common good. In the case of advanced technologies, these collaborative projects are broken down into several discrete parts or phases, as follows:

Phase I: System development and demonstration. At this stage, the supplier confirms the technical feasibility.
Phase II: Engineering management and development. At this stage, the supplier refines the system and demonstrates the possibility of supplying the product quantity within a given set of cost parameters.
Phase III: Full-scale production.

The declared milestones are crucial at each stage. In the case of turbulence and environmental dynamics, typically contracts should not exceed one year because they pressure the parties to act due to fear of losing the project or contract to competitors. From a strategic perspective, cooperation programmes should be designed to include both short-term penalties and long-term incentives [24]. In particular, transaction costs economics usually presupposes the existence of a legal environment within which companies interact. Thus, companies that face costly opportunism may sue an unreliable supplier or decide to acquire that supplier, thus internalizing the production of the goods. For example, in the case of Dreamliner 787, Boeing has been forced to purchase some of the leading suppliers, due to persistent quality problems [31].

In addition, trust is the central concept of behavioural economics, which deals with how individuals and societies engage in shared behaviour [15]. Therefore, from the point of view of trust, it is important to have a transparent cooperation structure. Building trust should be supported by new forms of cooperation technologies, e.g. sharing knowledge on a common technology platform. Kapstein [24] claims that developing organizational structures and incentive systems that reduce opportunism is sufficient in order to overcome the challenges of effective management even for complex technological projects.

11.2.1 Opportunism

It is recognized that specialization, specific resources and knowledge tempt fraud or change in the conditions of cooperation. Incitement to fraud can be combated by exchanging information and by requirements concerning the exploration of uncertainties. Helper et al. [20] emphasize that controlling opportunism provides information that allows for creating history of cooperation and consequently the reputation of the partner. Axelrod [2] stresses that repetitive transactions should be avoided for reasons of opportunistic behaviour. This argument is in line with the theory of transaction costs that implied that companies should be involved in one-off transactions or contracts. However, Kapstein [24] and MacDuffie [30] emphasize that long relationships give the parties more experience with each other to build trust, eliminate unreliability and teach them to act together in cases of emerging disruptions or threats. Learning through monitoring offers partners, information on whether they should trust their claims. Companies consider monitoring-based learning as a valuable way to circumvent limited rationality, especially in the face of an environment

characterize by high uncertainty and instability. Thus, long, sustained relationship minimizes the risk of opportunism and further increases future cooperation.

Luo [28] distinguishes two forms of opportunism:

- A strong form of opportunism, which involves activities that violate contractual rules (conditions, clauses, etc.), e.g. theft of common assets; expropriation of knowledge or technology; misappropriation of key personnel and avoidance of contractual obligations. The inciting party is opportunistic in areas that are explicit and contractual, even though it is aware of the consequences of a breach of contract.
- A weak form of opportunism, which involves activities that violate relational norms and are norms, which are not explicitly set out in the agreement or the contract. Such form of opportunism aggravates the situation for at least one of parties. Examples of breaches of relational standards include early termination of a commitment or failure to deliver on promises; breach of mutual understanding principle or sharing of knowledge; concealment of critical resources; misrepresentation and manipulation of information, unfair responses to contractual renegotiations or amendments and efforts to mislead.

Since obligations often arise from personal relationships, the role of a cooperation agreement is seen as limited [38]. The legal framework is incomplete in terms of protection of property rights and enforcement of signed contracts leading to a significant impact on strong opportunism. Unfortunately, from a practical point of view, a weak form of opportunism is not necessarily synonymous with a weak effect. For example, information, which is not specified in the contract, is manipulated or distorted—a weak form, but its impact on cooperation really depends on the essence of the information. This is because the distortion of insignificant information has less impact on the results of cooperation than the distortion of relevant information. In contrast, strong opportunism seems to be more noticeable or detectable than weak opportunism because it directly violates certain contract terms. A strong form of opportunism is also more susceptible to repair than a weak one. Contracts usually provide the injured parties with formal solutions and have a binding effect on the behaviour of each party [32]. A weak form violation of relational norms does not provide such a clear remedy or documented legality of the obligation.

Whatever its form, opportunism has serious consequences for the parties to the cooperation. It is worth noting that opportunism increases recurring transaction costs because hidden behaviour aiming at one-sided profit is difficult to observe and verify. Luo [28] shows the increase in the cost of information for companies that perceive this threat and monitor the behaviour of the other party. Luo [28] points out that fear of such behaviour is detrimental to trust-building and escalates conflicts between the parties, which weakens the basis for cooperation. Thus, one side is hindering the joint effort by optimizing its own short-term interest. Additionally, opportunism increases the uncertainty of the effects of cooperation, which achieves the highest value with the synergies related to the degree of coordination and the efficiency linked to the resources contributed by each party. Opportunism hinders the development of the relationships and decreases repeated mutually beneficial involvement. Luo [28] asserts that both strong and weak forms of opportunism inhibit cooperation. However,

a strong form opportunism has a more direct but less lasting impact on the creation of relationships than a weak one.

11.2.2 Risk Perception

Helper et al. [20] assert that due to the fact that many people and departments often have information relevant for problem-solving, a set of pragmatic mechanisms is necessary to ensure a disciplined, shared perception. These mechanisms enable continuous assessments of goals and insights and allow for new perspectives among partners involved in the cooperation. This is achieved through holistic risk management systems [36]. These mechanisms question routines in order to systematically identify risks and build or verify action guidelines. Effective awareness-raising through monitoring-based learning provides protection against opportunism and helps to maintain continuity of cooperation and compromise-based solutions in case of disputes or failures.

The study by Lianying and Qinzhen [26] based on construction projects shows the opportunistic tendencies of a contractor in terms of risk management. Their study shows that opportunism gives rise to two types of risk: relational risk and performance risk. They claim that perception of risk is an important bridge between external factors and opportunism. In addition, the perception of behavioural risks resulting from the uncertainty of each party may explain the motivation of an organization to behave in an opportunistic way.

Das and Teng [7] describe two types of risk in cooperation: relational risk and performance risk. Relational risk refers to results and probabilities where the parties do not behave as desired. Performance risk refers to probabilities and results where the objective is not achieved despite the absence of relational risk. Lehtiranta [25] suggests that cooperating parties must address internal (i.e. relational risk) and external risk. Internal risk relates to the interaction between the parties. On the one hand, external risks are related to environmental factors that are common to all decisions. On the other hand, relational risk is the risk of each individual case of cooperation. Hsieh et al. [21] show that if the parties perceive the feasibility of the decisions in positive terms and minimize relational risk, they build trust in each other leading to the success of joint ventures. Teimoury et al. [37] conclude that relational risks perceived by the party have an impact on the choice of management, including trust-based, monitoring-based, learning, and one-sided control. The above overview shows that the perception of different types of risks can provide a deeper insight into the antecedents of opportunism.

11.2.3 Research Hypotheses

Jagtap and Kamble [22] show that risk perception is an important cause of opportunism by one of the parties. If an entrepreneur sees a high relational risk during the execution of a contract, he may think that the supplier does not want to cooperate. According to the theory of expectations, if an entrepreneur perceives that a supplier is behaving improperly, he may also be reluctant in their behaviour. This is because, as demonstrated by Caniels and Gelderman [4], perception of opportunism can trigger a 'tit-for-tat' strategy. Teimoury et al. [37] point out that a high relational risk threatens trust. Moreover, Das and Teng [8] claim that low trust leads to a high probability of opportunism in relation between companies. Additionally, in the case of construction projects, Lianying and Qinzhen [26] show that the perception of risk by the contractor determines its opportunism. Therefore, the hypothesis is:

Hypothesis 1: *The higher the technological entrepreneur's perception of relational risk, the more likely it is to engage in opportunistic behaviour.*

Das and Teng [8] show that an entrepreneur who recognizes the performance risk may think that they will not achieve the assumed goals of cooperation. According to the theory of perspective, objectives are a reference point for the assessment of decision-making options. Therefore, they see problems with failure to achieve objectives as opportunities and behave in a way that reduces its own risk, sometimes behaving opportunistically [26]. High performance risk means that the ability to achieve the objectives would be reduced, namely that the final benefits of the cooperation would be below the benchmark. As a result, a technology entrepreneur who has recognised a higher level of risk associated with performance is more likely to adopt opportunistic behaviour in order to avoid or reduce her potential loss.

Hsieh et al. [21] find that the higher the level of risk perceived by the parties, the greater the degree of post-contractual control applied by these partners. In an empirical study, Delerue [10] stresses the need to raise awareness of the dynamics between the control systems in place and the perception of relational risk. Delerue and Dauphine [11] study the relational risk in connection with the level of relational capital, the structure of relations, and the level of asymmetry of the involved partner. They discover that the perception of relational risk depends on informal factors. According to the principle that obligations and benefits should be distributed fairly and transparently, contracting parties who see that they are exposed to higher risks tend to obtain (negotiate) greater financial incentives to cover potential losses. Therefore, hypothesis 2 is:

Hypothesis 2: *The higher the performance risk related to failure to achieve the objectives set, the more likely it is that a technological entrepreneur will engage in opportunistic behaviour*.

The paper analyses the antecedents of opportunism derived from the literature review and related to the perception of risk. The identification of opportunism is important for dialogue between theory and empiricism and between research and managerial practice in building cooperation risk awareness (Fig. 11.1).

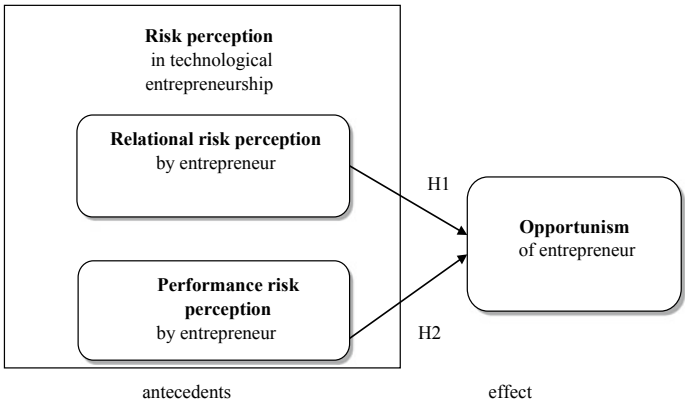

Fig. 11.1 Antecedents of opportunism in cooperation with a technology provider in technological entrepreneurship

Empirical studies indicate that entering distant markets may have a negative impact on results [39] due to greater asymmetry of information and lower accountability. It is worth investigating whether the extent of cooperation determines the impact of risk perception on opportunism. The current literature discusses different approaches to the range of cooperation, in terms of, for example, distance in kilometres, as cultural dissonance and so on. The following hypothesis has therefore been formulated:

Hypothesis 3: *The impact of risk perception on opportunism is mediated by the extent of cooperation.*

Depending on their size, companies may react faster or slower to perceptions of certain dependencies [20, 39] and may use various mechanisms to reduce the risks associated with opportunism [11]. Access to information is important here [21]. Therefore, the size of the enterprise is considered as one of the moderators of the impact of risk perception on opportunism. Consequently, the hypothesis is:

Hypothesis 4: *The impact of risk perception on opportunism is moderated by the size of the company.*

The literature review shows that the closeness of relations limits the asymmetry of information [21] and thus influences the perception of risk [4, 24, 30, 36]. Therefore, the hypothesis is:

Hypothesis 5: *The impact of risk perception on opportunism is moderated by the closeness of relations.*

Definitely, the age of the company is an intermediary for organizational experience [39]. Older companies have accumulated more organizational experience and are better prepared to anticipate and prevent opportunism. For example, they can document cases of opportunistic behaviour and structure internal decision-making

processes to prevent their occurrences in the future. Younger companies, on the contrary, suffer from novelty, and thus may make them more susceptible to opportunism [20]. The following hypothesis has therefore been formulated:

Hypothesis 6: *The impact of risk perception on opportunism is mediated by the age of the company.*

11.3 Research Methodology

11.3.1 Measuring Scales

In line with post-positivism, taking into account the existing theory, these studies used a deductive research strategy [16, 26]. Because the variables used are multidimensional, it is necessary to create measurement scales. After the literature review, it was decided to replicate the research carried out and to use items taken from the literature. Opportunism (O) in research is most often measured using a scale developed by John [23]. But based on earlier studies by Lu et al. [27], Lianying and Qinzhen [26], it is found that the scales proposed by them do not measure the perception of opportunism of the party as proposed by John [23], but the respondent, which is necessary from the point of view of the declared goal. Table 11.1 shows the detailed items. The measurement uses a five-point Likert scale, reflecting the views of respondents from '1—strongly disagree' to '5—strongly agree'. As in the case of opportunism for the constructs of relational risk perceptions (RR) and performance risk perceptions (RP), the measurement scales are taken from the papers by: Zhang and Li [42], and Lianying and Qinzhen [26]. The measurement is based on a five-point Likert scale (see Table 11.1).

Additional variables used in the study are the age of the company, the scope of cooperation, the size of the company and the type of relationship. Age of the company is measured as the number of years between the company's establishment and the study year. In the questionnaire, it is given by an interval form: up to 1 year, over 1 year to 3 years, over 3 years to 5 years, over 5 years to 10 years, over 10 years.

Range of cooperation—the paper, following Dow and Karunaratna [12, pp. 593–594] assumes an ordinal variable, where 1—means cooperation in the local market, 2—regional market, understood as an area of the province, 3—national market, 4—international market (country and export), 5—only foreign market (export only).

For the variable type of relationship—the questionnaire identifies the following options:

- the company is rather reluctant to cooperate with a technology supplier, not having a choice, because it is necessary for its business,
- the company has established a good neighbourly cooperation with a technology provider,

Table 11.1 Characteristics of individual items

Construct	Items	Factor loading values
Opportunism (O) the measurement scale is taken from the work by Lianying and Qinzhen [26]	O1: On occasion, we lie about certain things in order to protect our interests. Heide et al. [19]	0.628
	O2: We sometimes try to increase our own gain by evading contractual obligations. Lu et al. [27]	0.871
	O3: We do not always act in accordance with our contracts. Heide et al. [19]	0.863
	O4: We sometimes promise to do things without actually doing them later. Heide et al. [19], Lu et al. [27]	0.832
	O5: We sometimes take advantage of 'holes' in our contracts or agreements to further our own interests. Heide et al. [19]	0.654
	O6: We sometimes withhold from expending full effort in our cooperative relationship. Lu et al. [27]	0.614
	O7: We may hide critical information in order to benefit ourselves at this owner's expense. Lu et al. [27]	0.622
	O8: We sometimes react dishonestly to contractual renegotiation or change. Lu et al. [27]	0.633
Performance Risk Perceptions (RP) measurement scale is taken from the works by: Zhang and Li [42], Lianying and Qinzhen [26]	RP1: We think that the performance of this contract is likely to decline in the foreseeable future	0.682
	RP2: We think that our objectives will not be achieved	0.762
	RP3: We think that this owner has no competence to offer us support when meeting with difficulties in the implementation of the contract	0.681
Relational Risk Perceptions (RR) measurement scale is taken from the works by: Zhang and Li [42], and Lianying and Qinzhen [26]	RR1: We think that this supplier may break promises	0.746
	RR2: We think that the relationship with this supplier will deteriorate in the foreseeable future	0.907
	RR3: We think that this supplier will take advantage of us when the opportunity arises	0.617

Source Own study

– the company has worked closely with a technology provider, commissioning and participating in the solution of a specific problem or the development of a new solution, etc.,
– the company has established a permanent (partnership) cooperation with a specific technology supplier in order to continuously improve its own and the supplier's business.

Only small companies employing from 10 to 49 persons and medium-sized companies employing from 50 to 249 persons are surveyed. An identifier identifies each group.

11.3.2 Methods of Analysis

Reliability of the results obtained is verified using three criteria suggested by Fornell and Larcker [14]:

– all factor loadings should be significant and exceed a value of 0.5,
– construct reliability (CR) and Cronbach's α indicators should exceed 0.7,
– the average variable extracted (AVE) ratio should be above 0.5.

In addition, it is emphasized that the examined scales [18]:

– shall have Cronbach's alpha coefficient higher than 0.7 but not higher than 0.95 (this condition is called the Nunnally criterion);
– removal of variables from the scale should always result in a decrease in the Cronbach's alpha coefficient;
– correlations of individual variables with the total result of the scale should be higher than 0.4.

In order to assess the significance of the influence of individual variables observed on hidden variables, confirmation factor analysis is carried out. The factor loadings determine in this way show the degree of saturation of a hidden variable with an observable variable, and it is assumed that their value of 0.5 is a minimum value [3]. As a further step, structural equation models are estimated using the method of highest reliability for variables meeting these conditions. This method requires a multidimensional normal distribution hat can only be estimated for numerous samples. Additionally, the discriminatory validity of scales is assessed using the guidelines proposed by Fornell and Larcker [14], i.e. the square root of AVE should be greater than the correlation between the construct and other constructs of the model.

Verification of the received model is an ambiguous procedure with many variants. Table 11.2 shows the commonly used model goodness of fit tests.

In this study procedure, the impact force of an observable variable on a hidden variable is determined using standardized pathway coefficients and the impact is determined on their basis. Additionally, moderation and mediation are introduced in the study, allowing to test the admissibility of cause–effect hypothesis due to the

Table 11.2 Goodness of fit tests in the evaluation of structural equation models

Parameter	Values and requirements
Statistics λ^2 and their relevance	H0: no discrepancies between the observed covariance matrix and that implied by the model. $P > 0.05$ means that the limitations imposed by the researcher in the theoretical model are accurate. The usefulness of this test is limited, as it leads too easily to the rejection of real models. Very rarely used in empirical research to verify the reliability and accuracy of the model
Quotient λ^2 by the number of degrees of freedom	<1 means too good a fit [1; 5]—acceptable models (some say that the upper limit is 2) >5—unacceptable models
Root mean square error (RMSEA) of approximation	The Steiger-Lind test, which is of high rank in the opinion of experts. This is a measure of how badly the model is matched, taking into account the parameters of the model that need to be estimated. The closer to 0, the better the theoretical model fits the result matrix. It is assumed the following values: < 0.01—perfect fit [0.01–0.05)—good fit [0.05; 0.08) satisfactory fit [0.08; 0.10]—poor fit >0.1 indicate bad fit of the model
GFI (CFI, IFI) or AGFI indicators of goodness (quality) of fit	They measure the size of a variance-covariance matrix that is predicted by the reconstituted matrix. A value above 0.9 means an acceptable model, 0.95 a satisfactory model, and 1 a perfect fit for the model

Source Own study based on Fornell and Larcker [14] and Hair et al. [18]

characteristics of the studied phenomenon. It is worth noting that testing the role of a moderator is based on assuming the similarity of structural weights. The use of the effects of moderation or mediation [13, pp. 1–22] allows to deepen the causal analyses.

The data obtained as a result of the research procedure are analysed with the use of Excel, AMOS and IBM SPSS Statistics 20. In this study, models of structural equations performed a verification and descriptive function.

11.3.3 Research Techniques

In order to test the model and its hypothetical relationships between constructs, a structured and standardized questionnaire is developed for the operationalization of hidden constructs, based on the proposed scales. The questionnaire includes: eight statements for opportunism [26], three for relational risk perception [26, 42] and three for performance risk perception [26, 42]. In order to measure the identified items, a five-point Likert scale is used, although in the replicated studies it is a seven-point scale and is aimed at increasing the accuracy of the measurement. However, due to Polish conditions and indications that respondents avoid extreme evaluations (very high or very low), it is decided to remain on a five-point scale. The questionnaire additionally includes a footer concerning the size, years of activity, the range of the cooperation assessed and the relations established. The preliminary questionnaire is verified in pilot studies conducted by the authors. This stage of the analysis includes interviews with senior management to verify the clarity of the statements made and to exclude misunderstandings and possible ambiguities. The next stage, conducted by the research company aimed to confirm the validity and reliability of the proposed scales on the basis of statistical analysis with the use of the collected data.

The research company was commissioned to carry out the relevant studies and for this purpose, computer-assisted telephone interview (CATI) and computer-assisted web interview (CAWI) techniques are used, unless due to the respondent's wish, the interview is conducted directly with the respondent in the company. The disadvantages of these methods are the necessity for a short questionnaire and composed of simple and uncomplicated questions. Unquestionable advantages include continuous monitoring of the study, good quality of collected data, standardization of the data, short time of data collection and low costs. The advantages of these techniques also include minimizing the risk of errors related to lack of responses from the participants and consistent measurement, techniques.

In this type of research, the problem is always how numerous the sample should be. Of course, the larger the better. Aaker and Bogozzi [1] show that when analysing 2–3 subgroups, at least 200 people are sufficient. Due to the estimation method in structural models, the minimum sample size should be ten times the number of estimated parameters [18]. Therefore, the minimum sample size for this test is $10 \times 16 = 160$. It is worth noting that Lianying and Qinzhen [26] use a sample of 156 observations, and in the Zhang and Li [42], have 238 observations. In this current study, the sample size is 304. Thus, it is an acceptable sample size because it exceeds the requirements of being over 160 respondents [42].

The survey was conducted during October and December 2017, as the research project 2014/13/B/HS4/01517 funded by National Science Centre in Poland. It concerns only Polish companies defined as technological entrepreneurship. The subjects of the research are small- and medium-sized enterprises, which cooperate with the suppliers of new technical solutions resulting from own research and development or solutions developed by other entities (universities and scientific institutes, research

and development units, etc.), including ideas of persons. As a result of the validation, none of the questionnaires are rejected and no data are missing. It is a result of sensitizing interviewers to the need to obtain answers and convince respondents that there are no bad and good answers. Anonymity is also guaranteed [34, p. 888]. The use of a questionnaire based on the opinions of respondents is always burdened with an error related to subjectivism. However, in this case, the selection of respondents in the form of a person responsible for cooperation with a technology supplier—allows us to assume that the opinions expressed by them correspond to the situation of the company. In addition, the study is carried out once at a given time, and the cooperation is a long-term process. In the light of the substantiations provided, research constraints and potential errors should not affect the quality of the data obtained.

The research company used its internal databases effectively, approximately every 14th record called ended with an interview. A total of 4200 companies are selected, giving ca. 7.24% return in the survey. On average, the interview lasted about 30 min. The empirical studies consist of 304-element sample randomly selected. A research company based on its database of small and medium technology enterprises (SMTEs) conducts the draw. As a result, the following companies were obtained according to PKD: section B—mining and quarrying—4 (1.3%), section C—manufacturing—206 (67.8%), section D—electricity, gas, steam and air conditioning supply—3 (1%), section H—transportation and storage—34 (11.2%), section I—accommodation and food service activities—34 (11.2%), section J—information and communication—23 (7.5%).

11.4 Results

Three hundred and four companies from the SMTE sector are included in the research of factors determining the cooperation of technological entrepreneurship with suppliers of new technologies. Over the past year, these companies have signed a cooperation agreement with a technology provider. The age structure of the surveyed companies is as follows: up to 1 year—1.3% of the respondents, over 1 year to 3 years—2.0% of the respondents, over 3 years to 5 years—1.0% of the respondents, over 5 years to 10 years—13.5% of the respondents, over 10 years—82.2% of respondents. Since in the survey, the group of companies that exist up to 10 years is 17.8%, the division into the group of companies up to 10 years and above is used. Among the surveyed companies, cooperation on the local market is conducted by 10.2% of the respondents, regional, understood as an area of the province—20.1% of the respondents, national—41.9% of the respondents, international (domestic and export)—27.7% of the respondents, only foreign market (export only)—no representatives. The company declares that it has established cooperation with a technology supplier either:

– rather reluctantly, having no choice, because it is necessary for its activity—44.2% of the respondents,

– close cooperation with a technology provider, commissioning and participating in the solution of a specific problem or the development of a new solution, etc.—37.6% of the respondents,
– permanent (partnership) with a specific supplier in order to continuously improve its business—18.2% of the respondents.

Two groups of relationships are assumed in the analyses: the necessary ones represented by 44.2% and the close voluntary ones represented by 55.8% of the surveyed relationships. Only small companies employing from 10 to 49 persons are surveyed—constituting 75.9% of the respondents and medium-sized companies employing from 50 to 249 persons—constituting 24.1% of the respondents.

Confirmatory factor analysis (CFA) is used in order to assess the homogeneity of each scale (opportunism, perception of relational risk, perception of performance risk). Table 11.1 shows the values of individual factor loadings. They are all above 0.614, thus, presenting an acceptable level for exploratory research. Tables 11.2 and 11.3 show that all conditions of reliability suggested by Fornell and Larcker [14] are met. Additionally, Table 11.3 reports the values obtained in empirical studies already conducted by: Lianying and Qinzhen [26] and Zhang and Li [42]. Despite the numerical advantage of the sample, the obtained values of reliability coefficients are worse, especially in the case of risk perception. Since their research is conducted for the construction industry in China, it implies that industry and economic conditions in Poland and China are significantly different.

Table 11.4 presents the correlation coefficients and, on the main diagonal, the square root of AVE. The diagonal values exceed the correlation values, thus, the test of discriminatory reliability is acceptable. Additionally, for comparisons, Table 11.4 shows the values obtained in replicated empirical studies by Lianying and Qinzhen [26] and Zhang and Li [42]. The values of correlation coefficients between the coefficients are equally statically significant, but their strength is much lower. One may be tempted to say that it is almost twice as low. In both previous surveys for the same sector and the same economy, they are comparable. Therefore, the industry and other economic and behavioural conditions of managers in Poland may be of significance again.

For an estimated structural model, there is no reason to reject the hypothesis that the rest of the standardized empirical and theoretical matrices are equal to zero. The value of RMSEA = 0.068 (RMSEALO = 0.056; RMSEAHI = 0.081) indicates a satisfactory model match. Value of $\chi 2/ss = 2.414$ indicates the acceptability of the model. Indices GFI = 0.923 and AGFI = 0.900 have values above the required thresholds. In the measurement model, a significant positive (0.239) correlation dependence ($p < 001$) is identified between perception of relational risk and perception of performance risk, which is not mentioned in theoretical discussions or found in earlier studies. Although once one replicates the studies by Lianying and Qinzhen [26] and Zhang and Li [42], this relationship is detected it is larger more than twice. It is worth noting that the higher the average perception of relational risk, the higher, on average, the perception of performance risk (Fig. 11.2).

Table 11.3 Evidence of reliability and convergent validity

Constructs	Lianying and Qinzhen [26]			Zhang and Li [42]			Current study		
	AVE	CR	α	AVE	CR	α	AVE	CR	α
O	0.558	0.909	0.886	–	–	–	0.523	0.895	0.858
RP	0.675	0.862	0.759	0.869	0.952	–	0.503	0.752	0.733
RR	0.640	0.840	0.722	0.884	0.958	–	0.587	0.806	0.705

Note O: Opportunism, RP: Performance Risk Perceptions, RR: Relational Risk Perceptions
Source Own study

Table 11.4 Discriminate validity (Fornell–Larcker Criterion)

	Lianying and Qinzhen [26]			Zhang and Li [42]		Current study		
	O	RP	RR	RP	RR	O	RP	RR
O	0.747					0.709		
RP	0.609	0.822		0.940		0.324	0.723	
RR	0.494	0.402	0.800	0.448	0.932	0.252	0.212	0.766

Note O: Opportunism, RP: Performance Risk Perceptions, RR: Relational Risk Perceptions
Source Own study

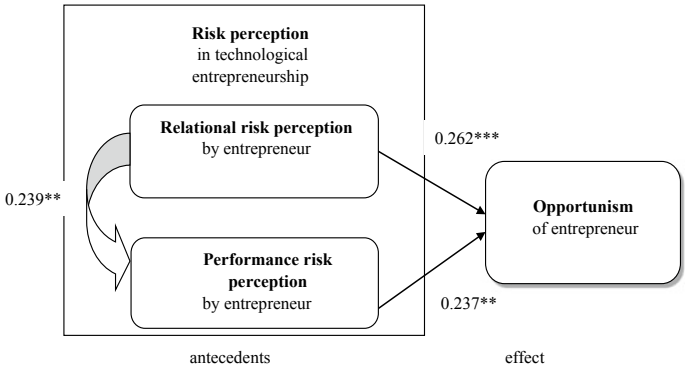

Fig. 11.2 Empirical model with determined standardized path factors (*Note* On the arrows there are standardized parameters estimated in empirical studies, *** means dependencies significant for <0.001, ** $p < 0.01$)

Empirical data (Table 11.5) confirm that the perception of relational risk has a significant direct impact on entrepreneur's opportunism. It also confirms that the perception of performance risk has a significant direct impact on entrepreneur's opportunism. The higher the entrepreneur's perception of relational risk and performance risk, the greater the entrepreneur's opportunism in relation to this cooperation. Therefore, the probability of opportunistic behaviour is higher. In the model, the strength of the impact of the perception of relational risk and performance risk on the entrepreneur's opportunism is comparable. Unlike in the study by Lianying and Qinzhen [26], where the impact of relational risk perception on entrepreneur's

Table 11.5 Standardized values of estimated parameters

Relation			Parameter	Lianying and Qinzhen [26]
Opportunism	←	Relational Risk Perception	0.262***	0.297***
Opportunism	←	Performance Risk Perception	0.237**	0.489***

Note: *** denotes significant relationships $p < 0.001$, ** denotes significant relationships $p < 0.01$
Source Own study

Table 11.6 Standardized values of estimated parameters in the structural model

Company size	Small	Medium	p
Opportunism ← Relational Risk Perception	0.226**	0.423*	0.435
opportunism ← Performance Risk Perception	0.283**	0.289	0.032
Relation with the supplier	Only necessary	Close	*p*
Opportunism ← Relational Risk Perception	0.208*	0.315***	0.061
Opportunism ← Performance Risk Perception	0.229*	0.249*	0.422

Note *** denotes significant relationships $p < 0.001$, **$p < 0.01$, *$p < 0.05$
Source Own study

opportunism is almost twice lower than the perception of performance risk (see Table 11.5). The results obtained confirm the results presented in the literature, i.e.:

– perception of relational risk has a significant and positive impact on entrepreneur's opportunism (H1 was confirmed),
– perception of performance risk has a significant and positive impact on entrepreneur's opportunism (H2 was confirmed).

Next, the paper examines whether the significance and strength of this impact are identical in the groups distinguished in the sample due to such characteristics as the size of the company and the relations established with the cooperating company.

The analyses carried out in groups (Table 11.6), due to the given groups of relations with suppliers defined as only necessary or close, show that the significance and strength of the impact of risk perception on opportunism are identical. If companies define relationships as only necessary and close or even partner relationships, the impact of perceiving relational risk and performance risk is similar on opportunism. Therefore, from a practical point of view, this means that the relationship established with the supplier does not change the impact of risk perception on opportunism (H5 is rejected). This result is significantly different from the one presented in Staniec [36]. Staniec [36] shows that for the case of close relations, the turbulence of the environment forces a reaction to changes and thus increases the awareness of the risk for long-term cooperation, and in the case of only necessary relations firms focus only on the current risk of cooperation.

Nevertheless, the results show statistically significant differences in the impact of the perception of performance risk on opportunism in groups of small- and medium-sized enterprises. In the case of medium-sized companies, the impact of the perception of performance risk on entrepreneur's opportunism is no longer relevant. The impact of relational risk perception on opportunism in both sized groups is identical (H4 is partially confirmed).

Next, the study investigates whether the mediation effects identified in theory, related to the range of cooperation or the age of the company, are present in the empirical research.

Determined path factors (Table 11.7) show that there is no significant correlation between opportunism and age or range of cooperation as well as perception of risk

Table 11.7 Mediation effects

Relation			Parameter
Opportunism	←	Scope of cooperation	−0.024
opportunism	←	Age of the company	−0.077
Scope of cooperation	←	Relational Risk Perception	0.043
Scope of cooperation	←	Performance Risk Perception	−0.103
Age of the company	←	Relational Risk Perception	0.031
Age of the company	←	Performance Risk Perception	0.026

Note Relationships is not significant
Source Own study

or age or range of cooperation. Therefore, they indicate a lack of mediation related to age or range of cooperation in case of the impact of risk perception on opportunism (H3 and H6 are rejected) (Table 11.8).

The study confirmed that antecedents of opportunism are related to risk perception. The results of the literature concerning the works by Das and Teng [8], Lianying and Qinzhen [26] and Delerue [10] are confirmed. Empirical studies indicate that the range of cooperation, which is important when entering new markets [39] does

Table 11.8 Verification of research hypotheses

Hypothesis	Decision
H1. The higher the technological entrepreneur's perception of relational risk, the more likely it is to engage in opportunistic behaviour	Confirmed
H2. The higher the performance risk related to failure to achieve the objectives set, the more likely it is that a technological entrepreneur will engage in opportunistic behaviour	Confirmed
H3: The impact of risk perception on opportunism is mediated by the extent of cooperation	Rejected
H4: The impact of risk perception on opportunism is moderated by the size of the company	Partially confirmed. The impact of performance risk perception on opportunism is different in small and medium-sized companies
H5: The impact of risk perception on opportunism is moderated by the closeness of relations	Rejected
H6: The impact of risk perception on opportunism is mediated by the age of the company	Rejected

Source Own study

not mediate the impact of risk perception on opportunistic behaviours. This current research confirms that the size of a company is not a moderator of the impact of risk perception on opportunism in technological entrepreneurship. In addition, this paper finds that the impact of risk perception on opportunism depends on the size of the company. In the case of perception of relational risk, this impact is independent of the size of the company.

However, the impact of perception of performance risk on opportunism in medium-sized companies does not exist, whereas it is important for small-size companies, contrary to the findings by Delerue and Dauphine [11]. The presented empirical studies do not confirm the results presented in the works by MacDuffie [30], Hsieh et al. [21] and Staniec [36], regarding the impact of risk perception on opportunism being moderated by the closeness of relations. It is also impossible to confirm the result of Verbeke et al. [39], claiming that the age of the company is an intermediary for organizational experience, i.e. a mediator of the influence of risk perception on opportunism.

11.5 Conclusions

Studies have adopted opportunism as a risk element. However, an emerging trend in the literature of perception of risk as an antecedent of opportunism is more important from the point of view of managerial implications. Because its existence depends at least in part on how the risk is perceived, perception of risk as the antecedent of opportunism allows for a look at holistic risk management systems and their benefits. The results of this paper confirm the literature's suggestions that opportunism is predictable can be eliminated through appropriate management policies. They indicate that opportunism is affected by risk perception—especially when monitoring and control is difficult [11, 39].

The results also confirm the need, perceived by Delerue [10], to raise awareness of the dynamics between the control systems in place and the perception of relational risk. In addition, the costs of technological security are very important in the case of such cooperation. Through careful structural solutions that provide the right incentives, through innovative technology management and trust-building, joint ventures can be beneficial for all parties, even in light of current risks related to opportunistic behaviour. Therefore, it is important to combine a hard and soft approaches allowing for the mitigation of opportunism. Companies should strive to build broad and deep relationships, which is essential as global manufacturing and technology networks develop. Thus, the results of this paper put into question the reliability of models, which are based solely on the theory of transaction costs. In the case of modern technology, one cannot rely on patents or property rights, but trust and risk minimization offer adequate guarantees [24].

The analysis of opportunism as an observed result of a human disposition feature indicates that this concept requires further research. Because the studies presented show that risk management tools are necessary in order to reduce the incidence and

effects of opportunism. Consequently, this study bridges the gap between academic work based on the theory of transaction costs, which assumes opportunism as the default behavioural feature and the practical needs of managers to anticipate and mitigate the effects of opportunistic behaviour adopted in cooperation.

The main limitation of this study is the concentration on Polish companies from the SMTE sector. From the point of view of replication of research, it is important to confirm the specificity of the results obtained for managerial determinants and the industry [39]. This will enable the identification of firms who are more inclined to engage in opportunism and under what circumstances. Further directions of research may experiment with alternative variables and indicated antecedents [39] and comparisons between the perception of risk and opportunism by the other side to the cooperation, namely the supplier [5].

Despite these limitations, this study contributes to the development of a theory of risk perception. This approach conceptually embeds the theory of transaction costs while allowing for a constructive interaction with managers in the pursue of tools to identify and mitigate the vulnerability of their companies. From a strategic point of view, it is important to show, at the microlevel, how companies are susceptible to insidious activities. It is necessary to conduct research aimed at a better understanding of the determinants of the business context of opportunism.

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Chapter 12
Financial Services Companies' Abilities to Collaborative Technology Absorption Versus Their Innovativeness

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Abstract The paper contributes to the research on the dependence between absorptive capacity and firm's innovativeness. The aim of the paper is to assess the impact of the degree of absorptive capacity components development on the innovativeness level of financial companies operating in Poland. The theoretical part of the paper discusses firm's innovativeness and its relations with inter-firm collaboration and developing the absorptive capacity. The empirical part of the paper presents the findings obtained in an online survey using a CSAQ—a conducted on the sample of 111 commercial financial sector companies operating in Poland. The presented study focuses on identifying the components of absorptive capacity that determine the increase of firm's innovativeness level. They indicate that the capability to use specific forms of acquiring new technologies from outside and the capability to develop the acquired technologies are those which most significantly influence firm's innovativeness level.

Keywords Innovativeness · Inter-firm collaboration · Firm's absorptive capacity · Technology absorption

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12.1 Introduction

Nowadays, companies that aspire to remain competitive need to develop various mechanisms contributing to enhancing their innovativeness. However, in contemporary economy, the process of generating innovations has significantly changed in recent years. It results from the fact that frequently, companies have limited potential, in particular regarding intellectual and organizational resources. In turn, very often, it seems more than reasonable to use external sources of innovation, which translates into searching the environment for knowledge and ready-made solutions supporting other specialized business entities [12, p. 58]. Hence, nowadays, it is argued that firm's innovativeness is mainly boosted through inter-firm collaboration. The desire to access external resources, among other knowledge, needed to innovate, forces companies to develop their absorptive capacity. Absorptive capacity is the entirety of specialized resources, in particular of an intangible nature, that enables a company to identify and recognize external knowledge and then effectively acquire and assimilate it as well as apply new and strategically valuable knowledge to achieve the intended results in the process of competition [10, p. 166; 30, p. 186].

The paper contributes to the knowledge and research on the dependence between absorptive capacity and firm's innovativeness. Assuming the existence of relationship between absorptive capacity and firm's innovativeness, companies should be extremely interested in the development of their absorptive capacities. What is more, the stronger the dependence, the more effort should be made to develop their capacities in order to insure long-term success. Thus, the intention of the authors is to verify the existence of such dependence in the reality of Poland's sector of financial services companies. The main aim of the paper is to assess the actual impact of the degree of absorptive capacity components development on the innovativeness level of financial companies operating in Poland.

The paper consists of two parts: the theoretical grounding and the empirical research based on the survey conducted in the Polish finance-company sector. The theoretical part, first of all, outlines the issues regarding company's innovativeness and its relations with inter-firm collaboration. Secondly, the concept of absorptive capacity and its role in strengthening company's innovativeness is discussed. The literature review provides the foundation for the empirical research. The empirical part of the paper starts with the presentation of the method and the context of study. Then the analysis of the research findings leading to verifying formulated hypotheses is presented. The outcomes of the performed research identify the key absorptive capacities components that determine the increase of company's innovativeness. Thus, our findings provide useful managerial implications concerned with developing particular components of firm's absorptive capacity.

12.2 Company's Innovativeness and Inter-firm Collaboration

It is indisputable that XXI century is the age of innovations. This results in both great opportunities but also challenges for business entities. Thus, while responding to these demanding circumstances, all companies need to create the ability to learn and change all the time. Such ability is nowadays perceived as one of the critical factors for market success.

Taking the abovementioned into account, nowadays all enterprises have to strengthen their innovativeness. Firm's innovativeness is the ability to create and commercialize innovations as well as to absorb them. It is also explained as the ability to constantly build and simultaneously restructure company's potential in order to modify its competences as well as market activities that distinguish it from the competitors. Nowadays, such ability is perceived as the fundamental feature of every company that aspires to be competitive on global market [7, p. 144].

Among pertinent issues regarding the importance of firm's innovativeness, there is a necessity for underling the number of trends observed in contemporary business environment. Firstly, nowadays technological developments have accelerated to a degree where product life cycles have shortened considerably. Due to this, companies are forced to active search for innovative products to replace the existing ones, while the time available to reap the benefits of this has been significantly reduced. In turn, the need to speed up the product development process has appeared as a great challenge for companies. Furthermore, new offerings in several sectors are increasingly complex so their development requires the combination of different areas of knowledge. Moreover, nowadays markets are becoming increasingly global so most companies can no longer confine themselves to create products for local markets only [6, p. 106]. Having to bear in mind, the aforementioned companies are forced to focus on strengthening their innovativeness, among others, through inter-firm collaboration. This is due to the fact that business entities acting alone are not best placed to capture the opportunities available in the market or cope with the challenges that face them [16, p. 4]. Inter-firm business relationships create the opportunities to reach global markets, absorb new technologies, share knowledge, human and material resources [23, p. 366]. This results from the fact that strengthening firm's innovativeness directly refers to its ability to learn, both by generating knowledge inside a firm and acquiring new knowledge from outside [25, p. 503].

According to the EU guidelines, the measurement of enterprise innovativeness should cover both the results of its innovative activity (innovations), its efforts (innovative activity), as well as its potential (assets and flows) [22, pp. 145–146].

Company innovativeness research is usually based on objective data, such as the number of patents, the share of revenues from sales of new products in total sales, expenditure on R&D, the number of employees employed in positions performing research and development functions, investments in new machines and devices [3, pp. 205–210]. The most common measure of firm's innovativeness is the number of innovations introduced by the entity and the results obtained thanks to them. Taking

the abovementioned into account, in our paper, the innovativeness of an enterprise is understood as its ability to create and implement innovations that bring benefits in line with expectations that constitute a direct motive for undertaking innovative activity.

It is doubtless that every company—regardless of its size, value or market position—is in possession of strictly defined, and at the same time, limited resources, that constitute its potential. The value of this potential determines the company's capacity, both in terms of its ongoing operations and developmental prospects [12, p. 58]. However, over the past decades, it was observed that while operating in hypercompetitive economy, many firms are not able to stay self-sufficient in the field of permanent monitoring and modifying their potential, in particular regarding knowledge resources. Nowadays, we can observe that companies became active in the field of inter-firm collaboration as they search for the external entities' resources that can boost their potential and in turn bring a variety of benefits [9, p. 49; 15, p. 3; 6, p. 106; 12, p. 59].

Inter-firm collaboration means an explicit or implicit agreement between independent business entities. In line with relevant literature, collaboration involving knowledge transfer may take one of two the basic forms: 'inter-firm collaboration' within supply-chain or between competing companies [29, pp. 35–36], and 'non-inter-firm collaboration' between business entities and public research organizations, e.g., universities or public research institutes [20, p. 1049]. Inter-firm collaboration involves voluntary participation by collaborating companies in a managed and controlled exchange process where the primary currency of exchange is knowledge leading to innovation (e.g., technology absorption) [27, p. 2]. Several studies presented in the literature investigated the link between inter-firm collaboration and collaborators' innovativeness, demonstrating such benefits as: enhanced learning capabilities, improved production efficiencies or lower innovation-development costs [1, pp. 317–343; 13, pp. 389–341; 16, p. 8; 23, pp. 363–378; 21, pp. 236–251; 31, pp. 181–194].

By enlarging one firm's knowledge base and accessing knowledge that can augment its sources of expertise, inter-firm collaboration helps a company to strengthen its innovativeness. Modern companies realize that through entering inter-firm collaboration, they get contact with 'knowledge milieus' beyond their local environments. In other words, they gain the access to competencies such as technological competencies and know–how that is not available in their local environments. So thanks to having established external relationships; firms are more able to gain assistance with technology development and innovation when a particular need arises [21, p. 246]. Furthermore, as highlighted by Bea and Chang, combining external sources of knowledge and innovation with a firm's own assets equates to increasing the efficiency of the process of creating its intellectual property and innovation by reducing costs as well as achieving higher profits from commercializing these innovations [2, pp. 967–980].

The concept describing a framework for a company's strategy to profit from inter-firm collaboration through opening its innovation process is open innovation [4, pp. 21–24; 14, pp. 2–9; 18, pp. 132–134]. Its fundamental thought refers to the need for any organization to transcend its boundaries and concentrate on purposive inflows

and outflows of information and knowledge to accelerate organizational internal innovativeness but also to allow the external market users to use firm's innovations [19, p. 69]. Taking such perspective, the idea of developing inter-firm collaboration aimed at increasing company's innovativeness is an inherent part of open innovation paradigm that treats R&D as an open system. Following open innovation approach, it is necessary to reorient R&D activities based on an organization's internal resources toward developing the ability to acquire knowledge from external entities and aiming to fully utilize already existing intellectual property and innovation [4, pp. 21–55].

12.3 Company's Absorptive Capacity

Building up company's ability to learn from external entities and use the new knowledge to innovate is explained by the concept of absorptive capacity [5, pp. 128–152; 26, pp. 774–786; 30, pp. 185–203]. Absorptive capacity concept was popularized by Cohen and Levinthal who define it as "the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends" [5], Zahra and George reconceptualised absorptive capacity concept and defined it as "a set of organizational routines and processes by which firms acquire, assimilate, transform and exploit knowledge to produce a dynamic capability" [30, p. 186]. The aforementioned authors identify two categories of absorptive capacity, namely potential and realized which perform separate but complementary functions [30, pp. 189–191]. Potential absorptive capacity includes firm's capability to acquire and assimilate external knowledge. Zahra and George claim that knowledge acquisition "refers to a firm's capability to identify and acquire externally generated knowledge that is critical to its operation" [30, p. 189]. Knowledge assimilation is described by them as "the firm's routines and processes that allow it to analyze, process, interpret and understand the information obtained from external sources" [30, p. 189]. In other words, potential absorptive capacity makes the firm open to acquiring new knowledge and able to learn it. On the other hand, realized absorptive capacity includes company's capabilities to transform and exploit knowledge. As highlighted by the aforesaid researchers, knowledge transformation refers to "a firm's capability to develop and refine the routines that facilitate combining existing knowledge and the newly acquired and assimilated knowledge" [30, p. 190] and knowledge exploitation regards "the routines that allow firms to refine, extend and leverage existing competencies or to create new ones by incorporating acquired and transformed knowledge into operations" [30, p. 190]. Thus, realized absorptive capacity enables the necessary transformation of the newly acquired knowledge and its purposeful use by including it in company's activities that allow achieving better result. Here, it should be highlighted that knowledge absorbed from the environment is a valuable asset for a firm as long as it constitutes an actual source of generating new value [17, p. 462]. Therefore, putting forth efforts to develop company's absorptive capacity is supposed to result in the increase of firm's innovativeness. It is highlighted in the relevant literature that offensive motives of the companies (related to firm development and

enhancing its competitiveness) for external knowledge acquisition and exploitation are much more frequent than defensive ones [10, pp. 234–242; 28, pp. 423–437]. Focusing on absorbing knowledge from the environment in order to transform it into new value is definitely an offensive activity. Thus, we assume that companies that concentrate on enhancing their ability to recognize new needed knowledge and then assimilate and transfer it to apply it to commercial ends, also aim at raising their innovativeness.

What is of significant importance, to insure the effectiveness of the absorptive processes, company has to develop both categories of absorptive capacity. However, while focusing on strengthening firm's absorptive capacity, it is of great importance to be aware of both dissimilarity and complementarity of potential and realized absorptive capacity. As noted by Glabiszewski et al., differentiation between two aforesaid categories allows answering the question why some entities fail as a result of changes 234-in the environment, while others, who operate under the same conditions, are able to develop significantly [11, pp. 122–123].

Absorptive capacity concept is visibly evolving and being modified as well as extended. Among others, it has been significantly modified by Zahra and George, who perceived absorptive capacity as "a dynamic capability pertaining to knowledge creation and utilization that enhances a firm's ability to gain and sustain a competitive advantage" [30, p. 185]. As argued in the relevant literature, dynamic capabilities are firm's routines enabling to change its resource base through acquiring, shedding, integrating and recombining them to create new value [8, pp. 1107–1108]. Following the statement that dynamic capabilities regard company's capacity to reconfigure its capabilities to adapt to the changing environment [24, pp. 914–915], while contributing to the discourse on absorptive capacity, we take Zahra and George's point of view.

Other researchers who contributed to the discussion on absorptive capacity are Todorova and Durisin [26]. They criticize reconceptualization made by Zahra and George and postulate reintroducing the elements of the original concept by Cohen and Levinthal [5]. Todorova and Durisin [26] claim that knowledge assimilation and knowledge transformation seem to be alternative processes instead of sequential ones as proposed by Zahra and George [30]. Moreover, Todorova and Durisin are very skeptical in regard to distinguishing between potential and realized absorptive capacity [26, pp. 775–776].

Combining the approaches proposed by Cohen and Levinthal [5] and Zahra and George [30], as well as considering the objections noted by Todorova and Durisin [26], we propose to define the scope of absorptive capacity components in the following way: **acquiring new external knowledge** (including the capability to identify and assess firm's needs and possibilities, the capability to identify and evaluate in the environment potential sources of knowledge, the capability to use specific forms of transferring knowledge, the capability to cooperate with other entities in order to acquire knowledge), **assimilating newly acquired knowledge** (including the capability to learn the acquired technology, the capability to adapt to the acquired knowledge, the capability to develop the acquired knowledge) and **using new acquired knowledge** (the capability to operate efficiently the implemented knowledge, the

capability to exploit effectively the implemented knowledge, the capability to generate the effects desired by the market through the implemented knowledge).

12.4 Method of the Study

The empirical part of the paper is based on the research findings obtained in 2015–2016 by means of an online survey using a computerized self-administered questionnaire (CSAQ) in which the respondents filled in a digital version of the survey questionnaire available online. The questionnaire was sent to the heads of 155 commercial financial sector companies registered in Poland, namely all banks, property and life insurance companies, and investment funds (TFI) and universal fund management companies (PTE). In total, 111 entities filled in the online survey questionnaire, constituting 71.6% of the population under study. Analysis is based on the results from 37 TFIs, 28 banks, 20 property insurance companies, 17 life insurance companies and 9 PTEs.

The research conducted was the primary source of data essential for realizing the paper aim which was **the assessment of the actual impact of the degree of absorptive capacity components development on the innovativeness level of financial companies operating in Poland**.

In order to accomplish the main research objective set, the authors formulated the following three specific objectives:

1. Assessing the development of absorptive capacity components of financial companies in Poland.
2. Assessing the level of innovativeness of financial companies in Poland.
3. Assessing the impact of the degree of absorptive capacity components development on the innovativeness level of financial companies operating in Poland.

We decided to distinguish three basic capability segments—the capability to acquire new technologies, the capability to assimilate the acquired technologies and the capability to use the newly implemented technologies—on the base of literature analysis presented in theoretical part of the paper.

In attempting to accomplish the above said specific objectives, and at the same time, the paper's main research aim, the authors formulated and verified empirically the following three research hypotheses:

H1. All absorptive capacity components are strongly correlated with company's innovativeness level.
H2. All three absorptive capability segments (capability to acquire new technologies—CAcNT, capability to assimilate the acquired new technologies—CAssNT and capability to use the acquired new technologies—CUNT) significantly influence firm's innovativeness level.
H3. The most strongly correlated components of absorptive capacity significantly impact firm's innovativeness level.

H4. The degree of development of the capability to develop the acquired technology has the strongest impact on firm's innovativeness level.

12.5 The Impact of Absorptive Capacity Components on Financial Companies' Innovativeness—Research Findings

In order to verify the existence of the dependence between particular components of absorptive capacity and firm's innovativeness, it is necessary to first diagnose the degree of the development of absorptive capacity of financial companies in Poland. The absorptive capacity was estimated on the basis of the level of development of the capability to acquire, assimilate and transform, as well as used knowledge. To be able to assess the above-said dependence, top managers of the investigated financial enterprises were asked to estimate the level of development of absorptive capacity components responsible for the implementation of specific areas of activities envisaged under the four stages of absorption of new technological knowledge. During the survey, there was used a subjective rating scale ranging from 0 to 100%, where 0% meant that they were not developed at all, and 100%—they were developed to a maximum degree, i.e., fully developed.

The average of the ratings of the three basic capability segments, i.e., those responsible for acquiring, assimilating and using new technological knowledge, results from the detailed capabilities that make up those basic ones. The findings regarding this issue are presented in Table 12.1.

The research findings presented in Table 12.1 show that investigated managers perceive a gap in their companies in regard to the development of the possessed capabilities to absorb new technological knowledge in relation to the expectations they assumed. The biggest deficiencies occur within the segment regarding firm's capabilities to transform the acquired technologies, which include the capabilities to learn them, adapt to the prevailing conditions in the company and develop them in order to make valuable use of them in terms of innovativeness. Here, it should be highlighted that the capability to transform and assimilate new knowledge is perceived as highly specialized segment of absorptive capacity, considered to be the most demanding one. The obtained results prove that analyzed financial companies noticed their greatest weakness in this area (average grade at the level of 56.36 points). In turn, the segment that was assessed the most developed in the analyzed financial companies refers to company's capacity to exploit the newly implemented technologies (average grade at the level of 71.77 points). While considering the components of this segment, the research findings indicate that the most developed were the capabilities to operate the implemented technologies efficiently which means reliably and consistently with the intended use (75.86 points).

Table 12.1 The degree of the development of individual segments of absorptive capacity of financial companies in Poland

Code	Components of company's absorptive capacity	Average grade
The capability to acquire new technologies—CAcNT		**69.26**
X1	The capability to identify and assess one's own technological needs and possibilities	75.59
X2	The capability to identify and evaluate in the environment potential technologies and their suppliers	68.38
X3	The capability to use specific forms of transferring (acquiring from outside) technologies	67.84
X4	The capability to cooperate with other entities in order to bring about technology transfer (the capability to establish and maintain relationships, negotiate, etc.)	65.22
The capability to assimilate the acquired technologies—CAssNT		**56.36**
X5	The capability to learn the acquired technology	63.60
X6	The capability to adapt to the acquired technology	53.87
X7	The capability to develop the acquired technologies	51.62
The capability to use the newly implemented technologies—CUNT		**71.77**
X8	The capability to operate efficiently the implemented technologies (as intended)	75.86
X9	The capability to exploit effectively the implemented technologies	68.74
X10	The capability to generate the effects desired by the market through the implemented technologies	70.72

Source Own elaboration based on survey results

The next variable that required estimation referred to firms' innovativeness level. Table 12.2 presents the data regarding the average level of innovativeness in regard to financial companies under research.

The research findings presented above allowed to calculate correlations between absorptive capacity components and firm's innovativeness by the use of Pearson correlation coefficients. The results of these correlations are presented in Table 12.3.

The results show that all correlations are statistically significant. However, some of the values of correlation coefficients are not high enough (lower than 0.5). This allows us to reject H1 according to which all absorptive capacity components are strongly correlated with company's innovativeness level.

To examine the influence of three absorptive capacity segments on company innovativeness level (H2), structural equations models (SEM) were developed. A two-step

Table 12.2 The level of the innovativeness of financial companies operating in Poland

Code	The innovativeness of financial companies in Poland	Average grade
CI	The level of the innovativeness of companies	74.59

Source Own elaboration based on survey results

Table 12.3 Means, standard deviations and correlations ($N = 111$)

Variable	Means	SD	CI	X1	X2	X3	X4	X5	X6	X7	X8	X9
CI	74.59	18.43	1									
X1	75.59	18.23	0.56***	1								
X2	68.38	17.81	0.53***	0.87***	1							
X3	67.84	17.45	0.61***	0.82***	0.84***	1						
X4	65.22	18.03	0.40***	0.72***	0.78***	0.68***	1					
X5	63.60	18.67	0.43***	0.52***	0.55***	0.51***	0.45***	1				
X6	53.87	23.01	0.58***	0.54***	0.52***	0.49***	0.50***	0.76***	1			
X7	51.62	21.93	0.65***	0.46***	0.49***	0.53***	0.40***	0.72***	0.84***	1		
X8	75.86	17.71	0.47***	0.64***	0.50***	0.54***	0.47***	0.43***	0.54***	0.42***	1	
X9	68.74	16.41	0.43***	0.63***	0.51***	0.57***	0.48***	0.42***	0.56***	0.44***	0.84***	1
X10	70.72	15.88	0.39***	0.53***	0.49***	0.48***	0.47***	0.44***	0.53***	0.51***	0.63***	0.59***

Note ***p-value < 1%; Xi codes as in Table 12.1

Source Own elaboration based on survey results

Table 12.4 Validity examination results for the constructs under measurement and goodness of fit evaluation for CFA model

	alpha	CR	AVE	CAcNT	CAssNT	CUNT
CAcNT	0.936	0.954	0.840	1.000		
CAssNT	0.909	0.944	0.849	0.632	1.000	
CUNT	0.869	0.920	0.793	0.717	0.657	1.000
χ^2	d*f*	*p*-value	CFI	GFI	RMSEA	SRMR
7.981	32	~1.000	0.997	0.996	0.034	0.038

alpha Cronbach alpha; *CR* Composite Reliability indices; *AVE* Average Variance Extracted indices; *CFI* Comparative Fit Index; *GFI* Goodness of Fit Index; *RMSEA* Root Mean Square Error of Approximation; *SRMR* Standardized Root Mean Square Residual; The subdiagonal entries show the factor intercorrelations; CAcNT, CAssNT, CUNT codes as in Table 12.1
Source Own elaboration based on survey results

Table 12.5 Structural estimates of links among CI and three segments of absorptive capacity

Construct	*B*	Std. Err *B*	*p*-value	β
CAcNT	0.341	0.158	0.031	0.320
CAssNT	0.365	0.095	0.000	0.430
CUNT	0.012	0.170	0.942	0.010
Goodness of fit	χ^2	d*f*	*p*-value	RMSEA
	11.348	39	~1.000	0.039
	CFI	TLI	GFI	SRMR
	0.996	0.995	0.995	0.041

B unstandardized parameter; β standardized parameter; *CFI* Comparative Fit Index; *TLI* Tucker-Lewis Index; *GFI* Goodness of Fit Index; *RMSEA* Root Mean Square Error of Approximation; *SRMR* Standardized Root Mean Square Residual; CAcNT, CAssNT, CUNT codes as in Table 12.1
Source Own elaboration based on survey results

data analysis process was adopted. First, the confirmatory factor analysis (CFA) was used. Later, structural equations models were developed. The CFA and SEM were estimated using robust weighted least squares estimation (robust WLS) in R program. The results regarding this are presented in Tables 12.4 and 12.5. The results of SEM model, presented in Table 12.5, are shown also in Fig. 12.1.

As clear from Table 12.4 showing the results related to validity examination for all the constructs, the three conditions for assessing the convergent validity (1. Composite reliability (CR) being greater than 0.7; 2. Composite reliability (CR) being greater than average variance extracted (CR > AVE) and 3. Average variance extracted (AVE) being greater than 0.5) were found to be fulfilled. The χ^2 for CFA model is 7.981 (d*f* = 32, *p*-value = ~1), so we cannot reject null hypothesis. The goodness of fit indexes, which are a measure of how well the model accounts for the sample variances and covariances, is greater than 0.99 (CFI = 0.997, GFI = 0.996). The χ^2 and the goodness of fit indices an excellent fit. The value of root

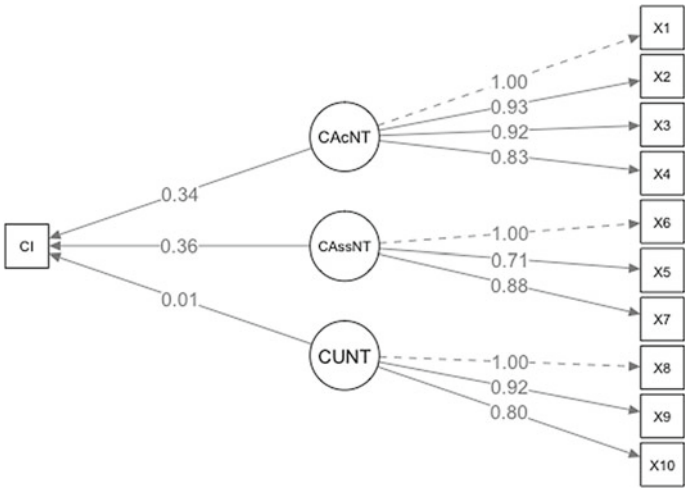

Fig. 12.1 The results of SEM model for company innovativeness (CI). CAcNT, CAssNT, CUNT codes as in Table 12.1. *Source* Own elaboration based on survey results

mean square error of approximation (RMSEA) and standardized root mean square residual (SRMR) is less than 0.05, and thus, the structural model was accepted to be fit for testing the hypotheses.

The goodness of fit indexes is greater than 0.99, the χ^2 is 11.853 (p-value = ~0.488, so we do not reject null hypothesis) and the value of root mean square error of approximation and standardized root mean square residual are less than 0.05. This means that the structural equations model has very good properties and we can use it for inference. The influence of capability to acquire new technologies (CAcNT) and capability to assimilate the acquired (new) technologies (CAssNT) on company innovativeness (CI) is statistically significant, whereas of capability to use the acquired new technologies (CUNT) is not statistically significant. The obtained research results prove that an increase in both CAcNT and CAssNT leads to an increase of CI. Summing up, the research results presented above allow to reject H2. The components of segment that is the capability to use newly implemented technologies (CUNT) mainly regards operating the acquired technologies efficiently and effectively to generate the effects desired by the company and market. We assume that this influence the ability to obtain the planned operational results of implementing new technologies rather than an increase in company's innovativeness.

In the next stage of the research process, we decided to exclude the absorptive capacity components regarding the capability to use the acquired technologies (the capability to operate efficiently the acquired technologies as intended, the capability to use effectively the acquired technologies and the capability to generate the effects desired by the market through the acquired technologies) due to the fact that this construct has insignificant impact on company innovativeness level (CI). We took into account only the two constructs: the capability to acquire new technology (CAcNT)

and the capability to assimilate the acquired new technology (CAssNT) and chose the components (Xi) of absorptive capacity for which the value of Pearson correlation coefficient is higher than 0.5. To assess the impact of abovementioned components of absorptive capacity, we used a hierarchical regression analysis. The results of regression analysis are presented in Table 12.6.

In Model 1, we used variables from construct CAcNT, that have correlations with CI are greater than 0.5. The results show that the 38.6% of variability in the dependent variable is accounted for by all the predictors together. Only the influence of the capability to use specific forms of acquiring technologies from outside (X3) on CI is statistically significant ($B = 0.522$, p-value < 0.01), although, in F test, we reject null hypothesis ($F = 22.4$, p-value < 0.01), that means all the predictors together have statistically significant. An increase of X3 leads to an increase of CI. It seems that the company having knowledge about possible forms of acquiring new technologies from its environment is crucial for successful technology absorption. It is because, without such knowledge, a firm is not able to make progress. Moreover, the knowledge regarding particular forms of acquiring new technologies is highly specialized.

When we add variable which is the capability to adapt the acquired technology (X6) to our model (Model 2), then the rise in the value of R^2 (when compared to previous model) is significant ($\Delta R^2 = 0.094$, $\Delta F = 19.21$, p-value < 0.01) and, in addition, the influence of this variable is statistically significant ($B = 0.294$, p-value < 0.01). This results from the fact that the capability to adapt the acquired technology to firm's needs enables to adjust the acquired technology to the new conditions of its use. The company cannot afford uncritical implementation of technology as in the new environment, without an adaptation, it may not bring about the desired results.

Table 12.6 Regression models of company's innovativeness (CI)

	Model 1		Model 2		Model 3	
	B	Std. Err *B*	*B*	Std. Err *B*	*B*	Std. Err *B*
Intercept	27.68***	6.072	27.46***	5.614	26.03***	5.36
X1	0.238	0.166	0.125	0.156	0.238	0.152
X2	−0.095	0.177	−0.158	0.164	−0.161	0.156
X3	0.522***	0.156	0.481***	0.144	0.321**	0.145
X6			0.294***	0.067	0.005	0.105
X7					0.379***	0.11
R^2	0.386		0.48		0.533	
F	22.4***		24.46***		23.99***	
ΔR^2			0.094		0.053	
ΔF			19.21***		11.97***	

Note B unstandardized parameter; ***p-value < 1%; **p-value < 5%; *p-value < 10%; Xi codes as in Table 12.1

Source Own elaboration based on survey results

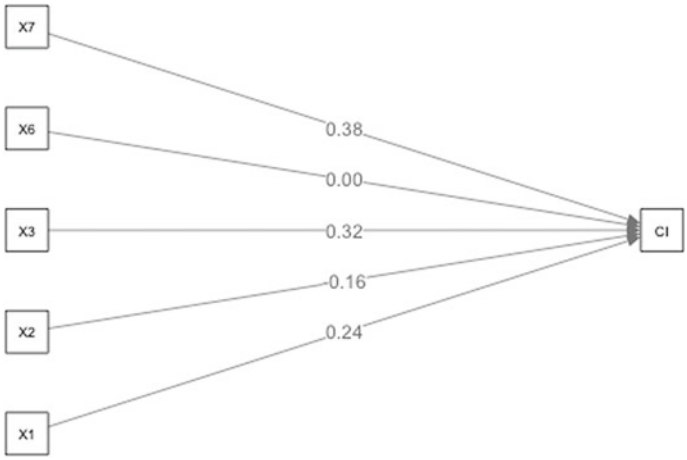

Fig. 12.2 Illustration of regression Model 3. *Source* Own elaboration based on survey results

Adding component which is the capability to develop the acquired technologies (X7) provides to increase the value of R^2 too ($\Delta R^2 = 0.053$, $\Delta F = 11.97$, p-value < 0.01), but the impact of X6 on CI has ceased to be statistically significant ($B = 0.005$, p-value $= 0.96$). The component mostly influencing CI is X7 ($B = 0.379$, p-value < 0.01). To our mind, having the capability to develop the acquired technology means that a company simultaneously is capable to adapt the transferred technology.

Model 3 presented in Table 12.6 and in Fig. 12.2 allows to verify hypotheses H3 and H4. The obtained results allow us to reject H3. In other words, not all strongly correlated components of absorptive capacity significantly impact firm's innovativeness level. Based on the research findings presented above, we cannot reject H4 according to which the degree of development of the capability to develop the acquired technology has the strongest impact on firm's innovativeness level. Therefore, companies aiming at increasing their innovativeness through collaborative technology absorption should focus on development of the capability to develop the acquired technologies.

12.6 Conclusions

In today's economic reality, the increase in company's innovativeness appears to be a prerequisite of its market success. This is all the more justified in the case of entities operating in a strongly competitive environment, which undoubtedly is a characteristic of the Polish financial sector. However, nowadays obtaining the increase of firm's innovativeness level is severely difficult as it requires the use of properly configured and developed absorptive capacity components to insure satisfactory results.

In our research, we have explored the dependence between the degree of absorptive capacity components development and innovativeness level of financial companies operating in Poland. The acquired knowledge is useful when allows the company to generate added value and achieve satisfactory results in the process of competition. From this perspective, we aimed at identifying these components of absorptive capacity which determine the increase of firm's innovativeness level. Our research indicates that from innovativeness point of view, the components of abortive capacity having the most significant impact are: the capability to use specific forms of acquiring new technologies from outside and the capability to develop the acquired technologies. These capabilities should be considered among crucial factors strengthening company's innovativeness and as such, they should be built and carefully maintained in every business entity. Although the development of abovementioned capabilities is not an easy pursuit and requires particularly great and consistent efforts on managerial part, it seems still that this action may be more efficient than, for instance, developing the capability to learn the acquired technologies or exploit them effectively. These capabilities rather influence the costs of exploitation of new external knowledge and generating the desired outcomes.

The conducted study inspires for in-depth investigations, not only with a use of quantitative methods, but possibly based also on qualitative research aimed at deepening knowledge about particular resources creating individual absorptive capacity components and their role in strengthening firm's innovativeness. Taking such a perspective, case study methodology seems to be particularly useful. Because of the fact that research focused on identifying the resources creating individual absorptive capacity components, indicating the degree of their development and assessing their impact on firm's innovativeness level is characterized by high complexity of cause—effect relationships between the variables. Therefore, the findings from the qualitative research might be used for the deepen as well as validate the findings from the quantitative survey. Moreover, high usefulness of qualitative research is due to possibilities to study companies' organizational mechanisms, lessons and best practices regarding increasing firm's innovativeness through developing particular absorptive capacity components.

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Chapter 13
Proximity: Synthesis, Six-Dimensional Typology, and Significance for Cooperation Performance

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Abstract In recent years, the concept of proximity becomes more popular not only in the field of economic geography but—surprisingly—also in strategic management. The growing attention paid to the considerations about proximity stems from the fact that it may be perceived as a significant factor leveraging effectiveness and performance of both cooperating (or coopeting) organizations and inter-organizational networks. Therefore, this paper attempts to explore and synthesize prior literature on proximity and its dimensions. Nevertheless, the main aim is to develop a consistent, logical, theory-based multidimensional proximity framework applicable in any further research investigations undertaken within strategic management, especially those adopting the relational view on strategic advantage. Drawn from existing literature, this paper presents the significance of proximity for collaboration and networking and helps to understand the essence of its particular dimensions. By identifying and limiting the drawbacks of prior approaches to proximity, six—separate hence interrelated—dimensions of proximity are outlined and discussed, thus the holistic proximity framework is developed. The main contribution of this conceptual paper is development of six-dimensional proximity framework (including geographical, cognitive, organizational, social, institutional, and communicational proximities) truly removing substantial barriers for further exploration and exemplification of proximity concept.

Keywords Cooperation · Coopetition · Proximity · Networking · Inter-organizational relationships

13.1 Introduction

Both theoreticians and practitioners of management are trying to come up with any solution for modeling beneficial external relationships, providing appropriate conditions facilitating coordination of inter-organizational collaboration and networking.

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It is so, as they are interested in making those relationships, cooperation in dyads and networks effective, efficient, and goal-reaching. Existing management literature suggests that among the factors increasing the probability of success while decreasing the risk of failure when it comes to collaboration, there is an appropriate (i.e., cultural, organizational, structural, strategic, etc.) fit of potential partners [13, 18, 23, 22, 24]. Similarly, the current stock of knowledge in economic geography emphasizes the role of proximity for establishment and beneficial exploitation of inter-organizational relationships. In particular, proximity is defined as the key factor for successful collaboration, especially in a long term. Moreover, in economic geography and regional policy, it is considered as significant success factor for cooperation and coopetition in macro (e.g., regional, global) perspective. This fast-growing popularity of proximity concept in economic geography [6, 44] resulted in transferring its assumptions into the strategic management considerations. It should not be surprising, as the question for antecedents, factors, or divers of successful cooperation either in dyads or in networks still remain unanswered within the field of strategic management and its relational approach in particular. Indeed, as claimed by Czakon [18], it can be noticed that the researchers' attention has started to more intensively be paid to the proximity hypothesis.

Inter-organizational relationships are complex and multifaceted, hence more often they can be defined using different proximity dimensions [41]. Nevertheless, a high level of ambiguity and inconsistency (see the results of systematic literature reviews—[41, 44, 83] regarding our understanding and conceptualization of particular dimensions of proximity creates a strong barrier for the development of the entire concept. It is claimed that this lack of commonly accepted perception hampers the application and utilization of proximity hypothesis in scientific considerations, research explorations as well as in practical implementation into the relational strategies adopted by organizations focused either on cooperation or coopetition.

Given the terminological, conceptual, and measurement inconsistencies and other limitations visible in prior literature, this paper aims to thoroughly explore and critically synthesize the existing state of knowledge on dimensions of proximity, hence paying extraordinary attention to the types of specific dimensions, their understanding, and the role played in inter-organizational relationships and networks. Therefore, this paper aims at: (1) organizing the terminology and different labels used in the literature so far; (2) synthesize previous accomplishments in proximity typologies; (3) putting forward the previously proposed conceptualizations of particular dimensions of proximity using much managerial and relational perspective; (4) outlining the significance of different components of proximity for sound and longitudinal cooperation, and (5) developing a holistic, six-dimensional proximity framework applicable—especially—in management. Given the adopted theoretical perspective, namely the relational view and networking, all of the considerations as well as the developed six-dimensional typology of proximity consider proximity and its dimensions as the explanatory and explaining factors having extraordinary importance not only for cooperating organizations but also for networks of those organizations.

This paper was divided into four sections. The first one gives a brief introduction into the proximity concept considered from the perspective of inter-organizational

cooperation. The second part discusses a wide range of issues related to proximity significant in management sciences. Nevertheless, in this section, the greatest focus is paid to the role of proximity for sound, beneficial, and effective cooperation implemented in a long term. The third part depicts specific dimensions of proximity identified during the systematic literature review. One by one, the proximity dimensions—geographical, organizational, cognitive, communicational, institutional, and social ones—are discussed through: the review of definitions and meanings found in extant literature, the originally proposed conceptualization, and the specific significance for inter-organizational cooperation. Finally, in the fourth section, a six-dimensional proximity framework is developed. This typology is shown as an appropriate one in any further investigations of proximity undertaken from strategic management perspective. Moreover, the last part summarizes the main theoretical contributions, indicates managerial implications, describes the most important limitations of the paper, and outlines some future research directions.

13.2 The Strategic Management Perspective on Proximity Concept

One of the mainstreams of research in relational view there are drivers, antecedents, conditions, and factors of inter-organizational cooperation, including those which can explain and positively influence the cooperation outcomes. In this paper, the focus is made on one possible explaining factor—proximity. It is claimed that proximity concept—originally developed in economic geography—might be useful in investigation of business, inter-organizational relationships including those included to relational strategies adopted by modern organizations [78] as it "explains how relationships and networks (…) emerge and collaborate" [49, p. 2071].

In the field of management, so far proximity has been explored in a two, separate directions. At the beginning, the researchers' attention was focused on internal proximity and its impact on effectiveness and performance of organizations [65]. More recently, however, the researchers' focus has crossed the boundaries of a single organization and researchers have started to concentrate on "external" ("inter-organizational") proximity. Indeed, the modern and current considerations and explorations of the proximity alludes to "external" proximity only.

Proximity refers to "the closeness of actors in the organizational terms" [9: 122]. In a broader sense, proximity can be understood as a "convergence of physical space, social and mental relationships, shared cultural values or institutional conditions" [18: 16]. Within the proximity concept, the underlaying premise is that the proximate (i.e., somehow closer or more similar) entities are more willing, more eager, more capable, and more tended to cooperate. It is so, as the more similar entities either individual or collective ones are more cable to find a linking bridge and thus making cooperation possible, goal-reaching, and effective. All in all, at the core of the concept of proximity (labeled also as the proximity hypothesis), there is an assumption that

organizations are becoming more inclined to cooperate with external partners which are similar and close in some aspects of their activity or profile [5].[1]

Investigation of proximity in the context of relational view is gaining growing importance as the critical role of proximity for establishment, implementation, and outcomes of inter-organizational cooperation becomes more often emphasized and proved by empirical findings [78]. It should be stressed that although proximity is considered in the area of inter-organizational cooperation for almost two decades, currently it started to be more frequently used in the field of coopetition the very specific type of cooperation linking direct or indirect business rivals [39]. Indeed, proximity is claimed as one of the promising concepts which can be used to develop knowledge on coopetition phenomena as it suits one of the most interesting and current coopetition research discourses, namely processes and practices of coopetition including tensions, dynamics, and interactions [66, pp. 4–6]. Furthermore, the need to explore proximity concept from the relational view standpoint is justified as proximity is claimed to be significant success factor not only for cooperation of companies but also for:

- cooperation of universities and industry [23, 73];
- cooperation within academic community between and among university researchers [84];
- trans-regional cooperation aimed at increase of competitiveness at the regional level [33].

Therefore, proximity is claimed to be a significant issue not only for researchers and managers facing the cooperative pressure but also for policy makers [33, 37].

In vast majority of literature related to the proximity concept, proximity is perceived as an exogenous variable describing efficiency and performance of key economic processes in the XXI century, i.e., inter-organizational collaboration [18], creation, transfer and diffusion of knowledge [14, 44, 46, 63], or creation and implementation of innovation [6, 18, 27, 49, 56]. Given the strategic management perspective, the positive impact of proximity on cooperation is recognized in three ways.

First, the *positive impact on cooperation* as proximity: facilitates creation of inter-organizational relationships [35], networks [78] and ecosystems [49]; makes cooperation easier [49]; drives sound cooperation across its goals [6, 10]; impacts process, outcomes, and continuation of cooperation in a long term [35, 84]; leverages outcomes of cooperation including innovation outcomes of innovation networks [24, 43]; increases effectiveness of partnerships [23] as it allows to reduce the coordination costs [35].

[1]It is worth noticing that the level of proximity may be evaluated in two ways. First, proximity level can be computed as the similarity of two particular cooperating partners, e.g., two members of strategic network. Second, it may be evaluated also based on the similarity of particular network member and all of the other network members. For instance, regarding geographical proximity, it is possible to assess its level either as the distance given in kilometers between two cooperating organizations or as the total distance of the particular organization from all other members of the network. Compare for instance Heringa et al. [37].

Second, the *positive impact on cooperating organizations* as proximity: triggers and stimulates mutual learning processes [23] and wide range of knowledge-related outcomes [37] including development of knowledge base of cooperating organizations [35] as well as intentional and unintentional knowledge flows [23]; improves innovation development [39], output [6, 37, 49] and commercialization [84], develops entrepreneurship [49, 78] or even contributes to the establishment of start-ups [35]; accelerates partners' development in terms of both turnovers and firm's size [35]; increases firms' performance [78].

Third, the *positive impact at the macro-level* as proximity: accelerates regional development [6], increases regional competitiveness and innovativeness [43]; enriches regional human capital [35] thus provides economic effects for local community, population, national institutions, industry, and government [37].

Summing up, most of the authors stress the positive relationships between: (1) proximity and collaboration, (2) proximity and innovation, (3) proximity and competitive advantage. However, those above-mentioned linkages are usually being pointed out in conceptual and purely theoretical publications. It is worth noting that the number of conceptual papers outweighs significantly the number of empirical papers (see the results of systematic literature reviews conducted by Knoben and Oerlemans [44], or Klimas [41]. Moreover, in majority of cases, the postulates regarding the importance of proximity for creating competitive advantage, establishing and maintaining inter-organizational relationships, learning processes, increasing pace and level of innovation are not supported by—even qualitative—research results (e.g., [6, 7, 44, 45, 58]).

13.3 The Dimensions of Proximity

Proximity is a multidimensional [37] and complex [39] construct consisting of variety of dimensions [78]. Unfortunately, as shown by prior literature reviews [41, 42, 44] although the different authors acknowledge the multidimensional character of proximity, they do list different types of its components. Originally, the term "proximity" referred to geographical distance between entities. When proximity was first conceptualized, physical distance was the only aspect considered. Over time, however, the literature became full of differently defined and named layers, components and types of proximity not necessarily referring to pure physical location of collaborating organizations. Indeed, in the newest literature, many different areas of those similarities and fields of convergence have been identified so far (e.g., [6, 12, 16, 37, 43, 59, 78, 88]).

One of the first and simplest approaches divides proximity into spatial and non-spatial dimensions of proximity [29]. Currently, however, as revealed by Klimas [41, 42], it is possible to distinguish more than 30 different dimensions of proximity, including, for instance: expressive, instrumental, geographic, temporal geographic, physical, spatial, co-locational, locational, functional, cognitive, technological, sectoral, industrial, professional, socioeconomic, organizational, organized, positional,

structural, visionary, regarding turnover, institutional, cultural, professional, social, relational, temporal relational, personal, regarding contacts, virtual, electronic, and others. Nevertheless, the most popular approach [37] distinguishes five, complimentary proximity dimensions, namely [6]: geographical, organizational, cognitive, institutional, and social.

Besides the above terminological and structural inconsistencies, in the literature, there are some generally acknowledged aspects. First, the authors do agree that proximity as well as its dimensions are dynamic [39][2] and change over time, especially during cooperative processes.

Second, given the multidimensional nature of proximity, the authors agree that the dimensions are interdependent [6, 23] and influence one another [49]. Therefore, any of proximity dimensions can be perceived autonomously neither as necessary nor as sufficient for cooperation establishment or optimizing its outcomes. Specifically, as claimed by Hahn [33, p. 104] "only when all dimensions of proximity are balanced, will they be able to serve as a mediator or infrastructure fostering cooperation" [33, p. 104]. Moreover, as suggested by Jakobsen and Steinmo [39], the sound cooperation, especially in case of coopetition, the different, alternative combinations of proximity dimensions may be needed to benefit from synergistic effects, thus to achieve the common goals and make cooperation successful. Theoretically, the interdependencies between and among different proximity dimensions may be examined as two complimentary mechanisms, namely substitution mechanism (where one dimension substitutes another or others) and overlap mechanism (were one dimension facilitates another or others). However, as shown by Hansen [35], the significant substitution mechanism seems to be valid just in case of geographical and institutional proximities, hence the overlap mechanisms seem to be possible but not existing in business reality.

Third, it is commonly acknowledged that proximity should not be maximized but rather optimized, as being too similar does not maximize the outcomes of cooperation [37, 49] or even might be harmful for cooperating partners [40]. It relates to the claims about the inverted U-curve importance of proximity for cooperation as well for outcomes reached by cooperating partners [6] indicating that proximity either facilitates or hampers cooperation [84]. Among the most often discussed negative effects of too high level of proximity, there are the increase in the risk of lock-in [6, 33] and the risk of opportunistic behaviors [35, 84]. Nevertheless, this aspect might be seen as doubtful as there are some studies which have not find evidence for it [37].

The wide range of dimensions and typologies of proximity is one of the main barriers to the development of proximity as it limits and even does not allow to: (1) compare the results of particular research, (2) make comparisons between different considerations, and (3) draw any general conclusion from research based on different classifications of proximity. In other words, in authors' opinion, the lack of consistency regarding the structure of proximity and the scarcity of fully consistent definitions and conceptualizations of its particular dimensions can be seen as

[2]Note that there is one exception, namely geographic proximity seen as permanent and constant [78].

current and essential cognitive gap which should be filled with detailed, theoretical, and literature review-based explorations. Following the relational view and the current stock of knowledge in this theoretical paradigm, the terminological chaos, lack of conceptual, operational and measurement consistency among scholar give solid grounds for asking critically important question "Collaboration requires proximity, but what kind of proximity, and how do different proximities interact?" [23, p. 552]. Answering the above questions seems to be particularly important as the above-mentioned positive effects of proximity for both cooperation per se and cooperating partners may depend on the type of cooperation and the type of assumed cooperation outcomes. As suggested by Heringa et al. [37], even though geographical and organizational proximities have positive influence on intangible (soft) outcomes, they negatively impact the tangible (hard) ones. Furthermore, as shown in prior literature, it might be that some dimensions are more important for cooperation-related issues. For instance, organizational and cognitive proximities are claimed to be critical for partner selection [84], hence social and cognitive proximities are argued to be particularly important for outcomes reached either at macro- or at meso-levels [37].[3]

The approaches and dominant perspectives on typology of proximity conceptualized to date were identified as a part of systematic literature review following all of its methodological requirements [51, 72].[4] To collect the relevant literature, four electronic databases were used: ABI Proquest, Ebsco, Emerald, and Web of Science. The searching criteria (including: proximity, external proximity, networking, collaboration, cooperation, and coopetition) allowed filtering the initial database of more than 60,000 papers to narrow it down to 126 articles. The initial dataset was prepared in 2013. Nevertheless, to cover the current stock of knowledge, it has been supplemented by re-searching and re-selection of litereture at the end of the year 2018. The update of the dataset allowed us to include further 27 articles identified using the same searching criteria.[5]

The created literature base (153 articles) was analyzed applying frequency, content, and bibliometric analysis. The frequency analysis allowed identifying the dominant theoretical and research perspectives on conceptualization and operationalization of particular dimensions of proximity. The content analysis was focused on: (1) assessment of prior publication and research including indication of their shortcomings, and (2) recognition of the postulated and investigated significance factors of proximity for inter-organizational collaboration (including coopetition) and networking. Finally, the bibliometric analysis was aimed at identifying the most important publications and authors in the field of proximity (citation and co-citation analyses)

[3]Compare also with other works showing the "the most critical" dimensions of proximity in the context of inter-organizational cooperation, e.g., cognitive, social, and organizational [49] or technological, cognitive, and social [39].

[4]The detailed description of the systematic literature review can be found in former publications of the author (e.g., [40, 41, 42]).

[5]The one and only one difference there was the intentionally set year of publication. The second round of literature searching excluded papers published before the year of 2013.

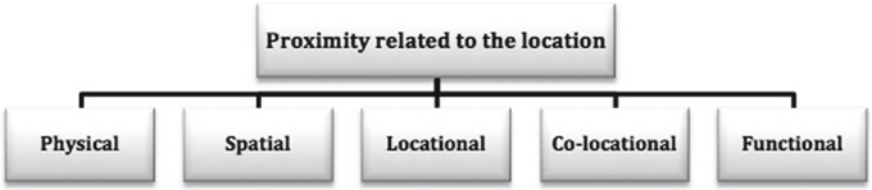

Fig. 13.1 Types of proximity related to physical location of collaborating organizations

to be able to make easier decisions about conceptualizations, definitions and even terminology adopted in case of particular dimensions of proximity.[6]

The main results of the systematic literature review referring (only) to the proximity dimensions and typology of proximity are presented below. In general, it was possible to distinguish six different and separable, however, interconnected (complimentary and to some extent substitutive) dimensions of proximity, namely: geographical, organizational, cognitive, communicational, institutional, and social.

13.3.1 Geographical Proximity

The most frequently described, yet rather vaguely defined type of proximity concerning relative location of organizations is geographical (geographic) proximity, perceived using either narrow or wide approach. The former concentrates on physical location of entities relative to each other [29]. Geographical proximity perceived from that angle is referred to as spatial proximity, physical proximity, or just the distance per se. From the other angle, geographical proximity could be perceived either absolutely or relatively [35]. In the first instance, it refers to distance between entities and accessibility of given organization using the infrastructure in place. In the second instance, geographical proximity is expressed by degree of concentration of entities around given area. Employing the wide approach means factoring in various aspects of geographical proximity—physical (spatial), locational (co-locational), and functional at the same time. Hence, as far as geographical proximity is concerned, relatively to specific assumptions the physical, spatial, locational, co-locational, or functional proximity could be referenced (see Fig. 13.1).

Physical proximity is also known as *spatial proximity* defined as physical distance between entities concerned [49]. This proximity is measured as distance given in kilometers [76, 80, 84, 87] or as some ratios, indicators, and proxies computed based on the real distance between or among organizations [23]. As this type of

[6] As this paper is a conceptual one, the focus—when presenting the results of systematic literature review—is paid to the content analysis, synthesis of prior and development of new conceptualizations of particular dimensions of proximity. If you are interested in more quantitative findings (e.g., analysis of citations, co-citations, and references carried out using social network analysis) please see Klimas [41].

proximity is constant, some authors label it as *permanent geographical proximity* [78]. *Locational proximity* also refers to distance and reflects the location of entities enabling them to have personal, face-to-face interaction [71]. However, Menzel [58] defines *co-locational proximity* in the same manner. Generally, the rule of thumb is that similar location means the same city or distance up to 50 km. A far broader type of proximity defining location of partners is *functional proximity* [16]. In this case, apart from geometric, pure distance [84] between entities, it also is conditioned by the transport infrastructure and available transport network. Therefore, functional proximity involves simultaneously the reviewing distance, transport availability, time and cost of reaching the other organization [53].

Conceptualization of geographical proximity. Geographical proximity is perceived as a construct formed from two components, i.e., physical and functional proximity. Physical proximity refers to physical distance between two organizations. Functional proximity, on the other hand, covers (apart from physical distance) time and cost of travel, infrastructure in place and availability of various forms of transport. Note, hat functional proximity as opposed to the locational one does not define the distance itself, but considers how accessible are other entities.

Significance of geographical proximity. Scientific efforts of researchers in investigating geographical proximity focus on its indirect influence on businesses performance through its direct influence on inter-organizational relationships, networking, and knowledge-related processes, i.e., creation, exchange, transfer, spillover, etc.

First, geographical proximity favors establishing [60] and tightening inter-organizational collaboration, fosters and stimulates willingness to create inter-organizational relationships. Moreover, geographical proximity is a key for establishing horizontal cooperation [26], creating clusters of SME companies [74], and for collaboration, especially if this collaboration needs a frequent and personal contact [58]. For instance, small distances between partners are important for establishing relationships with suppliers, sub-contractors, and clients as they need to contact quite often. Clusters are also a good example since they are formed through geographical proximity of partners [83]. In particular, in asymmetrical networks, geographical proximity is strategically important for network leaders [21] including other non-leading ego networks [84]. Furthermore, the sufficient level of geographical proximity within the whole network makes network coordination and management more efficient. Notice that geographical proximity is closely linked with direct contact between entities—the closer locations of organizations the more frequent and more efficient is their communication. It is so, as the face-to-face contacts affect all four critical inter-organizational functions, namely: facilitate knowledge transfer, foster mutual socialization, build trust and create informal networks [75]. The latter three functions would prove that geographical proximity indirectly encompasses social and cultural aspects [29]. Thus, usually the greater the physical distance between organizations the greater social and cultural differences between their employees.

Second, geographical proximity is beneficial for knowledge creation, exchange, transfer, and diffusion [23]. As discussed above, it facilitates frequent personal contact involving less time and costs. Therefore, due to the assumed opportunities of

more frequent F2F contacts, it is highlighted that geographical proximity—conversely to other proximity dimensions—not only stimulates knowledge transfer processes [8] but also allows partners to exchange the tacit [28] and sticky knowledge [23]. Personal contact is the best way for transferring the tacit type of knowledge, i.e., experience, skills, methods, and techniques of processes implementation, which is otherwise difficult to write down, codify, or verbalize. In a more general perspective, the processes of knowledge creation, transfer, diffusion, and absorption leveraged by adequate geographical proximity not only improve the growth rate of businesses but also increase their competitiveness [31] and stimulate fast-track innovation [6]. Furthermore, long-term inter-organizational relationships established based on frequent contact of closely located organizations help building trust, thus weakens, limits, or eliminates opportunistic behaviors, expensive mechanism of information protection, and other transactional costs. Moreover, sufficient physical proximity can facilitate the staff turnover between companies, what also streamlines and accelerates the processes of organizational learning and strengthening inter-organizational interdependencies [47].

Third, geographical proximity benefits innovation [52], especially when closely located companies, research institutes, governmental institutions operate within the same industry or sector [85]. Significant gains for innovation stemming from close physical distance are substantiated by popularity of clusters [43], industry agglomerations [54], innovative milieus [27], innovation networks [24], and ecosystems [49]. Another advantage of geographical proximity is the spillover effect, which requires collaborating entities to be closely located [50].

It should be noticed, however, that currently, the physical distance seems to become less important [20], hence in the literature, there are also more explicit statements claiming the death of geography [53, 59]. Indeed, the digitalization of modern social and business life, advancements in telecommunications, development of transport infrastructure, availability and accessibility to different communication forms and ever-shorter traveling cause that knowledge transfer (even of tacit knowledge) does not necessitate physical proximity. In particular, it is emphasized that face-to-face contact can be temporarily arranged during the trade fairs, symposia or conferences (distinguished as the temporal geographical proximity—[64, 78]) making physical proximity over-estimated [37].

13.3.2 Organizational Proximity

Chronologically second dimension of proximity which has been explored by researchers there is organizational proximity.[7] Given the results for prior literature reviews [41, 43, 44, 82], this dimension, its perception, understanding, and structure

[7]Note that organizational proximity developed and discussed by Boschma [6] is not the same as organized proximity considered by Torre [78]. Particularly, A. Torre, A. Rallet, and J. P. Gilly perceive organized proximity as a dimension covering not only organizational similarity (here

remain the most blurred one. Indeed, the exiting conceptualizations do differ significantly in terms of the scope of meaning, definition, and sub-components; hence, the latter seems to differentiate the authors the most (see Fig. 13.2).

Boschma [6]—the most cited author in the field of proximity—argues that proximity manifests itself as the convergence of relational space, interactions, coordination of actions, and knowledge bases. The Author sees organizational proximity as extent to which organizations share relations under mutual agreements. In this perspective, organizations sharing the same owner have the highest level of organizational proximity [5]. Even though Boschma's paper has the highest level of citations, provided conceptualization of organizational proximity seems to have some significant shortcomings. Given the current stock of knowledge, and papers published after Boschma's seminal study, in particular, his approach suffers from the following limitations: it covers aspects considered under other dimensions of proximity (e.g., cognitive proximity—the similarity of knowledge bases; social or communicational proximities—relational links); it is limited to control mechanisms determining how organizations collaborate, thus making organizational proximity a feature of inter-organizational relationship, as opposed to relative nature all other dimensions of proximity (different levels of analysis—dyad versus node); it assumes that the highest level is reached by organizations having the same owner what remains inconsistent with the general assumption of relational view that in case of inter-organizational cooperation and coopetition the focus is paid on cooperation of independent, or at least interdependent organizations (any ownership is included).

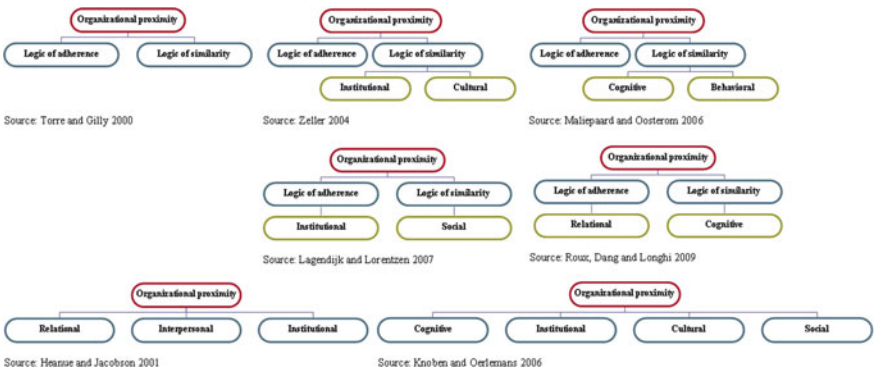

Fig. 13.2 Types of organizational proximity of collaborating organizations

organizational proximity) but also other aspects acknowledged by other authors as separate dimensions of proximity, e.g., cultural values and believes, technological complementarity, relationships including also the interpersonal ones. Specifically, Torre [77] distinguishes organized proximity covering logic of belonging (participation in a wide range of networks) and logic of similarity. In the latter, he considers not only cultural aspects (cultural similarity usually incorporated as a part of informal institutions under institutional proximity) but also mental models, cognitive distance, common languages commonly considered as components of cognitive proximity.

Conceptualization of organizational proximity. *Organizational proximity* reflects convergence of autonomous entities with respect to internal and external organizational determinants [6] assessed through the logic of belonging (adherence logic) and the logic of similarity (similarity logic) [29, 78, 79]. In terms of *adherence logic,* organizational proximity reflects overlapping relational spaces where collaborators or coopetitors do operate together [29]. It boils down to the adherence of partners to the same organization at the higher level of analysis [48], i.e., being part of the meta-organization [32]. Importantly, under the logic of adherence there are covered both direct and indirect inter-organizational relationships [78]. Nevertheless the scope of consideration is limited only to formal and inter-organizational relationships. It is so, as informal (social) and individual (interpersonal) ones are considered within the social dimension of proximity.

Organizational proximity, in terms of *similarity logic,* refers to the homogeneity of separate organizations with respect to the internal organizational determinants and characteristics. It is shaped by the similarity of adopted strategies and organizational goals [84]; the convergence of internal organization, i.e., organizational structures [15, 53] (including the level of internal coordination, hierarchy, bureaucracy [49] and control mechanisms [35]), organizational culture [25, 53, 84], management style [16], company profile [82], adopted organization-specific rules, regulations [84], incentives, and routines [37].

Significance of organizational proximity. For inter-organizational cooperation, organizational proximity is expressed as one of the most important from the strategic management perspective [35, 43]. It is so, as organizational proximity triggers creation of new inter-organizational ties [11] and improves the efficiency of cooperation interlinks which have been exploited already [17, 23]. Furthermore, it positively affects cooperation through improvements of coordination [57], building end reinforcing of trust [36], reduction of uncertainty [6], and finally limiting the risk of opportunistic behaviors [5, 6, 35]. Finally, organizational proximity is one of the three dimensions of proximity the most significant for knowledge-oriented collaboration [44]. Given the above, it is claimed that the high organizational proximity provides extraordinary valuable benefits for both cooperation initiatives (e.g., networks) as well as cooperating organizations—Table 13.1.

The current state of knowledge shows that adequate organizational proximity is desired in order to co-create new knowledge [19]. It is argued that similar organizations have greater understanding of what kind of (if any) combination of individually possessed knowledge, competences, and skills is required in order to do implement co-creation processes. Organizational proximity, however, offers much more than that. It improves, intensifies, and accelerates knowledge transfers. Companies are capable to acquire new and develop current knowledge faster as well as disseminate and share the knowledge already obtained more efficiently [62]. Furthermore, organizational proximity provides mechanisms coordinating and improving dissemination of knowledge throughout the network—both within its center and peripheries [45]. All in all, organizational proximity can be assumed as explanatory variable of the

Table 13.1 Significance of organizational proximity—network cooperation perspective

Author(-s)	Year	Significance of organizational proximity
Heanue and Jacobson Davenport Dangelico, Garavelli and Petruzzelli	2002 2005 2010	Facilitates and accelerates joint creation of knowledge, competences, and skills, including ability to absorb knowledge
Lagendijk and Lorentzem Petruzzelli, Albino and Carbonara Broekel and Boschma Dangelico, Garavelli and Petruzzelli Fu, Schiller and Diez	2007 2009 2009 2010 2011	Reinforces and enhances knowledge transfer (both tacit and codified)
Petruzzelli, Albino and Carbonara	2007	Gives access to knowledge (also this inaccessible at the market)
Heanue and Jacobson	2002	Allows organizations to integrate information and knowledge (including tacit knowledge)
Filippi and Torre	2003	Triggers and accelerate diffusion of technology
Boschma Fu, Schiller and Diez	2005 2011	Favors inter-organizational learning
Fu, Schiller and Diez Coenen, Moodysson and Asheim	2011 2004	Accelerates knowledge diffusion and spillover effect
Boschma Hall and Jacobs Fu and Schiller Klimas Herringa, Horlings, van der Zouwen, van den Besselaar and van Vierssen	2005 2010 2011 2014 2014	Stimulates innovation
Oerlemans and Meeus	2005	Leverages firms' performance
Klimas	2014	Improves innovation network performance

Source Own elaboration using Klimas [43]

overarching objective of innovation networks [43]. If its level is sufficient, it significantly facilitates creation and sharing knowledge, thereby improves innovativeness of individual actors of the network and of the innovation network itself.

13.3.3 Cognitive Proximity[8]

The third dimension of proximity widely discussed in the literature relates to knowledge bases, competences, skills, capabilities, professional experience, technology, and perception of the world. Although, these aspects are acknowledged as critically important for inter-organizational cooperation [44] and coopetition as well [39] it is hard to find one, commonly accepted label covering all of them. So far, those aspects of similarity have been considered under such proximities like: cognitive, technological, sectoral, industrial, and professional. Furthermore, there are authors considering the similarity of knowledge bases, competences, and perceptions under socioeconomic [82], or even organizational [6] and organized proximity [78, 79] making the boundaries among particular dimensions of proximity vague and blurry.

In the most popular, and the widest approach, the *cognitive proximity* refers to similarity of organizations regarding the knowledge bases [16] including the professional knowledge [37], technological competences [6], professional capabilities [23], experiences [63], and expertise [84]. It is emphasized, however, that this similarity is conditioned by, based on, and linked to the way in which organizations—seen as a collective community of employees—perceive, interpret, understand, and evaluate their business environment [58]. Therefore, cognitive proximity besides the knowledge- and technology-related aspects considered at meso- (i.e., organizational) level covers also the similarity of mindsets [88] or mental models [40] considered at the level of individuals (i.e., micro-level of analysis).

Together with the growing interest in cognitive proximity [6, 40, 44] further, more detailed, hence more or less overlapping types of proximities have started to be considered. For instance, *professional proximity* related to the employees' similarity in terms of their way of understanding the surround reality and their competencies [70]; *technological proximity* restricted to the similarity of technologies adopted by cooperating organizations [44, 61]; *sectoral (industrial) proximity* understood as running business activity in the same sector of the economy [53]. All in all, we claim that those aspects of similarity, as all are related to common understanding, knowledge, and experience should not be seen as separate proximity dimensions, hence as sub-dimensions included under the cognitive dimension of proximity.

[8]This dimension has been explored in great details in Klimas [40] whose conceptualization is fully adopted here. Nevertheless, as this paper aims at holistic typology of proximity, its cognitive dimension had to be included and discussed. However, this section should be seen as a brief—rewritten, developed, and updated—summary of proposition deeply discussed in the above-mentioned article.

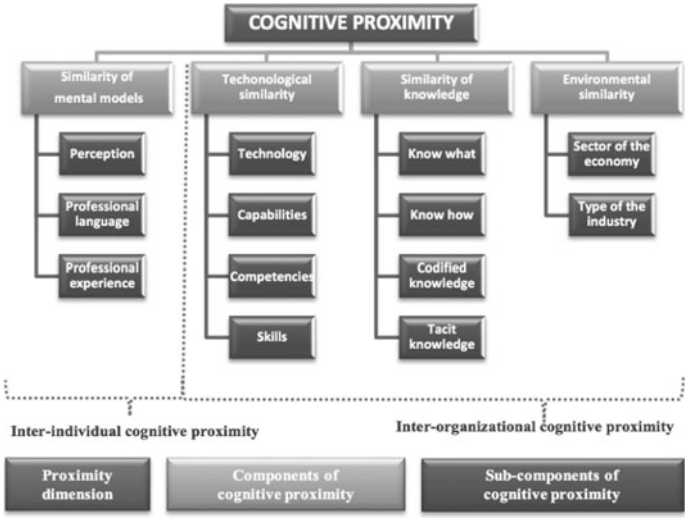

Fig. 13.3 Dimensions of cognitive proximity. *Source* Klimas [40, p. 17]

Conceptualization of cognitive proximity. Cognitive proximity is defined as convergence in specific knowledge and professional competencies owned by organizations, taking its source and influenced by similar ways in which employees perceive, interpret, understand, and assess the surrounding world. Following the results of literature review [40], cognitive proximity comprises four areas of similarity between organizations, i.e., mental, technological, sectoral, and knowledge-related one (see Fig. 13.3).

Following the typology developed by Klimas [40], cognitive proximity covers four interrelated sub-dimensions including three considered at meso- (organizational) level and one at micro- (individual) level of analysis. *Similarity of mental models* is the only one sub-dimension considered at micro-level of analysis. It results from shared perception (including mental models and ideological beliefs—e.g., [53]), common professional experience (including knowledge about regulations, norm, standards but also past work and educational experience—e.g., [83]), and understanding of professional language (including specific terminology, codes, jargon, or even non-verbal messages—e.g., [39]). At the meso-level of analysis, three sub-components are considered, namely technological similarity, similarity of knowledge, and environmental similarity.

First, there is *technological similarity* determined by the compliance, coherence, complementarity, and similarity of the adopted technologies (including technological solutions, implemented processes, and utilized machines and equipment—e.g., [40], professional capabilities (including mainly the codification capabilities—e.g., [23]), competencies (including mainly the manual ones—e.g., [78]), and finally both technical and non-technical skills—e.g., [35]).

Second, there is *knowledge similarity* resulting from the similarity of different types of professional knowledge [37, 68] and expertise [84] including, in particular: know-what, know-how [40], codified, and tacit knowledge [23].

Last but not least sub-dimension of cognitive proximity considered at meso-level there is *environmental similarity* resulting from running activity under the same sector and even the same type of the industry [40]. Regarding this sub-dimension of cognitive proximity, it should be emphasized that even though it used to be perceived as taken for granted in case of cooperation restricted to one industry [35], however, due to the growing technological complexity, increasing specialization we should not assume that cognitive proximity is high for all members of particular industry. For instance, video-game industry seems to be a multifaceted regarding the technological solutions, knowledge, and expertise. There are companies targeting the console gamers, mobile players, or PC hardcore gamers, hence games played by those types of gamers do significantly differ in terms of technologies adopted, e.g., compare games played on PC like the Witcher (developed for four years using the latest technological advancements) with games played on smartphones like Angry Birds (developed for several months using simple technological and graphic solutions).

Significance of cognitive proximity. The significance of cognitive proximity is reflected by its positive impact on inter-organizational processes as it improves communication and is particularly beneficial for a wide range of knowledge management processes. First, cognitive similarity accelerates communication by making it more precise [18], more efficient [39], and more informative [35]. Beneficial influence on effectiveness of communication processes further enhances knowledge management processes [6, 63, 68, 84], development of absorptive capacity of partners [39] as well as its profitable exploitation [35]. Second, cognitive proximity significantly enriches and develops knowledge management processes including [40, p. 15]: knowledge creation, knowledge access, knowledge acquisition, knowledge transfer, knowledge absorption, knowledge assimilation, knowledge interpretation, knowledge categorization, and knowledge exploitation. It is highlighted, however, that the positive impact of cognitive proximity on knowledge-related processes seems to be the strongest and the most valuable regarding the stages of codifying and decoding information and knowledge by partners [23]. Cognitive proximity provides relevant benefits, however, once it exceeds a certain level it could bring also opposite effect to those being intended by cooperating partner. This phenomenon is labeled as the paradox of cognitive proximity and represented by a parabolic (inverted "U") character of the relationship between cognitive proximity and—especially but not only—innovativeness [84]. Therefore, maintaining an accurate level of cognitive proximity is challenging, since it involves much more than just maximizing it. Indeed, this is continuous balancing between no cognitive proximity (misunderstandings, communicational difficulties, no common business areas) and maximum cognitive proximity (homogeneity of knowledge limiting or decreasing innovativeness, e.g., [6].

It is worth to note that the above effects of cognitive proximity should be seen not only as valuable for cooperating partners but also as significant for regional development, as at the macro-level, it contributes to knowledge spillover effect [50] and

technological acceleration [24]. Last but not least, given the general understanding of proximity concept, its cognitive dimension is claimed to be excellent substitute for geographical proximity [63] and significant accelerator for social proximity as it builds trust and informal contacts between experts [70].

13.3.4 Communicational Proximity

Many authors interested in proximity hypothesis stress its importance for inter-organizational communication [67, 78]. The relationship between proximity and communication seems to be extraordinarily important and strong as some scholars have started to introduce—more or less explicitly—components or sub-components of proximity reflecting both indirect and direct inter-organizational communication (for instance, see, the latest publications by A. Torre). Given the current stock of knowledge on proximity, as well as the specific link between cooperation and communication expressed in relational view, we claim that communicational proximity should be isolated as a separate dimension of proximity. Furthermore, acknowledging communication-orientated dimension of proximity stems also from the fact it could be perceived as complementary, substitutional [59], or moderating [23] for geographical proximity. Communicational proximity enables capturing involvement of partners to collaboration, crucial for inter-organizational relationships. This proximity dimension encompasses areas of communication referred in prior literature as: (1) relational proximity dedicated to indirect and direct communication [24], (2) virtual proximity dedicated to indirect communication, or (3) temporary geographical proximity dedicated to direct, F2F but time-limited communication processes [78].

Conceptualization of communicational proximity. The first component of communicational proximity is *relational proximity* determined by the frequency [67] and intensity of inter-organizational communication and involvement of partners in mutual communication processes. In that sense, relational proximity derives from strength of inter-organizational relationships [24], nevertheless the strength of inter-organizational contacts does not include the informal and interpersonal contacts (a part of social proximity or personal proximity in terms of [84]. When discussing relational proximity, we refer to organization–organization contacts (B2B), dedicated to business meeting targets, compliance with procedures and executing operations fundamental for those collaboration-oriented contacts. Hence, the interest lies in relationships underpinned by data feed instrumental for delivering on common goals. The relational proximity seen from the perspective of communicational relationships between separate organizations is a key for longevity of those relationships, however, formal and inter-organizational (not interpersonal and informal) relationships only. According to prior research [30], the strength of relationship (level of relational proximity) impacts network cohesion; the importance of particular nodes; information and knowledge diffusion. Nevertheless, beyond all of the above, it determines the level of heterogeneity and radicality of jointly accessible knowledge, thus the novelty co-innovation as it does influence both the bridging and bonding social

capital [24]. Importantly, as in case of cognitive proximity, the relationship between relational proximity and performance of collaboration is represented by an inverted "U". Exceedingly high relational proximity could lead to the paradox of proximity which may result, for instance, in the higher risk of opportunistic behaviors.

Second aspect considered under the communicational proximity is *virtual proximity* (*electronic proximity*). It is created when communicating organizations are using IT technology and electronic (audio, video, audio–video) devices to contact with each other [88]. Virtual proximity is determined by the frequency, intensity, and involvement of electronically communicating partners (indirect electronic communication). To a large extent, achieving high virtual proximity depends on access to the Internet and current IT technologies facilitating communication at distance. Communication media critical for virtual proximity are e-mail, video and virtual conferencing, phone calls, chats as well as wide range of digital communicators (including internet communicators such like Messenger, WhatsApp, Telegram, Signal; voice communicators such like TeamSpeak, Xfire; communicators available through social media, e.g., through Facebook) which in great proportion replace regular face-to-face interactions. It should be emphasized that current technical advancement makes virtual proximity an equivalent or even superior to geographical proximity due to the growing mobility, development of ICT, accelerating internet speed, and global digital revolution.

Third component of communicational proximity is *temporal (temporary) geographical proximity* occurring between organizations in a certain, usually quite short amount of time [53]. Temporary geographical proximity as opposed to geographical proximity is highly time-variable. Its dynamics is contingent on mobility of organizations which collaborate [77]. Temporary geographical proximity is achieved through taking the real part in inter-organizational meetings as it covers direct, F2F, and time-bounded contacts [78]. The latest findings [35] show, however, that temporal geographical proximity does not restrict to regular and planned meetings (e.g., during annual fair trades, conferences, symposia, convents, exhibitions, etc.) but covers also occasional ones (e.g., during periodically and ad hoc realized joint activities like lobbying or joint ventures like R&D consortia). According to prior research, obtaining periodically high geographical proximity (here temporal geographical proximity) could be an effective defense mechanism against the lock-in effect [64]. Direct and intensive contact, although brief, creates an opportunity for intensive exchange of information, experiences and knowledge with current and potential clients, competitors and all other stakeholders. In other words, the periodical—regular or occasional—maintenance of high temporary geographical proximity postpones until a later time or prevents altogether from materializing the cognitive proximity paradox. As virtual proximity is, temporal geographical proximity is a tool for making an organization more flexible [69] and accelerating the efficient flow of tacit knowledge [77]. The importance of temporal geographical proximity increases in case of long-term collaboration with multiple organizations, especially if this multi-actor cooperation is irrespective of physical distance or geographical proximity [23]. Importantly, as claimed by Sternberg [74], the personal contacts covered by both the relational and

temporal geographical proximities are substantially more important for efficiency of communication than even the lowest geographical distance.

13.3.5 Institutional Proximity

The level of proximity between organizations can be discussed in terms of similarity of determinants, factors, and aspects considered at the macro-level of analysis, e.g., industry, country, region, etc. The macro-perspective draws attention to institutional and cultural faces of proximity. *Institutional proximity* is reflected in similarity of institutional conditions imposed by specific administrative geographical territories [84] under which organizations operate. Companies similar in an institutional sense are established in the same institutional environment, e.g., country, region. Thus, they have to comply with similar political [78],[9] regulatory, and legislative frameworks put in place by the relevant bodies [38]. At the macro-level, the second significant dimension of proximity discussed in the literature there is a *cultural proximity* reflected in similarity of cultural surroundings [24]. It should be highlighted that Eklinder-Frick et al. [24] understood cultural proximity broadly, in a not commonly acknowledged way covering not only similarity of national cultures but also the closeness of organizational cultures of cooperating organizations. We claim, however, that cultural proximity relates to similarity of national cultures only. Our claim is reasoned as follows: (1) cultural proximity is considered at macro- (not meso-/ organizational) level [84]; similarity of organizational cultures is considered at meso-level under organizational proximity [25, 43, 53, 78]; national cultures which similarity is considered under cultural proximity [27, 83] are seen as an informal institutional environment [38]. In this perspective, cultural proximity is seen as not covering issues related to organizational cultures. Furthermore, as it is conditioned by macro-factors, including informal institutional aspects, it should be incorporated into institutional proximity.

Institutional proximity is seen as closeness of both formal and informal rules and regulations, thus including cultural aspects [49, 78, 84]. It is so, as the institutional environment is created by the network of formal (established on institutional level) and informal (emerging in an evolutionary manner) institutions. The formal institutional environment is constituted by a framework of legal standards and bodies appointed to execute them. Informal institutions (also referred to as social or cultural), on the other hand, are founded spontaneously and emerge from current moral standards, ethics, tradition, fixed action patterns, mindsets, habits, and customs [38]. Nonetheless, the issue of whether to distinguish formal and informal institutional environment is subject to a fierce discussion about proximity determined by factors considered at the macro-level and the two specific views are found across the current literature.

[9]It should be noticed that A. Torre does not distinguishes institutional proximity but considers its aspects under the logic of similarity covered by organized proximity.

The first one, in which both formal and informal institutions are classified under the institutional proximity [29, 35, 49, 78, 84]. In this perspective, the institutional proximity is defined in a broad way. The second view distinguishes institutional proximity concerning formal institutional environment and cultural proximity concerning informal institutional environment [44]. Note, however, that although the second approach emphasizes the close relationship between these two (macro) dimensions of proximity [24], the first one expresses that cultural proximity is a sub-component and co-creates institutional dimension of proximity [35].[10] All in all, the dominant approach is the broad one, implementing into institutional proximity also the cultural threads. Indeed, Boschma [6] who gets the most quotes and citations incorporates both formal (laws, political rules) and informal (culture, social norms, and standards) institutional aspects into institutional proximity.

Conceptualization of institutional proximity. It is generally recognized that institutional proximity is considered on the macro-level, i.e., where formal and informal institutional environments are convergent [35, 84]. Therefore, *institutional proximity* is the dimension of proximity stemming from similarity of macroeconomic conditions under which organizations operate. Institutional dimension of proximity is constituted by two components reflecting similarity of formal (e.g., legislation) and informal (e.g., culture, customs, and social standards) factors for business operations. In that vein, the level of institutional proximity is determined by hard and soft factors [57]. Among the hard-institutional factors, there are laws, administrative regulations [29], political regulations [78], economic practices, and general trade regimes [88]. Simultaneously, the elements such as standards, virtues, social and cultural routines [27], environmental and cultural restriction, official language [83], national habits, social rules [35], national values [78], and social and cultural norms and standards [49] are all the soft factors. The underpinning of the above-mentioned approach is an assumption that both hard and soft factors co-determine the institutional proximity by creating a mixture of sociocultural, economic, political, and legal context for inter-organizational collaboration [6].

When discussing the level of institutional proximity, and evaluation of this proximity among cooperating partners, in particular, it is noteworthy to point out one groundless and mistakenly accepted assumption. Because of its nature, institutional dimension of proximity is closely linked to location (country) where organizations operate (e.g., legislative differences, moral and cultural virtues). Therefore, some authors argue that in case of research restricted to a single country, institutional proximity should be excluded from analysis, as organizations operating in the same country are highly institutionally proximate [34]. In reality, however, it would be irrelevant and unreliable to undertake in advance that organizations operating in the same country display maximum level of institutional proximity. For instance, the institutional environment affecting activity of organizations varies relatively to their types or size (e.g., the differences between public, private, and non-government

[10]It is worth to note that there are some authors who identify institutional proximity with cultural proximity [80], but as others criticize [19] in such an approach some aspects, crucial for collaboration, could be overlooked.

organizations; the differences in financial regulations for large, medium, small, and micro-companies). Furthermore, the culture (i.e., norms, standards, common habits, etc.), in some countries, varies by location and particularly strong cultural hotspots are found near borders.

Significance of institutional proximity. Institutional proximity is perceived as a factor advantageous for establishing inter-organizational relationships as it gives grounds for building inter-organizational trust and lowering uncertainty [78]. Moreover, once the relationship is established, institutional proximity strengthens its meaning as it fosters development of a common ethos and mutual engagement [88] thus limiting the risk of opportunistic behaviors [84]. Significance of institutional proximity is also visible for efficient implementation of organizational learning and knowledge exchange. Organizations operating in similar formal institutional environment are more likely to build mutual trust, consequently fostering exchange of synthetic knowledge. Similarity of informal institutional environments, on the other hand, through literacy in current social and cultural standards expedites the transfer of symbolic knowledge [57] and improves the efficiency of tacit knowledge flows [60]. It is emphasized, however, that the role of institutional proximity in efficient implementation of knowledge- and innovation-related processes is time-variable. Its importance is most explicit at the preliminary stages of cooperation aimed at recognizing the potential areas of new knowledge/innovation development and identifying its hypothetical value. Nevertheless, as organizations strive together to devise knowledge and explore areas of common interest, the significance of institutional proximity decreases [86]. Furthermore, if cooperating organizations are too much institutionally similar the innovation outcomes are not maximized [49]. It is worth noting that given the multidimensional and complex nature of proximity, the significance of institutional proximity seems to be extraordinary important. As shown explored by scholars, it complements the low-level geographical [35] and temporary geographical [45] proximities. Moreover, it is the factor moderating and controlling any interaction between organizations at both micro- (interpersonal relationships thus social proximity) and meso-level (inter-organizational relationships thus organizational proximity) [53].

13.3.6 Social Proximity

It is only the social dimension of proximity that fully reflects micro-determinants (personal in terms of Hansen [35]) within the framework of proximity concept, i.e., people affiliated with collaborating organizations and maintaining inter-organizational relationships. In the literature, the social surroundings considered from proximity hypothesis standpoint are discussed using three different labels, but the scope of understanding taken by particular authors is quite similar. In general, proximity based on interpersonal relationships is being referred as relational (e.g., [24]), personal (e.g., [35]), or social proximity (e.g., [82]).

As far as *social proximity* is concerned, it is considered whether collaborating partners share any social roots or social embeddedness [78] using more sociological perspective [30], which is reflected in social consistency [15]. If organizations are similar in a social sense, should their employees have interpersonal relationships [82] based on trust [34, 39], friendship, kinship [15, 49], other family ties [78] as well as shared passions and interests [45], or past experiences [7, 37, 78].

Relational proximity relates to multivariate (vertical, horizontal, and lateral) interpersonal relationships [87] and less temporal interactions [24] between organizations based on trust, friendship, or acquaintance. Ramirez-Pasillas [64] divides relational proximity into *permanent* and *temporary relational proximity*. Permanent relational proximity is reflected by constant—or maintained in a long time—vertical, horizontal, and lateral multi-directional interpersonal relationships. It is complemented by temporary relational proximity regarding ties and interactions lasting for certain amount of time, e.g., during business trips.

The very last dimension of proximity related to interpersonal relationships found by means of literature review is *personal proximity* reflecting not only personal relationships and ties [35] but also personal contacts and acquaintances [70].

Conceptualization of social proximity. Bearing in mind previous approaches to relational, personal, and social proximity, it is fair to say that their logical content almost fully does overlap and differences between them are mainly caused by the nomenclature used. Nevertheless, two remarks should be discussed.

The first point needed to be highlighted seems to be an inclusion of formal (or even inter-organizational) relations under either social or relational proximity. Following, the mainstream of understanding social proximity is social, and it covers interpersonal relations [39] and should be considered at micro- (personal) level of analysis [35]. Thus, formal and inter-organizational relationships need not be considered here.[11]

Second, some authors draw a line between discussed dimensions of proximity by a virtue of assumption that the social dimension boils down to the acquaintance (e.g., consequence of shared past professional, education, and private experiences), whereas relational to the relationships currently maintained between people [44] either occasionally or regularly [64]. Distinguishing between the two is substantiated by the arguments that the people coming from the same backgrounds and sharing the social roots may maintain any contacts (e.g., they stopped contacting each other due to the lack of sympathy, they have never met while studying, etc.). Nevertheless, we do believe that the social proximity incorporates both active (currently used) and passive (currently maintained and existing but not used) interpersonal relationships. We claim it is important to include the passive relationships under social proximity, as even though they are not exploited in any shape or form as per today, they allow individuals to have an opportunity to exploit them in future, in a point of time when they would be a valuable source of first contact. In that manner, the passive interpersonal relationships can be seen as "ready to be used", thus limiting significantly the

[11] Furthermore, as discussed earlier, such relationships are covered by communicational proximity and its relational sub-component, in particular.

time-to-market reaction in comparison with the lack of past contacts, experiences, or social backgrounds.

Significance of social proximity. Among the most important implications of social proximity, there are improvement and acceleration of communication processes [2], creation of sound climate for cooperation [49], and improvement of cooperation performance [39]. Employees feel much more ease of working with and exchanging knowledge with people they know as they are "linked" by, e.g., friendship, kinship, university, education, work experience, etc.). Given the more detailed perspective, social proximity is seen as a vital factor influencing the scope and pace of knowledge co-creation, mutual learning, and successful co-innovation [39]. It is so, as social proximity is critically related to trust [35]. On the one hand, it is based on and driven by trust [78], on the other, it enhances trust [39] what makes social proximity crucial for creation, transfer, and diffusion of tacit knowledge [1]. As shown in research conducted in Chinese region of Pearl River Delta, a high social coherence improves and stimulates innovative behaviors of partners as well as innovativeness within the innovation networks [27].

Often emphasized in literature is that social proximity is a key for innovation-orientated projects carrying substantial risks [34]. Indeed, among all dimensions of proximity, the social one is acknowledged as the most important for limiting the risk of opportunistic behaviors [35]. Particularly, social proximity hampers and limits the tensions between and among cooperating competitors [39] seen as critically important success factor regarding coopetition performance [66]. The literature shows, however, that although social proximity reduces the risk of opportunism, too much of it significantly increases the risk of opportunistic behaviors of partners [49]. Therefore, reaping the very best benefits from social proximity does not mean constant strive for maximizing it.

The relationship between social factors and innovation is nonlinear and represented by an inverted "U" [81]. This parabolic relationship acknowledged in sociology finds its reflection in social proximity paradox. In order to optimize the benefits of social proximity, it has to be adequately moderated. Excessively low social proximity could result in a lack of involvement from partners in establishing inter-organizational relationship and increase the uncertainty of reaching the common goals. On the other hand, too close and intensive interpersonal relationships could lead to unintentional and uncontrolled leaks of both knowledge and information (at certain stage, employees are oblivious to the fact they represent separate or even competing organizations) and waste of time on activities generating little in the way of intended outcomes of collaboration. What is more, high level of social proximity could also cause other negative phenomena: favoritism, nepotism, corruption [34], or—as discussed above—opportunistic behaviors. Therefore, for smooth cooperation, it is important to monitor the level of social proximity to ensure that the valuable interpersonal relationships are maintained, while at the same keeping them at bay to protect partner against the problem of "over-embeddedness" [24, p. 996].

13.4 Discussion and Conclusion

Analysis of literature published to date reveals inconsistencies, overlaps, and shortcomings in how proximity is defined. There is an agreement, however, that proximity is a highly complex and multidimensional concept [44]. Nevertheless, this multifaceted character and intrinsic difficulty to define it (caused by intangible and abstract nature of proximity) have led to terminological chaos, difficulties in comparing results of prior research, and problems in generalizing. The willingness to limit the conceptual ambiguities and amend inconsistent definitions resulted in development of six, separate but interlinked dimensions of proximity including: geographical, organizational, cognitive communicational, institutional, and social (see Fig. 13.4).

The six-dimensional proximity framework includes:

- four dimensions of proximity based on convergence of organizational attributes (meso-level): geographical proximity, communicational proximity, cognitive proximity, and organizational proximity;
- one dimension of proximity based on convergence of attributes of institutional environments (macro-level)—institutional proximity;
- one dimension of proximity based on interpersonal relationships between people (micro-level)—social proximity.

The multifaceted character of proximity requires defining relationships between its dimensions [4]. If we take the perspective of the formal logic, the following assumptions and remarks should be highlighted:

- the sum of all of the identified dimensions of proximity does not necessarily provides the complete picture of overall proximity;

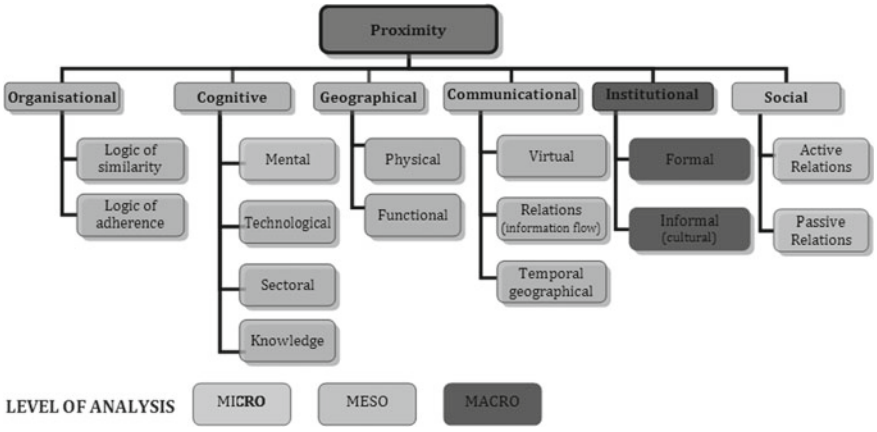

Fig. 13.4 Six-dimensional proximity framework

- all of the separated dimensions are considered at first level of division (at the current state of knowledge the particular dimensions of proximity could not be hierarchically ordered, thus for now, they are perceived as equal);
- the particular dimensions of proximity are not mutually exclusive;
- the logical contents and scope of understanding of particular dimensions of proximity are separate;
- all of the particular dimensions of proximity are mutually complementary, hence to some extent, they might be substitutive.

The dimensions of proximity should be seen as complimentary and quite substitutive. One should bear in mind, however, that their substitutive interdependency is restricted, as the minimum level of each dimension of proximity is needed. We see the developed six-dimensional proximity framework valuable as it constitutes both proximity concept and relational view considered within strategic management.

The originality of the considerations being the most important theoretical implication abolishing prior barriers to the further development of the proximity concept. It should be highlighted that the typology proposed above eliminates or at least decreases limitations of distinctions previously made in the literature.

First, our framework provides understanding and definitions exclusive hence tied in with clear and distinct confines of particular dimensions what prevents our proposition against any overlaps between and among different dimensions of proximity. As shown in prior literature [37, 41, 44], a high level of overlaps hampers both development and applicability of proximity concept in business reality. It is so, as the current understanding is blurry and confusing—the different labels are used for the same facets of proximity (e.g., personal, social, and relational proximity or cognitive and technological proximity); the same labels are used for different facets of proximity (e.g., technological and cognitive proximities; personal and social proximities); the borderline between different proximities are blurred (e.g., cultural aspects may be considered under social, organizational, and institutional proximities).

Second, the developed framework assumes that the level of proximity (no matter which dimension is considered) is perceived as relative feature of particular organization assessed in relation to other organization (or whole network of organizations). It means that proximity dimensions cannot be assessed in isolation from external entities what make it in particular importance for considerations undertaken within relational view adopted in strategic management research.

Third, the proposed framework argues to assess proximity simultaneously on different levels of analysis, namely: micro-people/individuals, meso-organization/inter-organizational aspects, and macro-institutional environment. It is so, as the overall proximity is determined simultaneously by personal factors (micro-level), organizational factors (meso-level), and factors regarding institutional environments (macro-level). The application of multi-level perspective should be seen as methodological contribution as the prior typologies have omitted the issues of multi-levelness, hence the application of multi-level approach is recommended and desired, especially in case of further studies within the relational view and inter-organizational cooperation in particular [3]. Furthermore, the proposed multi-level approach supports prior

claims highlighting that the dimensions of proximity do differ from the perspective of the reasoned level of analysis (e.g., [84]). In particular, the proposed framework remains consistent with exploration run in the Dutch nanotechnology industry showing that for research on inter-organizational cooperation the levels of proximity ranges from micro, through meso- to macro ones [84].

One should bear in mind, however, that the above-mentioned division is not complete (in terms of adequacy condition impost in the formal logic), thus it is a topology as opposed to classification [55]. Furthermore, the current stock of knowledge regarding inter-organizational proximity does not allow us to unambiguously confirm that all of the above-listed dimensions make up a full picture of proximity. We are aware that there could be dimensions of proximity, which have not been revealed or identified so far, and thus defined, thereby included in the proposed typology of proximity.

To sum up, in authors' opinion, the originality of the paper is based on the fact that the proposed typology of proximity: (1) synthesizes the earlier conceptualizations and definitions of the particular dimensions of proximity, (2) integrates and develops prior considerations concerning the dimensions and typology of proximity, and (3) points out the importance of proximity from the strategic management—namely cooperation and networking—perspective. Nevertheless, the authors are aware that presented findings are not free from certain limitations stemming mainly from limitations of the systematic literature review [72] being a source of data for our considerations, explorations, and exemplifications. Among the most important limitations resulting from the methodological approach adopted hereby is the limited range of the literature base and the authors' subjectivism.

In conclusion, some fruitful lines for further research should be outlined. Literature review proves that little research on proximity has been done from perspective of strategic management. The need to complete and verify current scientific accomplishments regarding proximity is the fundamental driver for further research both exploratory (e.g., dynamics of proximity, relationships between particular dimensions of proximity, holistic approach to proximity from perspective of different dimensions) and explanatory (e.g., research verifying hypotheses stated in literature about importance of proximity, identification of other, not revealed so far, dimensions of proximity). All in all, as the proximity hypothesis gains dynamically growing interest, while the vast majority of prior works is rather theoretical or conceptual, we do believe that there are many unexplored, interesting and very much topical research direction within the proximity concept.

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Chapter 14
The Tourism Sector's Development and Popularization of Sharing Economy. The Impact on Cooperation

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Abstract The paper aims at analyzing the role of acceleration of tourism sector development (observable due to the popularization of SE) in intra-sectoral cooperation. To test the above assumption, we carried out the quantitative research on 368 randomly selected Polish tourism companies. The positive impact of acceleration of tourism sector's development on intra-sectoral cooperation was identified using two separate analytical approaches, i.e., regression analysis and structural equation modeling. The results show that the influence is significant and positive, however, rather weak. Furthermore, it seems that intra-sectoral cooperation is driven rather by the acceleration of tourism sector's development conditioned either by popularization of ICT or by tourism companies' development than by the acceleration of tourism sector conditioned either by popularization of experience tourism or by development of tourism companies' innovation outputs.

Keywords Sharing economy · Cooperation · ICT · Experience tourism

14.1 Introduction

The dynamic, technological, and digital changes create a completely new environment for business. Simultaneously, together with the development of information and communication technologies (ICT), a willingness to feel new experiences, emotions and the authenticity of meeting new people and places, so-called the experience

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economy, has begun to increase its role played in tourism sector. Moreover, a growing role of tourism as a sector of economy manifests in tourism companies' development. Also, the increase of innovations in tourism sector is a factor characterizing the changes visible on the modern market. All of the above-mentioned issues can be perceived as particularly important factors stimulating the new socio-economic phenomena called the sharing economy (SE) [3]. Indeed, currently, the sharing economy is a heavily-debated phenomenon, especially in the tourism sector.

The sharing economy has started to be more and more important in recent years and is said to be "the future of our world" [6]. Therefore, especially tourism enterprises have started to transform their businesses, and tourism researchers have started to analyze this phenomenon. Nevertheless, although SE has become an important issue, it is still relatively not enough explored in the literature. The current stock of knowledge lacks, for example, a clear answer if (and how) the popularization of SE triggering the development of tourism sector impacts intra-sectoral cooperation in tourism sector. Some researchers stress, for example, that SE has some positive (e.g., environmental or social) impacts on development of the tourism sector [6]. At the same time, other authors claim that development of tourism sector stimulates cooperation between and among tourism companies [26, 27].

Given the above, this paper targets the knowledge gaps related to the role of acceleration of tourism sector development (observable due to the popularization of SE) in intra-sectoral cooperation. In particular, the investigation of this role considers acceleration driven by different issues, for example, the popularization of ICT, popularization of the experience tourism, development of tourism companies, and increase of innovation outputs of tourism companies.

The empirical investigation was carried out on a random and representative sample of 368 Polish tourism companies associated in collaborative structures in a form of Local Tourism Organizations. As sharing economy is particularly observable in tourism sector, the focus was restricted to companies operating in tourism sector but only those experienced in inter-organizational cooperation. The data collected from owners and top managers using PAPI techniques and Likert-based measurement tool was analyzed using two quantitative methods—regression analysis and structural equation modeling.

Apart from the introduction, the paper consists of four parts. First—a section which provides theoretical background linking the concepts of tourism sector development, the sharing economy, development of SE stimulated by different factors, and intra-sectoral cooperation. Based on the results of literature review, the research hypothesis is set out at the end of this part. Next part outlines the research framework and provides evidence for methodological quality and appropriateness of empirical material used in analytical investigation. Later on—a section presenting the results of hypothesis testing using three regression models and one model developed based on the structural equation modeling. The last section briefly comments research findings, sheds light on the main contributions, and outlines some limitations of the study and future research directions.

14.2 Theoretical Background

14.2.1 The Sharing Economy Phenomenon in the Tourism Sector

Although the term sharing economy is frequently used, the literature lacks a commonly accepted definition [1]. In the literature, the boundaries between SE and other forms of access to goods and services are relatively blurred [28]. In the literature, the sharing economy term is used interchangeably or even synonymously with other popular ones [compare with 2, 6, 28], for example, collaborative economy, peer-to-peer economy to give a few.

The literature indicates a wide range of definitions highlighting quite different issues under the "sharing trend". However, it must be stressed that for SE an utilization of underused assets facilitated by technologies, allowing people to use an item or service without obtaining any ownership, is crucial [2, 6]. What is more, in the light of SE also different kind of business models are considered, such as business to consumer (B2C), business to business (B2B), and peer-to-peer (P2P) [6]. Thus, for the purpose of research, SE is understood as a socio-economic model of bottom-up initiatives between individuals (P2P relationships) who utilize the idling capacity of assets based on sharing them via a digital platform for free or for a fee.

In the literature, different SE drivers are indicated and acknowledged as contributing to this phenomenon, implying that a multitude of drivers have pushed sharing as one of the mainstream practices in tourism, for example, tourists' increased feelings of financial constraint, visitors being in pursuit of a better value for money, lower costs of traveling [39, 43], etc. Besides the above, customer-focused factors, it is possible to indicate a few more managerial SE drivers:

- the development of ICT [29];
- the experience tourism—[38];
- tourism companies' development [34];
- innovations development [22].

Therefore, we claim that in the context of development of tourism sector, the following assumptions considering the triggering role of SE in acceleration of tourism sector are theoretically justified:

- acceleration of tourism sector—triggered by SE—is conditioned by both popularization of ICT and experience tourism;
- acceleration of tourism sector—triggered by SE—is conditioned by both tourism companies' development and development of tourism companies' innovation outputs.

14.2.2 The Popularization of ICT and Growing Interest in the Experience Tourism

The technological changes have become one of the most important in the twenty-first century [18] as creating a wide range of totally new possibilities. The global trend toward the development of new technologies, including ICT, together with the growing expectations of tourists, leads further to the digitization of the tourism sector. Therefore, new technologies entail changes in the functioning of modern enterprises. Those changes appear especially in the distribution and promotion methods of the tourist offer, wider usage of online sale channels and the use of new media, increasing personalization of offers [4]. In particular, the growing popularity of mobile solutions and social media has modified or even revolutionized tourists' behaviors [29], preferences, and expectations about the services offered to them.

ICT in tourism sector affects the change of internal strategies, rendering them more flexible to changes, helping them to adapt to the new needs of the market [17]. Moreover, most of the researchers underline that development of ICT among tourism sector entities leads to their greater efficiency and reorganization of business [17]. What is important, new technologies create also a proper basis for undertaking joint activities, using digital platforms—arousing growing interest of SE, both in management and research practice [39].

As mentioned earlier, nowadays when buying goods and services, tourists look for sensations and experiences. The new component—experience—adds an element of adventure and/or sensations to the time the tourist spends in a destination. The novelty lies in the fact that "experience" is designed, intentionally produced (staged), organized, foreseen, calculated, priced, and (often explicitly) charged for; it is a core strategic concern as a new value attribute [32]. Experiencing should also be associated with the desire to participate and combined with the uniqueness of the place. Moreover, the sensations should be accompanied by the feeling of the authenticity. Thus, it can be argued that the tourist offer should be characterized by an original character, based on creativity, including the elements of the given place identity, for example, culture elements, not distorted by general consumerism or the desire to generate quick profits [40].

Thus, the experience tourism can be referred to the creation of experiences, perpetuated in the memory of the tourist as individual emotions and impressions associated with a visit to a given place [40]. Tourists not only report the willingness and desire for experiences but also claim that they are ready to pay for them. Furthermore, they are eager to pay more if there is an opportunity to explore and learn new things or experience new adventures [35].

Most of the existing contributions acknowledge the willingness to feel new experiences, emotions and sensations, or the authenticity of meeting new people and places, for example, from the perspective of local residents, it is one of the motives of using digital platforms in SE [43]. The adherents of SE recognize the possibility of staying in someone's home, for a completely different—better and more authentic—way of exploring a new place. This fact, therefore, clearly shows the connection of the SE

concept with the experience tourism. Given the above, efforts are made to multiply and intensify impressions and emotions, trying to surprise, delight, and sometimes even shock tourists. Consequently, tourism enterprises may transform their tourist activities into unique tourist attractions, enriching traditional service packages with elements that provide emotions, or intensify the use of new technologies.

14.2.3 The Development of Tourism Companies' Innovation Outputs

Tourism development as well as the development of SE can be linked also with the development of tourism companies. It is so, as not only the technological pressure forcing ICT adaptation and customer pressure forcing delivery of more experience-based products allows (or pushes) tourism companies to develop. Also, quite significant is the fact that, as the global tourism sector develops (especially in terms of turnovers), its members namely tourism companies do develop as well. Tourism as a sector plays an important role in the economy thanks to transportation development, people higher awareness of a need to take care of their health and quality of free time, a society getting rich, etc., tourism companies can develop and broaden their forms of activity. The same trends lead to the development of other forms of goods and services provided on the market by new entities, i.e., those representing sharing trend. Those new actors on the market do notice potential benefits coming from serving tourists and provide them with accommodation, transport, food, and other goods and services, but not as formally existing tourism companies, but as SE representatives.

The cases of SE icons, such as Airbnb, which are the most explored in the literature, clearly indicate the way the "sharing trend" has started to transform the tourism sector [34], also implying its development. According to some studies, between 2013 and 2025, at a global level, revenues generated by activities belonging to SE will increase about 8.5 times [5]. It shows that SE representatives can complement the development of the whole tourism sector, as the SE activities enable destinations to better respond to peak demand in season by offering alternative tourism services [15]. It means that the entire tourism sector develops, stimulating further SE activities, for example, some visitors choose Airbnb as accommodation, but they spend time in a given region on traveling, using, for instance, other tourist services delivered by tourist entrepreneurs, or more restaurants are required to satisfy the increase in food demand by the tourist influx. Consequently, the tourism sector expands, and SE develops increasing the number of visitors, at the same time, generating new job positions as more tourists would come to a destination due to the lower accommodation cost.

Last but not least, in the context of the acceleration of tourism sector development is an innovation pressure. Currently, the tourism companies as well as all other types of business operate under growing innovation pressure. This pressure forces modern organization to provide innovation outputs. Moreover, it becomes required to

provide those innovation outputs faster, hence simultaneously at significantly much more sophisticated, complex, customized, and technologically advanced levels. This innovation pressure results in more intensive innovation behaviors and activities of tourism enterprises, hence further contributes to offering innovation to more requiring tourists. In tourism, we can point out, for example, product or service, process, managerial, marketing, and institutional innovations [22]. Some of them can be connected to ICT, since as Buhalis and Deimezi [7] claim, ICT presents a major opportunity for tourism entities having the potential to be innovative. However, some of the innovations can be a result of different changes, for example, in a process of delivering goods and services (process innovations), organizational changes in a company (organizational innovation), or marketing new activities (marketing innovation). All of them may stimulate SE development in a different way, for example, offering more individualized tourist services in general, offering better quality tourist services, taking care of good promotion and marketing, and using new technologies to fill the expectations of digitalized.

14.2.4 The Intra-sectoral Cooperation Within the Tourism Sector Development

Cooperation in the tourism sector is understood as a form of voluntary joint actions in which autonomous stakeholders engage in an interactive process, using shared rules, norms, and structures, to act and decide on issues related to tourism development in a region [12].

Such cooperation may occur between two partners or more, i.e., in dyads (bilateral cooperation) and networks (cooperation between three or more entities, often in a form of partnership structures). Currently, both forms of cooperation are required. In a tourist destination, tourists buy different goods and services provided by many entities (e.g., accommodation, gastronomy, tourist attractions, and recreation). Cooperation between those entities is significant and desired [27], since tourists assess their stay in a destination by considering a satisfaction from a bunch of goods and services bought in a destination and by the level of a coherence of a destination offer. Thus, each entity which serves a tourist is partly responsible for the overall tourists' satisfaction and for their decisions whether to come back to the destination in the future. Indeed, intra-sectoral cooperation enables to assure such a positive decision stemming from tourist's satisfaction [20]. Thus, cooperation in the tourism sector is perceived as critical not only for tourism companies' development, but also for destination management [26], including regional development [9].

There are a lot of potential motives of cooperation in tourism sector, for example, a desire to get unavailable resources owned by other entities, enter new markets through joint promotion, enriching a tourist offer by joint creation of products/provision of services, financing expensive investments by obtaining external funds, etc. [26, 37].

Those motives of intra-sectoral cooperation result from perceived opportunities for the whole tourism sector development, as well as own business activity. Potentially, the development may result from various factors, including the popularization of SE (among different factors) stimulated by the increase of ICT, the experience tourism, general development of tourism companies, and development of tourism companies' innovation outputs. Those factors, in turn, can stimulate inter-sectoral cooperation.

As Buhalis and O'Connor [8] claim, the use of ICT by traditional tourism entities can link up and bring together the core competence of independent firms. Thus, ICT development may stimulate the cooperation of various entities, for example, in the creation of common e-booking platforms, telephone applications (with the offer of various types of entrepreneurs), and other (including innovation) more and more important solutions regarding technology.

A factor that can also encourage tourism enterprises to cooperation is the increase of the experience tourism. It makes that traditional tourism enterprises notice the changing expectations of tourists—their desire to look for something new, unique, personal, and natural. Thus, they begin to adapt their offer to customers' experience-based needs. Because they are not able to satisfy all the needs of tourists, they have to cooperate with one another [40]. This may be, for example, a cooperation related to providing tourists with access to local cuisine (e.g., organizing meals with local hosts), arranging meetings with representatives of local culture, cooperation with local guides, and showing a tourist destination from a different perspective than offered by traditional travel agencies.

Cooperation is also stimulated by the development of tourism companies. Thanks to the fact that they generate higher benefits of their business, they get new clients—expand the market, invest in new solutions in their businesses, they are able to satisfy tourists' needs on a higher level and are able to suit the offer to a particular tourists' expectations. This makes them even more engaged in business activity which is reflected, among other factors, by establishing new forms of business cooperation [12].

Cooperation in tourism is also stimulated by innovations. When entities see an opportunity to develop product or process innovations, or any other type, and are not able to provide them alone, they usually need to join their forces with other entities in tourism sector [22]. To sum up, the recognition of current literature allowed us to claim that tourism sector development can be a result of popularization of SE driven by different factors, including for instance: an increase of ICT, the experience economy, innovations, and tourism companies' development. This in turn stimulates cooperation in tourism sector. Thus, we assume that SE can encourage, push, or force companies to intra-sectoral cooperation. Given the above, we see it justified to set and test the following research hypothesis: **acceleration of tourism sector development—conditioned by popularization of sharing economy—stimulates intra-sectoral cooperation**.

14.3 Research Methodology and Design

The study was conducted among tourism companies actively operating in one out of 124 Local Tourism Organizations (LTOs) in Poland. As a sampling frame, we took the total number of 1647 tourism companies associated with LTOs. In the final, representative sample consisted of 368 companies which were selected using computer software to draw a sample randomly.[1]

The data was collected in May and June 2016 from top managers and owners seen as the key informants in case of investigating organizational and managerial issues including inter-organizational ones [25]. To gather the data, a PAPI technique has been used. The interview questionnaire contained both open and closed questions, hence the latter was based on Likert-type scale seen as the most adequate to collect information about managers' perception on organizational issues investigated in tourism management. We decided to use a 5-point measurement (labels from 1 "strongly disagree" to 5 "strongly agree") as it suits the chosen methods of data analysis [21], may increase the response rate, is seen as less confusing for respondents, and does not distort the basic descriptives and normality measures [13].

The hypothesis testing followed two analytical approaches. First, regression analyses including linear regression and multivariate regression. Second, structural equation modeling (SEM) and structural regression method in particular [24]. Application of two separate analytical approaches allowed us to test the hypothesis following different measurement perspectives on our variables, namely observable in case of regressions and unobservable in case of SEM. Moreover, as the investigation was computed separately, it was possible to compare the findings and provide sounder conclusions.

As the measurement was based on Likert-type scale, the multivariate regression analyses could not be performed using directly measurable items. Thus, to investigate a causal relationship between considered constructs the six interval-level and mean-based variables were computed.

First, we calculated two independent variables referring to the acceleration of tourism sector triggered by the growing popularity of SE conditioned by the development of both ICT technologies (ACC_NT) and the experience tourism (ACC_ET). Second, we created two independent variables referring to the acceleration of tourism sector driven by the growing popularity of SE conditioning the development of tourism companies (ACC_FD) and the increase of tourism companies' innovation outputs (ACC_IN). Each of the above variables was computed as the means of two specific items, given the semantic content of particular questions. Third, we calculated two general variables as the overall means of all items related to acceleration

[1]The final sample was randomly selected using simple random selection technique as due to the clearly defined target group (members of LTOs) and the current list of members of all LTOs the probability of participation in the survey for all of the targeted organizations from the target group was the same. The sampling was done using computer software for simple random sampling setting out the measurement error as lower than 5% and significance level of $\alpha = 0.05$.

Table 14.1 Main descriptives of items and variables used in the study

Parameter	Mean	SD	Skewness	Kurtosis
Items				
ACC_1	3.77	0.937	−0.675	0.333
ACC_2	3.89	0.949	−0.526	−0.369
ACC_3	4.04	0.885	−1.094	1.542
ACC_4	4.08	0.883	−0.952	0.730
COOP_1	3.79	0.928	−0.918	1.064
COOP_2	3.31	1.288	−0.409	−0.909
COOP_3	3.68	1.073	−0.746	0.050
COOP_4	3.79	0.858	−0.640	0.663
COOP_5	3.33	1.241	−0.309	−0.921
COOP_6	3.66	1.029	−0.723	0.230
Variables				
ACC	3.9463	0.72071	−0.796	0.313
ACC_NT	3.8315	0.86177	−0.663	0.044
ACC_EE	4.0611	0.80169	−1.070	1.188
ACC_FD	3.9063	0.75377	−0.801	0.729
ACC_IN	3.9864	0.79411	−0.694	−0.070
COOP	3.5910	0.74967	−0.579	0.615
COOP_SE	3.5915	0.86305	−0.600	0.229
COOP_TE	3.5906	0.81961	−0.384	0.217

Source Own elaboration, using IBM SPSS ver. 25

of tourism sector triggered by the growing popularity of sharing economy (ACC—four items) and related to intra-sectoral cooperation (COOP—six items). The basic statistics for both the items and variables are presented in Table 14.1.

Furthermore, as the analytical part of the study assumed an application of SEM, the two latent variables were developed. Namely, independent one related to the accelerating development of tourism sector due to the growing popularity of SE and dependent variable related to intra-sectoral cooperation. These variables were developed using factor analysis carried out on our raw items.

To ensure that the empirical material suits the chosen analytical approaches, the raw data has been tested in terms of basic methodological requirements.[2] First, normal distribution of data was verified using Kolmogorov-Smirnov normality test, the levels of skewness and kurtosis. Even though the data was not positively tested using K-S

[2]It was possible to test the data in terms of common method bias, composite reliability, and convergent validity as the interviewing questionnaire covered more items than those discussed in this paper—the scope of the study was quite broader than focus on the influence of accelerating effect of popularization of sharing economy on intra-industry cooperation. For instance, our focus has been also paid on more negative (i.e. slowdown of industry development) effects.

test, the ranges of both skewness (between−1 and 1) and kurtosis (between−3 to 3) show the distributions of items as quite close to normal, hence slightly left-slanted distributions [10].

Second, the internal consistency seen also as the reliability of scale was tested using Cronbach's alpha coefficients. As the results of tests exceeded 0.7 (αCronb.ACC = 0.797; αCronb.COOP = 0.784), the scales were considered as reliable [36].

Third, the adequacy of raw data was verified using Meyer-Olkin test for sampling adequacy. The results show our data as suitable for running factor analysis—KMO referring to data measuring independent variable = 0.676, hence KMO referring to data measuring dependent variable = 0.711 (the threshold = 0.5 according to Osborne and Costello [31]).

Fourth, in order to additionally check appropriateness of data for factor analysis, the Bartlett's tests of sphericity were run. As for both set of items, the results are significant ($p < 0.05$), probably the items are interrelated thus suitable to identify potential factors. In order to support these findings, we run correlation analyses on items and variables. As shown in Tables 14.2 and 14.3 the items and variables do correlate. Therefore, once again, the data has been shown as suitable for running factor analysis.

Fifth, as the interviewing questionnaire was newly developed, we saw it important to test the scale in terms of common method bias [33]. To do so, the Harman's single factor test and non-rotated exploratory factor analyses were run. The results show the single factors representing the highest eigenvector and accounting for the majority of covariance among measures as explaining: 62,247% of the total variance in case of items related to the acceleration of tourism sector, 49,195% of the total variance in case of intra-sectoral cooperation. As the results do not exceed the maximum value of 70% [19], there is no risk that the variance of our data results from the adopted measurement method rather than from the considered constructs [33].

Sixth, as we assumed to apply SEM, it was important to run confirmatory factor analysis (CFA) and validate the scale in terms of convergent validity and composite reliability. The convergent validity was assessed using an average variance extracted (AVE), hence composite reliability using the basic composite reliability indicator (CR)—see Costello and Osborne [11]. The results of calculations show the measurement model for independent variable as valid (AVEACC = 0.534 > 0.5) and reliable (CRACC = 0.820 > 0.7), however, the measurement model for dependent variable as reliable (CRCOOP = 0.814 > 0.7), hence not fully valid (AVECOOP = 0.423 < 0.5). Nevertheless, the 6-item measurement model for intra-sectoral cooperation has been used in further analysis applying SEM as measurement model might be accepted if AVE exceeds 0.4 and simultaneously CR exceeds 0.6.

Table 14.2 Inter-item correlations

Parameters		ACC_1	ACC_2	ACC_3	ACC_4	COOP_1	COOP_2	COOP_3	COOP_4	COOP_5	COOP_6
ACC_1	rho_s	1.000									
	Sig.										
ACC_2	rho_s	0.651**	1.000								
	Sig.	0.000									
ACC_3	rho_s	0.356**	0.360**	1.000							
	Sig.	0.000	0.000								
ACC_4	rho_s	0.422**	0.486**	0.601**	1.000						
	Sig.	0.000	0.000	0.000							
COOP_1	rho_s	0.415**	0.389**	0.283**	0.325**	1.000					
	Sig.	0.000	0.000	0.000	0.000						
COOP_2	rho_s	0.186**	0.201**	0.146**	0.161**	0.385**	1.000				
	Sig.	0.000	0.000	0.005	0.002	0.000					
COOP_3	rho_s	0.494**	0.455**	0.306**	0.315**	0.592**	0.322**	1.000			
	Sig.	0.000	0.000	0.000	0.000	0.000	0.000				

(continued)

Table 14.2 (continued)

Parameters		ACC_1	ACC_2	ACC_3	ACC_4	COOP_1	COOP_2	COOP_3	COOP_4	COOP_5	COOP_6
COOP_4	rho_s	0.333**	0.289**	0.308**	0.314**	0.353**	0.275**	0.425**	1.000		
	Sig.	0.000	0.000	0.000	0.000	0.000	0.000	0.000			
COOP_5	rho_s	0.196**	0.142**	0.159**	0.190**	0.230**	0.583**	0.277**	0.382**	1.000	
	Sig.	0.000	0.006	0.002	0.000	0.000	0.000	0.000	0.000		
COOP_6	rho_s	0.308**	0.331**	0.322**	0.407**	0.311**	0.163**	0.477**	0.538**	0.368**	1.000
	Sig.	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.000	0.000	
N		368									

Interdependencies estimated using Spearman correlation analysis as the scale was based on 5-point Likert scale being an ordinal scale of measurement
** Significance at the level of 0.01 (two-tailed)
Source Own elaboration, using IBM SPSS ver. 25

Table 14.3 Inter-variable correlations

Parameters		ACC	ACC_SE	ACC_TE	ACC_FD	ACC_IN	COOP
ACC	r_{xy}	1					
	Sig.						
ACC_NT	r_{xy}	0.877**	1				
	Sig.	0.000					
ACC_ET	r_{xy}	0.856**	0.501**	1			
	Sig.	0.000	0.000				
ACC_FD	r_{xy}	0.927**	0.805**	0.802**	1		
	Sig.	0.000	0.000	0.000			
ACC_IN	r_{xy}	0.935**	0.827**	0.792**	0.734**	1	
	Sig.	0.000	0.000	0.000	0.000		
COOP	r_{xy}	0.489**	0.452**	0.393**	0.461**	0.449**	1
	Sig.	0.000	0.000	0.000	0.000	0.000	
N		368					

Interdependencies estimated using Pearson correlation analysis as the variables were computed as means of reasoned pairs of items
**Significance at the level of 0.01 (two-tailed)
Source Own elaboration, using IBM SPSS ver. 25

14.4 Empirical Findings

To analyze the directional relationships, three regression models were developed. The first model in independent part focuses on conditions under which SE develops so fast, i.e., popularization of ICT and the experience tourism. The second model in independent part pays attention to positive effects of growing popularity of SE thanks to firms' development and increase of innovation outputs. Finally, the third model takes the general perspective on independent variable. All of the developed models are statistically significant, thus acceptable as explaining cooperation in tourism sector—see Table 14.4.

The results of ANOVA show that all models are significant and represent quite similar explaining power. The first model $F(2, 365) = 58.042$; $p < 0.01$ explains 23.7% (adjusted R^2) of the variance of the dependent variable. The second model $F(2, 365) = 57.432$; $p < 0.01$ presents slightly worse fit as it explains 23.5% (adjusted R^2) of the variance of the intra-sectoral cooperation. The third model, the most general one, $F(1, 366) = 114.898$; $p < 0.01$ represents the best model fit as it explains 23.9% (R^2) of the variance of the dependent variable. All in all, the model fits are quite similar, hence the explaining power of the models seems to be generally quite low (less than 25%). It may suggest, there exist other, significant factors positively influencing intra-sectoral cooperation among tourism companies.

Table 14.4 Results of ANOVA and analysis of models fit

ANOVA								Model fit		
Models			Sum of squares	Df	Mean square	F	Sig.	R^2	Adjusted R^2	Durbin-Watson
1	ACC_NT ACC_ET	Regression	49.769	2	24.884	58.042	0.000	0.241	0.237	1.491
		Residual	156.487	365	0.429					
		Total	206.256	367						
2	ACC_IN ACC_FD	Regression	49.371	2	24.685	57.432	0.000	0.239	0.235	1.492
		Residual	156.885	365	0.430					
		Total	206.256	367						
3	ACC	Regression	49.280	1	49.280	114.898	0.000	0.239	0.237	1.493
		Residual	156.976	366	0.429					
		Total	206.256	367						

Source Own elaboration, using IBM SPSS ver. 25

In order to test hypothesis, the coefficients of considered variables were investigated as the general significance of model is not constitutive criterion to decide about the rejection/not rejection of the hypothesis—Table 14.5.

All of the considered variables, in all models, represent positive and quite similar level of standardized coefficients of influence on intra-sectoral cooperation. All of the predictors are significant. However, their influence is quite weak (the range of beta reaches from 0.223 to 0.489). Given a more detailed view, the highest impact can be identified for the general variable ACC (model 3, beta = 0.489). It is worth to note that in case of multivariate regression models there are no substantial differences between considered pairs of variables. Nevertheless, the development of tourism sector accelerated by popularization of SE conditioned by increase of ICT has stronger influence (beta = 0.340) on intra-sectoral cooperation than this conditioned by the popularization of experience tourism (beta = 0.223). Furthermore, the development of tourism sector accelerated by popularization of SE conditioned by the development of tourism companies has stronger influence (beta = 0.285) on intra-sectoral cooperation than this conditioned by the increase of innovation outputs (beta = 0.241). It is worth noting that for multivariate regression models, there is no risk of inaccurate estimation of contribution of particular predictors to the models as the variance inflation factors (VIF) for all variables in multivariate models are much below the critical value of 10 [30].

Summing up, the results of three developed regression models show that the rejection of the hypothesis would be unreasoned. To support the above conclusion and to provide the results taking the different measurement perspective, a structural equation modeling was applied.

SEM allows the researchers to investigate complex, directional links between and among variables which are directly unobservable [Kline, 2012]. It is recommended for studies exploring issues measured (indirectly) though proxies, especially if those proxies are rather subjective than objective indicators [21]. As our scale contains items based on subjective Likert-type scale, the data were collected as perceptions of our key informants; therefore, we saw it reasoned to apply SEM.[3] Before the analysis was run, our pre-defined structures of measurement models for both latent variables were verified using factor analysis. Its results supported our theory-based structure: (1) independent and latent variable consists of four observable items and (2) dependent and latent variable consists of six observable items.[4] Using the measurement models, it was possible to develop and test the structural model explaining the influence of the accelerating development of tourism sector conditioned by popularization of SE on intra-sectoral cooperation—Fig. 14.1.

[3]Note that the following, critical methodological requirements were also met: minimal sample size at the level of 200 or even 300 [41]; at least 3 items per latent variable [23], normal distribution of raw data (in terms of Byrne [10]).

[4]Rotation method: Promax (as the items were allowed to be interrelated—Byrne [2010]). Extraction method: generalized least square (recommended if the items and/or extracted factors may correlate—Fabrigar et al. [14]). All pre-defined items load the latent items at the levels exceeding critical point of 0.6 [16].

Table 14.5 Regression models and coefficients for specific predictors of intra-sectoral cooperation

Models		Coefficients			T	Sig.	95% Confidence interval		Collinearity	
		Unstandard		Standard						
		B	Stand. error	Beta			Lower bound	Upper bound	Tolerance	VIF
1	(Constant)	1.611	0.192		8.397	0.000	1.234	1.989		
	ACC_NT	0.296	0.046	0.340	6.461	0.000	0.206	0.386	0.749	1.335
	ACC_ET	0.208	0.049	0.223	4.224	0.000	0.111	0.305	0.749	1.335
2	(Constant)	1.580	0.191		8.285	0.000	1.205	1.955		
	ACC_FD	0.283	0.067	0.285	4.232	0.000	0.152	0.415	0.461	2.169
	ACC_IN	0.227	0.063	0.241	3.578	0.000	0.102	0.352	0.461	2.169
3	(Constant)	1.585	0.190		8.328	0.000	1.210	1.959		
	ACC	0.508	0.047	0.489	10.719	0.000	0.415	0.602	NA	NA

NA—non-applicable
Source Own elaboration, using IBM SPSS ver. 25

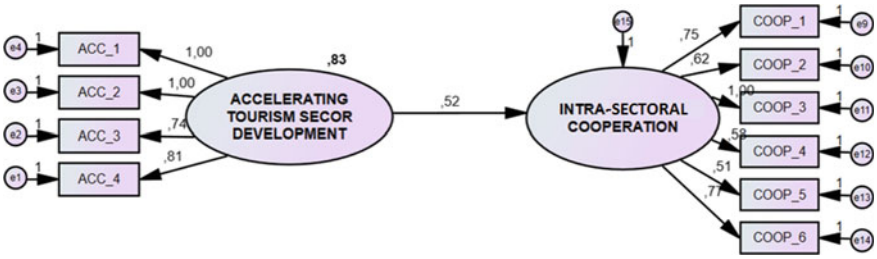

Fig. 14.1 Structural model for intra-sectoral cooperation. *Source* Own elaboration, using IBM SPSS Amos ver. 25

The structural regression method provided the result which shows significant, quite strong, and positive directional relationships. The evaluation of goodness of fit [21] shows the structural model as representing very good model fit as fit indicators exceed the thresholds, namely CMIN/DF = 2.180, GFI = 0.980, AGFI = 0.938, NFI = 0.973, CFI = 0.985, TLI = 0.962, and RMSEA = 0.057.

To conclude, the findings of SEM support the results of regression analyses showing that—at least in case of Polish tourism sector—there is no justification for the rejection of the hypothesis about the positive influence of the accelerating development of tourism sector conditioned by popularization of SE on intra-sectoral cooperation.

14.5 Discussion and Conclusions

The conducted research allowed to present findings regarding the drivers of intra-sectoral cooperation in the tourism sector. Thus, it is possible to point out several implications for the following subgroups: (1) discussion of the research with former scientific works and presenting the research contribution, (2) formulating practical implications, (3) presenting research limitations, and (4) future research recommendations.

14.5.1 Discussion and Contribution of Research Results

The study contributes to the rapidly growing streams of research focused on determinants—i.e., drivers, triggers, factors, and antecedents of inter-organizational cooperation. Given the quite low exploratory power of presented regression models, we claim that research findings support and supplement prior results identifying other significant drivers of cooperation in the tourism sector, for example, communication, commitment, social embeddedness, or trust [12]. Secondly, research findings expand the existing knowledge on cooperation per se, however, in the context of

tourism sector. The scope of presented consideration was much broader in terms of types of cooperating tourism organizations than adopted in prior studies. Hence, the findings exceed the prior focus restricted only to formal cooperation [e.g., 41], coopetition [26], or partnerships [42]. Given the above, it seems that findings could be seen not only as supportive, but also as more holistic and broader than the previous in the literature.

The results of quantitative analysis prove significant links between the popularization of SE and cooperation in the tourism sector, using a representative sample of tourist entities—such a significant link was proved in the literature. Moreover, the identification of positive influence of the popularization of SE on this cooperation suggests that tourism companies are more willing to cooperate due to the increase of ICT than the increase of experience tourism. The reason could be explained by the fact that respondents perceive this driver as more important in SE popularization and thus, in the tourism sector development. However, as the research was conducted among entities representing supply side of the market i.e., tourist entrepreneurs, tourist enterprises perceive ICT development more clearly (they use new technologies in a day-to-day activity) than the experience tourism (being a characteristic trend to the demand side of the market).

Furthermore, the research highlights that the development of tourism sector accelerated by popularization of SE conditioned by the development of tourism companies has stronger influence on intra-sectoral cooperation than the one conditioned by the increase of innovation outputs. This could be connected with a specificity of developing innovations in the tourism sector. Some difficulties connected with launching innovations in tourism can result of issues such as, for example, domination of SMSs (with limited resources for innovativeness development), using by tourist enterprises mainly a tacit knowledge and their reluctance to share it with others, a high level of employment fluctuation (mainly because of seasonality) in the tourism sector, etc. [22]. Nevertheless, the presented research is in line with works in which SE is perceived as accelerating tourism sector development [28], ICT is perceived as a stimulant of inter-sectoral cooperation [8], and the experience tourism is analyzed as such a stimulant too [40].

14.5.2 Practical Recommendations

With the reference to tourist entities and recommendations for companies in the sector, it would be important to inform entrepreneurs about possible forms of cooperation and their potential benefits, for example, by organizing various types of meetings—in the form of trainings or workshops. SE is a phenomenon that cannot be stopped; therefore, tourism entrepreneurs must adjust to it and learn how to run the business in a new reality. Since the research has shown that a hypothesis about the development of tourism sector driven by SE and stimulating intra-sectoral cooperation cannot be rejected, during such meetings some examples of this positive influence of SE on the sector development and intra-sectoral cooperation should be presented.

Moreover, they should be stressed together with a positive influence of cooperation on tourist companies' development and the sector development (some feedbacks effects) because this kind of link has already been proved in the literature [20]. During such meetings, it is important to pay attention to the specificity of tourism enterprises, i.e., different perception and opportunities of cooperation will concern entities that run different type of businesses (e.g., accommodation or catering facilities) of various sizes and (micro/large companies) in different locations (urban/rural). This perception is crucial regarding assessment of different phenomena in the tourism sector, including the ones analyzed in the research, i.e., ICT development, the experience tourism, or innovations.

Additionally, in Poland, some changes in the legislation regulating SE are required. The lack of legal arrangements in many areas intensifies the reluctance of tourism entrepreneurs to other entities on the market representing SE. Thus, such regulations regarding SE would certainly enable a more transparent and secured way of delivering goods and services to consumers. More and more countries have begun implementing various regulations in this area in the recent years and Poland also belongs to them. However, many issues still remain unregulated.

14.5.3 Research Limitations

Authors do believe that the empirical investigation contributes to the current stock of knowledge. Nevertheless, besides aforementioned positive insights, the study reveals some shortcomings. First and foremost, the study was purposefully embedded within the part of tourism sector, namely within tourism entities experienced in intra-sectoral cooperation (i.e., members of LTOs), thus the findings should not be seen as general. One should bear in mind, however, that due to the sectoral-dependent nature of managerial issues, running of research only in one sector is more often seen as methodologically reasoned [27]. Therefore, to test the findings and to provide supplementary knowledge, it is worth to run this investigation in other sectors and countries. Second, as the measurement approach was based on Likert-type scale, the results refer rather to the key informants' subjective perceptions than to the objective actual state of considered issues. Even though such measurement approach is the most common in management studies [e.g. 27], it is recommended to carry out similar investigation using objective indicators, for example, dynamics of sector turnovers (regarding independent variable) or a number of formally established alliances, clusters, networks, etc. (regarding dependent variable).

14.5.4 Future Research

In the context of future research, it would be worth to focus on three issues. First of all, it would be interesting to carry out research aimed at identification of possible forms

of cooperation between tourist entrepreneurs. They could be assessed and valued according to the criterion of their usefulness in operating on the market under SE development. In presented research, authors have not developed this issue. Secondly, it would be interesting to indicate—based on future qualitative research—whether and what forms of cooperation are possible to establish between tourism enterprises and other entities providing their services within SE. It seems that such cooperation is already taking place now, for example, between the owners of accommodation facilities renting them to tourists and tourist guides [34]—that issue has not been, however, examined in the literature, so far. Thirdly, it is worth to identify whether there are any tensions in undertaking such a cooperation, for example, between SE and established tourist entities.

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Chapter 15
Conflicts in Foreign Inter-organisational Relationships of Multinational Enterprises

Aleksandra Hauke-Lopes, Krzysztof Fonfara and Milena Ratajczak-Mrozek

Abstract Conflicts are incorporated in any company's business activity. The development of company's international operations entails higher probability of conflict situations with foreign partners. The aim of the paper is to analyse the sources of conflict in inter-organisational foreign relationships of multinational enterprises (MNEs) and to identify how these conflicts affect MNEs' activities. The outcomes are analysed both for inter-organisational relationship and for MNE's activities in general. Also, formal and informal actions undertaken by managers in order to resolve a conflict situation and to minimise potential negative consequences are investigated. The analysis is based on in-depth interviews conducted in five different units (headquarters and subsidiaries) of Polish-based MNEs. After internal and comparative analysis, obtained results are compared with the existing research. The results show that identified conflicts in foreign inter-organisational relationships of MNEs' units were not severe. The conflicts had sources mainly in everyday problems or cultural differences. Regardless of the source, in the majority of analysed MNEs' units, conflicts had a positive effect on the external relationships themselves and the MNE's activities.

Keywords MNE · Conflicts · Foreign relationships

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15.1 Introduction

Companies are forced to cooperate with various business entities. Among the numerous characteristics of the cooperation and inter-organisational relationships next to the complexity and long-time orientation, conflict is mentioned [16]. Being an inherent part of both social and business interactions [22], conflicts are inevitable. They manifest themselves with a different intensity—from marginal, such as everyday problems, to severe, posing a threat to the existence of the relationship or the company itself [19]. For companies, the importance of conflicts in relationships is high. Conflicts affect current and long-term management and require appropriate actions and then result in outcomes for a given inter-organisational relationship as well as the company itself. As far as these outcomes are concerned, existing research emphasises the negative consequences of conflict situations [14]; however, there are also studies underlining that conflicts can positively affect the relationship and a company's activity [7, 23].

In international business activity, conflicts are more frequent and more unavoidable. The risk and intensity of conflicts in business relationships involving foreign business entities are higher than in relationships with domestic ones [22]. This is mainly due to cultural differences between markets and the geographical distance. This is an important statement as the research of conflict in international relationships of cooperation is limited (exceptions include, e.g. [22, 28]). The business entities that are important players in the international arena are multinational enterprises (MNEs). MNE may be defined as 'a group of geographically dispersed and goal-disparate organizations that include its headquarters and the different national subsidiaries. Such an entity can be conceptualized as an inter-organizational network that is embedded in an external network consisting of all other organizations such as customers, suppliers, regulators and so on, with which the different units of the multinational must interact' [9, p. 603]. Being present in foreign markets MNEs cooperate with entities that come from different cultural or economic backgrounds. The multitude of relationships maintained by MNEs with different business entities highly increases the probability and diversity of conflict situations within inter-organisational relationships. However, insightful research on conflicts in the cooperation relationships of MNEs is limited (exceptions include, e.g. [13, 27]).

For this reason, the aim of this paper is to analyse the sources of conflict in inter-organisational foreign relationships of MNEs and to identify how these conflicts affect MNEs' activities. When identifying outcomes of conflict situations, we focus on outcomes affecting both the given inter-organisational relationship as well as MNEs' activities in general. Additionally, we analyse formal and informal actions undertaken by managers in order to resolve a conflict situation and to minimise potential negative consequences. Our intention is to contribute to the existing research and broaden the analysis on inter-organisational conflicts in MNE's foreign relationships by identifying the origin of conflicts as well as suggesting actions to be taken in order to handle conflicts in a positive (from the MNE's point of view) way.

We base our analysis on in-depth interviews conducted in five different units (headquarters and subsidiaries) of Polish-based MNEs. The qualitative analysis allows us to qualify the results with real-life illustrations of conflict situations encountered by managers. The analysed conflicts concerned inter-organisational relationships between MNE units (headquarters or subsidiaries) and their foreign customers or suppliers. This is especially important in the face of calls for more research on vertical coopetition that is the cooperation and competition between a seller and a buyer [12, 18].

In the paper, we present a literature review in which we focus on sources and outcomes of conflicts in inter-organisational relationships. Since the research on conflict situations in inter-organisational relationships of MNEs is limited, we first analyse conflict situations in general and underline the research from international business. Then, we discuss results of the research concerning conflicts from the perspective of MNEs. In the next sections of the paper, after discussing the method of the study, we present an analysis of in-depth interviews conducted with the managers of units of five different MNEs and discuss the results. The paper finishes with conclusions in which we draw attention to potential future research.

15.2 Literature Review

Inter-organisational relationships are characterised by cooperation as well as by competition. Companies collaborate in order to generate a higher mutual value and compete in order to seize the greater amount of this value [6]. The simultaneous pursuit of cooperation and competition [6, 20] constitutes a challenge for companies since 'the external forces or motives to compete and cooperate are seldomly balanced' [20, p. 189].

The most dominant perspective in the literature on coopetition is studied among business entities from the same value chain level, mainly competitors. Here, coopetition may occur at inter-individual, inter-organisational and intra-organisational level [6, 20]. However, this view towards analysis calls for changes of perspective. As Lacoste [12, p. 649] underlines: 'the 'coopetition' approach is often restricted to 'horizontal' relationships […], and there is little academic research applying the concept to 'vertical' relationships, e.g. between customers and suppliers'. The horizontal relationships embrace the cooperation with competitors, while vertical relationships include coopetition between entities acting as buyers and sellers or customers and suppliers [12, 18].

Tensions are an inherent part of coopetition [20]. It is therefore important to manage or to maintain and balance the cooperation and competition within buyer-supplier relationships [5, 6]. When entities are not able to manage or balance these tensions, they may, in turn, have an impact on the inter-organisational relationship and lead to conflict. Conflict may arise as the effect of action taken or not taken by another entity as well as the effect of interaction or the avoidance of interaction [13]. Therefore, they are an inherent part of every business activity, and every business

cooperation involves tensions or differences which may lead to conflict situations [22]. These conflicts may have a different intensity—from day-to-day problems to very severe ones, which may result even in the relationship termination [13, 19].

Relationships between buyers and sellers, due to their common but at the same time opposing goals, are characterised by coexistent collaboration and competition which increase the probability of conflict situations [4]. Other sources of conflict include power, interdependency [28], misalignment of interests or mutual inability to adapt [2, 7]. Conflicts can also be triggered by social ties [16], misunderstandings and problems in communication [2].

Conflicts in international activity can also result from cultural differences and psychic distance [26]. As pointed out by Skarmeas [22, p. 565], 'managing international trade relationships is a more challenging task compared with exchanges in the domestic context, due to geographical and cultural separation between exchange partners'. Although some studies do not confirm these results (e.g. [17]), cultural distance may sometimes inhibit the conflict handling in the relationship and even lead to the termination of cooperation [26, 28]. Some negative effects of relationship termination are visible, e.g. worse financial results, while others remain largely invisible, e.g. switching costs, lost market opportunities and reputation [23].

With respect to other undesirable outcomes, conflicts have been shown to have a negative impact on such aspects of the relationship as commitment [14]. Conflicts can also impede the development of relationships [15] or the company's foreign activities. As Duarte and Davies [2, p. 91] state, there is a dominant assumption that 'all other factors being equal, relationships where conflict is low will outperform relationships where conflict levels are higher'.

Interestingly, the impact of conflicts is not always negative—in some situations, they can positively affect the relationship and the company's activity. Vaaland [24, p. 447] states that conflicts 'provide the parties with insight into the core of the relationship, increase relational sensitivity, and as a result of these, insights restore the ability to manage a relationship under pressure'. Conflicts can strengthen a relationship [23]. Conflicts may also provoke discussions and decisions that aim at better coordination and performance [29] and also performance in inter-organisational relationships [7].

Given their potentially different outcomes, conflicts can therefore be damaging and beneficial at the same time [7, 25]. According to Koza and Dant [11], conflicts are more likely to have positive outcomes if they occur in the conditions of cooperative orientation and trust-based governance. These factors facilitate mutual communication between the business entities involved and make them better prepared for unknown and unplanned situations. Another important factor which increases the chances of a positive conflict resolution is the 'willingness to find a mutually satisfactory agreement' [21, p. 82]. It is also stressed that a conflict can have positive outcomes when it is managed with a certain degree of assertiveness on the part of the entities involved, who seek to satisfy their own goals during the cooperation [8]. The above actions may be classified as formal or informal ways of conflict handling. The formal ways of conflict handling are based mainly on formal agreements and

reference to procedures, while the informal ways rely, for example, on inter-personal contacts or meetings [19].

To the best of our knowledge, the existing literature lacks in-depth analysis of conflicts from the MNE's perspective. The analysis of conflict situations concerning MNEs focuses mainly on internal conflicts (within the MNE's different units). For example, Lauring et al. [13] focus on the antecedents for and the consequence of low-intensity inter-unit conflicts within MNEs, while Vahtera et al. [27] identify to which extent conflicts impact the identification of knowledge sources in MNEs. The research on inter- and intra-relationship conflicts is advanced by Nordin [15]; however, conflicts are analysed in a specific context of the alliance implementation process. The existing literature presents also other analyses of conflicts within MNEs; however, the conflict situations are mentioned as the effect of the main problem such as psychic distance [1].

15.3 Method

The study presented in the paper is of qualitative character as this kind of research is suitable for the analysis of inter-organisational relationships [3]. This approach enables an in-depth analysis of a research problem, although it does not allow the drawing of generalisation or statistical conclusions.

To maximise the information without referring to generalisations, we used a purposive sample [18]. We chose Polish-based units of MNEs (headquarters or subsidiaries), which were active in at least one foreign market. The detailed criteria under which we chose the sample included: (1) company size (employment more than 250 people), (2) company being part of a foreign multinational company (business unit or headquarters), (3) company being active in foreign markets and (4) presence of conflicts or problem situations in company's foreign relationships. The chosen criteria ensured that analysed units belong to large MNEs and not small companies active only in one foreign market. Additionally, as some managers might have been reluctant to speak about problems in relationships with other business entities (as it is perceived as a weakness), by conducting in-depth interviews, we could obtain needed information concerning conflicts and problem situations that took place in the relationships.

In the paper, we present the results of in-depth interviews conducted in five units of different Polish-based MNEs. After representatives of five units have been interviewed, the empirical saturation point had been reached, meaning that last interview provided narratives similar to those that had been already gained. Each interview lasted between 1 and 2 h and was conducted with the company's key informant. To ensure confirmability, [10] all the interviews were recorded with no objection by the interviewees, and notes were taken during the interviews. Afterwards, the recorded interviews were transcribed. Based on the transcriptions, we prepared interview protocols which were used as the basis for the preparation of the illustrative examples

presented in the paper. After internal and comparative analysis, the results were compared with findings of existing research.

During the interviews, we examined the process of entering a new foreign market for which the key informant was responsible, and we asked the key informants about the most important business entities and inter-organisational relationships in that process as well as their opinion concerning the mentioned relationships. One of the characteristics describing the inter-organisational relationships was conflicts. In each of the five analysed units of MNEs, we identified one important foreign inter-organisational relationship with either a foreign customer or a foreign supplier described by conflict. Thus, the units of our analysis are conflicts in inter-organisational relationships with foreign customers or suppliers perceived from the MNE's unit perspective. Key informants in their interviews did not refer to conflicts with competitors—we may assume that these entities were not important during a new, foreign market entry.

The main characteristics of the analysed units of MNEs are shown in Table 15.1.

15.4 Analysis and Discussion

15.4.1 Analysis

Table 15.2 summarises the identified conflicts in inter-organisational cooperation relationships of the analysed MNEs' units. They concerned relationships with external customers (e.g. distributors) and in one analysed MNE relationship with an external supplier. In the analysis, we adopt a broad definition of conflicts—we consider that conflicts may manifest themselves with different intensity from day-to-day problems to very serious conflicts, which may threaten further cooperation or the existence of company itself [19]. The identified conflicts mostly arose from various everyday problems regarding operational activities, such as work standards or supply punctuality, financial problems and cultural differences.

Conflicts in three of the analysed inter-organisational relationships of MNE's units were caused by different aspects of operational activities. These included everyday problems regarding product quality and supply punctuality (B, U, X). In these units, the negative situation was not seen as a conflict but rather as a problem—as one of the interviewees stated 'there are always some problematic situations' (U). The next source of conflicts was related to the financial aspects of cooperation. In one subsidiary (ZD), the conflict resulted from financial demands made by a foreign customer which was hard to accept by the MNE's unit in question. In another headquarters (X), the conflict was caused by financial problems of a foreign customer. This customer was responsible for contacts with a very big retailer, and the conflict might have threatened the further existence of the MNE on that foreign market.

Table 15.1 Characteristics of analysed MNEs' units

Company	Industry	Main foreign markets	Year of starting foreign activity	Unit described in the interview	Market described in the interview	Year of starting foreign activity in the described market
B	Production of household equipment	EU, Eastern Europe	1990	Headquarters	Germany	1991
U	Processing of fish	EU, Eastern Europe	2002	Headquarters	Hungary	2010
X	Production of fast-moving consumer goods	Global activity	1995	Headquarters	Germany	2006
Z	Transport of containers in ports and cargo terminals	Global activity	1983	Subsidiary	China	2005
ZD	Production of packaging equipment for the food industry	Post-Soviet states, Germany, selected African countries, CEE, the Balkan countries	1993	Subsidiary	Kenya	2007

Own study

Table 15.2 Sources, actions and outcomes of conflicts occurring in inter-organisational relationships of MNEs

Company	Conflict description	Sources of conflict	Actions taken to handle the conflict	Effects of conflict
B	The company entered a German market where the customer required products of better quality. These products were not offered by the MNE since the company had an old-technology production line. Due to problems with the organisation of work, the MNE could not assure delivery times on the German market	– Everyday problems regarding operational activity, quality of products and supply punctuality – Cultural differences regarding the organisation of work and procedures	– Formal actions—referring to procedures – Formal actions—changes in the organisation of work as well as improving product quality and supply punctuality – Importance of attitude—being open to learning	– Positive impact on trust and reliability in the relationship – Strengthening of the relationship – Positive impact on the unit's development and development's growth rate – Positive impact on other MNE's unit in terms of product quality and organisation of work
U	The customer on the Hungarian market asked the company to produce special packaging of the product dedicated only to this market. Meeting this request would be costly for the company and ineffective since the market is relatively small and the demand would not compensate for additional costs of new packaging	– Everyday problems regarding the quality of products and supply punctuality – Problems with communication – Financial aspects of cooperation: the customer's demand to adapt the product to local needs, which resulted in additional costs (adaptations regarding language differences)	– Joint effort of both business entities to solve the problem and look for a compromise	– Strengthening of the relationship – Positive impact on company's growth

(continued)

Table 15.2 (continued)

Company	Conflict description	Sources of conflict	Actions taken to handle the conflict	Effects of conflict
X	The MNE had to modify the product so as to adapt to the requirements of the local customer (a distributor) who was selling them to a big, local retailer (sometimes it meant production only for that market, since elsewhere these products were too expensive). Additionally, this customer (with whom the company was cooperating for 5 years) had financial problems and went bankrupt. The company encountered also with the same customer problems as the effect of cultural differences (mainly problems with the German language)	– Everyday problems regarding supply punctuality – Financial aspects of cooperation: financial problems of customer – Financial aspects of cooperation: final customers' demands for products of better quality, with certified ingredients which were dedicated only for that market (were too expensive to sell them on other markets)	– Formal actions—clearly sticking to the rules – Formal actions—obtaining certificates – Joint effort of both business entities to solve the problem – Bearing additional costs to solve the problem – Hiring people who could speak German and delegate them to work with local customers – Hiring a German-native person in the MNE's headquarters in Poland to work with the German unit	– Strengthening of the relationship (with new customer) – Positive impact on unit's growth – Positive impact on the MNE's growth—certificated and more advanced products developed for this foreign market allow further expansion on other markets

(continued)

Table 15.2 (continued)

Company	Conflict description	Sources of conflict	Actions taken to handle the conflict	Effects of conflict
Z	The external supplier had a different attitude towards safety standards which were required within the MNE. Supplier was also looking for better deals despite the existing contract with the MNE. MNE while entering the Chinese market offered a special training concerning cultural differences and business etiquette; however, during the cooperation with Chinese partners, the problems of cultural issues appeared	– Everyday problems in terms of safety standards and organisation of work – Cultural differences in terms of business etiquette in Poland and in China such as reliance and trustworthiness of the partner (e.g. the uncertainty if the negotiated contract will be realised) – Problems with the loyalty of local suppliers	– Formal actions: sticking to the work standards and Scandinavian organisational culture which aims at 'win-win' results – Referring to local experts to solve problems – Bearing additional costs—investment in employees' competences	– Strengthening of the relationship – Positive impact on the unit's development – Obtaining knowledge on handling cultural differences by the MNE and external supplier helped diminish potential conflicts in further collaboration
ZD	The MNE decided to enter the Kenyan market and started the cooperation with a local customer. However, the cooperation was encountering problems due to incompatibility in the MNE's and customer's mutual expectations: the MNE was looking for bigger market share, for which the customer was expecting a higher financial compensation	– Inter-personal problems connected with misunderstandings – Financial aspects of cooperation: high financial requirements of the customer – Cultural differences in terms of attitude to work standards	– Joint effort of business entities to solve the problem and look for a compromise (more effort on the part of the ZD unit) – Bearing additional costs to solve the problem which allowed the handling of the problem on a short-time basis, but was insufficient to solve the problem on a long-term basis	– Termination of the relationship

Own study

Specific to international activity were the different aspects of cultural differences which were listed as a source of conflicts, mainly in inter-organisational relationships with foreign customers (B, U, X, ZD) but also with the foreign supplier (Z). Three specific problems were identified in this respect. The first was the difference in attitudes to work and safety standards or work organisation (B, X, Z, ZD), which results from cultural differences (the differences were between Poland vs. Germany, China and Kenya). These problems and conflicts appeared in the internationalisation process despite the actions aimed at dealing with psychic distance and differences in business etiquette taken by MNEs before entering the market (X, Z). The actions were: language courses, business code workshops or hiring employees who spoke the local language and had knowledge about the foreign market. The second specific problem with a cultural background involved local final customers (U, the MNE makes products sold by distributors to final individual customers in Hungary): they wanted products with labels in Hungarian which meant extra costs for the MNE because the size of the target market was limited. This is an example of how indirect relationships (with individual customers) influence the conflict situation in direct inter-organisational relationships (with external customer—distributor). The third aspect concerned problems stemming from inter-personal relationships (ZD). The cooperation with local customer was initiated based to some extent on informal relationships. These informal relationships on the one hand helped to start the internationalisation on that specific market but on the other, they inhibited, for a short time, a positive, for the MNE, conflict handling.

The most frequently reported approach to handle conflicts in inter-organisational cooperation relationships was to take formal actions (B, X, Z). These actions included establishing new procedures or referring to existing ones (B, X), offering workshops on cultural differences (X), obtaining certificates confirming product quality (X) and introducing common work standards based on the organisational culture existing at the MNE's headquarters (Z). The introduction of new procedures was vital to the expansion on the foreign market as the existing procedures were not acceptable to foreign customers, especially in terms of product quality or meeting the punctuality of deliveries (B, X). Other actions taken to handle conflicts were the organisation of workshops on cultural differences or on business etiquette. One of the analysed MNEs (X) introduced a workshop for the employees who were to work with the German customer and hired a German-speaking person in its headquarters to deal with that customer. With the development of the cooperation and the MNE's presence on the German market, the company hired another German-speaking person in its headquarters and also employed a German native to work in Poland for this German customer. As the key informant stated (X): 'German people like to talk in their native language—they appreciate this possibility'. The next approach in handling conflicts in inter-organisational foreign relationships concerned obtaining certificates of the product quality (X) which was the necessary condition to continue the cooperation on that foreign market. Key informants stated that other formal actions of conflict handling required the introduction of common work standards (Z). One of the reasons was that the MNE's headquarters was in Sweden and the company's organisational culture was aiming at achieving a commonly shared solution so as to obtain the

'win-win' situation. The key informant added (Z) that 'the potential conflicts should be neutralised or prevented'.

Another approach to conflict resolution was to improve the atmosphere of cooperation by both partners making efforts to resolve the conflict and reach a compromise (U, X, ZD). This can be classified as more informal action towards conflict resolution. The interviewed key informants stressed the importance of common goodwill and determination to resolve the conflict. They were open to find a mutually positive solution that would be acceptable for both sides (U, X, ZD). According to one key informant (X), 'one feature of a crisis is that when you get out of it, you are stronger'. Actions focused on improving the attitude to cooperation also included a willingness to learn (B, Z). In these MNEs' units, the two key informants admitted that they relied on knowledge and developed competencies to be able to handle the conflict with external business entities in a positive way. These competences included mainly the ability to work in a culturally diversified environment with distinct business requirements. This focus on the development of employees involved extra costs, but was, however, perceived as an investment in their competences. As one key informant (Z) said: 'any coexistence with other cultures causes an additional challenge in the form of bridging cultural differences'. In another MNE, the cooperation aimed at creating a new product that was the condition for staying on that foreign market (X). It incurred additional costs because the product was of the excellent quality but as the key informant said (X) 'there were repair actions, there were costs, but we played fair and we may continue on that market'.

As already noted, most of the key informants and their MNEs' units were dedicated to finding a solution and resolving the conflict so that it would not jeopardise further cooperation with their customers or suppliers. As was stated by one key informant (Z): 'just as soon as the promised orders were forgotten, the turbulences and misunderstandings were forgotten just as quickly'. One of the common solutions for conflict handling was improving communication. As another key informant (X) stated: 'communication has contributed to the fact that successes have been, despite all, achieved'. Many key informants stressed that another important element was a quick reaction to a conflict situation and a mutual willingness to handle it in order to obtain a positive solution (B, U, X, ZD). As was stated (B): 'if problems are managed quickly and effectively, they do not have a negative impact on the cooperation and relationship between partners'.

The willingness to incur extra costs was identified as another way of handling conflicts in inter-organisational relationships of the analysed MNEs' units (X, Z, ZD). Key informants were aware that due to additional costs that appeared during conflict and actions to handle conflicts in a positive way, the MNEs were able to sustain the relationships and continue internationalisation in a chosen, foreign market. The costs helped the MNEs' development due to new product invention (X) or the increase in employee competences (Z). In one case, the extra costs were allocated for the increase of the customer's operating costs in a foreign market (ZD).

The conflicts identified in the four analysed foreign inter-organisational relationships of MNEs' units had mainly positive outcomes. As one key informant (X) summed up problems on a foreign market: 'we have started nearly from nothing, and

now, we have almost all the time a linear growth [on that market]'. In nearly all of the analysed MNEs' units, they enabled the MNEs to strengthen their relationships with customers (B, U, X) or supplier (Z). According to one key informant (B): 'a problem situation is an opportunity to check the partner, and partners do not run away from problems. On the contrary, they try to analyse the problem quickly and end the conflict'. However, in one unit of the MNE, the conflict did lead to the termination of the external relationship (ZD). It was caused by the mutual inability to meet the requirements—the MNE could not afford to fulfil the customer's financial requirements, while the external customer was not able to expand the MNE's activities on nearby markets. According to the key informant, the financial aspects of conflict were difficult to resolve since the cooperation was based rather more on informal relationships than on a formal basis. Additionally, the MNE's unit and its partner were not equally engaged in the relationship and were not dedicated to resolving the conflict to the same extent. That is why MNE decided to end this external relationship.

With respect to the impact of conflicts in inter-organisational relationships on MNEs' activities, the interviewed managers also reported positive effects. In their opinion, the conflicts had a positive impact on the development of their MNEs' units (B, X). MNEs obtained new knowledge and competencies that enabled them to develop their own skills, working procedures or product standards and in effect be more competitive in the foreign market. The experience and know-how gained from the cooperation were afterwards used to further the MNE's internationalisation process.

15.5 Discussion

The identified conflicts in foreign inter-organisational relationships of MNEs' units were not severe: they were mainly triggered by everyday problems, supply punctuality or cultural differences. Regardless of the source, in the majority of analysed MNEs' units, we have concluded that conflicts had a positive effect on the external relationships themselves and the MNE's activities.

It can be argued that MNE units which operate in foreign, diversified markets are more aware of having a well-established corporate culture and formal procedures in place. It is likely that these elements helped these units handle conflicts in a positive way. Some interviewed managers actually admitted that faced with conflict situations, they acted according to procedures and took formal actions. With the formal approach to conflict resolution, a similar course of action is taken throughout the whole MNE's internationally dispersed network of relationships, which may have a positive influence on its international activities. The existing literature on MNEs presents actions to be taken to handle conflict mainly on the inter-personal [13] or inter-unit level [27]. We have found that the analysed MNEs decided to take formal actions also at the inter-organisational level. The formal actions concerned introducing new or modifying existing procedures on inter-organisational cooperation, improving the quality of products offered to external entities and obtaining certificates

confirming the product's quality. The other formal actions consisted of modifying or implementing the new rules or common work standards of cooperation. These results confirm the previous research that actions including technical aspects are an important element of conflict handling [5]. In the analysed MNEs' units, these formal actions were of special importance in conflict handling since MNEs often operate in markets that are culturally distant. Formal procedures, common rules of cooperation or work standards may prevent some potential conflict situations emerging from cultural or legal differences. Outcomes of the above-mentioned conflict handling actions were the increased level of mutual trust and the unit's development and growth. In one case, the knowledge of product development and certificates gained on one market allowed the company to be more competitive on other foreign markets. Another important group of more informal actions undertaken by the MNE units to handle conflicts in inter-organisational relationships was related to knowledge management and ways of improving communication and learning. MNEs operate in markets that are characterised by different culture, language, a different approach towards the reliance on agreements or towards collaboration and relationship development. These elements result in attributing special attention to actions that support knowledge transfer between the different entities involved, both in a more formal but also informal way. In order to improve learning and communication, the analysed MNEs offered language courses or business etiquette courses for their employees. Another solution that MNEs undertook was hiring people with required competences (e.g. a native from the foreign market in the local MNE headquarters or people with language skills) to their units or headquarters. The next action related to knowledge management and learning was the introduction of a common organisational culture which aimed at the development of knowledge management tools. The analysed MNEs referred to local experts or invited employees and external entities to work together to solve the problem. The effects of these actions helped MNEs to improve communication and enhance learning. In effect, the key informants stated that the inter-organisational relationships were strengthened. In some cases, these actions prevented the relationship from ending and allowed further expansion on a foreign market.

The study showed that managers were aware of the need to handle conflicts in foreign inter-organisational relationships appropriately. This confirms previous research findings which indicate that a conflict can bring positive effects only when there is 'managerial involvement aimed at reducing negative emotions in personal relationships, increasing abilities to resolve conflicts as tasks and encouraging open norms in resolving conflicts of tasks and processes' [7, p. 1064]. Another important aspect of international business activities is cultural differences. They influence MNEs' international development and impact the learning abilities on new markets [30]. MNEs and their units operate and cooperate internationally in many foreign markets and thus deal with a number of foreign business entities and run a higher risk of conflict. The interviewed key informants were aware of cultural differences and their possible negative impact on cooperation and foreign inter-organisational relationships. However, adaptation to the cultural environment was not always perceived as the right solution in which case cost analysis was used as a way of choosing the right

course of action. MNEs as large organisations can sometimes afford to bear extra costs in order to resolve conflicts. However, as the example with cultural differences indicates, a MNE will only be willing to bear extra costs if this is likely to bring positive financial effects in the future.

Although it has been demonstrated in earlier studies that conflict has a negative impact on different characteristics of relationships (such as trust) between foreign entities [14], this tendency was not confirmed by the interviewed managers of MNEs' units. On the contrary, the results show that properly handled conflicts may have a positive impact on trust and contribute to a strengthening of the inter-organisational relationship. The analysis also shows that, when properly handled, conflicts experienced by MNE units can have mostly positive effects on their relationships and international activities. The positive effects manifested themselves in most of the cases in the strengthening of inter-organisational relationships. Foreign entities could see that MNEs are making an effort to handle the conflict and to find a mutually beneficial solution which would prevent further problems in the cooperation. These actions helped MNEs to prevent potential problems linked to the culture and cultural differences during the further internationalisation process. Our analysis confirms the findings reported by Vaaland and Håkansson [25] and by Finch et al. [7], which indicate that conflict can increase the perceived value of the relationship. Conflicts described in our study helped partners to analyse the sources of conflict in foreign business relationships and to find ways of resolving them. The analysis revealed that in some situations, the termination of the relationship was thought to be the best solution. In that specific case, the MNE was trying to maintain this relationship as the market was promising, and the MNE had already made some investment in the relationship. It was possible only on a short-term basis. After some time, and in continuous conflict situations, the analysed MNE decided to end the relationship because it was unprofitable in the long term. However, it has to be emphasised that such a termination did not have a negative effect on the unit's general development. This shows that sometimes termination of the relationship is the best solution to the problem.

15.6 Conclusions

The results of the study contribute to the existing, rather limited, body of literature by analysing sources and outcomes of conflicts occurring in foreign inter-organisational relationships maintained by units of MNEs and by identifying actions that can be taken in order to handle conflict in a positive way.

Our analysis has practical implications. It can be used to formulate recommendations for managers on how to handle conflicts in foreign relationships in order to reduce the negative consequences for both the MNE unit itself and the whole MNE. Cultural differences between business entities as well as operational problems are

common sources of problems that MNEs encounter during their international activities. In order to diminish the negative impact of conflicts in inter-organisational relationships, managers can take formal actions, such as following rules and established procedures, or bear extra costs to resolve the problem. Another approach involves more informal strategies, such as making a joint effort to solve the problem, looking for a compromise or knowledge management including openness to learning. As the analysis shows, it is not always possible to achieve a positive conflict resolution, and in extreme cases, the termination of the inter-organisational relationship is the only possible option.

The presented analysis is not free of certain limitations which simultaneously set the directions for further research. The conducted study is of qualitative character that enables an in-depth analysis of the research problem, however, does not allow the drawing of generalisations. Thus, quantitative study would enable to formulate statistical conclusions. Another limitation is linked to the particular country setting of the analysed MNEs and their units. All of the analysed units were based in Poland, and we have conducted interviews only with Polish MNEs' representatives. As the assessment of conflicts in relationships is at least partly constrained by the perception of particular individuals, we may assume that managers from units based in different counties could assess conflicts differently. This suggests that detailed single-case studies including interviews conducted with representatives of MNE's several units and representatives of external business entities should provide more complex information on conflicts in business relationships. Because MNEs and their units, both headquarters and subsidiaries, maintain a diverse network of relationships in foreign markets, the risk of conflict is always high. Further research should, therefore, concentrate on a more detailed analysis of ways how to handle conflicts and their effects on relationships and on the international activities of MNE units. In particular, research should focus on investigating the differences in conflict-handling strategies within coopetitive relationships, especially how the type of coopetition (that is coexistence, cooperation, *competition, coopetition*) impacts the conflict handling and the outcomes for both business partners. Additionally, it would be useful to conduct more detailed single-case studies aimed at the analysis of internal conflicts within the MNE network and assessing them taking into consideration the different actions used to resolve them.

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Chapter 16
Dynamics and the Dynamism of Strategy in Inter-organizational Network—Research Project Assumptions

Aleksandra Sus and Michał Organa

Abstract The main conceptual goal of this article is to present the preliminary assumptions of the planned research project focused on the influence of strategy dynamics and dynamism of inter-organizational network strategies on the overall development of network systems. Primary focus was put on the comparative aspects of centralized and decentralized networks (considering decisional centralization). The elaboration defines basic conceptual categories, i.e., dynamics and dynamism of strategy, as well as the results of these inter-organizational network activities in the form of their development. The main research assumptions and research questions were indicated in the text, as well as the main goal of the planned research was determined. This main research goal is formulated as the detailed analysis of relations between the strategy dynamics of inter-organizational networks (centralized or decentralized) and network development in the sense of increasing the effectiveness of activities within the considered systems. Moreover, the article presents fundamental, theoretical backgrounds of main categories, which are dynamics and the dynamism of strategy, analyzed within inter-organizational networks. The paper includes also main information about future research methodology, based on quantitative methods with the use of research questionnaire created with the focus on the scale of semantic potential. Issues described in the paper are mostly located within the evolutionary trend, in which the strategy takes the form of adaptation to widely understand variability of the organizational environment. The article is a part of a studies series on the dynamics of inter-organizational networks and a conceptual approach to analyzed issues.

Keywords Strategy dynamics · Dynamism of strategy · Inter-organizational networks

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16.1 Introduction

One of the main strategic management research areas is the notion of strategy, understood as a specific planning formula, an element of a larger venture, which is a strategic management process,[1] striving to achieve the organization's objectives [68, p. 9]. Despite being the most studied and analyzed area of management, paradoxically it is still one of the least understood. The reason is twofold: a significant number of definitions and considerable variability of conditions that organizations have to operate in [28, pp. 43–61]. As a consequence, there are difficulties in clearly defining the range of factors determining the concrete definition of the essence of strategy.

Defining the strategy[2] emphasizes the relevance of factors coming from the environment, and their impact on company's strategic activities [4], focus on resources [8] necessary to achieve strategic objectives [30, 67], the impact of sector elements on strategy effectiveness [44, 45], effects of strategy realization in the form of gaining competitive advantage [31, 46], and organizational development [5, 60]. Nevertheless, still few theoretical approaches take into account variability of strategy in real time. Therefore, it is assumed that the strategy is rather a piece of information about the company's plans for interested entities or determining the main strategic directions than the active and dynamic path of the company's strategic activity. It seems nowadays that the most accurate definition of strategy will include in its implementation (and thus in defining) its process character, which consists in its automatic emergence from phenomena that occur in the environment. This is in line with the evolutionary approach. The main difference between deliberate and emergent strategy is the fact that the first one focuses on guidance and control, while the other on the process of strategic learning [33, p. 270].

The emergent strategy does not really mean chaos, but an unintended order, which often means deliberate, considerable change. The essence of this strategy lies in adapting the organization's internal area to changes taking place in the environment. Such a strategy does not mean that management is out of control, but rather that it is open and responsive to change, and is flexible and strives for organizational learning. These features provoke managers to act before they fully understand the nature of undergoing change [33, p. 271]. According to H. Mintzberg, a purely deliberate strategy prevents strategic learning due to the fact that it is formulated on the basis of historical experience and data from the current period, in contrast to the emergent strategy, which is the organization's active response to the transformation of its environment. In practice, both strategies occur simultaneously, and therefore, strategic learning is combined with control [32, p. 79].

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[1] I. Ansoff was the first to outline differences between strategic planning and management. The author added to the management area: internal elements of the organization, implementation and control in the strategy formulation process, social and political aspects of the environment and the adaptive approach, thus creating the so-called "planned learning" of the organization [24, p. 382].

[2] A comprehensive analysis of "strategy" category definitions that appeared during the years 1962–2008 was presented by: Ronda-Pupu and Guerras-Martin [53, pp. 162–188].

Therefore, analyzing historical conditions, real needs of enterprises and lack of consensus in the understanding of "strategy" category, there was a need for an unambiguous definition of modern strategy, in the context of dynamic changes that enterprises undergo. Therefore, the considerations relate not so much to the definition of the strategy itself (although the points of its dynamics evaluation result from this analysis), but rather expressing the strategy dynamics and its dynamism. It is worth to explain that in the remaining part of the article, the term **dynamics** is understood as forces or properties which stimulate growth, development, or change of an organization. **Dynamism** is understood as an organization's quality of being dynamic.

In turn, the main subject of planned research is enterprises entangled in inter-organizational networks, due to the growing importance of these relationship systems in the modern business world. In addition to the definitional considerations, the article attempts to identify main discriminants of strategy dynamics and formulate future-oriented research proposals. **Therefore, the main research goal for the planned research process is the detailed analysis of relations between the strategy dynamics of centralized and decentralized inter-organizational networks and network development in the sense of increasing the effectiveness of activities within the considered network systems**. According to the authors' subjective opinion, the indicated strategy dynamics is strongly conditioned by the influence of internal and external factors (generated inside and outside the considered network system), as well as the dynamism—understood as overall potential to be dynamic, represented by the triad of chosen factors: propensity to risk, skills of identification, creation and exploitation of opportunities, as well as leadership skills of managers.

Above-mentioned theoretical elements create the field for further research. The authors plan to use quantitative methods to realize the formulated goal. It is assumed to prepare two stages of research—a pilot study (with strongly targeted choice of research objects) and a final study (after adapting research tools basing on the results of pilot phase, as well as defining a representative research sample). During both mentioned stages, research questionnaires will be created mostly with the use of the scale of semantic potential.

The article is the continuation of the previously chosen topic, which is dynamic strategic management in inter-organizational networks. The article is a part of conceptual framework creation (in the initial stage), preceding the empirical research process in mentioned areas.

16.2 Dynamics and the Dynamism of the Strategy—Theoretical Assumptions

Continuing the topic of H. Mintzberg's approach to the strategy, it should be emphasized that he was the first researcher who gave the strategy a procedural character. What is more, the dynamics of this category can be analyzed only in the strictly functional sense, non-factual form. This conclusion becomes particularly important

at the stage of refining research proposals—in the form of questions and research hypotheses. Therefore, the general assumptions are the conclusions derived from empirical studies proposed by Quinn [50, p. 36], which include:

(a) effectiveness of strategic processes depends on balancing between formal planning systems and irrational factors resulting from individual characteristics of decision-makers (propensity to experiment and risk, creativity, and intuition);
(b) effective strategy emerges from series of strategic subsystems, each of which involves specific strategic decisions made and realized by the organization's representatives (acquisition of new companies, sale of existing activities, structural reorganization of the company, and relations with environment), through formal activities, but emerging incrementally and opportunistically;
(c) efficacy of each subsystem's logic is, to some extent, based on the normative approach when formulating key elements of large organizations' strategies;
(d) due to cognitive and procedural limitations, almost all of these subsystems (including formal planning) must be managed and combined together as a result of a specific approach, described by the so-called logical incrementalism;
(e) mentioned approach is not chaotic, but rather a purposeful, effective and proactive technique of improving and integrating rational (analytical) and irrational (behavioral) aspects of the strategy formulation process.

Contrary to common belief, strategy is a product of target plans and emergent changes being the result of learning processes and gaining experience—both by managers and organizations. The process of building strategy is determined by cultural, political, and historical factors as well as by the influence of the environment—therefore, it cannot be fully rational [37, p. 84].

As a consequence, the strategy takes on the adaptation form—in a detailed view the form of coevolution (coevolving), i.e., symbiosis between the participants of the organization, resulting in forming strong bonds that are crucial for undertaking joint activities. These ties determine self-organization, which means spontaneous transformations of the organization as a result of entities cooperation.

The main goal of these activities is to improve efficiency of their cooperation within the organization's changing environment (variable context). The foundation of strategy is, therefore, an incremental decision-making model, with the primary objective stated as obtaining the consent for adopted solutions declared by these process participants, and not its optimization due to adopted criteria (games of interests). The strategy arises as a result of minor and piecemeal comparisons, specific proposals, which are often slightly different from each other, without astute insight into the overall company's situation, due to lacking information. In the literature of the presented topic, this model is known as disjointed incrementalism, a term coined by the political scientist C. Linblom [54, pp. 459–460]. In turn, in the theory of organization and management, the model—based on political and social relations—is called the organic model.[3] In this approach, an organization is influenced by a

[3] An important feature of the organic approach is interdisciplinarity and integrity of strategy in the form of knowledge accumulation and stimuli from the social, economic and legal environment,

variety of groups, none of which is able to push through its solution. As a result, negotiations and power are main mechanisms for making decisions [2, p. 509].

Therefore, the strategy arises in a growing manner, as the experience is gained and based on proven patterns, being a combination of intuition, logic, and empirical approach [57, p. 37].

If the strategy is created in a rational-intuitive manner (what means that during the implementation of the strategic plan, specific situations can be additionally included—those that were previously ignored or omitted), it is necessary to consider antecedents and consequences of the strategy. For this purpose, considerations of M. A. Peteraf and W. J. Ferrier can be utilized. The authors present a matrix of the most important theoretical, phenomenological, and empirical similarities of strategies bearing dynamic signs. Strategy dynamics is described in the language of its changes in shaping competitive skills, focused on strategic change (adaptation). The authors, analyzing the literature of the subject, pointed out that the category that appears in adaptive strategic processes is the strategic change. This, in turn, results from the variability of the environment [42, p. 23]. Changes within the organizations' environment and internal area create opportunities, the use of which or resignation from their application—makes a solid foundation for organizational development. Excessive risk-taking, capturing opportunities that are not part of the company's mission can lead to a reverse situation, i.e., a business failure. Therefore, not only control tasks must be carried out over these processes, but in a broader sense—leadership activities. The triad: "propensity to risk–opportunities–leadership" becomes then the key foundation for the dynamism of strategic activities, leading to a dynamic strategy in inter-organizational networks (Fig. 16.1).

The term "dynamic strategy" in the literature of the topic usually appears in the relation between strategic capabilities and dynamic capabilities [66]. Considerations contained in this study focus, however, not only on the company's ability to integrate, build, and reconfigure owned resources [59], which are the foundation for this concept, according to the authors of dynamic capabilities. Thus, they are the company's mechanisms to achieve a new competitive advantage, based upon specific path dependencies and market positions [58, p. 516].

Dynamics in physics is identified with relationships between factors that cause motion and properties of this movement. The state of stable equilibrium is described by the first principle of dynamics (Newton's first law), according to which if forces are not exerted on the body or forces are balanced (in the context of the network: forces coming from the inside and surroundings), the state of the body movement does not change (the body remains at rest or moves with uniformly rectilinear movement). In turn, the state of volatility will be understood as the degree of instability of factors that affect the process (in the context of the network: the decision-making process and

as well as other elements. Besides, its important distinguishing feature is relevance, which means existence of a consistent, logical connection with the organization's situational context. The organic approach accentuates functioning of the organization in time and space. Time is characterized by continuity and diachronism, or consequences of realized processes. In this approach, the organization is not constans, but rather dynamically transformed as a result of social phenomena changes [25, pp. 36–37].

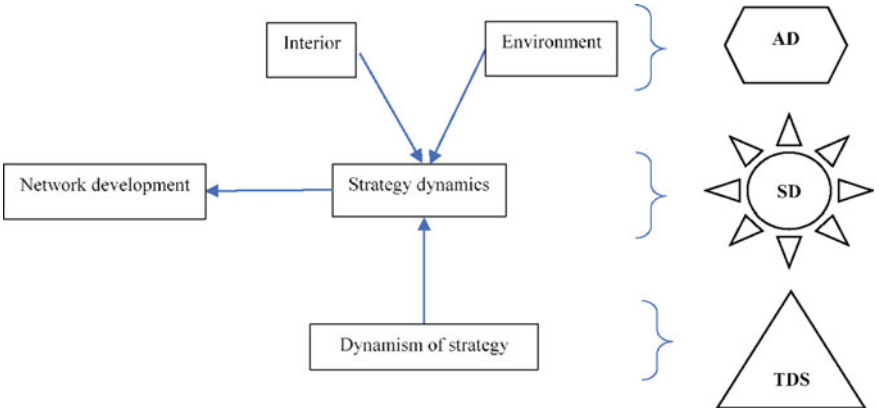

Fig. 16.1 Research concept of strategy dynamics and dynamism of strategy in inter-organizational networks. *Source* Own elaboration

effects of choices made by planners and decision-makers). The more diverse they are (the degree of diversity), the more difficult this decision-making situation becomes, and its potential speculative effects. Various factors can also lead to different types of tensions between members of inter-organizational networks—they are especially probable in case of competitive relationships [10, pp. 26–27, 18, pp. 70–71]. Such tension could then automatically increase the strategy dynamics within a specific network. In the view of conducted considerations, it is also worth to emphasize that described dynamics regards both the organizations-members within the network, but also significantly affects every involved person. This network dynamics imprints a mark on every human being; people change themselves by their relationships with others [63, p. 59].

16.2.1 Strategy Dynamics

Dynamics is usually understood as a form of various types of single or cumulated changes. It is worth to indicate that strategic changes introduced by companies are nowadays not an extraordinary phenomenon but rather ordinary and frequent issues (see Pangarkar [39, pp. 295–296]). In turn, strategy dynamics (SD) means the entity's activities related to changes of strategies implemented so far in the following ranges:

1. total—refers to cyclical, profound changes of strategy in the scope of implemented activities; in characterized areas, changes in following strategies will be analyzed: using opportunities, creating innovation, focusing on key competencies, investing in risky industries with high potential, etc.;

2. partial—implementation of the previous decision trajectory according to the set plan, but using special abilities to monitor both—the internal area and the environment of an organization in order to choose the most appropriate options for further development. Then it seems especially important to adjust to new circumstances and to create work attitudes and methods dedicated to them. The environmental unpredictability and the network-oriented and knowledge-oriented nature of organizations in which considered actions must be taken, make anticipating and matching the most vital issues [15, p. 21].
3. zero—zero-level dynamics means a lack of identification, creation, and use of opportunities by the company, a lack of risky activities and a lack of a human factor (the leader) that controls levels of dynamic activities inside an enterprise. This is a pure form of implementation of adopted strategic assumptions.

The access condition to the analyzed research database will be inter-organizational networks in the total and partial ranges of the dynamics of the strategy.

16.2.2 Dynamism of the Strategy

This is the category determined by the Triangle of Dynamics Factors (TDF). While the concept is not synonymous with the strategy dynamics, it should be considered as antecedent. The mentioned factors include[4]:

1. propensity to take risk and real ability to assess opportunities, i.e., formal and informal risk-taking strategies adopted in the company, recovery programs, dealing in conflict situations, conflicts and crises, as well as emphasis on achieving results, pace of company expansion, lack of experienced employees, internal competition, rewards for daring risk-taking, management's resistance to negative information, complexity of transactions, lack of performance indicators, and degree of decentralization of decisions[5];
2. skills and processes of identification, creation, and exploitation of opportunities, including: vigilance [7, 6, p. 9], prior knowledge, creativity, self-efficacy, social networks [3, 55], entrepreneurial skills [34, p. 26], learning through experiments [12, p. 22], and human capital [62, p. 24];
3. leadership skills of managers—due to the multiplicity and variety of factors determining leadership, it was decided to choose those that directly affect the dynamics of the strategy in the context of leadership. To the most important following can be included: motivating to take risks, but also due to decision-making caution when using and generating opportunities, ability to coordinate activities of many independent entities connected by common goals within the conditions of complex network systems. Nowadays, the last of listed factors seems to have

[4]This is the first layer of antecedences. Perhaps during the research additional results will be obtained that testify to the remaining critical elements affecting the dynamism of the occasion.

[5]Elements of the risk exposure calculator [56].

undeniable significance, especially in reference to the so-called network myopia phenomenon, causing that "managers may be narrowing the number and diversity of relevant actors to manageable levels, making their extended network largely invisible" [14, p. 116]. Therefore, leadership is seen here not only in the perspective of formal authority but primarily in the view of complexity leadership theory, as the emergent and interactive category focused on complex interactions during common actions and introduction of changes, generation of new behaviors patterns, as well as new methods of work. The authors perceive leadership within inter-organizational networks as a dynamic category, which changes along with the phases (or stages) of its development. This is reflected mainly by the variability of leadership manifestations in the subsequent phases of networks' life cycles. The TDF forms the basis for creation of research assumptions and questions presented in the research part of this article.

16.2.3 Interior and Environment

The internal area of the organization and its environment are the main determinants of strategic changes, which can generate both threats and opportunities for inter-organizational networks. Depending on a load of innovation and the degree of uncertainty (ambiguity), strategic activities of allocating, constructive, imitating, and revealing character have been identified, which constitute a range of actions determining the strategy dynamics. These activities are planned to correlate with specific strategic activities located in specific network strategies.

In turn, the intensity of an environment's variability may depend on two basic factors, namely a) the nature of environment's elements variability affecting the transformation of strategic decisions (static vs. dynamic) and b) the number and variety of factors affecting the decision processes (simple versus complex). These dependencies are presented in Fig. 16.2.

The dynamic strategy will be located within the fourth quarter as a result of the complexity and variability of surrounding elements. It applies to entities that are able to identify key changes in the context of their core business, use opportunities or create opportunities and can minimize the risk of strategic changes.

16.2.4 Network Development—Results of the Dynamic Strategy

The network's development, which was interpreted as increasing the value of the net, is considered as the primary effect of the inter-organizational network strategy dynamics. Thus, it will be conducted an attempt to determine the exact percentage increase in the network revenues within the assumed period, as well as to analyze its

nature of environment's elements variability	number and variety of factors affecting the decision processes: simple	number and variety of factors affecting the decision processes: complex
static	**I: low level of uncertainty** – a small number of factors and components in the environment; – environmental characteristics are homogeneous; – factors and components remain the same and do not change or change slowly, and this change is predictable;	**II: low or medium level of uncertainty** – a large number of factors and components of the environment; – environmental characteristics are homogeneous; – factors and components remain the same or change in a predictable way;
dynamic	**III: high or medium level of uncertainty** – a small number of factors and components in the environment; – environmental characteristics are homogeneous; – factors and components change quickly and unpredictably or difficult to predict;	**IV: high level of uncertainty** – a large number of factors and components of the environment; – the environmental characteristics are diverse; – factors and components change in an unpredictable way or are difficult to predict;

Fig. 16.2 Dimensions of the organization's environment in the context of decision uncertainty. *Source* Own elaboration based on Duncan [17, p. 320]

market shares. In addition to financial values, network development was defined in the context of the network stakeholders' satisfaction.

The new logic of the inter-organizational network's dynamic strategy allows to formulate conclusions, which are presented in the next part of the article.

16.3 Dynamics and the Dynamism of the Strategy—Research Assumptions

The accumulation of strategic thoughts and related theories, as well as various definitions of strategy, provokes simplification of existing descriptions of reality. Using existing attempts to classify evolution of strategy, the simplest one was chosen, which positions theories in three major eras. The first era is the strategy of the portfolio of businesses (circa the 1970s), which is based on gaining an advantage based on economies of scale, and strategic thinking uses the concept of learning and the curves of experience [19, pp. 197–203]. In this period, the concept of the BCG curve is created, which emphasizes the needs of enterprises in the scope of seizing the dominant market position and thus generating the competitive advantage [22, pp. 12–13]. This is also the period of physical assets significance for rivalry deterrence [16, pp. 187–195], positioning business for competitive advantage [20, pp. 329–343, 44],

and broader environmental analysis for strategy [1, 43]. The second era is called the era of strategy as a portfolio of capabilities (ca. mid-1980s). This is the foundation of a resource-based view to the company, where the concept of key competencies arises [23, pp. 273–294, 48, pp. 79–91], and also leveraging relatedness across business [29, pp. 149–166, 47, pp. 485–502] and leveraging intangible resources [69, pp. 76–92]. The evolution of strategy concepts based on subsequent perspectives with the emphasis on the most important concentration points was presented in the paper by Venkatraman and Subramaniam. These authors identified the three eras of the strategy evolution, which are [65, p. 462]:

1. Era 1—focused on the portfolio of business and economies of scale, where key resources were physical assets and the key concept leverage industry imperfections; in that era, dominant view was concentrated on positioning the company in the environment;
2. Era 2—emphasized the portfolio of capabilities, where key resources were organizing skills for managing relatedness across businesses, and the key concept relies on leverage intangible resources; the second era focused on inimitability of processes and resources;
3. Era 3—underlined the portfolio of relationships, where the key resource is a position in the network of expertise, and the key concept is to leverage intellectual capital; the third era's dominant view was network centrality.

In the third era, the attention of enterprises focuses on generating a portfolio of relationships that can be standard outsourcing or be a more sophisticated form of creating capabilities between partners, using complex forms of cooperation. In this approach, cooperation arises as a result of a lack of required skills, know-how and the need to reconfigure complementary capabilities, necessary and relevant in the changing circumstances of the business environment. Expertise era is characterized by the creation of a network of relationships, the aim of which, as opposed to reducing transaction costs, is to develop mechanisms to identify, create, and use a broader range of expertise necessary for strategic adaptation. These processes go beyond the boundaries of traditional industrial branches, and the portfolio of established relationships significantly differentiates companies in terms of intellectual property, resulting in the evolution of corporate strategies involved in these systems and the generation of the so-called economies of expertise [65, pp. 466–467].

During expertise era, which should be treated as the most current and compatible with actual conditions of the business environment, the fundamental emphasis in relation to the formulation and implementation of the strategy was put on the creation of relationships between organizations. For this reason, the authors of this article focus on inter-organizational networks as the main subject of planned future scientific research in a more detailed approach to the issues of strategy dynamics. It is necessary here to clarify the indicated concept of inter-organizational network, due to the fact that there are plenty of different definitions developed so far. According to K. G. Provan, A. Fish, and J. Sydow, inter-training networks are presently a commonly understood phenomenon in the area of the organization's activity, while it is sometimes difficult to clearly identify what types of objects are written by scientists

dealing with the subject matter. Often, the term "network" is replaced by some similar expressions, e.g., partnerships, strategic alliances, inter-organizational relationships, coalitions, cooperative arrangements, or collaborative agreements. However, it is possible to indicate some immanent elements—social interactions, relationships and trust, as well as connectedness, collaboration, collective actions, and cooperation [49, pp. 2–3]—despite different interpretations and perspectives present in various definitions. The question, however, is whether it is necessary to formulate a universal definition of an inter-organizational network. According to the authors, this type of aspiration should be considered pointless. It seems that instead of specifying the category being characterized, it would lead to even greater theoretical and conceptual confusion, due to the fact that the essence of the network cannot be simply defined, but should rather be described in detail [36, p. 9]. In relation to the above, the authors of this article adopted a specific perspective for interpretation of inter-organizational networks through the selection of available definitions, presented in further parts of the article.

The term "network" can be used to define the set of two or more organizations connected by a long-term relationship [61, p. 37]. Other important elements of the network are informal contacts that accompany them, interdependence (in terms of resources, entities, and activities) and the simultaneous absence of clear boundaries and structure [51, p. 29]. According to G. Müller-Seitz, the network is a social system in which joint actions of at least three independent legal entities are coordinated in a repetitive manner. The important thing is that the benefits apply to all interested parties [35, p. 429]. As it is seen, just clarifying the exact minimum number of entities forming the network can be problematic.

Referring to the characteristics of the era expertise (indicated previously), special attention should be paid to the centrality aspect in the case of analyzed inter-organizational networks. It can be assumed that nodes with the highest centrality level will show the greatest impact on other participants of chosen systems. For this reason, many organizations focus on obtaining the central position in a network to which they belong or plan to belong. In turn, centrality itself, as one of the key categories of inter-organizational networks' characteristics "can be defined on the basis of local occurrence in the fragment of the analyzed network, e.g., as the number of direct relations or relations with a certain degree of remoteness" [70, p. 38]. In connection with the above, authors of the article assume selection of a research sample based on the affiliation of network interaction systems to two main types of networks distinguished in relation to the aforementioned measure/category—namely centralized and decentralized inter-organizational networks.

The main difference between discussed types of networks concerns the presence of the main, central (dominant) entity, supervising activities, managing the network, coordinating the creation of its strategy—the so-called network leader able to initiate connections and select the most appropriate partners for the implementation of common goals [52, pp. 19–20]. In centralized inter-organizational networks, in which, according to the name, the mentioned central entity will appear, the strategic business intention will be strongly dependent on that particular node. In the case of decentralized networks, the responsibility for creating the strategy and its joint

implementation—at least theoretically—should apply to all participants of a given co-operation system. The distinction between centralized and decentralized networks is related to other typologies of inter-organizational networks, among which are indicated opposite each other, for example, dominated (star) networks versus network of peers [9, p. 120], unsymmetrical networks[6] versus symmetrical networks [13, p. 49], or monocentric and polycentric networks versus not centralized networks [13, p. 49].

The analysis of selected definitions has made it possible to clarify the final definition of a centralized network, which will be understood as a system of cooperation of at least two organizations, independent and legally involved in long-term relationships based on their potential, in which a company acting as a decision-making center initiating and activating activities of other entities can be identified [38, pp. 72–73]. In order to emphasize the specific role of the central entity, one more definition—by K. Perechuda—should be given: "a network enterprise is a set of independent in the legal sense economic units implementing various ventures and projects coordinated by the integrator company, which has distinctive (key, basic) competences" [41, p. 55]. The node integrating activities of other participants in the network of relations, because of own developed key competencies in this area, can efficiently control the dynamics of the strategy of the entire network system—perhaps much more effectively than in the case of network systems without such a focusing node. This perspective seems particularly valuable because it transfers the interpretive pressure of the central node's role from the category of domination to integration. In turn, decentralized networks can be considered as so-called nodal connection networks in which all participants are equal [26, p. 20] or as "systems that are built on a strong market position of individual nodes included in the network" [11, pp. 49–50].

The authors of this article will, therefore, use the concept of centrality to determine the strategic nature of the cooperation type undertaken within a given inter-organizational network. Centralized cooperation systems are, therefore, based on the clearly dominant position of the central node (the network leader), which has real possibilities (both formal and informal) to impact activities undertaken by other (non-central) entities. In practice, this will involve strategic decision-making capabilities (which can be identified with the network leadership role), but also with the assumption of total responsibility for wrong decisions assigned to the central entity. In turn, in decentralized inter-organizational networks, the dominant entity will generally not exist, which should be interpreted as the equal or partner positions of all other nodes forming the network. Responsibility for successes and failures will, therefore, fall to all participants of a given network system. Analyzing the above information, the selection of research entities for the planned research process will be carried out in terms of belonging to a specific type of inter-organizational network—centralized versus decentralized.

The planned research will have a retrospective character, which means it will cover the period from the establishment of chosen inter-organizational networks under

[6] In an asymmetrical network, one entity (in relation to the power criterion) has a dominant position over other participants in the inter-organizational network.

review to the present time, including the period of the strategic forecast (proposed horizons of three, five, or seven years).

Guided by the theoretical assumptions presented in the article, the general goal of future empirical research is set, based on the analysis of the dynamics and dynamism of centralized versus decentralized network strategies juxtaposed with the category of network development understood as increasing the effectiveness activities realized by the chosen network as a whole. In addition, a research model was adopted for the purposes of the work (Fig. 16.1—presented previously), which allowed to identify the following research assumptions and questions:

Research assumption 1. The strategy dynamics depends on the type of the network system.
Research question 1. Which of the network systems—centralized or decentralized—show a higher strategy dynamics?
Research assumption 2. The higher strategy dynamics results in a greater development of the inter-organizational network.
Research question 2. Does the higher strategy dynamics cause higher development of the network?
Research assumption 3. Changes occurring in the network environment, as well as changes in its individual internal components, cause an increase in network dynamics.
Research question 3A: Are strategic activities of a constructive and revealing nature or those of an allocation and imitation character more important for the development of the network?
Research question 3B: To what extent do the variability and complexity of the environment determine the strategy dynamics?
Research assumption 4. The dynamism of the network strategy depends on the processes of dealing with risk, the use of opportunities and leadership skills of managers.
Research question 4A: What is the difference between the tendency to take risks through the elements of a centralized network and the elements of a decentralized network?
Research question 4B: What is the difference in identifying, creating, and using opportunities in decentralized and centralized networks?
Research question 4C: What are the differences between managerial leadership skills in decentralized and centralized networks?

The adopted research assumptions and research questions are the introductions of the empirical research. Due to their complexity, affiliation to industries will not be taken into account, hence potential research directions are clarified. Concerning the research methodology, it is planned to utilize a quantitative procedure. Statistical surveys will be based on a questionnaire using the scale of semantic potential. With such a high degree of complexity, pilot studies are recommended; therefore, the authors will conduct the preliminary research. The planned selection of the pilot test sample will be based on a purposeful approach. The selection of networks to be included in the planned research will be focused on two main groups of such

systems—centralized and decentralized (in the sense of decisional centrality). The main criterion for the selection of research units in the case of pilot studies is the availability of the analyzed networks while maintaining the homogeneity of the industry in which the networks function. The next stage of the research procedure will be adapting the research tool to the changes resulting from the pilot study and defining the population, as well as a representative research sample. The size of the planned research sample is not yet known.

16.4 Summary and Conclusions

Mechanisms of strategy improvement as a result of evolution and learning are rather criticized in the literature of the subject. K. Obłój, using the garden's metaphor, stated that evolution is a natural process, but as such there are no goals—in contrast to the organization. The costs of trial and error of evolution bear nature, in the case of companies—people: employees, customers, suppliers, and recipients. The immanent organization's ability to learn is also an act of faith rather than a reality—as evidenced by the numerous cases of companies that were not able to learn, neither on their own nor on others' mistakes [37, pp. 97–98]. Also, the way of exemplifying the strategy raises many objections from researchers in this area of management. The authors emphasize the lack of integration of strategic planning with the entire management process, the lack of influence of lower levels of management on the process of strategy creation, without taking into account the comments of those who directly operate in the environment closer to the organization. In addition, an exaggerated application of quantitative indicators of strategy implementation arouses frustrations and misunderstanding among its contractors [27, p. 30]. Concentrations on numbers—and not on qualitative factors, adjusting companies to market conditions and separating thinking from action—these factors also underline Urbanowska-Sojkin et al. [64, p. 41].

The general goal of the planned empirical research (mentioned before) was formulated as the detailed analysis of relations between the strategy dynamics of centralized and decentralized inter-organizational networks and network development in the sense of increasing the effectiveness of activities within the considered network systems. Categories of great importance to diagnose will be then components of dynamism of strategies realized by considered networks, thus defining the possibility of eliminating basic errors related to the strategy implementation seems especially important, i.e., [21]:

1. the lack of strategic goals flexibility. Although they are becoming obsolete, they are still maintained due to the very idea of strategic management and due to the already implemented plan,
2. discontinue minor improvements and initiatives important from the perspective of short-term interests due to the rigid mechanisms of actions related to long-term goals,

3. narrowing thinking horizons only to the strategy provisions, thus limiting the opportunities to seize opportunities.

Problems related to rapid changes in the organization's environment—especially into technologically advanced markets—are becoming equally important. In such cases, the adopted strategy may significantly limit the innovativeness of the organization as well as inhibit the processes related to learning. It is an excuse for not taking innovative actions [40, pp. 21–26].

Barriers to an effective strategy become determinants of its dynamic approach. The importance of strategic improvisation still grows—it requires constant attention and immediate strategic actions within the scope of determined strategic intentions. Because every organization is limited in the use of resources, the speed of strategic movements and their intensity will vary depending on the level of resource redundancy. The goal of strategic improvisation is the accumulation of maximum knowledge and, consequently, instant understanding of changes within the environment—especially their causes and consequences for the organization [40, pp. 6–7].

The article is a description of initial assumptions for planned empirical research. It is a part of a studies series in the area of strategy dynamics and dynamism of inter-organizational networks strategy. This conceptual paper presents then the wide field of author's interest with reference to planned research focused on two various types of inter-organizational networks—centralized and decentralized, distinguished based on the decisional centrality criterion.

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Chapter 17
Significance of Proactive Customer Orientation in Creating Product Innovations in Cooperation with the Consumer

Katarzyna Liczmańska-Kopcewicz and Maciej Zastempowski

Abstract Introducing new, innovative products to the market is nowadays a necessary condition for development in a saturated and demanding market. Customers' expectations are constantly growing, which results in a need for constant reaction to them better than competition does. Customers, by making choices concerning a countless number of goods, demand satisfaction by being ensured both articulated and hidden needs. An interactive dialogue with a consumer, making use of the knowledge it provides, may become a source of leverage in creating innovation. Customer orientation is one of the key elements of an innovative company, and one can also observe its significance in creating new products. The aim of this paper is to diagnose the dependence between proactive customer orientation and creating product innovation in cooperation with consumers in companies from the FMCG sector. The study was conducted on a sample of 165 companies. The results indicate that there is a positive correlation between proactive customer orientation and (a) the evaluation of the significance of the buyers' knowledge in creating product innovations, (b) the number of buyers' sources of knowledge used and finally (c) the assessment of the degree of realising the objectives concerning product innovations. These results suggest that proactive customer orientation seeking cooperation with the consumer can influence the market success of product innovations that are created in cooperation.

Keywords Proactive customer orientation · Product innovation

17.1 Introduction

Innovation is commonly believed to be the key source of competitive advantage in the increasingly turbulent environment [4, 22, 36]. Porter [28] claimed that "competitive advantage is created by the value that a company is capable of creating for

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its customers". Growing customers' expectations and competitive pressure are factors which modify companies' strategies [19] and encourage them to take special interest in customer-oriented strategies. Minding the satisfaction, and consequently, loyalty of their customers, companies strive to constantly provide new solutions in order to cater for the buyers' needs, both the articulated and hidden, as well as future ones [4]. A growing number of companies try to understand the expectations of their customers basing them on relationships, meeting them, creating laboratories or other places where one can observe, identify problems and test solutions. The actions lead to the emergence of numerous innovative products, which are enthusiastically received by markets. The presented approach defines them as proactive customer orientation [4, 24].

During recent decades, there has been a notable interest in innovations and cooperation with customers in the process of creating them [16, 27]. Many of the studies published so far concerned primarily the relations between capabilities and organisational culture and orientation towards the customer with innovative activity. Some studies have proven that there was a strong correlation between orientations towards the customer with innovative outcomes. The studies also indicate that the efficiency of new products can be increased by cooperation with customers by proactive orientation towards them. The extension of the topic of creating product innovations in cooperation with consumer of the FMCG sector seems to be interesting.

The research gap still requires exploration of the influence of proactive customer orientation on creating product innovation in cooperation with consumers by companies from the FMCG sector.

In the course of this study, a review of subject literature has been conducted, along with a presentation of empirical research findings related to innovation and the brand-related strategies employed by companies from the FMCG sector, with special focus on diagnosing the significance of proactive customer orientation in the process of creating product innovations by companies. The aim of this study is to diagnose the relationship between proactive customer orientation and the creation of product innovations in cooperation with consumers in FMCG sector enterprises.

17.2 Orientation Towards the Customer—Theoretical Background

The innovative potential, and at the same time, the prospects for growth and development are influenced, among others, by the culture of an organisation open to changes in the environment [34]. It refers to the values and beliefs that shape the norms of desired behaviours followed by employees [33, p. 580]. Empirical evidence suggests that a company which develops pro-innovation culture may achieve better market and financial outcomes, as well as organisational effectiveness [11, 17, 26, 37]. Pro-innovative organisational culture is a set of shared beliefs and concords within an organisation which determine all its actions embedded in formal and informal

systems, behaviours, competences and processes, and which inspire the search and implementation of innovations [6, 31, p. 1133–1141].

Despite a common agreement that orientation towards the customer may have influenced a company's efficiency, some scholars suggest a direct dependence between the two factors [3, 8, 20], while others claim that orientation towards the customer has varying influence on efficiency-related figures depending on environmental factors and the sector of economy [15].

Engaging in activities that could result in innovative outcomes has become a key imperative for many firms [18]. The ability to predict the customers' needs and reacting to them faster than competitors should generate great benefits for innovation-oriented companies [31]. An increasing number of companies actively identifies and anticipates their customers' needs and reacts appropriately to them, creating greater value for the buyers [22].

Orientation towards the customer refers to a set of actions which put the customer's best interest in the key position, in order to reach a strong competitive position [9, p. 27]. Brady and Cronin [5] noticed that a customer-oriented company benefits from concentrating on the customer, both directly and indirectly. Recent studies in the field of marketing of relations suggest that orientation towards the customer may lead to gaining competitive advantage by exploiting a strong and trustful relation between a company and its customers [30]. On the other hand, involved customers, who believe in the seller's honesty and competence, are key factors for exploration of the company's value. Griffith and Harvey [12] suggested that orientation towards the consumer influences the development and reinforcement of a customer's trust for a company, which in turn has an impact on a company's dynamic potential and efficiency.

Narver et al. [24] define two types of orientation towards the customer: proactive and responsive. The latter one refers to the supplier's ability to effectively react for the purpose of catering for the needs articulated the customers. Proactive orientation, on the other hand, is defined as the supplier's ability to constantly check the customers' hidden needs and discovering the future ones, or possibly offering ideas before the customers realise that they have such a need; from the customer's point of view, it reflects the customers' opinions that suppliers have proactive processes and abilities fit for anticipating the hidden and future needs.

Such a distinction appears to be relevant, as reacting to the needs demonstrated by customers does not take into account consumers' hidden needs, which are potentially important, but hard to articulate [32]. It is a field in which proactive customer orientation plays a crucial role and gains significance in the process ensuring the success of new products [2]. The manufacturer's ability to discover hidden needs by proactive dialogue, conducting consumer surveys or ethnographic studies may reveal early signals concerning customers' needs [32].

The studies conducted by Blocker et al. indicate that customers expect proactive market orientation from manufacturers and are in addition eager to share knowledge, talk about their needs and get involved in creating innovations. The key effect of proactive customer orientation is the involvement of consumers to jointly create product innovations.

17.3 Cooperation with Customers in the Process of Creating Product Innovations

In order to ensure and maintain a strong competitive position, companies must be able to innovate faster and more effectively than competitors. The potential should allow a company to enter a new market, offer new products, reach a new level faster than their competition, or improve the quality before their rivals [22]. The strategy of innovation refers to the innovative position devised by a company, which depends on the competitive environment of its assets and competences [16]. According to Oslo methodology [25], there are four types of innovation:

1. product-related—introduction into a market a product or a service which is novel or significantly improved in terms of their features or uses;
2. process-related—implementation of a novel or significantly improved method of production or delivery;
3. organisational—implementation of new methods of company management, which concerns changes in organisation of workplace or relationships with the company's environment;
4. marketing-related—implementing a new marketing method involving significant changes in the product's design/structure, packaging, distribution, promotion or pricing strategy.

Those four groups of innovations are further divided into technological and non-technological. Technological innovations include product and process innovations, whereas non-technological ones concern organisation and marketing. In this paper, the emphasis is on product innovations.

In marketing-related literature, there is common agreement that knowledge of the market and cooperation between functions are two basic assets which enable successful product innovations [2]. A high level of innovativeness also provides companies with the ability to shape the consumers' preferences and know their basic behaviours and expectations, in order to follow the directions which ensure advantage over others [1, 29]

Currently, the localisation of innovative processes has too large extent undergone a shift from the inside of a company to the inter-organisational space, with integrated relations between manufacturers and their environment allowing companies to gain sustainable competitive advantage [10, 36]. Researchers who study company development strategies more and more frequently focus on cooperation with customers undertaken for the purpose of creating value [13, 27, 35].

Users are considered to be an important source of innovation, and with increased frequency, cooperation with them is becoming a crucial element of companies' innovative strategies [23]. Customer integration in the process of innovation provides new ideas and opportunities to better understand the users' needs and expectations. That cooperation allows a company to make sure that it responds to the market's needs and thus avoids potential losses resulting from faults in creating their offer [14].

Users are one of the key sources of knowledge, with the ability to include end consumers into all stages of the innovation process being considered a relevant factor of innovation capabilities [7]. A thorough insight into consumers' needs is relevant for the success of new products, with a company being able to develop its competence in this field by intense searching for knowledge about a consumer and by cooperation in the creative process.

Cooperation with consumers aimed at creating new products facilitates the market adaptability of those products. An involved customer may provide immense contribution to creating product innovations. In addition, having high product awareness users participate in the creation of innovations which are better tailored, and thus accepted by other users. That is why companies more and more often engage in cooperation with their customers and are increasingly eager to make use of different sources of the users' knowledge.

Proactive customer orientation aimed at the best possible understanding of the needs and expectations of users manifests itself by inviting them to cooperate in creating product innovations. The factor that shows both the willingness to cooperate and how it is implemented is, above all, the assessment of the importance of the knowledge of consumers in creating product innovations. Other indicators that suggest cooperation are the number of sources of knowledge used by users.

Bearing in mind the above elaborations, the following hypotheses have been put forward:

H1. There is a positive correlation between proactive customer orientation and the evaluation of the significance of consumers' knowledge in creating innovations
H2. There is a positive correlation between proactive customer orientation and the number of sources of consumers' knowledge used
H3. There is a positive correlation between proactive customer orientation and the extent of realizing the objectives concerning product innovations.

17.4 Cooperation with Consumers in the Process of Creating Product Innovations

For the purposes of the implementation of the research objective, we made a review of national and foreign literature and we also applied thought mapping. Cognitive methods were supported by our own research. This study aims to diagnose the importance of knowledge gained from consumers in the process of creating product innovations by enterprises from the FMCG sector.

Representatives of management staff of companies operating in Poland's FMCG sector were invited to participate in a study carried out in the period from January 2016 to February 2017. The selection of the sample was deliberate. The study covered those companies that were assessed by their management boards as innovative ones. Yet another criterion for eligibility for participation in the study was the launch of new products in the last three years. Taking into account the research objectives

and the deliberateness of the sample, we decided to choose the interview method implemented via the Internet (CAWI) as our information collection method. In the case when contacting a respondent was problematic, the computer-aided telephone interview (CATI) method was applied. In each case, the same interview questionnaire was used. The survey was carried out using the questionnaire method. Although this article presents partial results of the empirical research conducted, they allowed us to evaluate the sources and inspiration of product innovations in the FMCG sector. Altogether, 165 observations were taken into account. Table 17.1 presents the characteristics of the test sample.

FMCG, i.e. fast-moving consumer goods, is a sector of the economy that includes the so-called quickly tradable goods, also known as basic necessities. This group includes various and broad categories of goods such as food products, beverages and spirits, tobacco products, cosmetics, personal hygiene articles, household chemicals and over-the-counter drugs. These are products whose unit price is not high and are bought in mass quantities. Taking into account the dynamics of the FMCG market development, the global character of all social, political and industrial changes, the brand gains importance as the main tool of competition and the key to the entrepreneurs' strategy. The things that change and how customers adapt their behaviour to new conditions are significant for companies and their brands. Abundant and accessible literature along with market examples prove the occurrence of a strong dependence between the creation of strong brands within the offer and the success achieved by the company [21].

Statistical analyses were carried out using the IBM SPSS Statistics version 24 software package. Altogether, 165 observations derived from enterprises operating

Table 17.1 Characteristics of the enterprises surveyed ($N = 165$)

The questionnaire elements	Volume	Participation in %
Enterprise size		
– Small (10–49 employees)	69	41.82
– Medium (50–249 employees)	61	36.97
– Large (over 250 employees)	35	21.21
Industry		
– Groceries	80	48.48
– Household chemicals	11	6.67
– Personal hygiene articles	7	4.24
– Cosmetics	18	10.91
– Non-alcoholic beverages	22	13.34
– Beer	12	7.27
– Spirits	11	6.67
– Pet food	4	2.42

Source Elaborated by the authors based on the results of the study conducted

Table 17.2 Descriptive statistics of the variables examined ($N = 165$)

Variable	Range	Min.	Max.	Average	M	D	Standard deviation	Variance
Proactive customer orientation	6.00	4.00	10.00	7.01	8	9	1.513	2.288
The assessment of the degree of the achievement of product innovation objectives	6.00	4.00	10.00	7.82	8	9	1.567	2.455
Market success for product innovations	6.00	4.00	10.00	6.77	7	8	1.492	2.227
The assessment of the importance of buyers' knowledge in creating product innovations	5.00	5.00	10.00	7.93	8	9	1.570	2.465
The number of used sources of buyers' knowledge	5.00	4.00	9.00	6.67	7	8	1.658	2.748
Social media activities	10.00	0.00	10.00	8.09	8	10	1.844	3.400
Customer expectations surveys	10.00	0.00	10.00	6.99	7	6	1.826	3.335
Customer satisfaction surveys	8.00	0.00	10.00	6.49	7	7	2.426	5.886
Co-creating new products	10.00	0.00	10.00	3.12	2	0	3.354	11.249
The information exchange platform	10.00	0.00	10.00	3.96	5	0	3.500	12.248
Helpline	8.00	0.00	8.00	0.29	0	0	1.142	1.305
Online forums	10.00	0.00	10.00	6.78	7	9	2.651	7.025
Testing of new products	10.00	0.00	10.00	5.53	6	0	3.773	14.239

Source Elaborated by the authors based on the results of the study conducted

in the FMCG sector were taken into account. Table 17.2 presents descriptive statistics of the variables examined.

17.5 Significance of Proactive Customer Orientation in the Process of Realising the Objectives Concerning Product Innovations—Conclusions from the Conducted Study

The first variables examined were the factors determining cooperation with customers aimed at acquiring consumers' knowledge. They were assessed using an 11-point scale and the Cronbach's alpha coefficient of reliability for the entire group of factors was 0.916. This result indicates the internal coherence of the factors analysed.

The study was started from an empirical problem in the study concerning implementation of proactive customer orientation in creating product innovations.

In order to determine whether in the enterprises examined there is a monotonic dependence between individual factors and proactive customer orientation, used the Spearman's rank correlation coefficient. The results obtained are contained in Table 17.3. They show that all factors are correlated with the proactive customer orientation with a positive and statistically significant relationship. The positive nature of these correlations means that the increases in individual factors in the field of cooperation with clients are accompanied by an increase in the level of the proactive customer orientation. When analysing the correlation strength for r, it should be noted that a moderate dependence (0.4–0.7) occurs in the case of such factors as testing of new products, the information exchange platform, co-creating new products, customer expectations surveys and online forums. A fairly strong dependence (0.7–0.9) was observed for factors: customer satisfaction surveys and social media activities. No factor was found with a very strong relationship.

The next step was to assess the dependence between the degree of the achievement of product innovation objectives, assessment of the importance of consumers' knowledge in creating product innovations, number of used sources of consumers' knowledge and proactive customer orientation, using the Spearman's rank correlation coefficient. The correlation coefficients between the factors are: 888**, 943** and 964**, which indicate the existence of fairly strong dependences (Table 17.4).

Table 17.3 Correlations between individual sources of acquiring knowledge from buyers and proactive customer orientation

Spearman's rho		Proactive customer orientation
Social media activities	Correlation coefficient	0.796**
	Significance (two-sided)	0.000
Customer expectations surveys	Correlation coefficient	0.670**
	Significance (two-sided)	0.000
Customer satisfaction surveys	Correlation coefficient	0.816**
	Significance (two-sided)	0.000
Co-creating new products	Correlation coefficient	0.677**
	Significance (two-sided)	0.000
The information exchange platform	Correlation coefficient	0.565**
	Significance (two-sided)	0.000
Helpline	Correlation coefficient	0.330**
	Significance (two-sided)	0.000
Online forums	Correlation coefficient	0.483**
	Significance (two-sided)	0.000
Testing of new products	Correlation coefficient	0.538**
	Significance (two-sided)	0.000

**Correlation significant at 0.01 (two-sided)
Source Elaborated by the authors

Table 17.4 Correlations between the analysed factors and proactive customer orientation

Spearman's rho		Proactive customer orientation
The assessment of the importance of consumers' knowledge in creating product innovations	Correlation coefficient	0.943**
	Significance (two-sided)	0.000
	N	165
The assessment of the degree of the achievement of product innovation objectives	Correlation coefficient	0.964**
	Significance (two-sided)	0.000
	N	165
The number of used sources of consumers' knowledge	Correlation coefficient	0.888**
	Significance (two-sided)	0.000
	N	165

**Correlation significant at 0.01 (two-sided)
Source Elaborated by the authors

17.6 Significance of Proactive Customer Orientation in the Process of Realising the Objectives Concerning Product Innovations—Conclusions from the Conducted Study

The presented results do not give grounds for rejecting the accepted hypotheses H1 and H2 and H3. There is a positive relationship between proactive customer orientation and the reach of searching for sources of knowledge of consumers, the assessment of the importance of consumers' knowledge in creating product innovations and the assessment of the achievement of product innovation goals.

The implications of this study indicate that there is a positive correlation between proactive customer orientation and the evaluation of the significance of consumers' knowledge in creating innovations and the number of sources of consumers' knowledge used, as well as the extent of realising the objectives concerning product innovations. Thus, it seems relevant to assume that proactive orientation towards the customer by cooperation with consumers brings the desired outcomes in terms of realising the objectives concerning product innovations in companies from the FMCG sector.

In the context of conclusions from the conducted study, one should agree with the authors quoted [4, 24, 27, 35] that a consumer may be one of the creators of success in making and implementing product innovations. Proactive customer orientation and cooperation with the user in the process of creating product innovations can help companies formulate directions of their improvement. Thus, proactive customer orientation seems to be the direction which will be followed by an increasing number of companies which aim at market success.

The diagnosed direction and significance of pro-innovation organisational culture for ensuring the success of product and marketing innovations of companies functioning in the FMCG sector justify the need to tackle the research problem analysed in this study, while at the same time encouraging its further exploration, especially in order to formulate valuable recommendations for economic practice. A special opportunity for future studies concerns the role of managers in developing and supporting the culture of innovation.

It should be noted, however, that sector of fast-moving consumer goods is characterised by high volatility and enterprises operating in it represent a high level of innovation. Moreover, a certain limitation may be the deliberate selection of the sample, assuming that the study will involve enterprises that assessed themselves as innovative; therefore, an additional criterion is the introduction of new products during the period of the last three years.

The diagnosed direction, scope and strength of cooperation with the final client, aiming at creating product innovations in enterprises offering fast-moving products, justify the need for the research problem analysed in this study and at the same time encourage further recognition, especially for the purpose of formulating valuable recommendations for business practice. A special opportunity for future research concerns the role of managers in building and supporting proactive customer orientation and cooperation with consumers aimed at creating innovations.

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Part III
Problems of Organizations' Development in the Age of Industry 4.0

Chapter 18
Revolutionary Context of the Evolution of a Business Enterprise

Cezary Suszyński

Abstract The complex goal of this article is (1) to present the main paths and tendencies of a historical evolution of a firm, (2) considering the succeeding four industrial revolutions, (3) with focus on the challenges and changes brought into the business enterprise by the Fourth Industrial Revolution. A vast theoretical study, with some insights into research done by different authors as well as contemporary business practices, has been conducted. The main conclusion is that a progressive, more and more complex fusion of technologies, historically initiated by single advances and continued in our times with spectacular, AI-based, cyber-physical systems have been reinforcing the evolution of business enterprises for recent two hundred years. At present, breakthrough technologies remain the leading force of revolutionary changes, but the ability to communicate and get connected with partners rather than a narrow manufacturing aspect of technologies has recently become crucial for the evolution of business enterprises.

Keywords Business enterprise · Industrial revolution · Breakthrough technology

JEL Classification L14 · L21

18.1 Introduction

Business enterprise (interchangeably business organization, enterprise, firm) is a phenomenon that has been attracting an interest of a growing number of scholars and professionals representing a wide range of scientific disciplines and activities. One of the basic reasons is that contemporary business enterprises remain essential units of each economy, and it is really hard to imagine our daily life without this form of an organization. However, it is worth to remind two fundamental, well-known facts. Firstly, the firm as an entity had not appeared in prehistoric times, when a human economic activity had started, but it had emerged much later. Secondly, a business

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enterprise that we know today is quite different from its historic ancestors rooted in the idea of a medieval manufacture. These observations bring to the conclusion that the birth of a business enterprise must have been the result of a complex process, and since its inception an enterprise has evolved significantly and will be still evolving in the future.

This emphasizes on historic and dynamic aspects of an evolution of a business enterprise and constitutes a starting point for further analysis. Given the limitations of a short article, the analysis focuses on the essential changes within historical stages of development, widely accepted and defined by economists as the three succeeding industrial revolutions. Business enterprises, like many other entities, were also affected by the past revolutions, and according to many present studies they face a new revolution again. Thus, the goal of this article is to present the main paths and tendencies of a historical evolution of a firm as a socioeconomic unit, within the times of the succeeding industrial revolutions, including the latest challenges and changes brought into the business enterprise by the Fourth Industrial Revolution (4IR).

While considering the nature of the 4IR, also labeled Industry 4.0, or IR 4.0, it is assumed that traditional, societal, and historical premises of a business enterprise development are outpaced in our times by new technologies and external dynamics which lead the way to disruptive changes. Following this assumption, the main proposition of the study argues that the Fourth Industrial Revolution is a phenomenon to dramatically reshape the practices and transform the concept of a future business enterprise.

The presentation of main paths and tendencies of a historical evolution of a firm as a socioeconomic unit, including the perspective of the Fourth Industrial Revolution, require to address the three following questions (issues) which determine the article's structure:

1. What are the most important changes brought by the three former revolutions shaping a business enterprise to perform a business activity?
2. What are the most important, ongoing changes in a business enterprise evolution brought by the Fourth Industrial Revolution? activity?
3. What are the expected challenges to the future development and evolution of a business enterprise, generated by the Fourth Industrial Revolution?

The presented below analysis is mostly theoretical, and it is based on a profound study of economic and management literature, with some insights into research done by different authors as well as contemporary business practices.

18.2 Industrial Revolutions and Development Paths of Business Enterprises

Tracing history and evolution of a business enterprise are undoubtedly an exciting scientific process which leads back to the ancient times and covers vast areas of a human civilization development, far beyond pure economic concerns. Having in

mind the earlier declaration to focus on times of the industrial revolutions, one should stress that historically it is a relatively short period of some more than 200 years. Within that time, the three industrial revolutions took place and the fourth one is heralded to start.

18.2.1 The First Industrial Revolution

The First Industrial Revolution (1IR) covers the period from 1760 to mid-1800s. It is usually defined as the "Age of Steam" to denote and point out its main driving force epitomized by the famous J. Watt and M. Boulton steam engine and a landscape of railroads and cotton spinning factories. The new technology contributed to the unprecedented boom in economy, mostly expressed in quantity of industrial output.

From the perspective of a business enterprise, evolution of at least three revolutionary phenomena accompanying this historical boom should be emphasized.

1. The consequences of the implementation of the new technology ushered in mechanical production [11, p. 11] and gave the birth to the realization of division of labor that targeted increase in volume of output. The division of a production process into separate, homogenous sequences of operations performed by different workers at different organizational levels was to become the milestone of modern business organizations for more than a century. A specialization and high skills developed due to the division of labor are still crucial for a firm, becoming valuable assets of each business model and implemented strategy. Thus, the specialization path of development as a lasting output of the 1IR and the Smithian economics remains one of the constitutive features of a business enterprise.
2. The booming industrial economy of XIX century stimulated a rapid and multidirectional development of many business entities performing functions previously performed occasionally, or not performed at all. Newly established firms involved in transports, warehousing and distribution, insurance services, legal and financial assistance to business operations were real pioneers, but with a bright perspective ahead. A diversity of emerging business enterprises and a nascent business system, though still scattered and in its infancy, allowed to significantly reduce bottlenecked limitations of a remote (barter) economy. Thus, the diversity and plurality of a business environment that was brought by the 1IR had become another immanent feature of a business enterprise development.
3. The rapidly accruing industrial output, new distribution practices, and obvious need to initiate marketing activities gave, among many others, a natural boost to the development of the market. The 1IR, despite its primary industrial content, established the foundations of a market economy. Since then the market mechanism has been remaining the main drive to shape the whole life cycle of each firm, including such fundamental determinants like its inception (the idea), goals, functions, form (the organization), strategy (the business model). Thus, the

1IR had started the market orientation as another inherent determinant of a business enterprise development and evolution. Moreover, an emerging capitalistic economy and its mechanisms, especially market competition had soon released the enormous potential of changes influencing significantly the next period of a revolutionary transformation of business entities.

18.2.2 The Second Industrial Revolution

The Second Industrial Revolution (2IR) dated from 1870 to the break of the World War I (1914) may be perceived as a dynamic process consisted of two complementary and mutually reinforcing subprocesses. On one hand, an electric power and electrification, i.e., a new technology once again turned out to be the leading force of the 2IR, also labeled as the "Age of Electricity" [12, pp. 33–98] or just the "Gilded Age" [18]. On the other hand, a number of earlier innovations and solutions introduced during the 1IR paved the way for another economic boom. The earlier growth of coal, iron, textile industries was complemented by the expansion of electricity, petroleum, and steel. In other words, using symbolic expressions, a steam engine was replaced by new models of engine (an internal combustion, electric engine). But there was also a myriad of significant, mostly technology-based inventions and solutions that contributed to the second name of the 2IR, i.e., the Technological Revolution.
As in the case of the 1IR, it is impossible to present in a short paragraph the complexities of the 2IR, which was a great leap in technology and society. Considering its industrial, technological nature, and many vast studies exploring different aspects of that period one can draw another set of conclusions on the conditions and major paths of a business enterprise evolution within a particular period of the 2IR.

1. A division of labor and specialization as a path of a business enterprise development, both born during the 1IR, made the significant increase in an industrial output possible, but only technologies of the 2IR allowed to build a massive industry and to start a mass production. It spurred a mass distribution to reach a large number of customers and finally resulted in the phenomenon of a mass consumption. Since then, even in times of highly customized products and services, a long-lasting idea and mechanisms of a contemporary mass consumption significantly influence development programs, strategies, and structures of business enterprises. The 2IR generated a rapid development of industrialized cities and areas causing dynamic growth of the urban population. People moved to the cities trying to benefit an increase in the purchasing power of money and hoping for the higher living standards. To illustrate this exodus, it is worth to note that between 1870 and 1920, almost 11 million Americans moved from farm to city, and another 25 million immigrants arrived from overseas [18]. Business enterprises had for the first time in history to face such scale and pace of complex changes, make use of deep demographic, social, economic, cultural changes. Already mentioned mass production, an iconic Henry Ford moving assembly line

Table 18.1 Changes of sector shares in the US economy in 1840–1900

Year	Employment			Output (1860 prices)		
	Agriculture	Industry	Services	Agriculture	Industry	Services
1840	68	12	20	47	21	31
1850	60	17	23	42	29	29
1860	56	19	25	38	28	34
1870	53	22	25	35	31	34
1880	52	23	25	31	32	38
1890	43	26	31	22	41	37
1900	40	26	33	20	40	39

Source Mokyr [22]

and mass-produced the Model T (started in 1908, the first generally and widely available automobile) was the answer at the industrial level. The evolving structure of the US economy, the boom in industry and services, which meant also a dynamic growth in the number and performance of new enterprises, can be illustrated by the following data showing deep changes in the country's employment and output (Table 18.1).

At the booming market-level practices initially related to buying and selling activities were quickly transformed into the firm's lasting orientation toward the marketplace. This orientation, in turn, resulted in a broader concept of marketing with its classic 4Ps formula, which was both, the challenge and the answer of evolving business enterprises.

2. Innovations in transportations, most notable railroads—presented as a typical of a "hybrid" technology [21, p. 12]—linked far-distanced communities together. It opened up new markets, significantly reducing the time and money the transport took before and created new opportunities for different groups of society. New possibilities of cost reduction, profit maximization, optimization of allocation of resources, profit and loss account, economies of scale, standardization, etc., had underlain the comprehensive process of development of business enterprises as centers of rational, economy-based decisions. Regardless later discovered limitations of a homo economicus paradigm, the 2IR made the economic rationality a sine qua non of existence and development of a firm.
3. A large-scale production and distribution required an adequate form of a business enterprise which would accumulate dispersed resources, run business activities, and reach customers on widely spread markets. It was possible through an incorporation of business enterprises. No brief comment can do justice to the meaning of a corporation in the evolution of a business enterprise. In fact, the process of incorporation commenced earlier, during the Elizabethan era. However, the 2IR was the very period when corporations started their historical path to become a dominant and most influential form of a contemporary business organization in highly developed market economies [10, pp. 3–6].

4. The 2IR brought in a fierce market competition, which was far beyond its idealistic model developed by classical economists. The early capitalism competition shaped to great extent development opportunities of business enterprise and so do their internal and external status. Countless firms collapsed, went out of business, or were bought out by large corporations controlling the marketplace. The economic growth was spectacular but unstable with two depressions in 1873 and 1897. Economic insecurity became a basic way of life for business enterprises.
5. Technological innovations alone were often not enough to ensure competitiveness, and it was necessary to develop managerial structures and functions to exploit them. The 2IR revealed the need for and significance of a modern business management and the crucial role of managers in business organizations entering the phase of a managerial capitalism [10, p. 5]. The rising scientific management (F. Taylor, H. Fayol, H. Gantt) offered managers new rules and tools that helped to increase industrial performance of leading companies. For example, the pioneers, who instinctively aimed to capitalize on particular configurations of business units (the synergy, value chain concept)—A Carnegie Steel Company controlled every stage of business from raw materials to transportation, manufacturing, and distribution [18]—were additionally equipped with more general knowledge. Even if the feedbacks between research and business use of its results were not so effective as today, the period of the 2IR established foundations of a knowledge economy. It put the firms on a qualitative path of development, essential in the perspective of the next industrial revolution.

18.2.3 The Third Industrial Revolution

The Third Industrial Revolution covered the period between the late 1950s and late the 1970s. Once again a revolutionary technology, i.e., the digital communication became the leading force to introduce profound changes comprising also the transformation of business enterprises. To realize the earlier expansion, dynamics, and present power of the digital communication, it is worth to note some basic figures [20, pp. 60–65]. In 2007, humankind was able to store 2.9×10^{20} optimally compressed bytes, communicate almost 2×10^{21} bytes, and carry out 6.4×10^{18} instructions per second on general-purpose computers. General-purpose computing capacity grew at an annual rate of 58%. The world's capacity for bidirectional telecommunication grew at 28% per year, closely followed by the increase in globally stored information (23%). Humankind's capacity for unidirectional information diffusion through broadcasting channels has experienced comparatively modest annual growth (6%). Telecommunication has been dominated by digital technologies since 1990 (99.9% in digital format in 2007), and the majority of our technological memory has been in digital format since the early 2000s (94% digital in 2007).

Besides the introduction of new technologies and development concepts [9, pp. 161–191], the Digital Revolution, converted a large number of the earlier, the

2IR born mechanical and analog technologies into digital ones, e.g., conversion of an analog record-keeping into digital recording as a new standard in business, or disappearing telex replaced by widely used fax. However, the most significant transformations of business enterprises are linked to the dynamically expanding use of a computer, which became the symbol of the 3IR, and the advent of the Internet as a leading communication technology at this stage of the Information Age. The possibility to create a whole new global platform for multiple forms of collaboration is perceived as a powerful tool to "flatten" the world and deeply change the way of doing business [2, pp. 91–107]. From the perspective of this process a synthesis of major conclusions on evolution paths of business enterprises could be drawn.

1. Communication technologies of the Information Era reinforced and accelerated the phenomenon started during the 2IR, i.e., making the world appear to be smaller ("shrinking world"), bringing about "the annihilation of distance" [5]. Collaboration possible among individuals, firms, nations, and countries around the world opened another stage of a globalization—a going global process which has become the strategic path of development of a large number of firms. However, despite widely recognized significance and validity of globalization remain, the comparison of opportunities and benefits to become global showed and still shows significant disparities among business enterprises representing highly developed and emerging economies. It concerns also the development of communication technologies. In fact, the world is still not as connected as many people believe and only a fraction of what we consider globalization actually exists, e.g., in 2008 more than 90% of all phone calls, Web traffic, and investment were local [19].
2. Thanks to a direct communication through social media business enterprises opened as much as never before to their customers, making use of directly available market information, customers' experience and resources (crowdsourcing, crowdfunding), also involving customers as partners to solve particular business problems [15, pp. 88–90].
3. Loosed boundaries of a business enterprise, for a long time perceived as fixed and rigid, deep and permanent contact with its customers, and use of resources not owned but available for the firms in their environment, were at the heart of another qualitative changes marking evolution of a business enterprise in times of the 3IR.
4. A mass communication has driven openness of business enterprises to the market, partnership relations with customers and other stakeholders lead to the development of a value co-creation process [8, pp. 35–50]. It became the precondition of new, dynamic business models developed initially by business entities, but soon a value co-creation yielded an idea of shared value [7]. Within the last decade, this idea has been transformed into the set of activities and solutions pioneering the prolific concept of a sharing economy which reshapes particular business practices not only at the firm level [4, p. 1–3]. The early practices have revealed both, good and bad sides of a collaborative economy. A booming micropreneurship,

new platform for sellers, or proliferation of new business ideas are still accompanied by an insufficient protection from fraud, unfair competition, loss of tax revenues for the government, etc. The nearest future seems to be decisive as far as the development of a sharing economy and evolution of business systems are considered.

5. Dynamically developing social networks turned out to be particularly effective among business partners who decided to establish relationships based upon mutual interests. Business networking as the distinctive model of a collaboration and development of business enterprises has become another characteristic of the 3IR.
6. Negative consequences of a large-scaled industrial activity, particularly its environmental footprint, it promoted the idea of a corporate social responsibility and sustainable development of business enterprises. The three pillars of this concept, symbolically presented as the 3Ps (People, Planet, Profit) denote a three-dimensioned development balancing social, environmental, and financial functions performed by business enterprises. One should admit that the idea of a corporate social responsibility and triple bottom line (TBL) principles are among most often discussed and criticized. It is stressed that attempt to combine the very different and often competing imperatives of profitability, social justice, and environmental protection is problematic and limited. Business enterprises are constantly changing and improving, while TBL has been fairly conservative in its approach to change [13, pp. 91–111]. Despite all those discussions, there is no doubt that the path of a sustainable development makes a part of the 3IR achievements which are worth to be refined and continued in the future.

18.2.4 The Fourth Industrial Revolution

According to prominent authors today, we are at the beginning of the Fourth Industrial Revolution, labeled also *Industry 4.0,* which started at the turn of this century [11, p. 12] and has been the next, but a significantly different stage of the 3IR. Among different approaches to identify the nature of the 4IR, there is also a straightforward proposal of the four complementary characteristics of *Industry 4.0* [17]:

- vertical networking of smart production systems;
- horizontal integration via a new generation of global value chain networks;
- through-engineering across the entire value chain;
- accelerating through exponential technologies.

Trying to catch the difference between the 3IR and 4IR and analyze the context of an evolving business enterprise at least two of the above-mentioned characteristics should be emphasized and briefly developed. These are the emerging breakthrough technologies and the way the existing and emerging technologies converge to create the new and unanticipated quality of a human life.

Breakthrough Technologies of the 4IR

There are a number of new technologies attributed to the initial stage of 4IR, which may be perceived as a creative advance of a basic digital technology introduced during the 3IR. In fact, each industrial revolution brought in technologies which have remained its trademarks. In the case of an ongoing transformation, there are new technologies including also those, which at this stage clearly challenge a business enterprise development and evolution. A few examples of such technologies can be found among 10 breakthrough technologies of 2018 [6]:

- 3-D metal printing. The technology which develops and expands a standard 3-D printing invented and introduced yet in the early 1980s. Unlike the previous one, limited mostly to prototypes, the 3-D metal printing is expected to be used on a large scale. From the perspective of industrial enterprises, it may contribute to making complex objects on demand and thus to pave the way to the significant transformation of a mass manufacturing and its subordinated processes, e.g., no need to maintain large inventories of replacement and spare parts which would be printed and delivered to particular contractors. For example, the Siemens NX software applied in an additive manufacturing/3-D printing technology "allows to reimagine products, reinvent manufacturing, and even rethink the existing business models with additive manufacturing technology" [23].
- Cloud-based artificial intelligence (AI) available to a broader audience. The use of cloud makes this technology cheaper and available even to startups, not only to big tech companies like Amazon, Baidu, Google, Microsoft. According to the MIT publication, AI cloud services market creates for those who become its leaders "a huge business opportunity." Furthermore, the cloud-based AI products will help to diffuse AI in different sectors of economy, e.g., medicine, manufacturing, resulting in a considerable growth of an economic productivity.
- Communication in a close to real-time language translation. Already existing devices (e.g., Google earbuds, called Pixel Buds) enable to produce a near-real-time translation in many languages. Breaking the language barriers may open a new era in a global business communication, including an introduction of highly effective, quick activities performed by worldwide connected business enterprises.
- Technology cutting carbon emissions (zero-carbon natural gas). Apart from technical details, this technology may contribute to the production of a clean energy from natural gas. Introduction of such technology (-ies) on a large scale might lead, among other impacts on business enterprises, to further and sometimes alternative ways of providing energy services to consumers.
- Cryptographic technology ensuring a perfect online privacy (zero-knowledge proof, a zk-SNARK). It is meant to give users the power to transact anonymously, i.e., without revealing the personal data or other details. Development of this technology, which resulted in introducing Zcash—a new digital currency launched in 2016, was spurred by Bitcoin and other public blockchain systems, which, in truth, do not guarantee a full anonymity. From the perspective of business partners representing different sectors and profiles the zero-knowledge proof, already said

to be an "absolutely game-changing technology" yields quite new possibilities for a growing number of cryptocurrency applications.

Converging Technologies and Cyber-Physical Systems of the 4IR

The process of a profound fusion and convergence of new technologies is the second early mentioned characteristic of the 4IR. As a matter of fact, an interconnection and mutual reinforcement of inventions, e.g., the railroad development spurring the growth of the telegraph machine, were also observed back in the period of the 2IR. However, an unprecedent scale and scope of such phenomenon can be observed in our times. Following the current tendency to combine physical, digital, and biological dimensions of the realty the complex cyber-physical systems emerge, with blurred barriers between people and machines. These intelligent systems operate within ubiquitous and mobile Internet environment, which has been also developing and comprising the Internet of people (social and business networks), the Internet of things (mobile intelligence), the Internet of services (intelligent networks and logistics), and the Internet of data. The Sensing City, one of the 10 earlier mentioned 2018 breakthrough technologies, is the example of a technology underlying an intelligent system to make a Toronto neighborhood the smart city. The Quayside project is scheduled to begin in 2019, and it assumes "to base decisions about design, policy, and technology on information from an extensive network of sensors that gather data on everything from air quality to noise levels to people's activities" [MIT editorial].

Business models are defined by the way the value is created for customers (the value proposal) and the way they capture the value (making money) [3]. According to these authors, the digital revolution has been changing both critical elements of a business model. The case study of the general electric business model for more than a thirty-years period (1980–2014) illustrates the shift from the transactional model (selling industrial hardware and repair services) to contractual model (sharing the risk, reducing the total cost of ownership), and to expanded customer outcomes model. The last change was introduced by 2009, and it is based on an "open global network of machines, data, and people to generate a plethora of new business opportunities and outcomes-based business models" [Iansiti M. and Lakhani K. R].

Ongoing changes, breakthrough inventions, futuristic visions, and time needed to fully benefit new solutions it all makes the 4IR transformation results very complex and hard to be instantly quantified [16]. This is also the truth in case of a business enterprise transformation. Considering the nature of the 4IR and following, the above example of the GE business model changes it is rather expected that new technologies will lead to a significant number of disruptive changes [1] affecting almost every industry. An interconnection between people and machines, widely available, transparent and vast information, quick solving of short problems, decisional autonomy of the AI-based cyber-physical systems seem today to be crucial elements of revolutionary changes of business enterprise.

18.3 Conclusion

The study of a revolutionary context of the evolution of a business enterprise allows to draw few conclusions referring to only a part of a broad spectrum of issues and aspects.

This what remains an essential element or a "common denominator" of all four industrial revolutions is undoubtedly their technological aspect. Disruptive technologies change profoundly the reality, obviously including the transformation of practices and status of business enterprises. Moreover, a progressive, more and more complex fusion of technologies, historically initiated by single advances and continued in our times with spectacular, AI-based, cyber-physical systems influence the evolution of business enterprises for more than two hundred years. Volume boosting, industrial technologies of the 1IR and 2IR evolved to the "products" of a lateral thinking—elaborated, synergistically oriented business models benefitting the ubiquitous Internet, opportunities of global networks, revolutionary changes in a generic value chain. Today, breakthrough technologies remain the leading force of a digital transformation, but the ability to communicate and get connected with partners rather than a narrow manufacturing aspect of technologies has recently become crucial for the evolution of contemporary business enterprises.

Development of the network economy, particularly the mobile Internet leads to shift in a business enterprise evolution—from the long-lasting in-house philosophy to the idea of a firm as an open system, from the bricks and mortar business to the clicks business models, from tangible assets to the knowledge and digital capital [14]. It is just as important that an open leadership and soft management instead of a common command and control practices underlie the development of the growing number of firms, and sustainability and digital shareholders' perspective replaces a narrow profit orientation.

Presentation of the trends and tendencies in the development of a digital transformation would be incomplete without opinions of managers working in different business organizations expected to benefit the exponential technologies. The data in Table 18.2 illustrate responses to selected issues of the 4IR, identified in a surveyed sample of more than 50 manufacturing companies, like ABB, Alstom, Hiliti, Siemens operating in Switzerland [17].

On one hand, Table 18.2 provides a few clear-cut conclusions, e.g., believe that the digital transformation to Industry 4.0 could dynamize the Swiss industry's global competitiveness, or that the importance of exponential technologies varies depending the company's size and/or sector. On the other hand, one can draw a significant number of conclusions confirming that for many companies the digital transformation is going to be much more of a tough encounter. 36% of companies did not feel at all, or felt very small impact of the digital transformation, which means that they were not enough motivated to start deep changes. The weak motivation to change might be additionally confirmed by the fact that 32% of companies did not expect that the digital transformation to Industry 4.0 would be able to slow down the trend to relocate production to low-wage countries. More than 30% of companies were not

Table 18.2 Key challenges faced by Switzerland's manufacturing companies in achieving the digital transformation of the industry

Issue/Question	Scale 1–5 Share in %				
	1	2	3	4	5
Competitiveness—Swiss manufacturing companies Do you believe that the digital transformation to *Industry 4.0* could boost Switzerland's global competitiveness? *(1—completely disagree, 5—completely agree)*	8		8	44	40
Competitiveness—Swiss companies How strongly is your company feeling the impact of the digital transformation to *Industry 4.0*? *(1—no impact, 5—very substantial impact)*	20	16	28	24	12
Competitiveness—Relocation of production Do you think that the digital transformation to *Industry 4.0* will be able to slow down the trend toward relocation production to low-wage countries? *(1—completely disagree, 5—completely agree)*	8	24	20	24	24
Opportunities and risks—Integrating customers To what extent is your company already integrating customers' needs and/or preferences in its development and production process, e.g., through data exchange directly with machines? *(1—not at all, 5—very strongly)*	29	4	25	17	25
Opportunities and risks—Resource efficiency To what extent is your company already making use of the opportunity to analyze machine data, e.g., to avoid defects in the production process? *(1—not at all, 5—very strongly)*	17	25	29	21	8
Opportunities and risks—Cyber risk Do you think that the digital transformation to *Industry 4.0* could further increase cyber risk for manufacturing companies? *(1—not at all, 5—very considerably)*	4		12	36	48

Source Based on Deloitte [17, pp. 11–14]

integrating customers' needs in their development and production processes though customization has been remaining a global trend. 42% of surveyed entities admitted the lack, or eventually weak use of the opportunity to analyze machine data. Finally, almost half of the examined companies rated as "very considerable" the possibility that the digital transformation to Industry 4.0 could further increase a cyber risk.

Revolutionary context of the evolution of a business enterprise reveals positive sides of changes; however, a broader perspective would be far incomplete if detached from limitations and negative sides of this process. As they were not discussed in this article, one should only mention such issues, like a social and organizational inertia and resistance to changes, protection of industrial know-how, possible unemployment and new social policy, ethics of innovations. The above-mentioned issues make only the part of a wide range of problems to be solved if the outstanding, cutting-edge technologies are to change business activities and our life for better.

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Chapter 19
Understanding Cognitive Biases in Strategic Decisions for Value Creation and Capture

Mariusz Bratnicki and Wojciech Dyduch

Abstract Firm-level strategies of value creation are typically identified with rational, analysis-based processes as well as conscious strategic choices made by decision-makers upon the broad access to information. Meanwhile, decisions concerning the sources of value creation (e.g., innovation, shaping strategic potential) and the value creation and capture itself (e.g., imitation, mergers, and acquisitions) are often dependent on inward-oriented managerial choices that underestimate facts and information. In this paper, we attempt to describe how cognitive biases, perceived as an irrational perception of reality, may influence strategic decisions, which translate into value creation and capture in organizations. In a similar vein, we offer some ideas of debiasing managerial decisions, looking specifically at organizational learning and diligent strategy based on interactions, constructive dialogue, and facts rather than perceptions.

Keywords Cognitive biases · Value creation and capture · Strategy

19.1 Introduction

Both value creation and value capture are processes taking place at a strategic level of the firm, and thus, it is assumed that they are rational, fact-based and require a prior information-intensive strategic analysis. Nevertheless, as every strategic process that concerns people, value creation and capture are influenced by decisions that not always are rational, but often influenced by postures, emotions, and managerial behaviors resulting from cognitive biases [71]. It is worth looking at the linkages between cognitive biases and value creation and capture. In the first section, we will generally look at how the value creation and value capture processes can be affected

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by psychological mechanisms such as biases. The processes concerning value will be discussed from the point of view of innovativeness, mergers and acquisitions, and value creation for customers. In the second part, we will look at some specific cognitive biases that can influence the managerial and strategic decisions, thus result in more or less value created and captured. Specifically, we will discuss overconfidence and overoptimism, with other biases being mentioned concisely. Eventually, we will offer some scholarly propositions that recently hold promise as debiasing mechanisms in the managerial and strategic decision-making. We will look at the organizational learning from mistakes and failures, eliminating biases that came into play in the past. Additionally, we will discuss a diligence-based strategy that gives a central role to strategic decisions and interpersonal interactions based on productive dialogue and facts rather than perceptions and biases.

Since our study aims at the preliminary introduction of managerial biases in decision-making translating into value, we have adopted narrative literature review, presenting some articles are publications that describe and discuss the managerial biases from a theoretical and contextual point of view. The objective of this paper is to provide readers with up-to-date knowledge about the topic of managerial biases, and the role they play in decision-making, which in turn may influence the value creation processes in organizations. Due to the nature of this study, we do not describe the methodological approach that would permit the reproduction of data nor answer specific quantitative research questions [81]. Instead, we identify the problem of cognitive biases, which—as a psychological phenomenon—might have a relation with economic results of organizations. The existence and the nature of such relations would require formulating a research proposition in the future.

Our considerations attempt to look at the strategic management process through the lens of cognitive psychology. Assuming that management is a social process, where decision-making is prone to heuristics, we stress on understanding the cognitive biases in decision-making. Our narrative literature overview indicates that biases may be detrimental to a proper decision-making, and they may inhibit the process of value creation and value capture. In this vein of reasoning, we offer some ideas as to debiasing the strategic decision-making process, e.g., fact-based strategic decisions, organizational learning or diligent strategy formulation.

19.2 Cognitive Biases in Strategic Value Creation and Value Capture

Some companies are able to capture more value than others in spite of the fact that they do not create as much of it. It is explained by the firm's ability to efficient use of resources that translate into higher performance than competitors are able to achieve. This phenomenon focuses on attention at managerial competences concerning resource bundling, exploiting them to shape the strategic potential as the environment changes dynamically, and new challenges from competitors arise [106].

Top management competences are frequently attributed with strategic success and are seen as one of the main antecedents for firm's performance. On the other hand, the use of managerial competences in decision-making is shaped by psychological mechanisms, whose financial, strategic, and ethical outcomes may turn very significantly [13]. We will briefly look at some general linkages between biases and value creation and capture resulting from innovations, mergers, and acquisitions as well as customer-oriented value-creating processes.

Endeavoring to understand value creation as an innovation-based process, it is proposed to look at generating or discovering creative ideas that will be later filtered and selected for commercialization. Recently, it has been noted that managerial overconfidence in regard to own abilities, underestimating unexpected opportunities and surprises, presenting intuition-based behaviors and heuristics, is strongly connected with decisions concerning the selection of creative ideas for further innovation development and commercialization [29]. Specifically, ideas that seem conventional are selected more eagerly than ideas that hold some promise due to their unconventional character. What is more, an inward-looking bias can come into play. Innovations are perceived as significant if they are based on new opportunities and create added value for customers. Meanwhile, firms label some of their innovations as significant, radical or breakthrough, even though customers do not perceive them as such. The radicality of innovations is a firm-based perception, resulting from the inward-looking bias, which suggests the managers treating innovation as important to them [98]. In this stream of reasoning, it is often indicated that holistic innovations (concerning new business models, new ways of solving problems, new value propositions, managerial processes or value capture rules) should replace the product-only innovations [97], as the decisions involved in such innovations are more resistant to cognitive biases.

While analyzing value creation and capture from the mergers and acquisitions perspective, it is sufficient to concentrate on the cognitive biases influencing managerial decisions concerning the expected value of the firm merged. Recently, it has been indicated that such biases predicting the future based on past data, strong convictions based on stories and scarce data, overoptimism, illusion of control, accessibility bias, effect of possession, confirmation bias, affect, embeddedness, and the sunk-costs effect are among the most crucial biases influencing decisions about mergers and acquisitions in the context of expected future value created [69]. In sum, the cognitive biases distort the managerial perception of the future value creation potential, possibilities of value capture in the future, or the actual possibility of retaining the value created. For instance, overoptimism can lead to the failure of the value capture strategy, even though the level of created value may be high [92]. Cognitive biases might also influence decisions concerning strategic value capture understood as creating value for customers and measured by, e.g., return on sales or the potential price the customers are willing to pay. The recent findings indicate that introducing an innovative product to the market—in spite of direct benefits for end users—can face some customer resistance. Additionally, cognitive biases are construed as the reason for influencing customer decisions [91].

It may happen that even highly effective organizations undergo sporadic catastrophes [70]. The explanation of this phenomenon lies in cognitive policies and the

nature of the environment, yet first of all, in cognitive limitations that narrow the abilities to identify, interpret, and communicate information as well as to give the sense due to the surrounding reality and act upon it. Specifically, the scope, scale, durability, and quality of actions undertaken by organizations trace back—among others—to current abilities they possess [27]. Cognitive abilities frame the activity range that the organization is able to undertake with sensible coherence and reliability [93]. With reference to the behavioral approach to strategy, the key elements are cognitive processes and their influence onto strategic decisions made by managers [53, 77]. In turn, these decisions impact on the processes of value creation and value capture in organizations.

Psychologists explain that people are prone to various cognitive biases reflecting in systematic aberrance from rationality in the time of making judgments and taking decisions [36], or facing uncertain situations [43]. Cognitive biases are present in the decision-making processes at the organizational level since decision-makers use various heuristics and cognitive shortcuts. Under such circumstances, preferences tend to count more than facts. Cognitive biases, understood as specific heuristics, are decision-making strategies that ignore some part of the available information in order to save time and effort of the decision-maker [32]. A majority of the cognitive biases are deeply rooted, unrealized, and resistant to reparative measures at the individual level, regardless of the knowledge the person may possess [76]. However, it is important to understand their presence in the decision algorithm, particularly as the external environment is highly volatile, becoming a salient source of uncertainty [59]. Consequently, it is difficult to fully explain the process of value capture without referring to strengths and weaknesses of cognitive processes, specifically the biases. Hence, we argue that it is worth considering the problem of cognitive biases in strategic decision-making, and the outcomes they might produce.

As it has been noted, the management team varies in regard to influencing strategic change and firm performance due to managerial cognition, social capital, and human capital [37]. In particular, cognitive biases that are deeply rooted in mental processes make it possible for people to understand themselves [10]. For example, biological processes taking part in human brain result in ignoring the information that questions to-date decision preferences [63]. Strategic managers, while making strategic judgments, are subject to various cognitive biases [5, 77] that lead to the differentiated perception of organizational phenomena, even if the quantity and quality of information are comparable [43, 56].

Not only are managers or entrepreneurs directed by the idiosyncratic set of cognitive biases and heuristics-based thinking [9]. Cognitive characteristics of managers influence what they perceive and how they interpret and respond to competitive actions [60]. A properly formulated strategy may become unsuccessful when cognitive biases come into play during its implementation [50], which results in using only part of the information available. For example, decision-makers, facing original ideas whose realization bears large risk, attempt to ignore them, as they prefer ideas that are easy to understand, bringing quick benefits, and being coherent with the existing social norms [6, 66]. Cognitive biases negatively influence identifying problems, generating and assessing alternative action paths as well as making

strategic choices which leads, for example, to a certain inertia in corporate climate change [57]. Strategic managers regularly simplify the complex reality to incomplete and inaccurate mental models which influence the strategic decision-making process leading to unexpected outcomes [62]. In many cases, managers deny credible information if they are inconsistent with their mental models [94]. Moreover, strategic management team shows a tendency to sketch a positive image of themselves and their leadership competences [73]. These phenomena undoubtedly shape new cognitive abilities that strategic managers are able to develop. The awareness of these shortcomings becomes significant in the process of counteracting destructive cognitive mechanisms by correcting the beliefs and mental representations through learning [19, 79]. The interaction of contextual factors and cognitive biases strongly distorts the top management team performance assessment made by the supervisory board or external stakeholders [100]. Nonetheless, cognitive biases at the same time play a positive role in the decision-making process. The recent scholarly research concentrates mostly on two types of cognitive biases, namely overconfidence and overoptimism.

19.3 Overconfidence and Overoptimism as Micro-Foundations of Strategic Decision-Making

The scholarly literature indicates that overconfidence is one of the most recognized cognitive biases. It boils down to too much trust in one's knowledge and competences what, in turn, leads to the overestimation of the probability of desired outcomes [67]. Overconfidence may thus be understood as expecting positive results, in spite of lack of rational basis [40, 95]. Garbuio et al. [31] have identified this bias in managerial decisions in terms of overestimating the value of the existing assets and capabilities. In turn, Navis and Ozbek [67] analyze overconfidence in relation to sensing and seizing opportunities in uncertain environment. They conclude that entrepreneurs revealing strong overconfidence and narcissism are propelled toward more novel venture contexts which can be harmful to achieve success when a new area of activity, no prior experience, illusion of control over reality come into play [24, 49].

Taking into account a wide range of managerial experiences, beliefs, and preferences that constitute the non-financial motivation, overconfidence plays a significant role [104]. This tendency of top management results in taking the excessive strategic risk [55]. Top management overconfident in their competences makes faster, less comprehensive, and more centralized decisions, as well as takes more strategic risk [38]. Managers with overconfidence are more aggressive in financial reporting [1] what compensates unjustified preliminary optimism about the expected financial results [84], at the same time being less sensitive to feedback, which could help correct the prognoses [15]. Overconfidence linked with excessive self-confidence increases the probability of innovative behaviors [30] and innovation successes [39],

which naturally shape the investment decisions of the firm [84]. What is more, overconfidence leads entrepreneurs toward taking too risky decisions and behaviors [34], which often can be a reason of failure [105] and detriment the venture success [35].

The specific categories of overconfidence include overestimation of one's actual performance, overplacement of one's performance relative to others, and excessive precision in one's beliefs [65]. The overestimation is articulated with high positive assessment of one's performance, knowledge, probability of success, or level of control over future events. It is accompanied by much higher level of self-assessment than the level perceived by others what leads to fulfilling unreal objectives with inadequate risk and uncertainty anticipation [28]. As well as this, the overestimation may lead managers to undermining the threat from competitors [107], as they firmly believe in higher-than-real precision of judgments they make.

The overplacement is reflected in assessing one's performance higher than the performance of other individuals or companies. The key aberration here is not ignoring the competition but underestimating it [11]. Unprecise self-assessment decreases the sensitivity to feedback and correction, while in case of failures, they are justified by external factors and the lack of luck [15, 87]. Naturally, it may often happen that the success is a result of luck and not proper reasoning [52]. Simultaneously foreseeing technological breakthroughs are at the same time completely misguided [22]. The luck—or contingency factors shaping performance such as uncontrollable variables, unexpected consequences, or opportunities—is underestimated, while the role of strategic competences, personal traits, and the effort undertaken is overexposed [68]. To sum up, to-date research results indicate that the decision-makers' overconfidence in some situations can negatively influence the value creation and capture. At the same time, it is worth mentioning, that the environment's high indeterminacy can promote overconfidence as a foundation for value creation based on opportunity sensing and seizing, which would not take place in the case of the lack of overconfidence. This logic can become useful in value capture in the context of entrepreneurial actions, which are frequently based on resources beyond current control.

Unrealistic expectations have been of scholarly interest for some time [102]. Overestimating one's abilities and the success probability is often accompanied by overoptimism, which is reflected in a tendency to unsupported or rationally unjustified expectations of positive outcomes [25], where past experience and industry dynamism can act as moderators [40]. The overoptimism may be understood as overestimating the likelihood of positive events appearance, with underrating the possibility of negative events happening [86]. Moreover, due to improper attributions placement, a failure is linked with effective organizational processes while a success is related to dysfunctional measures, which inhibit organizational learning from mistakes and failures [20].

Decision-makers are exposed to an optimistic bias of overestimating the success possibilities, with risk being underrated [42]. Creative top management usually attributes excessive organizational benefits to their own ideas [4]. The perception of overoptimism can lead decision-makers to overestimating potential benefits resulting from new ventures with underestimating the connected risk, which eventually results in perceiving small changes creation as great opportunities [41]. Managers do not

appreciate new ideas and at the same time link excessive value to conventional ones [66]. The overoptimism leads decision-makers toward interpreting decision dilemmas as less risky than they really are. At the same time, the probability of taking actions by managers as a reaction to negative feedback decreases [3]. Individuals with a considerable dose of optimism indicate the attention bias, focusing perception on a positive stimulus, and are less prone to accept negative information [85]. This means that it is highly improbable for optimistic managers to concentrate enough attention on reacting to competitive moves.

As it has been noted above, the phenomenon of overoptimism is reflected in the perception of increased likelihood of positive events and decreased likelihood of negative events [48]. The overoptimism can lead entrepreneurs to much positively assess their competences and new start-ups [21]. A growing body of evidence indicates that entrepreneurs starting new ventures overestimate future financial and non-financial results what is a basis for misguided decisions [74, 80] and unnecessary operating in an ineffective business [18]. Optimism regarding future governmental regulations weakens the positive influence of informal competition onto new product development [58].

It is worth looking at overoptimistic level of firm aspirations. The level of aspirations plays an important role in assessing the firm effectiveness, which in turn shapes organizational behaviors such as seeking new solutions or implementing changes [33]. Naturally, undesired effects of excessive level of aspirations and expectations may occur: conventionally effective enterprises implement measures that are detrimental to their success [64]. The overoptimism of managers, entrepreneurs, and other decision-makers shapes the value creation and value capture processes twofold. On one hand, it can lead to ineffective ventures that sustain or increase the level of value capture, as the influence of strategic factors is overestimated, and the expectations of positive events likelihood increase. On the other hand, the overoptimism lies at the heart of the managerial courage needed for firm development and facing the strategic challenges in particular. The shortly presented cognitive biases undoubtedly can influence the value creation and capture, whether they act independently, overlap or enter various interactions. In total, they create cognitive fundamentals for strategic dynamics of the firm, whose understanding can facilitate the explanation of real strategic behaviors translating into firm strategic effectiveness measured by value capture.

The overconfidence and overoptimism phenomena do not exhaust a wide range of cognitive biases, while for space and parsimony reasons could not be presented here extensively. The list of other biases embraces such phenomena as illusion of control [45], hindsight [75], self-potentiating [82], confirmation bias [16], accessibility [103], affect [89], avoidance [90], risk aversion [72], framing [96], representation [71] embeddedness [14], status quo [8], homophily [61], or egocentric biases [99]. The future considerations could be extended with these biases as well.

Biases are not exclusively cognitive phenomena as they are rooted in emotions as well [26]. The overconfidence creates positive affects [54], while the overoptimism increases activation [86]. Positive affects broaden cognitive processes, while

the negative ones preserve the existing status quo [17]. Generally speaking, the interactions between cognition and effect may be a fruitful direction of future research concerning the organizational behaviors or strategic decision-making. When looking through the lens of entrepreneurial activity, it turns out that the key antecedents of cognitive biases are: large personal experience, high perception of self-efficacy, ease of the task, versatility of strategic decisions, strategic misfit between organization and its environment, the hostility and dynamism of the environment, or high level of social capital [108]. Through analogy, we could conclude that similar antecedents are present in the process of value creation and value capture as a consequence what can be a worth taking path of future research.

19.4 Debiasing the Firm for Value Creation: Learning from Failures, Diligence-Based Strategy, and Value-Creating Leadership

Since cognitive biases influence decisions that can result in losing value, it becomes evident that debiasing or eliminating biases from the decision algorithm may correct the decision-making process and result in a higher level of value creation and value capture. The research conducted among 1300 top managers has indicated that firms with above-average performance bind decisions concerning capital allocation with financial outcomes and value creation level using procedures eliminating cognitive biases [47]. Some helpful insights concerning debiasing have been noted: (a) creating mindsets open for statistical data and reliable market information, (b) preparing alternative solutions, (c) preparing a decision algorithm that eliminates biases, (d) considering the scenarios analyzing possible effects of the decisions made, (e) involving teams to criticize decisions, (f) devoting more time for decision-making to avoid acting upon emotions. Additionally, bias reduction can take place by introducing design thinking that eliminates such biases as projecting own vision onto others, limiting accessible options, overestimating own predictions. This in turn improves the value creation processes, especially the innovation-based value creation by eliminating such decisions as introducing quick innovation based on early stage ideas, early termination of possible options analysis, overinvesting in early stage solutions [51].

Dahlin et al. [20] define learning from mistakes and failures as a process, through which individuals, groups and organizations identify mistakes and failures, analyze them to discover the reasons for failure as well as seek and implement solutions preventing similar mistakes or failures in the future. Zhao [109] explains that learning from mistakes and failures understood broadly means the involvement in activities that facilitate modifying or excelling cognitive maps, emotional postures, or organizational behaviors. From this standpoint, the mistakes or the experienced failures resulting from cognitive biases are useful for improving firm performance [12, 88, 101]. Unless the company does not learn from mistakes and failures, it continues to

support dysfunctional practices [7] and loses its resilience. It is the shortage of organizational learning that results in accidents, failures, and inadequate policies [44]. As long as mistakes refer to improperly fulfilled tasks or routines, failures reflect undesired effects. In any case, there is a distortion from the expected and desired outcomes, which result in better understanding, changing behaviors or improving firm performance. As a consequence, the drawbacks of value creation and capture resulting from cognitive biases are corrected.

In the strategy-making process, an important phase becomes its implementation overflowing with equifinality, coincidentality, and constant interaction with external forces [23]. Employees implementing a strategy do not behave as purely rational agents, but they are prone to cognitive biases, emotions, or dynamics of social interactions [2]. That is the reason why proper strategic choices may not be sufficient success factors. Still, it may happen that proper strategic choices lead to failure, while improper ones end in success. From the strategic perspective, value creation and capture require shifting attention toward organizational practices implemented by real people, and not by fully rational economic agents. In particular, an important counterbalance for dysfunctional influence of cognitive biases lies behind the concept of diligence-based strategy that strongly focuses on capabilities required for mastering a small number of fundamental activities determining strategic successes such as building external relations, developing social capital, deciding on priorities like developing new products and serving customers, or strategic effectiveness measurement and monitoring [78].

Salvato and Vassolo [83] offer an explanation for strategic dynamics by giving a central role to strategic managers and interpersonal interactions based on a productive dialogue. As a starting point, an assumption is made and then assuring conditions for creative acting, thinking and perceiving during effortful social accomplishments translates into strategic adaptation. The offered framework offers a new ground for improving the entire enterprise, supporting—as we think—the value creation and capture processes, and sustaining the competitive advantage. However, the necessary condition is interpersonal relations based on the constructive dialogue that eliminates the negative effects of cognitive biases. A constructive and productive dialogue is necessary for developing and accepting possible change options, especially when interests are conflicting, opinions on resource renewal vary and cognitive biases influence the strategic decisions.

It seems that eliminating cognitive biases can be implemented through linking individual-level leadership with strategic leadership which would make it possible to eliminate some managerial decisions distortions and to develop value-creating leadership [46]. The value-creating leadership model extends to-date leadership concepts and approaches in that it directs the spotlight onto the role of leadership in creating value, specifies the systems and processes required to create and capture value, and also brings the attention to the notion of added value that improves performance in the core activity of the firm.

19.5 Conclusions

The recent literature analysis shows that a considerable number of articles in entrepreneurship and management cover overoptimism and overconfidence, while limited attention is given to other biases we have mentioned in this paper, such as illusion of control, hindsight, conformation bias, self-potentiating bias, or the belief in the law of small numbers, escalation of commitment, planning fallacy, and status quo bias [71]. In the literature overview presented in this paper, we found a similar phenomenon, where overoptimism and overconfidence are being discussed most. As a result, a major part of the review indicated these two most popular biases in relation to managerial decision-making. However, the role of other biases in the decision-shaping should not be ignored. We have not described them extensively, as they are known in the cognitive psychology literature. As a result, a major part of the review indicated these two most popular biases in relation to managerial decision-making. However, the role of other biases in the decision-shaping should not be ignored. We have not described them extensively, as they are known in the cognitive psychology literature.

The goal of this paper was to look into cognitive biases as psychological factors shaping the strategic decision-making process that, in turn, can influence economic outcomes of organizations (Fig. 19.1). We posit, that cognitive biases may, with a bit of luck, positively shape the value creation and capture processes in organizations. However, in most cases the decisions made and the results that they produce cannot be left luck-driven. We argue, therefore, that fact-based decision-making, organizational learning, diligent strategy adoption, and value-creating strategic leadership may limit biases in the decision-making process, thus positively influencing the value-creating processes and firm performance.

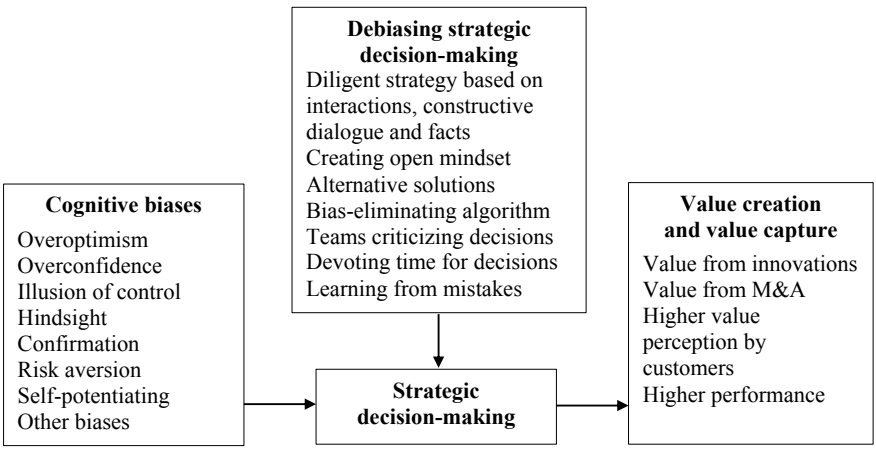

Fig. 19.1 Cognitive biases, debiasing processes, and value creation and capture in organizations

One of the key factors determining the success of organizational change is fact-based interventions [83]. Similar factors are needed in managing the value creation and capture of organizations acting in a dynamic environment, where changes are necessary for sustaining a high level of strategic effectiveness. Basing decisions and strategic behaviors on facts facilitate overcoming difficulties related to cognitive biases what helps conclude that referring to facts becomes very useful. As a consequence, seeking facts from stakeholders as well as from management science should be a natural part of the strategic alertness. Basing the value creation and value capture processes on data that reflect real situations and circumstances assure a valid diagnosis as well as proper problem formulation. As a result, the likelihood of proper solution of the wrong problem inadequate to organizational reality significantly decreases.

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Chapter 20
Managing Organization Development: Identifying Research Patterns and Mapping the Research Field

Andrzej Lis

Abstract The aim of the paper is to map the research field related to the issues of organization development in order to identify leading research patterns and thematic boundaries of the field. In the study, the combination of methods including research profiling, keywords co-occurrence analysis, and systematic literature review was applied. The paper contributes to the body of knowledge with answering to the following research questions: (1) how has intensity of research in the field evolved? (2) who are the main contributors (countries, universities, journals, authors, core references) to research development in the field? (3) what are leading topics within the field and how are they interrelated? (4) what are the emerging topics in research on organization learning?

Keywords Organization development · Organizational development · Research profiling · Topic profiling · Keywords co-occurrence analysis

20.1 Introduction

Although organization development (OD) is a well-established concept in management theory and business practice [7, 23], it seems still to be found a "buzz-word" [38, p. 3–4], attracting the attention of researchers and managers. As claimed by Sorensen et al. [42], contrasting with other behavioral field of research, organization development remains an emerging area of inquiry enabling new ranks of scholars to contribute to its "golden age".

According to the classical definition, organization development is described as "a planned effort that is organization-wide and managed from the top, intended to increase organizational effectiveness and health through planned interventions in the organization's processes, using behavioral science knowledge" [5, p. 9; quoted after: 24, p. 356]. Discussing challenges for organization development, Worren et al. [45, p. 275–276] point out four dimensions of the concept including: (1) focus on

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increasing effectiveness at the organizational level, (2) strong connection with behavioral sciences, and psychology in particular, (3) long-term orientation and continuous character, and (4) emphasis given to humanistic aspects of management such as: organizational culture and climate, communication, leadership, job satisfaction. Nevertheless, there is still a lack of one commonly accepted approach to understand the concept of organization development. As observed by Cacioppe and Edwards [13, p. 87]: "The lack of an integrated framework is evidenced in the debate on how OD is defined. Many definitions refer to the ideas of effectiveness and strategic planning to improve organizational performance. (…) Other authors have suggested that the purpose of organizational development is not only to increase organizational effectiveness but also to improve organizational health and quality of working life. (…) Still, other approaches define OD more in terms of cultural and values development as opposed to behavioral effectiveness".

Referring to changes in the field, Marshak and Grant [29: S7] state: "[a] new ensemble of organization development (OD) practices have emerged that are based more on constructionist, post-modern and new sciences premises than the assumptions of early founders. These include practices associated with appreciative inquiry, large group interventions, changing mindsets, and consciousness, addressing diversity and multicultural realities, and advancing new and different models of change". The authors suggest to include the issue of organizational discourse into research on organization development. In consequence, the traditional concept of diagnostic organizational development is revisited and dialogic organization development is proposed [9, cf. 3]. The idea of dialogic organization development is cultivated in following contributions [e.g., 10, 11].

Recent interventions on the issues of organization development highlight the importance of the sustainable, i.e., long-term oriented approach to organization development making change a permanent aspect of the company's life [30]. The interest of researchers is given to transformational change considered to be the dominating type of changes, nowadays [1, 37]. Tenkasi [43] revisits the concept of organization development and finds that contemporary interventions are too much focused on unreflective use of tools and techniques and seem to be less successful than those in the past. Moreover, he discusses the challenges for organization development in the conditions of the VUCA (i.e., volatile, uncertain, complex and ambiguous) environment. Dealing with contemporary changes in technological and socio-cultural environment (e.g., development of IT technologies, artificial intelligence, and egalitarian cultures) is another important aspect of managing strategic organization development [20].

What is interesting, in some contributions, the attention is shifted from organizational change itself to engaging stakeholders in the process of change in order to build-up great organizations [12]. Building communities of practice is one of the techniques contributing both to individual and organization development. From the organizational perspective, communities of practices are particularly important for implementing company strategy, developing new lines of business, resolving the problematic issue and sharing lessons [28]. Human resources strategy and organizational change are considered the most critical aspects of organization development [32]. The concept of positive organizational scholarship, based on psychological and

humanistic assumptions, is recommended to support organization development to generate positive organizational change [14].

Taking into account the multidimensionality of approaches and developments, there is a need for mapping and profiling of the research field. Although there have been conducted some comprehensive and interesting theoretical studies on organization development, its evolution, state of the art and perspective of future research [e.g., 7, 8], they applied a traditional literature survey methodology. So far, the research field has not been mapped (profiled) yet with the use of bibliometric methodology. As of 27 December 2018, there were found no relevant publications in the Business, Management and Accounting subject area for the following search query in the Scopus database:

> Searched for Topic (Title, Keywords, Abstracts): ('organi?ation development' OR 'organi?ational development') AND ('research profiling' OR 'research profile' OR 'bibliometric'). Time span: unlimited.

The same query repeated in the Web of Science Core Collection (on 17 February 2019) retrieved two items. Having abstracts analyzed only one of them was found relevant. Nevertheless, Guo et al. [25] focus their research on organizational constraints of sustainable organization development and their study does not cover the whole field related to research on organization development. In consequence, the identification of the research gap may be confirmed.

Therefore, the aim of the paper is to map the research field related to the issues of organization development in order to identify leading research patterns and thematic boundaries of the field. The research process is oriented to answering the following research questions: (1) how has the intensity of research in the field evolved? (2) who are the main contributors (countries, universities, journals, authors, core references) to research development in the field? (3) what are leading topics within the field and how are they interrelated? (4) what are the emerging topics in research on organization development?

20.2 Method of Study

20.2.1 Data Sampling

Scopus was used as a source of data for research sampling. Truncation technique was applied in order to include into the sample publications written in both British and American spelling standards of English. The following research query was used in the sampling process:

> Searched for Topic (Title, Keywords, Abstracts): ('organi?ation development' OR 'organi?ational development'). Subject area: Business, Management and Accounting. Time span: unlimited.

In total, as of 29 December 2018, 2463 records were retrieved. The dominant majority of publications (2415; 98%) was written in English. Therefore, it should be noticed that the bias towards English as a language of the publication provides a limitation to the study as there is a risk of neglecting important works written in other languages. Some of the publications in the research sample are indexed in more than one subject area. In consequence, the Business, Management and Accounting sample shares some items with 21 other subject areas. Among them, the strongest links are noticed in regard to Social Sciences (648 co-shared publications), Economics, Econometrics and Finance (351), Decision Sciences (274), Psychology (249), Arts and Humanities (178), Engineering (146).

Moreover, for the purposes of core references profiling, the "title sub-sample" was selected. This sub-sample, numbering 557 records, comprises publications indexed within the Business, Management and Accounting subject area and including the phrases "organi?ation development" OR "organi?ational development" in their titles. For the purposes of emerging topics identification, the "2010 and beyond sub-sample" was extracted from the main topic sample (i.e., the phrases were searched in titles, keywords, and abstracts). The sub-sample numbers 1157 publications which have been issued since 2010.

20.2.2 Applied Methods, Techniques and Tools

In the study, the combination of methods including research profiling, co-occurrence analysis, and systematic literature review was applied. Research profiling is a bibliometric descriptive method recommended to be used for quantitative analyzing of a wide body of publications and mapping scientific output in the given research field [35]. In its classical version, research profiling procedure includes three main components, i.e., general research profiling, subject area profiling and topic profiling [cf. 15, 31]. In this study, the focus was given to general research profiling in order to analyze the development of the research field and its main contributors. As the analysis relates to publications indexed in only one subject area of the Scopus database (i.e., Business, Management, and Accounting), subject area profiling was excluded from the research procedure. In regard to identifying principal themes in the field, traditional, descriptive topic profiling conducted from the perspective of leading journals, authors, subject areas and core references was replaced with keywords co-occurrence analysis. While designing the research procedure and the structure of the paper, the works by Martinez et al. [31], Kim et al. [27] and Guo et al. [25] were used as benchmarks.

The VOSviewer application developed by the Centre for Science and Technology Studies of the University of Leiden, the Netherlands was used to support co-occurrence analysis with creating keywords networks and clustering keywords. VOSviewer is a tool recommended for creating and displaying bibliometric maps. As noticed by Van Eck and Waltman [44, p. 536], "[u]nlike programs such as SPSS and Pajek, which are commonly used bibliometric mapping, VOSviewer pays special

attention to the graphical representation of bibliometric maps. The functionality of VOSviewer is especially useful for displaying large bibliometric maps in an easy-to-interpret way".

Recognizing the power and advantages of bibliometric methodology, the author strongly supports the view of Czakon [17, p. 59] that the findings of quantitative literature studies should be complemented with qualitative literature survey and interpretations. Therefore, the bibliometric findings from author and core reference profiling are supported with systematic literature review. Nevertheless, it should be made explicit that due to formal restrictions concerning the length of the manuscript, the thoroughness of systematic literature analysis is limited. In regard to the analysis of leading topic areas within the research field identified through keywords co-occurrence analysis, the literature analysis was given up for the aforementioned reason. Therefore, this aspect of the study should be developed in further research.

20.3 Research Productivity in the Field

The analysis of the number of publications is used to assess productivity in the research field and the stage of its life cycle [17, p. 59]. Two earliest publications in the research sample are dated as of 1969. The yearly distribution of scientific productivity in research on organization development from 1970 to 2018 is displayed in Fig. 20.1. From the beginning of the 1970s to the mid-1990s, the research productivity was growing slowly from a few to around thirty papers per year. From the mid-1990s,

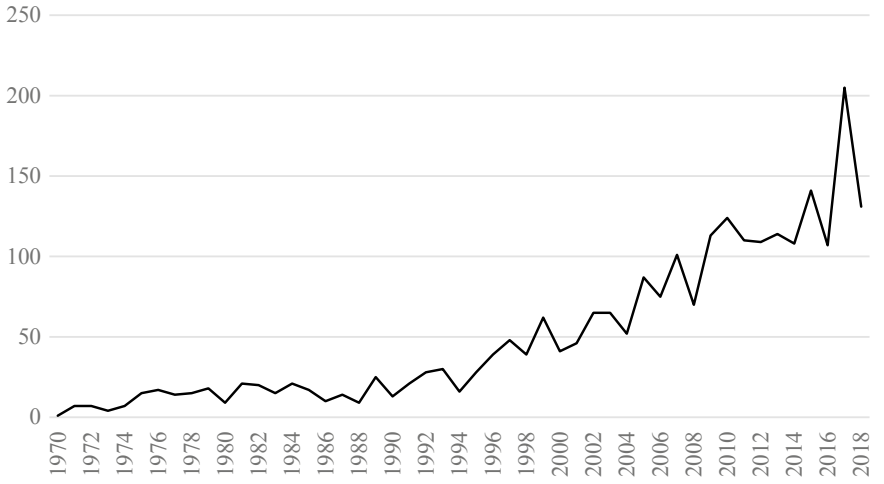

Fig. 20.1 Scientific productivity in research on organization development. Subject area: Business, Management and Accounting. Time span: unlimited. *Source* Own study based on data retrieved from Scopus database (accessed 29 December 2018)

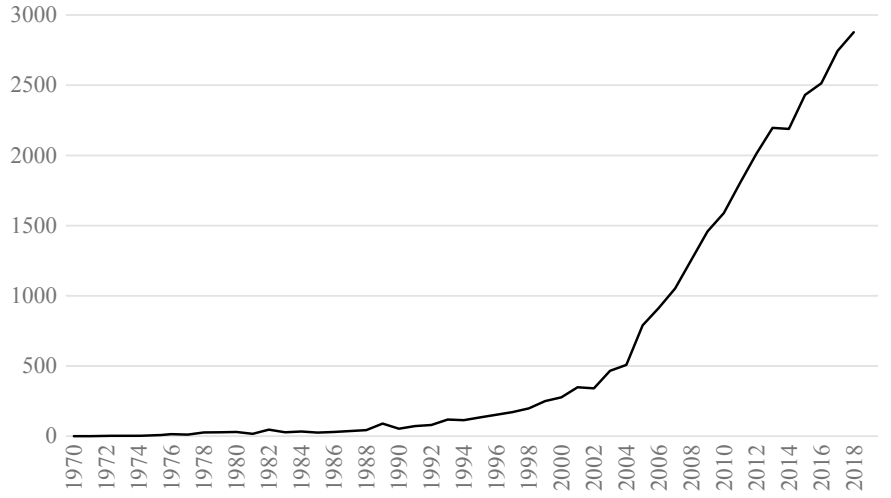

Fig. 20.2 Received citations in research on organization development. Subject area: Business, Management and Accounting. Time span: unlimited. *Source* Own study based on data retrieved from Scopus database (accessed 29 December 2018)

generally, the acceleration of the long-term growing trend has been observed. The number of publications increased from 28 in 1995 to 205 in 2017. The trend line representing distribution of the scientific output in 1970–2018 is best described with the 2-degree polynomial function ($y = 333785 – 337.57\ t + 0.0853\ t^2$; t^2 p-value < 0.01; $R^2 = 0.8773$) or the exponential function ($y = 3E{-}60e0.0704\ t$; $R^2 = 0.8499$).

As of 29 December 2018, the publications comprising the research sample received in total 29,671 citations. Yearly distribution of citations is displayed in Fig. 20.2.

Analyzing the number of citations received by the research sample publications, three periods may be distinguished: (1) from the 1970s to 1992 characterized a relatively low number of citations and their slow growth, (2) from 1993 to 2004 while the number of citations increased from 118 to 507, and (3) the from 2005 to 2018 marked with the growing attention of the academia in the topic of organization development. The 2-degree polynomial function ($y = 9E + 06 – 9557.7\ t + 2.409\ t^2$; t^2 p-value <0.01; $R^2 = 0.9184$) matches best with the trend line representing the increase in the number of citations received by studied publications.

Summing up, the research related to the issues of organization development is on increase, which is represented by the growing scientific output and the number of received citations. Analyzing research productivity from 1970, the rising trend has been observed since mid-1990s. Another milestone is found around mid-2000s, when the rise became more intensive, which is manifested particularly in the number of received citations.

20.4 General Research Profiling

20.4.1 Country Profiling

Within the research sample, there are 302 papers of undefined country/territory. All remaining works are distributed among 88 countries/territories. Top 10 most productive countries contribute with 76.2% of all publications in the field, which manifests a high level of quality research concentration. Among them, Anglo-Saxon, Scandinavian and European continental countries are the main contributors (cf. Table 20.1).

All top 4 positions in the ranking are occupied by English speaking countries which have a natural advantage in the English-biased Scopus database. The United States is the unquestionable leader in research on organization development, both in regard to quantity and quality of the scientific output. The U.S. affiliated publications make up 36.1% of the sample. The followers are: the United Kingdom (17.1%), Australia (5.9%), and Canada (4.0%). Among the most productive countries there is only representative of developing nations, i.e., India. The leading countries representing other continents are: South Africa ($N = 24$, rank 16) and Brazil ($N = 12$, rank 28–31). Poland contributing with 10 publications is ranked 34–36 (together with Lithuania and Singapore).

Table 20.1 Top most productive countries/territories in research on organization development

No.	Country/Territory	Publications		Citations		
		N	%	*N*	%	*h*
1.	United States	890	36.1	12747	43.0	49
2.	United Kingdom	421	17.1	6274	21.1	41
3.	Australia	145	5.9	2172	7.3	23
4.	Canada	99	4.0	1533	5.2	21
5.	Germany	76	3.1	784	2.6	15
6.	Sweden	65	2.6	761	2.6	17
7.	India	56	2.3	245	0.8	8
8.	Netherlands	50	2.0	1202	4.1	13
9	Finland	42	1.7	1042	3.5	11
10.	France	33	1.3	243	0.8	7

Source Own study based on data retrieved from Scopus database (accessed 29 December 2018). Subject area: Business, Management and Accounting. Time span: unlimited

20.4.2 Institution Profiling

The dominating position of English speaking countries in the research field is even more evident while analyzing the top most productive universities. Institution profiling shows that all most contributing institutions represent Anglo-Saxon nations, and the United States in particular (cf. Table 20.2). The highest positioned research institution from a non-English speaking country is Copenhagen Business School, which contributes with 10 publications and is ranked 22–25.

Identifying the leading most productive and most influential research institutions enables researchers to seek potential partners for networking. In regard to quantity of scientific output the U.S. based universities such as Benedictine University, Texas A&M University and Columbia University in the City of New York are the leaders. However, from the point of view of quality of research manifested in the number of received citations and *h*-index[1] Pennsylvania State University and Cranfield University should be highlighted.

Table 20.2 Top most productive institutions in research on organization development

No.	Institution	Country/Territory	Publications		Citations		
			N	%	*N*	%	*h*
1.	Benedictine University	US	24	1.0	35	0.1	4
2.	Texas A&M University	US	21	0.9	183	0.6	7
3.	Columbia University in the City of New York	US	20	0.8	228	0.8	8
4–5.	Pennsylvania State University	US	16	0.6	703	2.4	7
4–5.	Trinity College Dublin	Ireland	16	0.6	167	0.6	6
6–7.	University of Manchester	UK	15	0.6	178	0.6	7
6–7.	American University	US	15	0.6	216	0.7	5
8–9.	Cranfield University	UK	14	0.6	590	2.0	12
8–9.	The University of Georgia	US	14	0.6	214	0.7	9
10–12.	Alliance Manchester Business School	UK	13	0.5	302	1.0	8
10–12.	University of Southern California	US	13	0.5	49	0.2	6
10–12.	Griffith University	Australia	13	0.5	142	0.5	6

Source Own study based on data retrieved from Scopus database (accessed 29 December 2018). Subject area: Business, Management and Accounting. Time span: unlimited

[1] H-index provides information about the number of publications included in the analyzed body of literature which have received at least the same number of citations. Cf. Hirsch [26].

Table 20.3 Top most productive source titles in research on organization development

No.	Source title	Publications		Citations		
		N	%	*N*	%	*h*
1.	Organization Development Journal	131	5.3	440	1.5	12
2.	Leadership and Organization Development Journal	69	2.8	926	3.1	19
3.	Industrial and Commercial Training	65	2.6	215	0.7	6
4.	Group & Organization Management	64	2.6	599	2.0	14
5.	Journal of Organizational Change Management	52	2.1	680	2.3	15
6.	Advances in Developing Human Resources	50	2.0	596	2.0	14
7.	Journal of Management Development	44	1.8	380	1.3	11
8.	Palgrave Handbook of Organizational Change Thinkers	40	1.6	4	0.0	1
9–10.	Human Relations	38	1.5	1798	6.1	19
9–10.	Human Resource Management International Digest	38	1.5	14	0.0	2

Source Own study based on data retrieved from Scopus database (accessed 29 December 2018). Subject area: Business, Management and Accounting. Time span: unlimited

20.4.3 Source Title Profiling

Identifying leading source titles in the field not only shows their impact on research development but it also provides valuable information to potential new authors searching for options to submit their studies in the most relevant journals. Table 20.3 presents the source titles publishing the highest number of papers presenting the findings of research on organization development. *Organization Development Journal* is the unquestionable leader among top most productive source titles. However, *Human Relations* and *Leadership and Organization Development Journal* publish the papers which attract the highest interest of the academia measured in the number or received citations.

20.4.4 Authors Profiling

Identifying the most productive and most influential researchers (Table 20.4), similarly to research institution profiling, not only highlights main contributors to the field but also indicates potential valuable partners for further research projects.

A. H. Church is particularly interested in analyzing the field of organization development from the perspective of OD practitioners. He also includes in his research emerging aspects related to organization development such as talent management, diversity, and inclusion or new technology. D. Coghlan focuses his research on action

Table 20.4 Top most productive authors in research on organization development

No.	Author	Institution	Country / Territory	Publications		Citations		
				N	%	*N*	%	*h*
1.	Church, A. H.	PepsiCo.	US	18	0.7	178	0.6	8
2–3.	Coghlan, D.	Trinity College Dublin	Ireland	13	0.5	169	0.6	7
2–3.	Rao, M. S.	MSR Leadership Consultants India	India	13	0.5	8	0.0	2
4.	Levasseur, R. E.	Walden University	US	12	0.5	53	0.2	4
5.	Burke, W. W.	Columbia University in the City of New York	US	9	0.4	178	0.6	7
6–8.	Sorensen, P. F.	Benedictine University	US	8	0.3	31	0.1	4
6–8.	Appelbaum, S. H.	Concordia University	Canada	8	0.3	95	0.3	4
6–8.	Marshak, R. J.	American University	US	8	0.3	205	0.7	4

Source Own study based on data retrieved from Scopus database (accessed 29 December 2018). Subject area: Business, Management and Accounting. Time span: unlimited

research. M. S. Rao's main research topics are: organizational excellence, leadership, employee engagement, and HRM aspects. The studies by R. E. Levasseur are centered around change management related issues such as: leadership, building and leading teams. Many of Church's works are co-authored by W. W. Burke, whose research focus is on the status and perspectives of the organization development field and its practitioners. P. F. Sorensen is interested in appreciative inquiry, evaluation of organization development interventions as well as international and global aspects of organization development. The research of S. H. Applebaum deals with the issues of resistance to change, leadership, including toxic leadership, and deviant workplace behaviors. R. J. Marshak studies discursive and dialogic approaches to organizational development.

20.4.5 Core References Profiling

Identifying core references shows the publications in the field attracting the most of researchers' attention. However, it should be made explicit that using the number of received citations as a measure for profiling core references shows the bias towards the earliest works while prejudicing those published recently. As already mentioned, the analysis of core references in research on organization development focuses both on the topic sample (i.e., publications relating to organization development issues in their

titles, keywords, and abstracts) and the title sample (referring directly to organization development). The findings from the analysis are presented in Table 20.5.

Core references in the topic sample deal with the issues of leadership, support of decision-making processes and interorganizational collaboration. Bass and Staidlmeier [4] discuss the features of "authentic" transformational leadership, deeply embedded in morality, which are: idealized influence, inspirational motivation, intellectual stimulation, and individualized consideration. Sarkis [39] develops a framework supporting strategic managerial decisions regarding green supply chain management. Shim et al. [41] analyze decision support technology and implications for further development in this area. Fry [21] proposes the theory of spiritual leadership and studies the processes of organization development from the perspective of spiritual leadership. Gray [22] uses the findings from the field of organization development to explore the conditions facilitating interorganizational collaboration.

Title sample core references relating directly to the concept of organization development are focused on organization development interventions, their antecedents and effects. Marshak and Grant [29] study new organization development practices emerging from the social constructionist perspective. Neuman et al. [33] analyze the influence and effects of organization development interventions on satisfaction and some other attitudes. Dawson [19] discusses knowledge capabilities as a central issue for organization development and options for developing these capabilities. Choi and Ruona [16] theorize about individual readiness for organizational change and its impact on human resources and organization development. Applebaum [2] discusses socio-technical systems theory to integrate organization development and technological interventions.

Table 20.5 Core references in research on organization development

Topic sample			Title sub-sample		
No.	Publication	Citations	No.	Publication	Citations
1.	Bass and Staidlmeier [4]	847	1.	Marshak and Grant [29]	99
2.	Sarkis [39]	738	2.	Neuman et al. [33]	82
3.	Shim et al. [41]	737	3.	Dawson [19]	81
4.	Fry [21]	578	4.	Choi and Ruona [16]	76
5.	Gray [22]	554	5.	Appelbaum [2]	69

Source Own study based on data retrieved from Scopus database (accessed 22 December 2018). Subject area: Business, Management and Accounting. Time span: unlimited

20.5 Topic Profiling

20.5.1 Leading Topics

The papers comprising the research sample provide 5105 keywords. However, among them, there are only four keywords with the number of occurrences equal to 100 and more. For subsequent thresholds the following numbers of keywords are reported: 50 occurrences—15 items, 20–49 items, 10–122 items. 3854 keywords from the research sample occurred only once. Table 20.6 presents leading keywords in research on organization development which occurred at least 50 times in publications comprising the sample.

The findings presented in Table 20.6 indicate leading aspects of research in the field. Certainly, organization(al) development is the most often cited and central keyword. Other leading streams of research include leadership, organizational change and change management, organizational culture, knowledge management and organizational learning, action research, management, and human resource management in particular.

In the next step, findings from keywords frequency analysis will be supplemented with keywords co-occurrence analysis and cluster analysis. Following Donohue [18]; cited after Guo et al. [25, p. 7], the number of high-frequency keywords used for further analysis was calculated as 86. It means that the minimum number of occurrences of a keyword to be included in the co-occurrence analysis equals to 13. Figure 20.3 presents the results of this analysis. In the figure, the size of nodes represents the frequency of keyword's occurrence, while lines depict relationships between keywords.

Mapping relationships among high-frequency keywords in the field creates the possibility to categorize them with the cluster analysis. As presented in Table 20.7, all the 86 high-frequency keywords may be clustered into five categories.

Table 20.6 Leading keywords in research on organization development

No.	Keywords	N	No.	Keywords	N
1.	Organizational development	591	9.	Knowledge management	64
2.	Organization development	204	10.	Organizational learning	59
3.	Leadership	130	11–14.	Action research	55
4.	Organizational change	126	11–14.	Learning	55
5.	Change management	94	11–14.	Management	55
6.	Innovation	82	11–14.	Societies and institutions	55
7.	Organizational culture	70	15.	Human resource management	53
8.	Organisational development	67			

Source Own study based on data retrieved from Scopus database (accessed 29 December 2018). Subject area: Business, Management and Accounting. Time span: unlimited

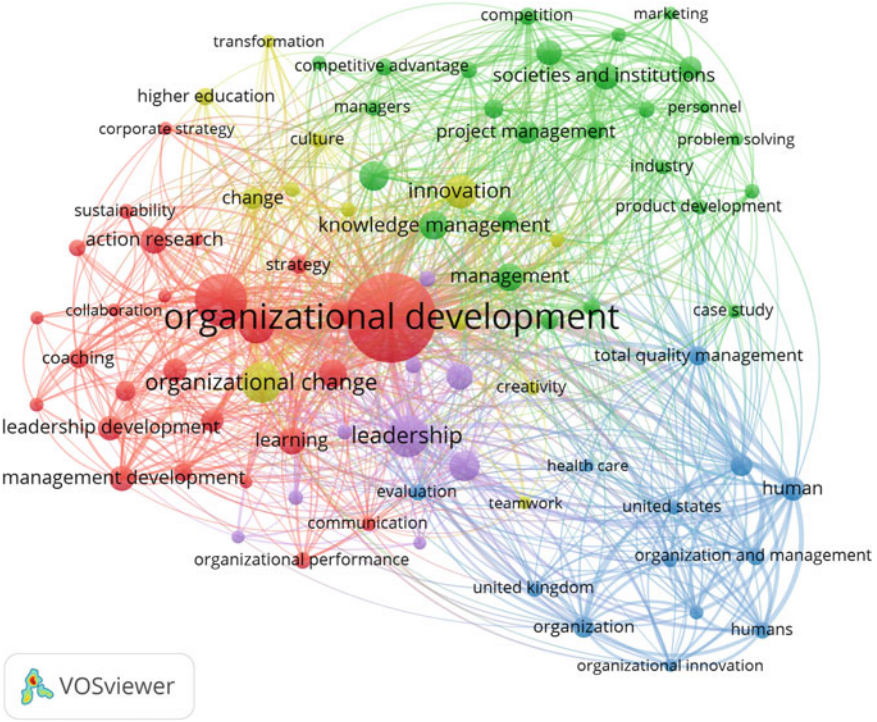

Fig. 20.3 Keywords co-occurrence analysis of research on organization development. Subject area: Business, Management and Accounting. Time span: unlimited. *Source* Own study based on data retrieved from Scopus database (accessed 29 December 2018) and analyzed in VOSviewer (02 January 2019)

Cluster 1 (marked in red in Fig. 20.3) is directly oriented to the concept of organization development. Keywords comprising the cluster are listed in 1035 publications. "Organizational development" (591 occurrences) and "organization development" (204) are the leading and most central keywords in the cluster and in the whole map showing strong relationships with all other clusters. The structure of keywords in Cluster 1 manifests the idea of combining "change management" and "organizational learning" aimed at achieving "organizational performance" with development of the members of an organization (represented by such keywords as: "human resource development", "leadership development", "management development", "competences"). Important aspects reflected in leading topics are: supporting techniques (such as: "action learning", "action research", "coaching", "mentoring", "training") and the positive organizational context (stressing the importance of "appreciative inquiry", "collaboration", "communication"). The keywords related both to techniques and the positive context show more and stronger relationships with other issues within Cluster 1 than with topics represented in other clusters.

Table 20.7 Clusters of high-frequency keywords in research on organization development

Symbol	Items [N]	High-frequency keywords [N]	Issue
C1	26	action learning (30), action research (55), appreciative inquiry (21), change management (94), coaching (28), collaboration (14), communication (15), competences (13), corporate strategy (13), development (26), experiential learning (13), human resource development (43), leadership development (46), learning organizations (44), management development (49), mentoring (16), organization development (204), organizational development (591), organizational learning (59), organizational performance (22), performance management (15), strategy (25), sustainability (17), talent management (13), training (40)	Organization development
C2	26	case study (16), competition (23), competitive advantage (23), decision making (28), education (22), industrial management (33), industry (18), information management (22), information technology (19), knowledge management (64), management (56), managers (19), marketing (13), organisational development (67), performance (27), personnel (14), personnel training (15), problem solving (13), product development (18), project management (38), research (22), societies and institutions (55), strategic management (15), strategic planning (45), sustainable development (27), technology (17)	General and strategic management

(continued)

Table 20.7 (continued)

Symbol	Items [N]	High-frequency keywords [N]	Issue
C3	13	article (37), evaluation (21), health care (14), health care quality (15), human (41), humans (21), methodology (15), organization (33), organization and management (23), organizational innovation (14), total quality management (27), United Kingdom (19), United States (16)	Industrial and geographical OD research contexts
C4	12	change (35), creativity (16), culture (18), empowerment (16), ethics (17), higher education (24), innovation (82), learning organization (17), motivation (19), organizational change (126), teamwork (14), transformation (14)	Organizational change and innovation
C5	9	career development (17), corporate culture (17), human resource management (53), human resources (13), job satisfaction (20), leadership (130), organizational behavior (14), organizational culture (70), organizations (21)	Leadership, organizational culture and human resource management

Source Own study based on data retrieved from Scopus database (accessed 29 December 2018) and analyzed in VOSviewer (02 January 2019). Subject area: Business, Management and Accounting. Time span: unlimited

Cluster 2 (marked in green in Fig. 20.3) deals with the issues of general and strategic management and represents the content included in 434 publications. However, there is not observed any keyword occupying the central position within it. The keywords of the highest occurrence within the cluster are: "organizational development" (67), "knowledge management" (64), "societies and institutions" (55), "strategic planning" (47). Exploring thoroughly the structure of the cluster, the following areas of management should be highlighted: strategic management, information and knowledge management, project management. It should be noticed that publications comprising such keywords as: "organizational development", "knowledge management", and "management" are located more in the center of the map and show more relationships with items from other clusters than keywords typical of strategic management (e.g., "competition", "competitive advantage", "strategic planning"), industrial management or marketing.

Cluster 3 (marked in blue in Fig. 20.3) is mainly organized around industrial and geographical contexts of organization development research. Keywords comprising the cluster come from 139 publications. Leading keywords indicate the focus of

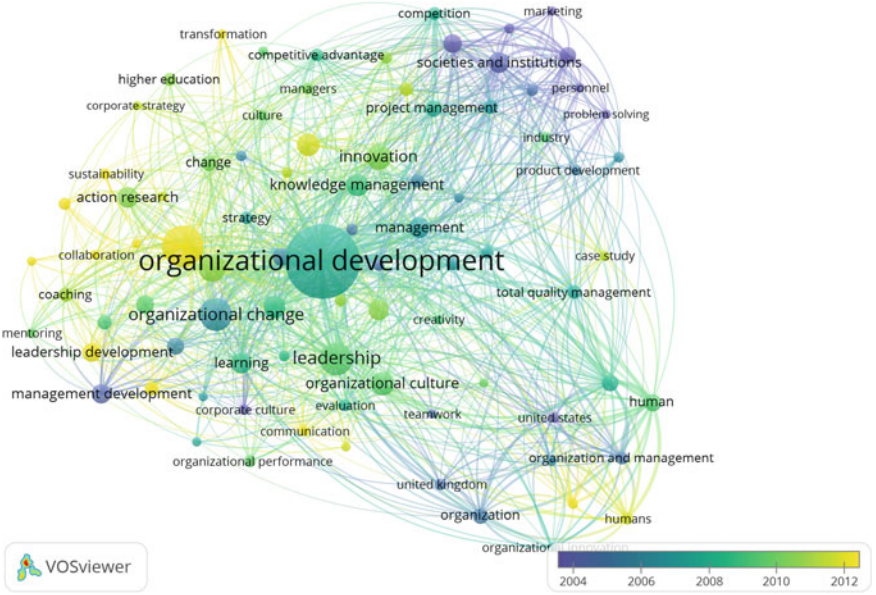

Fig. 20.4 Emerging topics in research on organization development. Subject area: Business, Management and Accounting. Time span: unlimited. *Source* Own study based on data retrieved from Scopus database (accessed 29 December 2018) and analyzed in VOSviewer (05 January 2019)

research on the health care industry and cases representing the United States and the United Kingdom. In regard to research topics which are the most highlighted in the cluster, they include innovation, total quality management, and humanistic aspects.

Organizational change and innovation are the leading aspects of Cluster 4 (marked in yellow in Fig. 20.3). Its keywords are listed in 339 publications. Other keywords represented in the cluster point out such aspects of study as creativity, empowerment, motivation, teamwork. What is interesting the items of this cluster are dispersed in the map and show many links with other clusters.

The last, but not least, Cluster 5 (marked in violet in Fig. 20.3) is focused on "soft" aspects of management. Its keywords come from 306 publications. Leadership, organizational culture, and human resource management are three central nodes. The keywords comprising the cluster are located in the center of the map and are well connected with other clusters.

20.5.2 Emerging Topics

The identification of emerging topic was conducted in two steps. Firstly, the most up-to-date high-frequency keywords within the topic sample were located on the

map and listed (Fig. 20.4). Secondly, the same procedure was replicated for the sub-sample including papers published in 2010 and later.

The analysis points out the following keywords manifesting the most up-to-date issues in research on organization development: "transformation", "learning organization", "sustainability", "sustainable development", "humans" and "human resources", "talent management", "leadership development", "communication", "collaboration", "appreciative inquiry", "health care quality", "case study". The findings may suggest the growing interest of organization development research in: the aspects of strategic management related to organizational learning and the idea sustainability as well as the issues encompassed by the umbrella concept of positive organizational scholarship (POS). In regard to the contexts of the study, the interest in the health care industry should be noticed. Growing attention to the case study methodology is another aspect worth mentioning.

As already mentioned, in the second step the procedure of identifying the emerging topics in the field was replicated for publications issued in 2010 and beyond. To make the research tool more sensitive to recognize weak signals of new "hot" topics, the threshold of the minimum number of occurrences of a keyword was tuned to 5. In result, among 3587 keywords 163 of them meeting the threshold were included in analysis, what is visualized in Fig. 20.5.

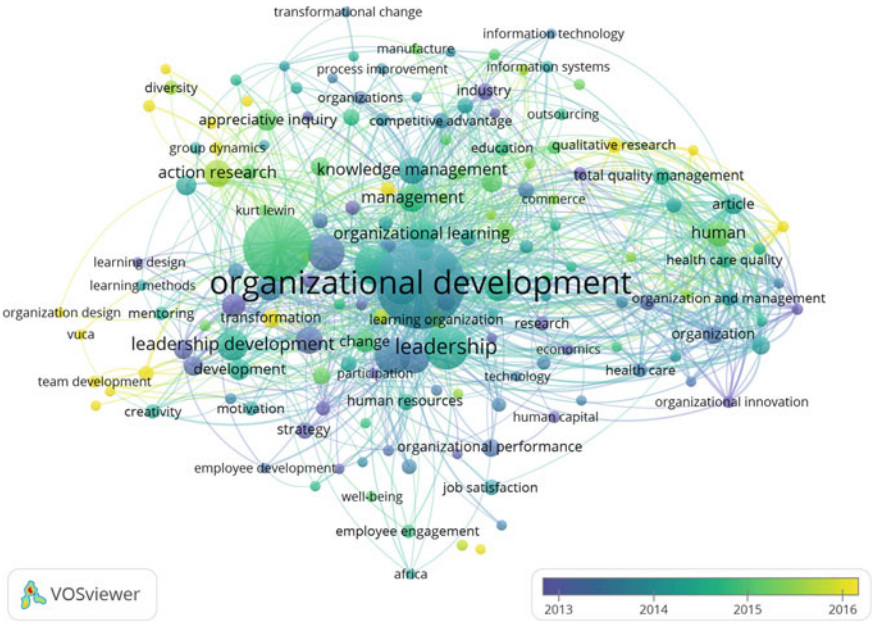

Fig. 20.5 Emerging topics in research on organizational development (2010 and Beyond Sample). Subject area: Business, Management and Accounting. Time span: unlimited. *Source* Own study based on data retrieved from Scopus database (accessed 29 December 2018) and analyzed in VOSviewer (05 January 2019)

The analysis of the map presented in Fig. 20.5 indicates emerging keywords within the research field. Exploring their relationships with keywords clusters may be an indication to point out topics associated with them. First, "transformation", "organizational transformation", "organizational change and learning", "mindfulness", "team development", "VUCA" (i.e., volatility, uncertainty, complexity, ambiguity), "organization design" relate to issues of leadership development, learning and training. Second, the study of "group dynamics", "inclusion", "organization change", "resistance to change" emerges in a direct relation to the concept of organization development. Third, "learning organization" and "design thinking" make up an emerging dyad located in the central position of the map. Fourth, "work engagement" is an emerging aspect of organization development studies related to the concept of positive organizational scholarship. Fifth, in regard to organization research contexts, the interest in "health care delivery" and "qualitative research" is confirmed. However, questionnaire research is also indicated among up-to-date methods applicable to research on organization development.

Combining the findings from both studies on emerging topics may suggest the growing interest of organization development research in: (1) organization transformation, change and learning, (2) sustainability and sustainable development, (3) the issues encompassed by the umbrella concept of positive organizational scholarship (e.g., human resources, talent management, leadership development, communication, collaboration, appreciative inquiry, work engagement). Appreciative inquiry makes a bridge to another up-to-date stream of research related to (4) group dynamics, organization change and resistance to it. (5) "Learning organization" and "design thinking" make up an emerging dyad located in the central position of the map. In regard to the contexts of the study, the interest in the health care industry should be noticed. Growing attention to qualitative research and the case study methodology is another aspect worth mentioning.

Taking into account the focus of the proceedings on the contemporary problems and challenges in cooperation and coopetition in the Industry 4.0, additional search within the sample was conducted to find out the position of these aspects in the scientific output in the field. The topic search for the conjunction of phrases ("organi?ation development" OR "organi?ational development") AND ("cooperation") retrieves 46 items, while the title search brings only 5 items. However, the study of abstracts of identified publications shows very weak links between studied issues. The search for the conjunction of phrases ("organi?ation development" OR "organi?ational development") AND ("coopetition" OR "co-opetition") brings no results. In case of searching for conjunction with the expression "Industry 4.0", 3 records are retrieved. Binner [6] discusses the implications of technological changes associated with the Industry 4.0 concept for the future of business including organization development. Prause and Atari [36] study "the relationship between networking, organizational development, structural frame conditions and sustainability in the context of Industry 4.0". Orth et al. [34] call for "new concepts of organizational development" for successful Industry 4.0 and analyze operational and strategic knowledge management in this context. Summing up, the issues of cooperation and coopetition in the context of Industry 4.0 are very little represented in the publications dealing with organization

development included in the sample. Certainly, such an observation needs to be validated with the use of other sets of bibliometric data and research methods. However, while validated, a new potential research gap emerges offering scholars opportunity to explore relationships between the concepts of organization development and Industry 4.0.

20.6 Conclusions

The paper contributes to the body of knowledge with mapping the research field related to the issues of organization development, highlighting leading research patterns in the field, as well as identifying leading and emerging topics. First, in regard to intensity of research in the field (analyzed from 1970), the rising trend has been observed since mid-1990s. Another milestone is found around mid-2000s, when the increase became more intensive, which is manifested particularly in the number of received citations. Secondly, identification of main contributors to the field has been conducted. Analyzing most productive countries, research institutions and authors in the field, the dominating position of English speaking countries is observed. The United States, the United Kingdom, Australia, and Canada make up top four contributors. Among research institutions, Benedictine University, Texas A&M University and Columbia University in the City of New York should be mentioned for the number of publications, they contributed with. From the point of view of quality of research manifested in the number of received citations and *h*-index the position of Pennsylvania State University and Cranfield University should be highlighted. The most prolific authors are: A. H. Church (the United States), D. Coghlan (Ireland), M. S. Rao (India) and R. E. Levassur (the United States). *Organization Development Journal* is the unquestionable leader among top most productive source titles. However, *Human Relations* and *Leadership and Organization Development Journal* publish the papers which attract the highest interest of the academia measured in the number or received citations.

In order to identify the leading topics within the field and recognize how they are interrelated, keywords co-occurrence analysis has been conducted. In result, the research output has been categorized in five clusters related to: (1) the idea and assumptions of the concept of organization development, (2) general and strategic management, (3) industrial and geographical OD research contexts, (4) organizational change and innovation, (5) leadership, organizational culture and human resource management. Last, but not least, the emerging topics in research on organization development have been identified. They relate to the issues of organization transformation, sustainability, positive organizational scholarship, managing organizational change and resistance to it, as well as learning organization and design thinking.

As highlighted by Shani and Coghlan [40], organization development is characterized by its dual character of the field of scientific inquiry and professional social action. Combining scientific research and business practice shows a lot of potential

to create synergies and may be of primary importance for the future of the field [40]. Therefore, although this paper is mainly focused on mapping the research field, i.e., theoretical aspects of organization development, the usefulness of its findings for business practice is worth mentioning. Identifying leading research institutions and the most prolific authors in the field points out potential partners for cooperation with academia. Recognizing the top most productive source titles and core references provides useful information not only for scholars but also for practitioners enabling them to quickly find valuable publications. Identifying the emerging topics in research on organization development may be an indication for business which issues they should pay attention to while designing and managing long-term changes in their organizations. What is more, showing actual focal points of research interest may trigger a feedback from business practice to define and submit to academia for consideration some thorny issues which have not been covered, so far—certainly only if both clans successfully establish effective dialog.

Summing up, the avenues for further research are worth mentioning. First of all, in order to mitigate limitations of the study related to the research sampling procedure (using only one database, bias to English language publications), replication of the research with use of other databases is recommended. Such research projects should go beyond using other world-class bibliometric databases (e.g., Web of Science Core Collection) and they are encouraged to include and bring to the attention of the members of global academia the findings published in local national languages. Secondly, due to its focus on bibliometric methodology, this study presents a wide perspective of the status of research in the field but it lacks enough thoroughness of analysis while discussing leading and emerging topics in the field. Due to formal limitations concerning the length of the manuscript, the depth of the literature analysis may seem to be too superficial. Therefore, separate systematic literature reviews focused on identified leading and emerging topics in the field are recommended. Finally, taking into account the dynamic development of the field, the replication of the study mapping the field is suggested to be conducted in 4–5 years perspective. Such a replication would give the chance the assess, from the dynamic perspective, changing patterns in research on organization development.

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Chapter 21
Virtual Brand Communities as a Source of Value Co-creation

Dagna Siuda

Abstract Social media are considered to be one of the most important communication channel, widely used in almost every aspect of life. Their popularity and accessibility have influenced various fields, including marketing. One of the most prominent features in this domain is the virtual brand communities, gathered around fanpages. They do not only enabled the occurrence of efficient, almost real-time dialogue between the consumers and marketers, but also allowed the fans to participate in brand's value co-creation. The main aim of the article is to present the issue of brand value co-creation in the social media. The author completed the research based on the survey carried out among a representative group of 650 Polish Internet users. The results indicate that fans eagerly engage in value co-creating activities, however they choose those requiring less effort. Therefore, the marketers should concentrate on increasing members' involvement and partially moving the control to the consumers.

Keywords Virtual brand communities · Value co-creation · Social media · Fanpages

21.1 Introduction

In the era of the Internet's omnipresence and steadily growing popularity of social media, used by 44% of world's population [1], portals like Facebook or Instagram have become an indispensable component of brands' marketing activities. One of the possible options of social channels use in marketing is employing the tribal marketing [2], connected with facilitating the creation and functioning of consumer groups, based on common affection towards a certain brand. These groups, located usually on fanpages, offer multiple advantages for the enterprises, among them the possibility of brand's value co-creation by the fans.

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The main aim of this article is to present the issue of brand value co-creation in the social media. The author based the results on empirical research, consisting of the survey carried out among a representative group of 650 Polish Internet users.

21.2 Virtual Brand Communities and Brand Value Co-creation

The rapid development and quickly growing popularity of social media over the last two decades have resulted in changes in various elements of humans' existence, including consumer behaviour. Media users are no longer only passive consumers of marketing content, but have gained power to publish their own opinions, in this way impacting the brands' owners. The most important location for the customers to share their thoughts are the fanpages, around which virtual brand communities gather.

21.2.1 Virtual Brand Communities

In the times preceding the development of the Internet, groups connected by a common consumption pattern were characterized by limited geographical range, as the communities' life focused around regular meetings (e.g. Harley-Davidson rallies or Jeep owners meet-ups) [3]. Along with the introduction of tools offered by various websites, the physical co-presence requirement has been eradicated [4] and quick, efficient contact between group members became possible on the global scale. Currently, one of the most popular communication channels employed by the consumption communities are the social media, most commonly defined as "a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of User Generated Content" [5, p. 61]. Networks such as Facebook, Twitter or Instagram enabled the users to evolve from passive consumers of published content into "active co-creators", capable of freely voicing their views, thoughts, and opinions [6, 7].

Virtual brand communities are consumption-based groups, located in the social media on specific sub-sites called fanpages, connected by common passions and views reflected in their purchase behaviours [8, 9]. These online groups enable the two-way communication between the members and brands' representatives [10], which resembles real-time dialogue due to the technical possibilities provided by the portals. Numerous research has proven the participation in virtual brand communities to positively influence consumer engagement, brand loyalty and its antecedents [11, 12], as well as the readiness to co-create brand's value [13], e.g. by boosting its image [14, p. 13].

21.2.2 Brand Value Co-creation in the Social Media

New media, among them social networks, empowered consumers to the extent greater than ever before. Users nowadays can access extremely vast range of information, express their own opinions freely and communicate with others. One of the most advanced possibilities of influencing the brands is the chance to co-create brand's value by the actions undertaken on the fanpages, such as use of reaction buttons and publishing comments or reviews. It is worth mentioning that these activities are visible to the users' contacts, therefore the brand-related content becomes a subject of nonlinear diffusion of information [15], increasing the brand's popularity and contributing to the increase in its value even more.

In the early phase of virtual brand communities existence, the researchers often equated the value co-creation practices with the process of knowledge exchange between the brand and its consumers [16], however, later works point out to the creation of value through consumers' engagement in the group's life [17, 18]. Such behaviours build a loyal community, connected by strong emotional ties. The fact of such group's existence and the possibility of being included in it serve as additional benefit for the customer, therefore contributing to brand's higher worth and attractiveness to other consumers on the market.

Still, the aspect of knowledge acquisition from the fanpages is widely exploited by the brands' managers. The marketers are able to evaluate consumers' satisfaction with the products by analyzing their statements in comments and opinions or the reactions statistics. Additionally, communities serve as a source of knowledge regarding users' needs and expectations as well as connected with the possible demand for modifications of the offer [19]. Moreover, fanpages enable the users to participate in polls, by means of which community members can vote for their favourite products or choose from certain propositions of new additions to the offer. In this way, brands' owners transfer some of the control over the brand to the consumers—such transmission of "power" is psychologically attractive for the fans and brings favourable outcomes to the companies, being beneficial for both parties [20].

The importance of fans' participation in brands' development has forced the companies to modify their marketing activities in the social media, especially fanpages. The marketers shifted their focus in terms of brand communication from "telling stories to consumers" to "sharing stories with consumers" [21]. Nowadays, brands' representatives aim at increasing fans' engagement in the community as much as possible, trying to persuade them to participate in value-creating activities, such as "liking" fanpage content, taking part in polls, expressing opinions in forms of comments or reviews. Various researchers underline the extremely important role of dialogue between the marketers and consumers in achieving higher level of members' commitment and loyalty [22, 23].

Table 21.1 Structure of the research sample

Age group	Women	Men
18–24	48	50
25–34	87	90
35–44	76	78
45–54	50	50
55–64	42	37
≥65	26	16

21.3 Research Methodology

The main aim of the research was to investigate the issue of brand value co-creation in the social media. To complete the abovementioned goal, the author employed the method of empirical quantitative research in form of indirect data collection by means of survey technique, carried out among a representative group of 650 Polish Internet users in the 3rd quarter of 2017. In this group, 277 respondents declared membership in at least one virtual brand community (located in the social media)—their answers served as the basis of the analysis. The structure of the research sample is presented in Table 21.1.

The questions in the survey regarded the activities, performed by the community members, which have the value-creating potential, i.e. using reaction buttons, posting comments and product or brand reviews. The respondents were asked about the frequency with which they usually perform such actions.

The main hypothesis of the article states that virtual brand communities may serve as sources of brand value, which is co-created by the actions of marketers and consumers. The fans spread the information about the brand among other users and contribute to building brand image by posting various contents on communities' websites.

21.4 Results and Discussion

The first part of the questionnaire research was connected with using the reaction buttons by the fanpage users. The results (Fig. 21.1) show that a vast majority of brand communities' members engage in such kind of activity—83.4% of them admitted to having done so at least once. What might be surprising, the users who tend to be more involved in reactions are among the older respondents (with all of the interviewees of 65 years and older declaring the buttons usage), while the two youngest groups, commonly considered more active in the social media, achieved the lowest scores. Such findings might be explained by the fact that younger persons often join many communities without feeling strongly connected with them, while older users enter less groups and become engaged in the communities' lives.

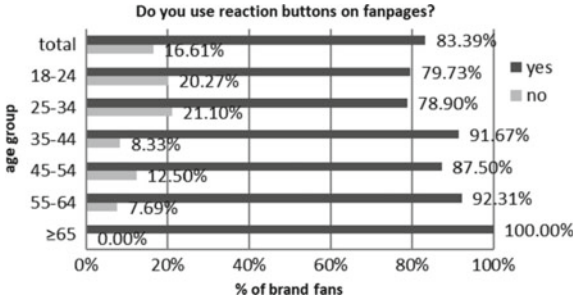

Fig. 21.1 Percentage of respondents declaring at least one use of the reaction button on the fanpage, according to the age group

No prominent disparity was observed while analyzing the results for each sex separately—the number of men which had answered positively is 4.9% points higher than in case of women. The author has also conducted the chi^2 independence test, which has shown that neither the relation between sex nor age and the use of reaction buttons is statistically significant.

The use of reaction buttons by the community members creates the brand's value in a twofold way: by increasing the perceived brand popularity and by providing information to brand owners. First, engagement with the brand content enhances fanpage visibility and builds brand's image as successful. For many consumers owning a popular brand, as well as being a part of its community, constitutes for an additional benefit—in this way value is co-created by the fans by means of elevating brand's fame.

What is more, "likes" and other reactions act as source of information for the brand representatives—the buttons are the easiest and quickest way to share opinion about certain content, therefore the marketers can observe what is liked by the consumers and what is not widely accepted. Reaction buttons can be also used in a very direct method of value co-creation with community members' participation, namely, polls dedicated to the choice of the best option regarding, e.g. favourite version (colour, taste) of a product or new object to be added to the offer.

In the next part of the research, the author enquired about posting comments on the virtual brand communities' fanpages by their members. The collected answers indicate that over 51.6% of the respondents have posted a comment on a fanpage at least once (Fig. 21.2). Results show that 25.6% of interviewees published pos-

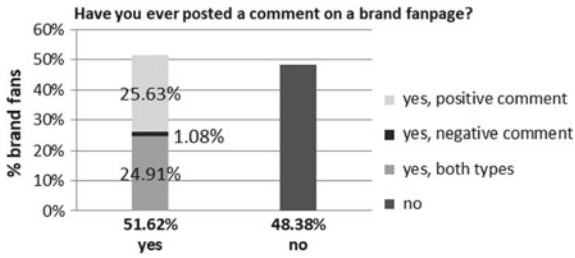

Fig. 21.2 Percentage of respondents posting comments on brand fanpages

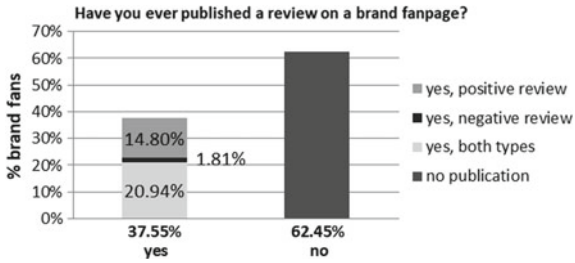

Fig. 21.3 Percentage of respondents publishing reviews on brand fanpages

itive comments regarding the brand, 24.9% submitted positive as well as negative comments and 1.1% of the members expressed only negative opinions.

The greatest tendency towards publishing comments under marketers' posts were observed among respondents aged 35–44, of which 71.1% wrote on the fanpage (58.1% of them expressed only positive opinions, 4.7% only negative and 37.2% submitted both types). Similarly high results occurred in the age range of 45–54, where as many as 68.8% of interviewees published their comments. On the contrary, the fans from the two youngest age groups turned out to be the least active in this aspect. 41.9% of members aged 18–24 admitted to expressing their opinions on a fanpage, while this percentage in the age group of 25–34 equals to 43.1%, majority of each group submitting both positive and negative thoughts. Chi^2 independence test proven the relation between age and willingness to publish comments in virtual brand communities' social media to be statistically significant.

Close to no difference between the scores of both sexes was observed and it bears no statistical significance. 52.8% of female community members expressed their views on fanpages, while among male fans this result was only 2.5% points lower.

Similarly, as in case of using the reaction buttons, publishing comments on brands' fanpages can contribute to brand value creation in two ways. Firstly, the opinions expressed by fans constitute a valuable source of direct and often very detailed information for the brand representatives and owners. In the comments' section the users tend to include descriptions of brand's aspects they do not approve of as well as suggestions regarding possible improvements. Taking fans' opinions into consideration, the owners are able to respond to the market's needs, increasing brand's value.

Moreover, the possibility of real-time communication between community members (e.g. exchanging information about modes of use, etc.) itself contributes to brand's value creation. The fans, engaged in the group's life, feel increased loyalty to the brand and to the other members. The ability to participate in an active community improves the overall satisfaction of the consumers, therefore posting comments can be treated as a tool of value co-creation.

The next question in the research regarded publishing brand or product reviews on fanpages by brand communities' members. As depicted in Fig. 21.3, it can be seen that majority of fans have never written an opinion in the review section of the website—only 37.6% of respondents have answered the question affirmatively.

The results indicate that the most of them (20.9% of all the interviewed brand fans) published both positive and negative reviews of the brands, 14.8% of fans expressed only opinions in favour of the brand, while only 1.8% of the respondents belonging to the communities published only unfavourable reviews.

Similarly as in case of posting comments, the willingness to publish reviews increases with age, however, this relation is not statistically significant. The highest results were observed in the eldest group, where 60% of community members declared to be involved in such activity at least once. It is worth mentioning that none of them have written only negative opinions. Considerable score was also recorded in the age range of 55–64 years, in which reviews were posted by 53.9% of respondents. However, in this group the number of users expressing solely unfavourable opinions increased visibly, to 14.3% of reviewers. The lowest results were obtained by the youngest fans—31.1% in the range of 18–24 years and 33% in the range of 25–34 years. Majority of young respondents tend to publish only positive reviews, with minimal number of those presenting only disadvantageous thoughts.

The role of sex is not statistically significant in this case. Still, it can be noted that women are more willing to post their opinions (40.9% in comparison with 34.1% of men). The proportion of positive and negative reviews is almost identical to male and female respondents.

In a similar manner as comments and reactions, reviews deliver to the brand representatives numerous pieces of information regarding consumers' opinion about the offered product. Moreover, the reviews frequently include indications about possible improvements or developments to be implemented by the brand. In this way, brand community members are able to direct the company towards certain changes and modifications of the offer, leading to an increase of the brand's value.

The author used the chi^2 independence test method to analyze the relations between demographic factors (age and sex) and the investigated behaviours. The results for calculations utilized in this article are presented in Table 21.2.

Table 21.2 Values of chi-squared test for analyzed aspects and demographic data ($p < 0.05$)—statistically significant differences in bold

	chi^2	p-value
Use of reaction buttons		
Age	7.055	0.13301012
Sex	1.2195	0.269455
Posting comments on fanpages		
Age	**18.142**	**0.00115768**
Sex	0.1659	0.68381
Publishing reviews on fanpages		
Age	7.207	0.20569503
Sex	1.3531	0.244738

21.5 Conclusion

The development of social media revolutionized the way brand communities form, communicate and gather consumption-related information. One of the extremely important features of fanpages is simplifying the process of brand's value co-creation by the members and making it easily available for each of the fans. Social media users are able to use various functionalities to build the value, the most significant among them being utilizing the built-in reaction buttons, posting comments under the brand-related content and publishing reviews in the special section of the website.

The process of brand's value co-creation on fanpages can be considered as two separate aspects, one connected with knowledge transfer and the other with additional value derived from the activity of the community itself. First, members deliver important data to the marketers, regarding their satisfaction with brand or the still unfulfilled needs. They are also able to influence the brand's development directly, e.g. by voting for the type of product to be included in brand's offer (by means of special polls). On the other hand, loyal and highly involved community itself is an additional value for the brand on the emotional level—consumers are able to feel like a part of an important group, along with being less anxious about the brand, knowing that they can obtain required help from the community.

The results of the research indicate that brand communities members actively participate in value co-creating activities. However, it can be noted that they tend to choose those requiring less effort—83.4% of the respondents belonging to fanpages use the reaction buttons, while only 37.6% of them have ever published a review.

On the basis of the research, it might be stated that the hypothesis of the article is confirmed. Virtual brand communities may be treated as sources of brands' value co-creation—the activity of fans leads to, among other things, the growth of brand loyalty of the members and increase of brand awareness among other social media users. Additionally, the fans are able to take part in shaping the brand's offer by, e.g. voting for a new addition to the portfolio or by voicing their opinions about the existing products.

Therefore, it might be concluded that brands' representatives should undertake actions leading to increasing members' involvement in the community and persuade them to dedicate more time to the interaction with the group. In this situation, a crucial aspect might be the transfer of control, understood as shifting part of the decision-making power toward the community members. Modern consumers like to feel empowered and are more likely to cooperate while knowing that their opinion matters. Due to that fact, it is highly recommended for the brand representatives to make all the active fans to feel appreciated and not to underestimate the significance of members' co-creating actions.

Still, it cannot be forgotten that the actions of consumers might also have negative effects on brand's value. Unsatisfied customers voicing their discontent surely affect the way other social media users perceive the brand. In fact, unfavourable comments are considered to have stronger impact on the brand than the positive ones. An example of such harmful influence has been presented by Chevalier and Mayzlin

[24], who had found out that the increase of negative opinions' number contributes to the decrease of sales in a more prominent way the favourable statements contribute to the sales' growth. Therefore, the marketers should not underestimate the significance of ability to react to the displeased customers' voices in a careful way.

The conclusions of the study are presented with the caveat as to the limitations of the sample (only consumers from Poland filled in the questionnaire). An interesting research idea might compare the results of similar studies performed in various countries. Moreover, the relation between fans' activity and the type of brand might be also worth exploring.

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Chapter 22
Chosen Aspects of Co-creating an Employer's Image by Employees as Prosumers

Agnieszka Izabela Baruk

Abstract The article had some research goals: identifying determinants of recommending an employer by employees; defining the hierarchy of these determinants; etc. To prepare the theoretical part, the method of cognitive-critical analysis of literature on marketing, management and HRM was used. To prepare the empirical part, the following research methods were used: a questionnaire (to gather primary data) and the methods of statistical analysis (correspondence analysis). The statistical analysis allowed to identify the dependences between several variables and recommending an employer and to arrange them hierarchically. The strongest determinants of recommending an employer turned out to be: emotional attitude toward the employer, identifying with the company, the way of treating subordinates by superiors. Other dependences were statistically important (apart from one) but their strength was weaker. The main value of this article is applied approach presenting employees as prosumers. This approach is quite new because so far only consumers were treated as the prosumers.

Keywords Employee · Employer · Employer's image · Prosumer

22.1 Introduction

Each participant of the present market that is subject to dynamic changes (connected among others with globalisation [1, pp. 178–198; 2, pp. 71–92]) plays simultaneously many important roles. Most of adult final purchasers appear at the same time in the role of employees and each employee is also the purchaser of personal products and other values as well. Every organisation, regardless of its specificity, is a bidder of specific values addressed to various consumers whose needs decide about the subjective opinion on the usefulness of the marketing offer of a given organisation. It appears simultaneously in many market roles, among which the key position belongs to the role of employer offering personal products to present and future employees.

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One should remember that roles played by a given organisation are not fully separate categories but, in practice, influence each other to a larger or smaller extent. It results in the situation that every organisation oriented holistically should strive not only to shape its general image but also to carry out complex image actions in relation to partial images, including its image as an employer (which is discussed much less often), since the way in which it is perceived by employees influences directly its general perception as a market subject, thus allowing it to be distinguished positively among other organisations. This way in which the employer is perceived by employees can lead to their activities in the form of sharing the opinions about employer with other employees. So, they play the role of active participants in the marketing process, that is prosumers.

Consumers' engaging into the process of preparing a marketing offer is defined as prosumption [3, pp. 379–398; 4, pp. 3–24]. One should remember that employees are consumers of personal offer which can be prepared by employer only (traditional approach) or with them (modern marketing approach). The influence of the phenomenon of prosumption on the present, more and more competitive and multifaceted, market is increasingly bigger [5]. It results from the fact that co-creating various elements of market offer favours the increase in the level of compatibility with increasing expectations of purchasers who simultaneously fulfil in this process the role of its active co-creators. Co-creating an offer is in accordance with assumptions of present marketing concepts [6]. Their foundation is the increasingly stronger necessity to fulfil individual requirements of particular recipients as well as possible. A fast and flexible adjustment to these requirements contributes to the increase of the quality of purchasers' professional and private life by more better satisfying their various needs.

Prosumption can be treated as an example of social innovations since it fulfils two basic assumptions [7] which are connected with them. Its effect is fulfilling the needs of a specific community's members more effectively and creating and tightening new social ties [8, pp. 12–20], including relations between employer and employees as prosumers. Their shaping should be treated as one of the key bases of relational strategic orientation of contemporary enterprise [9]. Attitudes and behaviours of both groups of market's participants change. In the practice prosumption requires their openness and re-defining the hitherto market roles which start to permeate each other. Mentioned changes are ideally compatible with the change of the so-called exchange paradigm into network paradigm that reflects the present evolution of marketing approach [10, pp. 35–52]. Employees playing the role of internal purchasers are potential prosumers but their active engagement into creating personal offer equals transforming them into real prosumers. It is very big challenge for each contemporary employer especially in the age of '4.0 industry' based on such foundations as climate of innovation and continuous learning in the organisation [11, pp. 81–97; 12]. He should also generate innovative practices in the scope of human resources management [13, pp. 1228–1253].

One of the areas of employees' prosumeric activity is the image creating process. Presenting and transmitting their opinions about employer leads to his positive or negative image. That's why the aim of the study is to identify and regularize

hierarchically factors determining one of important forms of prosumeric activity of employees, that is recommending their employer and at the same time co-creating their external image. In the research process 3 hypotheses have been verified applying correspondence analysis and analysis of total value of chi-square during the statistical analysis process.

22.2 Review of Literature

22.2.1 The Essence of an Employer's Image

Creating and strengthening an image of an attractive employer is a specific catalyst to engage employees in realising professional tasks (regarded that its reflection will be contentment felt [14, pp. 308–323]), thanks to which it is possible to create values that fulfil the expectations of external addressees of a market offer of such a bidder in a better way. Then, it is much more easier to recruit employees characterised by an outstanding intellectual and emotional potential who will use it to achieve the organisation's goals by identifying them with their own objectives. In practice, none of the organisations can develop if its members do not develop, since its success favours their self-realisation and the other way round. To make their development possible, they must have proper material and immaterial conditions created. It requires from the employer to adopt marketing orientation and practical consistent realisation of its principles, the foundation of which is empathy, individualised treatment of every employee, authenticity [15, pp. 1962–1976] and ethicality. It can be even stated, that rising competitiveness on the market makes bidders face new challenges. Among them, we should mention the change of orientation into marketing orientation covering with its range also employees, which requires implementing assumptions of personal marketing which is one of four key fields of holistic marketing [16]. This approach should be based on the openness for innovative solutions in the workplace which key role is underlined also by others authors, for example by Bamber et al. [17, pp. 1216–1227]. Thanks to applying this approach it is possible to shape a positive image of a bidder as an employer.

It has to be stressed that from the point of view of effectiveness of image actions, unambiguous interpretation of a concept discussed seems to be extremely important. We can, however, prepare, realise and monitor actions properly only in those fields that are clearly and exactly defined. Unfortunately, in the subject literature, there can be observed a considerable discrepancy between ways of understanding the employer's image as a category. Above all, many authors use concepts such as image, reputation, identity, personality and even make interchangeably, but each of them means something totally different.

For instance, Lievens et al. [18, pp. 45–59] write straightforward that the employer's make and even employer branding is the equivalent of employer's image. Moreover, they stress that the employer's image is influenced by the same factors

as company's identity. Concepts make and image with reference to an employer are treated synonymously by Ambler and Barrow [19, pp. 185–206] who define make, and thus employer's image, as a collection of functional, economic and psychological benefits delivered by employers and identified with them. Furthermore, Bhatnagar and Srivastava [20, pp. 35–48] present employer's image as their personality preferred by employees in comparison to other employers. Other authors focus on perceiving employer's make, using this concept interchangeably with employer's image [21]. However, the make's image constitutes a separate category and of course should not be identified with employer's image.

The lack of terminological coherence in the field concerning perceiving the employer may result from a similar inconsistency in using the concepts mentioned in marketing from which they were borrowed for the purpose of personal problematics. Nevertheless, it does not pose any excuse, since it sometimes surely makes it more difficult or even impossible to conduct a comparative analysis with reference to research results of various authors, often leading to incorrect conclusions.

Discrepancies in interpretation cause that we must unambiguously specify the essence and range of employer's image. It can be defined as an image shaped in present and potential employees' consciousness on the basis of their personal experiences (in case of people employed by this employer) or information gathered by potential organisation's members from people employed by a given employer (as an informal way of shaping an image) and those spread by an employer by means of all kinds of the mass media (as a formal way of shaping an image) [22, p. 48].

It results from the definition suggested, that the employer's image reflects the way they are perceived by two basic groups of consumers, that is people employed at present in a given organisation and people outside the organisation who create its external labour market. At the same time, it has to be stressed that both groups, from the employer's point of view, are equally important. Therefore, the employer should take them into consideration in their image actions. Moreover, such a perception of employer's image is emphasised by the fact that its shaping happens in two ways simultaneously, that is by means of formal channels (which employer can influence directly) and informal ones such as social media [23, pp. 11–15] (which employer can influence only indirectly through personal actions directed towards present employees). This dichotomy has to be taken into account in the image policy, all the more that any informal opinions are usually regarded as more reliable than messages conveyed in a formalised way. The internal image based on informal activities is the result of the employees' feelings connected with their wellbeing which has been analysed by Vakkayil et al. [24, pp. 548–562] or Sebastiano et al. [25, pp. 563–573].

Internal and external image create together an image of a given organisation as an employer. Its image as an employer influences further the image of an organisation in other roles and the image of its market offer, determining a general image of an organisation and thus relationships between it and various subjects, among them final purchasers and employees which are unfortunately often forgotten about by present employers. These relations are bidirectional, which causes the image of a company as an employer becomes its key marketing attribute.

22.2.2 Chosen Aspects of Employees' Prosumeric Activity

One of the main marketing trends is prosumption defined as consumers' participation in the process of creating material and immaterial features of marketing offer. Engaged consumers or other individuals (like employees of enterprises) taking part in the process of creating marketing values play a very active market role [26, pp. 742–751]. In the practice, it means that each of them can be treated like potential or real prosumer.

Shaping by a bidder conditions for purchasers to join actively into creating an offer brings advantages not only to consumers but also to the bidder themselves. Among them an important place belongs to image advantages which are of immeasurable character but are felt through a long time. An enterprise showing an ethical [27, pp. 889–900] and open attitude towards consumers and employees is perceived by them in a definitely better way than a bidder who separates from them. What is more, they are in practice much more willing to share their positive opinions about a bidder treating them in a partner manner, that is to recommend a bidder to others. It not only contributes additionally to creating and strengthening a positive perception of a given company, but it is also a sign of prosumeric activity of purchasers who expect valuable benefits for themselves [28, pp. 97–108]. In case of employees as internal purchasers, it is a greater job satisfaction [29, pp. 116–128], greater contentment from the fact of being a part of a given team of workers, feelings of active influencing on internal social system and organisational culture, etc. Therefore, it is visible that the consequence of bidders being open to the phenomenon of prosumption are benefits of individual character gained by a specific company and a specific purchaser and profits of group character gained by a specific society (e.g. employees of a given company or employees of companies in a specific branch).

It has to be, however, stressed that in subject literature prosumption is explored, above all, in individual aspect [30, pp. 2–10; 3, pp. 379–398; 4], whereas no attention is paid to a social aspect of this phenomenon and thus it is not associated with social innovations. Moreover, it is mainly applied to external purchasers. The fact that employees as internal purchasers can also be prosumers, for instance through co-creating personal offer with employer (the so-called personal prosumption) is totally ignored.

Similarly as in case of prosumption concerning external purchasers described in subject literature, also in respect to prosumption encompassing internal purchasers we can say about creating relationships between purchasers and a bidder and between purchasers themselves. An example of shaping relationships of the first type is creating by employees together with an employer-specific personal values which can be treated as the effect of the process of interpartner learning [31, pp. 732–742]. Whereas, the sign of prosumeric activity, in which the company does not appear directly, is recommending it by present employees to participants of external labour market (as potential employees). These are the actions connected with creating relationships and information exchange which are mentioned in subject literature as two key fields of prosumption [32]. What is more, some authors emphasise the primacy of

fulfilling employees' expectations over fulfilling expectations of external purchasers [33]. However, it seems contradictory to a basic assumption of holistic marketing [34], in which the necessity to adopt a comprehensive marketing perspective and equal treatment of all partners of a company is emphasised.

Some authors use a category 'workplace innovations' [35, pp. 12–16; 36, pp. 404–415] encompassing innovations in a place of work which contribute among others to improving employees' feelings. The prosumption's essential role in achieving such a state is not, however, written about. Despite the fact that some authors identify workplace innovations with social innovations, social innovations are a wider category in which workplace innovations appear and their component is personnel prosumption. Of course, engaging employees as prosumers requires their open attitudes towards innovation, especially the high level of their individual innovativeness. Individual innovations are analysed by Audenaert et al. [37, pp. 608–623], etc. but not in the relation to playing the role of prosumers by employees.

On the base of the previous deliberations it can be stated that the scope and character of opinions shared by employees as prosumers depend to much extent on personal actions taken up by an employer and, above all, on the degree of their harmony with professional and non-professional expectations of employees. Their needs can be satisfied better by preparing personal offer with them which requires open and close contacts [38, pp. 409–420] between employer and employees. Opinions, the authors of which are the recipients of personal actions themselves, are considered by their addressees to be more reliable than image messages directed towards them by an employer. That's why one of the main objectives of each employer should be striving to change employees into prosumers co-creating personal offer including employer's image. In subject literature, it is emphasised that it should be the key striving of present bidders [39, pp. 388–392]. Unfortunately researchers reference these approach to a bidder-purchaser relation, ignoring the importance of such an attitude in the case of employer-employee relation. It is therefore worth trying to specify factors determining the employees' willingness to share positive opinions about an employer.

The objectives of the conducted empirical research included:

(1) identifying determinants of recommending an employer by employees;
(2) specifying the hierarchy of the identified determinants of recommending an employer by employees;
(3) indicating the suggestions of actions favouring including employees in creating a positive image of an employer.

22.3 Research Hypotheses and Conceptual Model

The cognitive-critical analysis of subject literature allows to state that there are, above all, the issues of employer's brand presented in it [40, pp. 389–409; 41, pp. 129–144; 42, pp. 136–148; 43, pp. 893–907; 44, pp. 160–175; 45, pp. 134–146] or its reputation

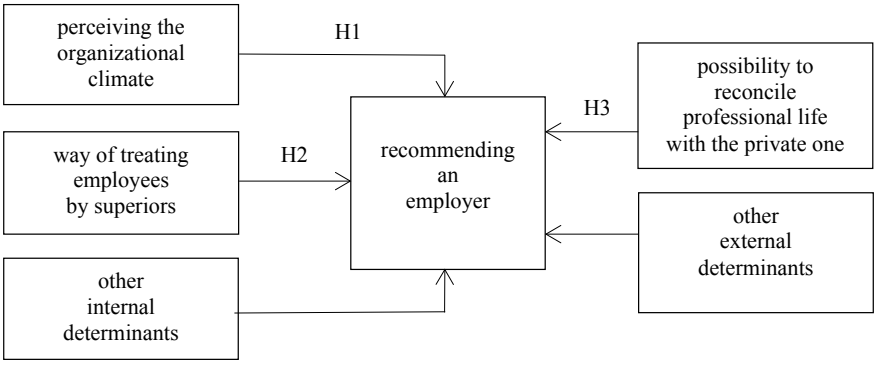


Fig. 22.1 A conceptual model. *Source* Own study

[46, pp. 2244–2266; 47, pp. 125–146], etc. On the other hand, the recommending employer by employees as the effect of the internal relationships are described and studied by some authors but not in the context of prosumption. For example the vertical relations are analysed in the context of individual attitudes by Borowski [48, pp. 1623–1632]; in the context of psychological contract by Dadi [49, pp. 88–100]; in the context of organisational justice by Yean and Yusof [50, pp. 798–803]; in the context of participating in decision making [51, pp. 183–200] etc. Unfortunately, aspects connected with the employer's image, especially with external image of an enterprise in this role and co-creating this subimage by present employees are not analysed there. Thus, they are not perceived as prosumers who co-create specific marketing values, among which employer's image appears. It means that the cognitive gap and the research gap exist in this scope.

Therefore, in this article, there was an attempt to verify three research hypotheses (Fig. 22.1) formulated on the basis of the results of literature's analysis:

H1 there is a strong dependence between perceiving the climate which reflects horizontal relations and recommending an employer;
H2 there is a strong dependence between the way the employee is treated by their superiors which reflects vertical relations and recommending an employer;
H3 there is a strong dependence between the possibility to reconcile professional life with the private one, which reflects external relations and recommending an employer.

22.4 Characteristics of Empirical Research

Striving to achieve objectives mentioned and thus to verify research hypotheses formulated became the basis to conduct primary empirical research. They were carried out in the II half of 2016. To gather primary data, a questionnaire method was used. It

encompassed 500 people representing present employees of production enterprises located in Poland. The purpose-quota sampling was adopted. This article is based on a part of much more developed empirical research conducted by means of a questionnaire encompassing a several dozen of questions to employees as addressees of marketing personnel offer. Therefore, only primary data gathered thanks to asking respondents chosen questions (marked with numbers 19, 3, 2, 10 and 1, respectively) connected with recommending an employer by employees and chosen aspects of professional life, mainly of relation character, were subjected to a detailed analysis. The scales of answers to these questions were presented in the description of particular tables.

Primary data gathered were subjected to a statistical analysis, during which the method of correspondence analysis was used [52, pp. 215–221]. Its aim is to specify closer dependences between at least two categories of variables represented by questions asked to respondents. The key element of correspondence analysis is creating a multidimensional map of output data (contingence table) which reflect the frequency of appearing respondents' answers with reference to categories analysed. Contingence tables are next analysed by means of a chi-square test of independence, where statistics are determined that show the strength of the relation between quality variables. Also, an assessment of the reliability of models identified was carried out by defining the border probability of critical "*p*" in chi-square test. If it is higher than 0.05, the defined diversity of inertia in relation to zero, which was used to build models, does not have any statistical significance. The concept of inertia is used in the correspondence analysis similarly to the concept of variance appearing in statistics.

Using the method of correspondence analysis allows as well to visualize spatially on one- and multidimensional axes relations between categories. Such a visualisation enables to build a model on the basis of mutual arrangement of points neighbouring with each other which represent categories analysed. The analysis of statistics and diagrams gathered by means of this method allows to assume the linkage between categories of two variables. In this analysis it is assumed that the variable (in this article it is recommending an enterprise as an employer), in relation to which relationships between other characteristics are researched, is always a column variable. The statistical analysis of primary data was conducted with the use of Statistica 8.0.

22.5 Results of Empirical Research

22.5.1 Recommending Employer Versus Organisational Climate

Organisational climate is a reflection of relationships existing in a given enterprise. As results from Table 22.1, the greatest part of respondents assessed the climate positively. However, a significant percentage of people considered mutual rivalry between employees as its main characteristics. Almost every third respondent emphasised the

Table 22.1 Recommending an employer by respondents versus organisational climate

Answers	b	d	a	c	Total
b	8.74	1.94	1.94	3.88	16.50
a	30.10	0.00	16.50	5.83	52.43
c	13.59	4.85	2.91	9.71	31.07
Total	52.43	6.80	21.36	19.42	100.00

Source Own study
where: for column variable concerning the willingness to recommend an employer—(a) I strongly recommend, (b) I rather recommend, (c) I rather dissuade, (d) I strongly dissuade; for row variable concerning organisational climate—(a) friendliness, (b) mutual rivalry, (c) indifference
Row variable: question 3 (3); Column variable: question 19 (4)

fact that they are characterised by mutual indifference. Over 1/5 of respondents recommended their employer unambiguously, and 52.43% of people recommended the employer less strongly. Still, 26.22% of respondents, in general, dissuaded others from working in the company that employs them. Thus, a question can be asked if there is any relation between these variables.

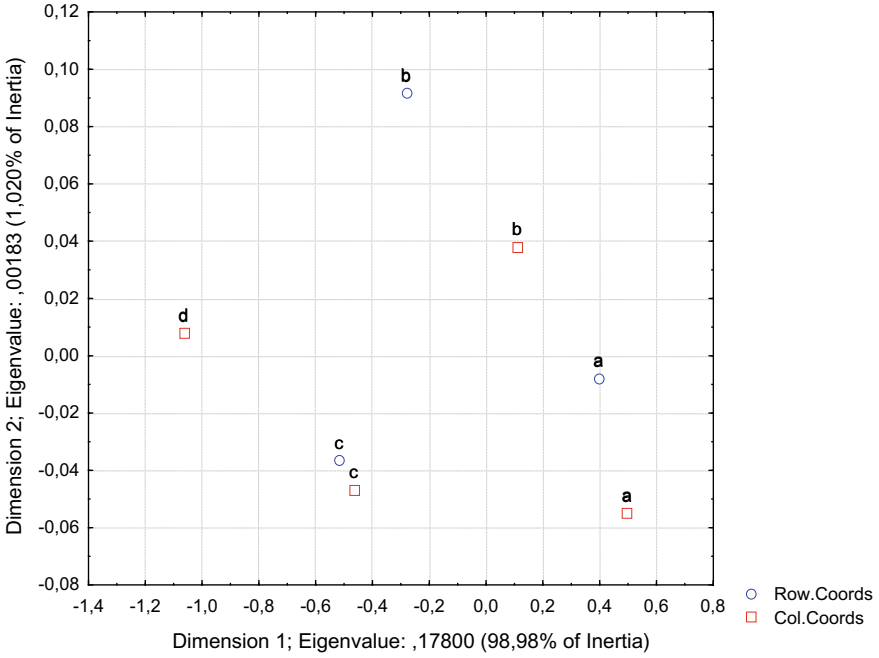
It turns out that there is a statistically significant dependence ($p = 0.0051$) between them, although it is not too strong, which is proved by the total value of chi-square that amounts 18.5225. Therefore, the hypothesis H1 cannot be confirmed.

On the model based on research of correspondence analysis, a distinct vertical polarisation of the arrangement with regard to dissuading or recommending the work at a given employer can be observed (Fig. 22.2). The right side of the arrangement reflects the segment of respondents who more or less strongly recommend their employer ("a" and "b" from question 19), who, at the same time, noticed friendliness ("a" from question 3) as a superior characteristics of the organisational climate. Whereas the segment of people discouraging others from working in a given company, which is connected with the left side of an arrangement, can be divided into subsegments, taking simultaneously into consideration more or less negative assessment of the organisational climate.

It is a subsegment of:

(1) people who anti-recommend their employer less strongly ("c" from question 19) and who simultaneously notice mainly indifference in relationships with other employees ("c" from question 3);
(2) people who strongly anti-recommend their employer ("d" from question 19) and who, at the same time, notice mainly mutual rivalry between employees ("b" from question 3).

It has to be stressed that the strongest internal relation exists in case of the first of sub-segments mentioned and relatively the weakest relation is in case of the second one of them. It is shown by distances between points that represent participants of specific communities. The totally shortest distance appears between points in the first of these sub-segments. It can be therefore stated that assessing the climate as neutral



Row variable: question 3 (3); Column variable: question 19 (4)
Eigenvalues: 0.1780; 0.0018; Total chi-square = 18.5225; df = 6; p = 0.0051

Fig. 22.2 Model "recommending an employer—organisational climate". *Source* Own study

persuades respondents to dissuade others from working in a given place much more than experiencing mutual rivalry.

It cannot, however, be forgotten about, that there is also a statistically essential relation between the feeling mentioned as the last one and definite dissuading others from working for a given employer. Therefore, employers should counteract such vertical relations and strive, at the same time, to shape them in such a way so that employees could assess them positively. As results from the model presented in Fig. 22.2, only in such a case are employees willing to recommend their employer.

22.5.2 Recommending Employer Versus the Way of Being Treated by the Superiors

Employees of a company are participants of not only horizontal relations but also vertical ones. Their reflection is the way subordinates are treated by their superiors. It turns out that the majority of people were always or in most situations treated

by their superiors in this way (70.88%). The rest of people declared that the superiors respected them only sometimes or seldom, and relatively lower percentage of respondents felt subjective attitude on part of the superiors with the lowest frequency. Nobody claimed that the superiors had never shown them respect (therefore this option signed as "e" is not taken into account in Table 22.2 and Fig. 22.3).

Showing respect to another person in each situation, regardless of the fact if they are superiors or subordinates, should be something natural but, as results from the research, only 29.13% of people have always had the feeling of being treated subjectively. Thus, it can be stated that the majority of answers indicates the existence of dysfunctions in the superiors' attitude towards their subordinates, which results in conveying negative opinions about a given employer. The total percentage of people recommending their employer was very similar to the total percentage of respondents who felt that they were treated subjectively in at least majority of situations. The percentage of respondents who dissuade others from working in a given company was also similar to the percentage of people indicating that their superiors showed them respect quite seldom. It could suggest the existence of dependence between recommending an employer and feelings that reflect vertical relations in an organisation.

It turns out that between these variables there is a dependence which is significant statistically ($p = 0.000$). It is strong, which is proved by a large total value of chi-square (48.7465). There are no reasons for rejecting the H2 hypothesis.

In case of the model gained on the basis of results of the correspondence analysis conducted for this relation, a strong regularity between the area lying on the left and right side of the axis of ordinates which amounts 79.32% of inertia (that is variability) of the whole arrangement (Fig. 22.3), can be observed. Similarly, as in case of the first model, it is polarised into the segment of people recommending their employer and into the segment of people anti-recommending a given organisation in this role.

To the right side, points reflecting respondents who recommended the company as an employer more or less strongly ("a" and "b" from question 19) and those who

Table 22.2 Recommending an employer by respondents versus the way of treating them by their superiors

Answers	b	d	a	c	Total
c	10.68	3.88	0.97	8.74	24.27
b	28.16	0.97	5.83	6.80	41.75
a	13.59	0.00	14.56	0.97	29.13
d	0.00	1.94	0.00	2.91	4.85
Total	52.43	6.80	21.36	19.42	100.00

Source Own study
where: for column variable concerning the willingness to recommend an employer—(a) I strongly recommend, (b) I rather recommend, (c) I rather dissuade, (d) I strongly dissuade; for row variable concerning being treated with respect by the superiors—(a) yes, always, (b) yes, in most situations, (c) yes, but only sometimes, (d) no, seldom, (e) no, never
Row variable: question 2 (4); Column variable: question 19 (4)

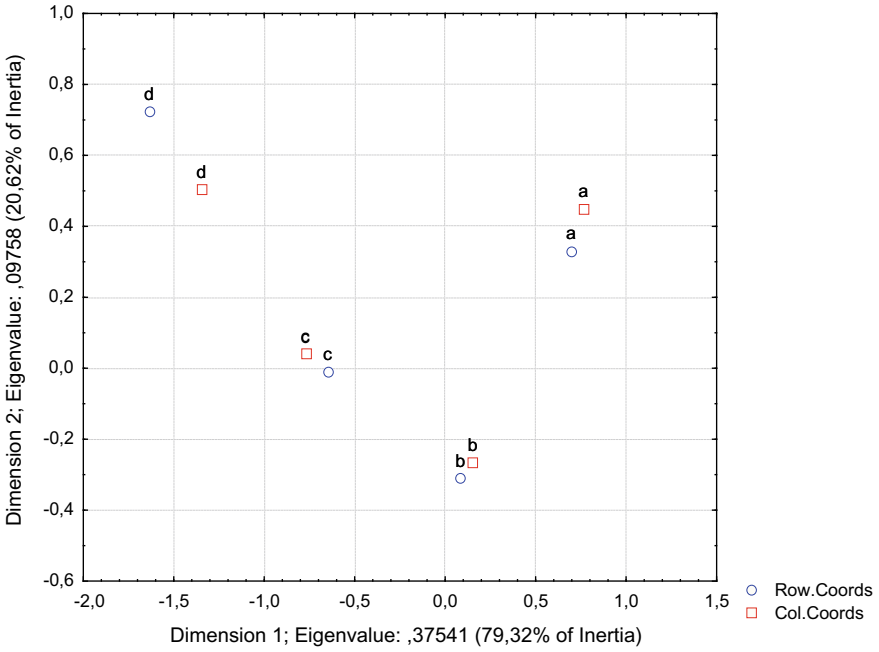


Fig. 22.3 Model "recommending an employer—the way of treating subordinates by superiors". *Source* Own study

feel that their superiors show them respect always or in most situations ("a" and "b" from question 2) are localised. They create two homogeneous subsegments of respondents, and relatively stronger relation appears in case of the group encompassing respondents who rather recommend their employer ("b" from question 19) and those who are treated subjectively by the superiors in the majority of situations ("b" from question 2). It is shown by a smaller distance between points belonging to this group. Moreover, it is the smallest distance between points from all groups presented on the model (Fig. 22.3), which proves the relatively strongest relation in its case.

On the left side of the arrangement analysed, there are points reflecting respondents who dissuade others from working in an organisation that employs them more or less strongly ("c" and "d" from question 19) and only very seldom treated respectfully by the superiors ("c" and "d" from question 2). Both sub-segments belonging to the left side of the arrangement are also of a homogeneous character, although relatively stronger relations appear in case of the group encompassing people showing less extreme emotions. On the other hand, weaker relations appear in case of the group presenting extreme negative emotions, and the biggest distance between points creating them proves the relatively weakest relations in case of this group in comparison with all other groups. It can be, therefore, stated that it is relatively

easier to evoke among employees the willingness to recommend their employer by applying towards them a subjective attitude than to provoke them to share negative opinions through showing them no respect. Of course, this conclusion cannot be interpreted as the consent to treat subordinates in an objective way but, above all, as an important hint proving the necessity to shape vertical relations in the way that is expected by employees.

22.5.3 Recommending Employer Versus Possibility to Reconcile Professional and Private Life

Each employee is not only a member of a specific organisation but participates simultaneously in specific external relations. It seems that a precious value for him should be the possibility to reconcile professional obligations with personal life. Nearly two-third of the respondents more or less often had problems with reconciling both spheres of life, and in case of every fourth person such situations happened at least often (Table 22.3). Nobody claimed it is a day-to-day problem for them (therefore option "e" is not included in Table 22.3 and Fig. 22.4) but it doesn't change the fact that only 36.89% of respondents could, without problem, reconcile professional life with private matters.

It is worth noticing that the total percentage of respondents, for whom it was a problem at least often, was similar to the total percentage of people who dissuade others from working in a given company more or less strongly, which may indicate the existence of some relations between these variables.

The results of statistical analysis show, that there really is a statistically significant dependence ($p = 0.0002$) between recommending an employer and the possibility to

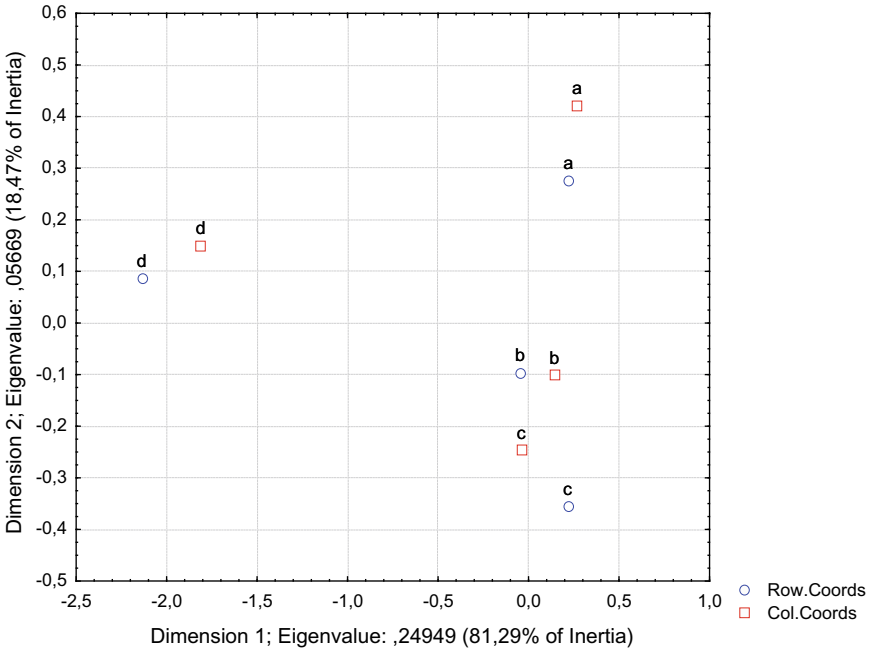
Table 22.3 Recommending an employer by respondents versus the possibility to reconcile professional and private life

Answers	b	d	a	c	Total
a	18.45	0.97	12.62	4.85	36.89
c	12.62	0.00	1.94	4.85	19.42
b	20.39	2.91	6.80	8.74	38.83
d	0.97	2.91	0.00	0.97	4.85
Total	52.43	6.80	21.36	19.42	100.00

Source Own study

where: for column variable concerning the willingness to recommend an employer—(a) I strongly recommend, (b) I rather recommend, (c) I rather dissuade, (d) I strongly dissuade; for row variable concerning the possibility to reconcile professional and private life—(a) I never have any problems with that, (b) It is sometimes difficult but such situations happen seldom, (c) It is difficult and such situations happen often, (d) It is very difficult and such situations happen very often, (e) It is practically my day-to-day problem

Row variable: question 10 (4); column variable: question 19 (4)



Row variable: question 10 (4); Column variable: question 19 (4)
Eigenvalues: 0.2495; 0.0567; 0.0007; Total chi-square = 31.6100; df = 9; p = 0.0002

Fig. 22.4 Model "recommending an employer—the possibility to reconcile the professional and private life". *Source* Own study

reconcile professional life with the private one. It has to be, however, noticed that this dependence is relatively weaker than in case of the previously analysed dependence, which is proved by the lower value of total chi-square (31.6100). Therefore, the H3 hypothesis cannot be confirmed.

On the model created on the basis of results of the correspondence analysis 4 groups of respondents may be distinguished (Fig. 22.4):

(1) group of people recommending strongly their employer ("a" from question 19) and not having any problems with reconciling professional and private life ("a" from question 10);
(2) group of people recommending their employer less strongly ("b" from question 19) and seldom having problems with reconciling professional and private life ("b" from question 10);
(3) group of people who rather dissuade others from working for their employer ("c" from question 19) and who often have problems with reconciling professional and private life ("c" from question 10);

(4) group of people who strongly dissuade others from working for their employer ("d" from question 19) and who very often have problems with reconciling their professional and private life ("d" from question 10).

All segments distinguished are characterised by homogeneity although relations within their area have different strength which is proved by different distances between points that create them. The relatively strongest relation appears in case of the second group encompassing people who show moderate positive emotions, whereas in case of the other three groups the strength of relations is comparable which is reflected by similar distances between points that create them.

22.6 Hierarchy of Determinants of Recommending an Employer

An analogical attitude allowing to identify detailed aspects of dependences between categories researched may be conducted also in case of other potential determinants of recommending an employer by employees, which is a sign of their prosumeric activity. However, taking into consideration the limits connected with the volume of this article, in the further part of the study the focus was placed on ordering hierarchically relations between recommending an employer and variables chosen. As results from Table 22.4, among 18 variables analysed, in case of 17 of them, there was a statistically significant dependence between them and recommending an employer. The existence of it was not stated only in relation to the variable "the basis to assess an employee".

As far as relations analysed in a detailed way in the hitherto deliberations are concerned, a relatively bigger strength appeared in the dependence between the way of treating subordinates and recommending an employer by them than between the possibility to reconcile both spheres of life or the organisational climate and an analogical column variable. It was not, however, the strongest dependence. It took the 3rd place among other dependences analysed (Table 22.4). Dependences between emotional attitude towards a company and recommending it and between identifying with it and the same column variable proved to be stronger. Both of them, as the only ones, reached the total value of chi-square over 50.

Accepting by agreement the ranges of chi-square values, the dependences identified can be divided into four groups:

(1) "A"—total chi-square value of 50.00 or more—dependences of a very large strength
(2) "B"—total chi-square value of 35.00 up to 49.99—dependences of a large strength
(3) "C"—total chi-square value of 20.00 up to 34.99—dependences of a medium strength
(4) "D"—total chi-square value of below 20.00—dependences of weak strength

Table 22.4 The hierarchy of analysed determinants of recommending employer

Row variable analysed	chi^2	p	Position	Group
The way of treating respondents by superiors	48.7465	0.0000*	3	B
Organisational climate reflecting horizontal relations	18.5225	0.0051*	14	D
Time spent in the workplace	17.0279	0.0483*	15	D
Time spent on performing professional duties	22.0845	0.0086*	12	C
The basis to assess employees	5.83262	0.7565	– **	–
Possibility to reconcile professional and private life	31.6100	0.0002*	8	C
Designing a career path	21.1407	0.0484*	13	C
The accordance of actual course of career with the designed path	25.2881	0.0027*	11	C
Just awarding pay rises, promotions, etc.	28.3550	0.0000*	9	C
Feeling of stabilisation, self-development or danger	35.2598	0.0001*	6	B
Showing by employees an initiative in acquiring knowledge and skills	36.9502	0.0053*	4	B
The feeling of integrating with other employees	33.6581	0.0008*	7	C
The range of independence in making decisions	36.2581	0.0016*	5	B
Conducting by an employer research on satisfaction and contentment among employees	9.93878	0.0191*	17	D
The feeling of influencing the company's future	16.2495	0.0125*	16	D
Identifying oneself with the company and its objectives	57.8750	0.0000*	2	A
Emotional attitude towards the company	73.5325	0.0000*	1	A
Style of management	27.0949	0.0014*	10	C

Source own study
*$p < 0.05$
**Lack of dependence

As it was mentioned, in group "A", there are 2 dependences. Group "B" encompasses 4 dependences, group "C" respectively—7 dependences, whereas group "D"—4 dependences.

It is worth paying attention to the fact that the last position was taken up by dependence between conducting research on employees' satisfaction and contentment and recommending an employer by them, which may suggest the lack of usefulness of this type of actions in prosumeric activating employees. It seems, however, that the explanation of this surprising result is the fact that this research are still not conducted in relation to internal purchasers for whom they are something "exotic" and do not contribute to their activity within the area of recommending an employer. Companies should all the more conduct such research systematically and use their results to fulfil employees' expectations better and better. The dependence between the level of contentment felt by them and recommending an employer is very strong (the total $chi^2 = 84.9382$).

22.7 Conclusions, Limitations and Directions of Future Research

Summing up the deliberations presented, it can be stated that an employer must take up actions leading to transforming employees into real prosumers engaging into creating a positive external employer's image. The condition to achieve an effect of recommending him as the attractive employer is evoking in employees' positive feelings and opinions connected with vertical and horizontal organisational relations. The special attention each employer should pay to provoke among employees the emotional attitudes towards the enterprise. It leads to identifying oneself with given enterprise and its objectives. These two variables are the main determinants of recommending employer. In their case the chi-square values exceed limit of 50.00. It's worth to underline that the third place among analysed determinants of recommending takes the way of treating respondents by superiors reflecting vertical relations. Whereas the dependences between variables reflecting other organisational relations and recommending are not so strong.

It must be stated that research conducted have obviously their limitations that at the same time will mark up the directions of future research planned by the author. To basic limitations, one can include the fact that the research was carried out among Polish employees and they concerned only people employed in production companies on executive posts. The relations between the willingness to recommend an employer and row variables analysed with reference to employees of other enterprises (also servicing companies) or in case of people who hold posts of at least medium level of management were not thus researched. In the research presented in this article other variables connected to a company, such as size or branch, were not taken into consideration either. Variables reflecting demographic, economic, etc. features of employees were not dealt with as well. Therefore, the range of future research will be extended of the branches mentioned, which will allow to conduct comparative analyses between different types of companies or various groups of employees. Thanks to that it will be possible to state whether conclusions drawn in this article are of universal character or are specific only to executive employees employed in production companies.

22.8 Managerial and Social Implications

The results of research conducted have implications of a large application value for managers in contemporary enterprises. Evoking in employees strong positive emotions towards the work place and leading them to identify their objectives with the company's objectives is of a particularly great importance in encouraging employees to share positive opinions about an employer. An essential role in this respect is definitely played by the way the subordinates are treated by superiors (there is no reason to reject H2 hypothesis) who, through mentorial support, may discover

and take advantage of the potential of each employee in the way that is profitable for them and their employers. Superiors take also crucial part in creating conditions that enable employees to reconcile their professional and private life, which determines recommending an employer, although this relation turned out to be relatively weak, similarly as the relation between organisational climate and analogical column variable (H3 and H1 hypotheses cannot be thus confirmed).

Conclusions drawn have also social implications. Skillful shaping of relations inside the organisation, especially vertical ones, influences essentially the prosumeric activity of employees. It contributes in this way to creating a positive image of an employer proving the fulfilling by them the role of an innovator within the area of social innovations. It leads to distinctive changes in attitudes and behaviours of large communities, that is employees in enterprises.

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Chapter 23
Interoperability of Manufacturing Information Systems

Andrzej Kamiński

Abstract In this article I have presented the original concept of heterogeneous manufacturing information systems' cooperation by means of the integration platform. In detail, discussed integration standards based on electronic documents and interoperability technologies (SOA, XML, Web-Services). The main part of the article is a description of the results of the industrial research program, whose goal was to develop the model of decision support systems improving diagnostic process of workplaces. The immanent element of the research program was interoperability. It has been observed that lack of integration between specific branch systems and existing enterprise's systems significantly limits their implementation in industrial practice. The solution for the cooperation and exchange of electronic documents between autonomous systems of industrial partners is the construction and implementation of the integration platform.

Keywords Interoperability · Integration platform · Middleware

JEL Classification L63 · O32

23.1 Introduction

The interoperability of the information systems by using the integration platform is a relatively new research field in the modern economic informatics. There is a lack of the reference list in the national research literature regarding both project method and description of the adequate technological solutions.

The article presents the results of an industrial research program aimed at developing the model of decision support systems improving diagnostic process of workplaces. The key element of the project was to create a technology for integrating the newly developed system with standard ERP/MES software. The article discusses the

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methods of integration based on electronic documents and modern integration technologies (XML, SOA, Web-Services). The results of a practical solution integrating the newly developed diagnostic process of workplaces with standard software using Microsoft Biz Talk Server platforms were also presented. Microsoft BizTalk Server is an integration broker that is optimized for asynchronous straight through transactional processing of business messages in all formats and carried over an extensible set of protocols. The construction and implementation of the integration platform make it possible to maintain the independence and autonomy of heterogeneous systems supporting production management. The integration process will be carried out based on the exchange of electronic documents, preserving the transaction and security of individual data processing operations. Article was created basing on the results of project POIG.01.03.01-14-059/12.

"Interoperability is ability of two or more systems or components to exchange information and to use the information that has been exchanged (IEEE 1990)" [2, p. 20]. Research in Enterprise Interoperability (EI) suggests that organizations can seamlessly interoperate with others at all stages of development, as long as they keep their business objectives aligned, software applications communicating, and the knowledge and understanding of the domain harmonized [9, pp. 127–144]. The ideal would be to rely on dedicated knowledge models and international standards as information regulators among organizations, covering industrial areas and activities. In [3, pp. 1322–1327], the Authors define interoperability demand function according to the evolution of automated versus manual operations in manufacturing tasks: Id $= A/M$, where A is a percentage of project's time completed in an automated manner (i.e., automated data exchange, automated manufacturing systems) and M is the percentage of project's time completed in traditional, manual way (i.e., manual data exchange, manual field work). However, interoperability, especially at the level of software applications, is typically obtained by point-to-point mappings, hardcoded to relate information models, services and data files [1, p. 2400].

Lack of interoperability disturbs creation of collaborative work and networked systems. Apart from being a technical issue, interoperability challenges also emerge at organizational and semantic levels, underlying the need for solutions that support the seamless cooperation among manufacturing systems, processes and methods, information and knowledge, organisational structures and people [6, pp. 1–9].

In fact, different manufacturers have different production management applications. Programs are provided by different suppliers, which makes the integration work become more complex, and raise the cost of implementation and maintenance work. Especially for a common model, it is necessary to have a common terminology and understanding to support it. For example, ISA-95 standard, defines the functional view of the enterprise. According to the ISA-95 standards, manufacturing operations management activities including production, maintenance, quality, and the inventory management. ISA-95 specification requirements are aimed to encourage the use of common terminology and model, namely software vendors are encouraged to offer clients products and frame in standard reference model [16, p. 947].

Two-way integration with ERP—MES systems is about processing referential models included in these systems. Unfortunately, in most cases, integration means only the transfer of data records.

An alternative is the standard B2MML. B2MML is an implementation of the American ISA-95 norm developed in the 1990s by the International Society of Automation (ISA). ISA-95 has been adopted as the international standard IEC 62264. It provides a conceptual and terminological framework as well as an information model for integrating enterprise and control systems of manufacturing companies. IEC 62264 consists of five parts: (1) Models and terminology. (2) Object model attributes. (3) Activity models of manufacturing operations management. (4) Object models and attributes for manufacturing operations management integration. (5) Business to manufacturing transactions [7].

Enterprise Application Integration (EAI) is the process of information management system integration. These systems are created independently and could use non-compatible standards and technologies. The integration could be implemented on various levels, such as data, software elements of particular applications and user interface. Some of the most common integration scenarios in enterprises are the following: (1) Information portals. (2) Data replication. (3) Service-oriented architectures. (4) Distributed business processes. (5) Business-to-business integration [12, p. 116].

EAI is based on middleware technology. Special attention among middleware solutions should be paid on the middleware integration hub. The role of the hub is to exchange the electronic messages between two or more final systems. The middleware integration hub sends messages regardless of their architecture and implementation technology of the information system.

Technical solutions based on the integration platform can be used both in business activity of domestic enterprises (information systems interaction in the process of development and implementation of the integrated logistic chains) and in the information systems on national level.

23.2 Integration Based on Electronic Documents

This solution is based on the substitution of traditional paper documents traffic by e-document transfer. Such documents as orders, shipment orders, invoices, payment confirmations, etc. do not have to be printed but generated in the relevant computer memory structures of the sender's information system and sent as an e-document to the recipient's computer system. On the other hand, e-document will be read by recipient's information system which will initialize relevant actions linked to the following processing of the source data contained in the document. Electronic data interchange is held automatically without human intervention in the process. Sender's and recipient's information systems could vary in all aspects. The only demand is structural and formal definition of the submitted e-documents.

The above-mentioned solutions result in concept definition of Electronic Data Interchange (EDI). „Electronic Data Interchange is the process of automatic information exchange between computer systems of different organizations. The process is carried out by electronic medium and based on the approved message standards" (Definition of GS1). The goal of EDI based solutions is the substitution of paper documents (circulating traditionally between companies) by e-documents [8, p. 61].

EDI implementation brings the whole range of benefits which could be classified into two categories:

1. Direct benefits associated with automatization of operating procedures are the following: cost reduction, error elimination during data input, transmission rate and processing; invoicing and payment possibilities, language barrier elimination.

   – Error reduction related to multiple manual data input. The data are entered into the information source system only once. Afterward the data are sent to the partner's information system as an e-document.
   – Elimination of time-consuming process of issuing and sending the documents in traditional way. A command to send relevant message results in automatic processing of EDI commands and sending it to the recipient.
   – EDI guarantees stock reduction, transport and shipment improvement, quicker order processing. EDI provides quick data interchange between companies cooperating in logistic chain.

2. Long-term benefits accomplished through anew creation of information flow and adaptation of the action plan to the new possibilities provided by EDI: improvement of the information management and flow, strengthening the relationship between partners, up-grading the logistic cycle, amelioration of company's competitive ability, multiplication of investment effects in the area of IT solutions and telecommunications.

   – Efficiency increase of the internal company systems. The need to implement EDI could cause a modernization of the existing information systems which could improve the internal data transfer,
   – The partnership will improve in consequence of error reduction in order processing, mutual settlements, and balance confirmations. If errors would appear, they could be set straight quicker, which helps cooperation and business network development [13, pp. 224–225; 15, pp. 87–88].

Initially, industry groups developed industry-wide standards for EDI transactions. In the US automobile industry, for example, it soon became apparent that if suppliers had to process incoming orders in a unique proprietary standard adopted by each of its major customers, the burden would be severe. Accordingly, the Industry group MEMA (Motor and Equipment Manufacturers Association) facilitated the development of a standard that would be used by all of its members. Similar proprietary standards arose in other industries. When it became apparent that cross-industry standards would be beneficial, inasmuch as industry members did business with

trading partners outside their own industry, or with government, the cross-industry standards ANSI X12 and, later, EDIFACT were developed and put into widespread training services, translation software, model trading partner agreements, and so on [5, pp. 113–114].

The implementation of EDI standards as a medium for document interchange between enterprises and public institutions could not be possible without implementation of special legal regulations. The Acts from September 18th, 2001[1] about the electronic signature and from December 17th, 2010[2] about the transfer and storage of electronic invoices and its' submission to the tax authorities are to be mentioned here. The Act from 17/12/2010 permits issuing and sending of the e-invoices if two conditions are met: the recipient accepted this form of document interchange and both authenticity and content integrity of the invoice are maintained. According to the Act mentioned above, the invoice authenticity means confidence in relation with the identity of the vendor, supplier or issuer while the content integrity means data permanence and security.

The first condition is a formal one—it means the settlement of certain agreements and cooperation between partners. The second one allows the development and implementation of information processes supporting the automatic data interchange between companies according to the standards mentioned above (authenticity, content, and structure integrity). It is important to add that documents are often sent as unsecured, editable files in e-mail attachments. It is highly controversial whether this way of data interchange ensures content integrity of the document, because the possibility of file editing creates a thread of unauthorized changes by unendorsed parties.

According to the Author, creation and saving documents in typical office applications and usage of public electronic media in their transmission do not ensure the needed level of security. Moreover, the participants of this process do not have any warranty that the document would be received correctly by the recipient. It happens frequently, that in consequence of incorrect configuration of the firewall software the transfer of particular files could be blocked without any information to the recipient about potential anomalies.

The development of specific interfaces connecting applications by means of point method is a currently dominant strategy for systems' integration. The teams of software engineers create complex convertors which allow data selection from the app, conversion of data format and structure, performance of simple processing operations and data transmission to the final application. At the end, we get an unhomogenous collection of integration functions (interfaces and convertors) which are created by means of heterogeneous platforms of operation systems, management database systems, structural and object technologies, and programming languages. It is important to mention that in this case system actualization, update version implementation or software replacement demand repetitive decompiling, analysis and reconstruction

[1] Dz.U. nr 130, poz. 1450 z późn. zm.

[2] Dz. U. nr 249, poz. 1661.

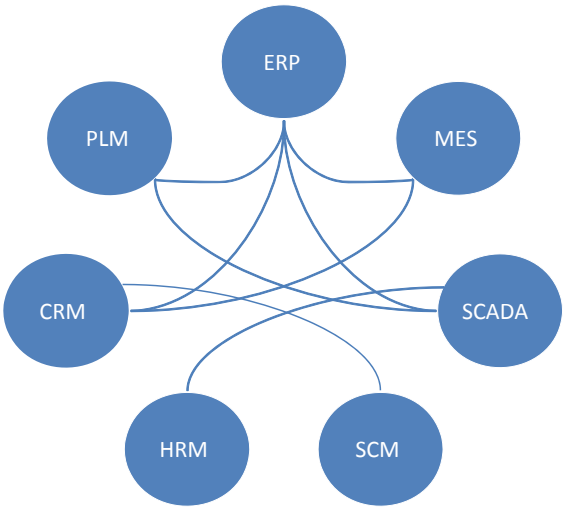

Fig. 23.1 Integration "spaghetti" system. *Source* Author

of particular interfaces. On the other hand, it increases the cost and investment risk significantly and leads to various errors in the operation of integrated applications.

In this way, and quite inevitably, we create "spaghetti" systems (Fig. 23.1), where it is very difficult to analyze the potential impact of modifications to an application or to measure the scope of changes required to integrate a new application.

In addition, as we have seen, these applications were not originally designed to communicate with each other. The links and interfaces that allow them to cooperate had to be created between each application. The introduction of commercial software packages in information systems has only reinforced this problem, since they were designed to respond to a particular problem without being preoccupied about communicating with the existing system.

If we consider the extreme case where all applications must communicate with all other applications in the information system, then the number of bi-directional interfaces required is the direct result of the application of the formula:

$$i = \frac{n(n-1)}{2} \tag{23.1}$$

where "i" is the number of interfaces and n is the number of applications.

To connect six applications, 15 interfaces must be created. To connect 150 would require 11,175 [10, p. 13].

The alternative solution, ensuring security and integrity in the process of e-documents interchange could be the development and implementation of the integration platform for manufacturing information systems.

23.3 Integration Platforms of Manufacturing Information Systems—Case Study of Decision Support Systems Improving Diagnostic Process of Workplaces

Trends in manufacturing are moving towards seamless integration of physical and digital worlds in order to enable fast integration, feedback and control loops throughout distributed manufacturing infrastructures. As the demand for personalized products increases, product lifecycles are becoming shorter and shorter.

The e-Factory concept from Japan is achieving an advanced use of the industrial internet with regard to both manufacturing control and data analytics, with the aim of effecting an optimization of productivity and energy conservation. The e-Factory approach helps to make the factory truly visible, measurable and manageable with the help of emerging technologies. To realize the next generation e-Factory approach, a multi-company organizational structure has been formed to enable cooperation between assemblies of companies. This partner alliance is aimed at joint product development, manufacturing, and marketing, as well as solution innovation for the entire supply chain. Meanwhile, governmental organizations have also launched investigation and studies to support the industrial companies undertaking such activities [4, pp. 23–25] (Fig. 23.2).

The e-factory concept requires the implementation of platforms integrating autonomous and incompatible IT systems that were created using various programming tools and database technologies. For example, The Manufacturing Service Bus (MSB) is an integration platform, which is based on a service-oriented architecture and allows flexible linking of different production-based IT services. It also introduces the five layers of integration, which are depicted in Fig. 23.3.

The Data Source Layer (0) is containing all manufacturing systems and digital factory information systems, which comprises a number of heterogeneous data sources,

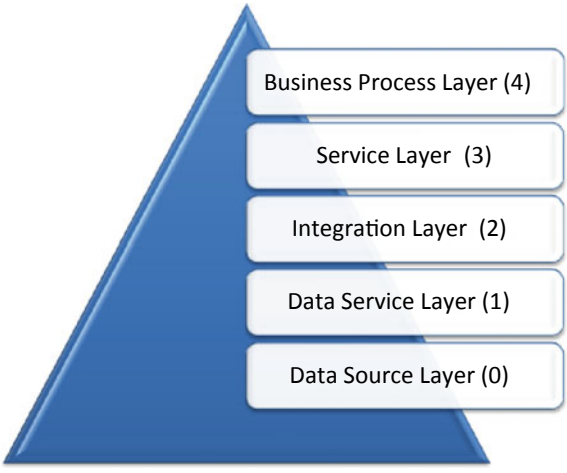

Fig. 23.2 The model of Manufacturing Service Bus. *Source* Author, base on [11, s. 108]

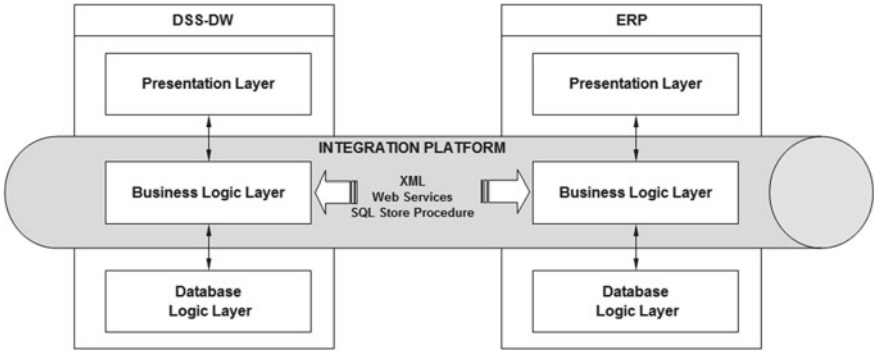

Fig. 23.3 Integration platform DSS-DW—ERP. *Source* Author

diverse data models and various use of different communication protocols. The Data Service Layer (1) enables manufacturing systems and applications to provide data as services, with the help of service adapters. These are interfaces which can be connected to the MSB. The Integration Layer (2) is the MSB itself and includes an ESB enhance by content-based routing of events and mediation services, e.g., for message transformation or BPEL processes. The Integration Service Layer (3) contains integration services and manufacturing applications, which are typically the end destination of the event notifications processed by the mediation services. The Business Process Layer (4) contains all business processes in a manufacturing environment that are relevant to the execution of production processes.

The MSB transmits the well-known concept of an Enterprise Service Bus (ESB) to the production and extends it by additional functions: ease of reconfiguration, loose coupling of production object, asynchronous communication, standards-based integration [14, pp. 179–184].

The e-Factory concept was an inspiration for the implementation of the industrial research program "Decision support systems improving diagnostic process of workplaces" (POIG.01.03.01-14-059/12).

The project objective was to develop an innovative method of analysis supporting the process of so-called intelligent diagnosis of workplaces in manufacturing and to prepare new technological, applicative and system-related solutions connected to the implementation of software prototype. The innovation of the proposed method is based on implementation of certain aspects in output and optimization planning, such as human factor in the working process, technological and production process security and other factors related to the influence of the working environment on a human body.

The mission of "Decision support systems improving diagnostic process of workplaces" (DSS-DW) is the following:

1. Agile modeling of the working environment in a manufacturing enterprise, such as buildup of virtual production lines considering process-dependant parameters

of the equipment, shifts and job rotation between interrelated groups of working positions and service and maintenance performance.
2. Safety management of technological processes considering quality level of safety equipment, personal safety kits, safety and convenience of maintenance activities.
3. Working environment management including level monitoring of harmful factors influencing human health, climate parameters and other nuisances related to work and implementation of regular industrial auditing using expert evaluation methods.

The results of this research project enable the evaluation of measureable economic losses being a result of sick leaves due to unfavorable working conditions (i.e., noise, lighting, microclimate). In particular, they should allow to develop multi-criteria computer-aided decision-making models in order to analyze professional risks, job-related psychophysical burden, environment factors, costs of down-time related to accidents and sick leaves, costs of amends related to injuries and treatment of occupational diseases. The immanent element of the research program was interoperability. It has been observed that lack of reciprocity between specific branch systems and existing enterprise's systems significantly limits their implementation in industrial practice.

The DSS-DW integration with another systems and branch applications could arise from development and implementation of the integration platform (recommended solution) or by applying dedicated interfaces (not recommended due to complexity and high maintenance costs of particular software interfaces).

The integration platform is an independent part of the middleware class software which enables to connect the interdepartmental and dispersed systems. For one hand, the platform guarantees the independence of particular information systems and for another hand, it provides a set of elements and services facilitating the process of data and electronic documents transfer. Taking into consideration the necessity of DSS-DW integration with other systems and branch applications, this kind of integration guarantees the autonomy of particular systems, the possibility of transactional data interchange between heterogeneous systems and the flexibility. The flexibility is to be understood as a chance for functional and technological development of different integrated systems without changes and reconstruction in implemented integration platform. System development in SOA standard could be a technological solution providing the possibility for future integration of the application software. For instance, component approach and Web-Service technologies should be used if the newly designed information systems are implemented.

DSS-DW will enable fully automatic data and electronic document exchange with other information systems within the enterprise such as MRP, MES, HRM maintaining authorization and safety procedures and transactional processing. The possibility to use Microsoft Biz Talk Server technology for the implementation of the DSS-DW integration unit has been experimentally proved.

Microsoft Biz Talk Server is a platform to integrate heterogeneous systems. It combines the functionality of integration on both the transaction and operating processes levels. It facilitates designing business processes connected with document

exchanges together with assigning programming components to them within a single environment. In the system, specification of input and output data is defined as well as diagrams of data transformation. Also, organizations and applications and channels and ports involved in sending documents are defined. The format used in BizTalk are XML files, but it also complies with basic EDI standards. BizTalk has also interfaces (accelerators and adapters) with standard business applications (e.g., my SAP) and database management systems.

Microsoft Biz Talk Server platform provides solutions in automating data and documents exchange using EDI and XML standards and maintaining authorization and security procedures and complete transactional processing.

23.4 Interoperability Technologies

The client-server system design enables the development of safe and scalable applications. However, the main disadvantage of this kind of solution is undoubtedly high encapsulating level of app code and lack of app interaction on program object level. Having the app code as closed, monolithic structure, it is extremely difficult to perform modifications and software changes. The adaption of standard software for company specifics demands time-consuming and expensive activities related to analysis of thousands of lines of the existing code and implementation and testing of all program changes and extensions. High costs and risks related to modifications in standard software make its' implementation uneconomic for the majority of SME sector companies.

Conclusion. The development of new generation of information systems requires the implementation of technologies which can guarantee interoperability, scalability, flexibility, adaptiveness, and safety of designed solutions by using component engineering and so-called open standards (i.e., XML, SOA, Web-Services). In the framework of the industrial research in "Decision support systems improving diagnostic process of workplaces" (DSS-DW) project, the analysis and assessment of modern technologies of software systems design and integration will be conducted.

At the present moment, the leading technologies are the following: component engineering (concept for information systems' implementation from atom procedures and independent, hermetic fragments of application code), middleware class solutions and network services such as Service-Oriented Architecture (SOA) or Web-Services and asynchronical data processing techniques (queue systems).

Component engineering is defined as a growing practical branch aiming to standard development which could allow to design huge systems from smaller parts (components). From application perspective the components are code units which provide relatively independent parts of so-called business logic layer of the system. The development of component software is a SOA concept with service-oriented design. The SOA concept is based on the statement, that business logic of the application is not a monolithic system. On the contrary, it is divided between many spread service components which are coordinated through the central control application.

The control application and service components are connected through Internet. Usually, CORBA, DCOM, EJB, and Web-Services technologies are used for implementation of spread service components.

In the framework of the DSS-DW project, the SOA concept is planned to be used in order to implement particular functional units. Potential advantages are the following:

1. Adaptiveness. App code modification will be limited to the introduction of adequate changes in single software component without analysis, test, and recompilation of the whole software, which was a common disadvantage of traditional monolithic systems. So, the time needed for analytical activities, programming, and designing will be significantly shortened and the costs of program modifications will be decreased.
2. Scalability. The software implementation with multi-layer design will enable the division of tasks and processing operations between application servers. Proposed solution will allow virtualization and cluster linkage of servers which will guarantee scalability and acceptable level of investment outlays in hardware infrastructure.
3. Interoperability. The development of software component using Web-Services technology will enable the design of advanced integration solutions with the help of Enterprise Service Bus (ESB).

In the DSS-DW project framework, particular units of the software will be implemented using: MS Visual Studio.NET (C#.NET), MS WorkFlow Foundation, program components SOA—Web-Services, ADO.NET, ASP.NET, COM+. The database and data storage will be developed in MS SQL Server 2014 environment. The Business Intelligence unit will be elaborated using: MS SQL Integration Services (extraction, conversion, and data supply), MS SQL Analysis Services (components of analytical application), MS SQL Reporting Services (intranet reporting module). The integration unit will be implemented in Biz Talk Server environment.

23.5 Conclusions

Computer support of planning, technological, production, logistics and diagnostic processes requires the implementation of complex, specialized IT systems. So far, the dominant strategy of computerization of industrial enterprises has been the implementation of monolithic ERP/MES systems and their time-consuming and costly customization and integration. The article presents an alternative approach - integration of industry systems using middleware technology. The middleware integration hub offers advanced technological solutions supporting the process of data transformation and data integration based on central repository and adapters, it also makes possible the message interchange between non-compatible information systems. The proposed solution will enable the construction and development of a flexible architecture of information systems for the needs of modern industry.

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Chapter 24
Company Involvement in Sustainable Development—Proposition of a Theoretical Framework

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Abstract The idea of corporate social responsibility (CSR) responding to the challenges of sustainable development is currently being questioned, mainly due to its implied nature and alleged lack of genuine involvement of businesses in the implementation of CSR ideas. We argue that the basic requirement for genuine involvement of a company is the engagement of its employees in projects supporting sustainable development goals. Such projects can create positive social change in the organization and lead to various beneficial outcomes for the company. However, factors that trigger company willingness to conduct the aforementioned projects are still unclear. The aim of the paper is to present a theoretical framework in this regard.

Keywords Sustainable development · Social capital · ARA model · MOC mechanism · PSC model

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24.1 Introduction

The concept of sustainable development is a result of growing awareness of the links between environmental degradation, the depletion of non-renewable resources, the quality of life, and the well-being of societies [39]. The issues of environmental protection and social development as critical to the future of the whole humanity were recognized by the United Nations and led to the establishment of the World Commission on Environment and Development in 1983. The result of its work was a report entitled *Our Common Future* prepared by Brundtland [15], which was the first to identify sustainable development as a path to the harmonious development of societies [1]. The report defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [15, p. 41].

The current prevailing view is that achieving sustainable development requires taking and integrating action in three dimensions: economic, environmental, and social (e.g. [3, 25, 39]). The achievement of long-term growth that will be shared by all nations and communities remains the goal of sustainable economic development. In turn, the environmental pillar of sustainable development points to the need to protect the environment and manage natural resources in a way, which allows them to be preserved for future generations. At the same time, the current approach to the protection of the environment needs to be modified: from the current focus on responding to emerging issues to anticipating and preventing the negative impact of human activities on the environment. The social dimension of sustainable development is related to improvement of the quality of life for present and future generations. Global social goals for sustainable development include eradicating poverty around the world, eliminating hunger, ensuring food security, health protection, equal access to education, and equality between women and men [66].

Sustainable development is a multidimensional concept, the implementation of which requires integration of the above three dimensions, i.e. combining economic and social development by providing access to renewable and non-renewable resources [1, 3]. This integration has to take place at all levels: global, regional, and local [33]. At the same time, achieving the goals of sustainable development requires a change in the behaviour of people, which should take place along many dimensions: consumer, corporate, institutional, social, and political. While scientific investigations may improve long-term quality of decision-making, the development of real changes in human behaviours must also take into account their emotional aspect [38].

Sustainable development will fail without engaging businesses in this process, as they shape not only economic development but also increasingly influence the quality of life of societies and the state of the natural environment. For this reason, companies are experiencing increasing social and political pressure to engage in sustainable development, especially in the environmental aspect [40, 58]. Corporate sustainability means a continuous commitment to the creation of new processes, products, and business models that contribute to improving the company's economic, social, and

environmental performance [24]. Meanwhile, there is a discrepancy between the actions declared by companies as socially responsible and the actions undertaken [23]. Society increasingly perceives corporate social responsibility (CSR) and its slogans concerning the need for companies to implement sustainable development as distracting public attention from other, more serious problems [55]. The genuine motivation of companies in this regard, as well as the real costs and effects of such actions, is questionable [54]. The situation is made even worse by cases appalling the public such as, practicing the so-called greenwashing by an energy company advertised as an organization that uses renewable energy, while 95% of its energy comes from hard coal and lignite, or the case of a company selling the so-called road salt to bakeries [65].

Implementing sustainable development in business remains a challenge due to the fact that a large number of businesses focus mainly on profits rather than on managing stakeholder relations [44]. It remains a key challenge to involve top management, employees, and other stakeholders in this process and redesign the organization's systems to allow for planning, management, and measurement of sustainability outcomes. Only changing the company's attitude and building an organizational culture that enables the inclusion of stakeholders in these activities make a sustainable development and a significant part of business performance [27, 44].

This paper proposes a theoretical framework for company involvement in projects supporting the achievement of sustainable development goals (we propose to label such projects as the company projects for sustainable development). In our approach, we use concepts that have not been incorporated into one framework. These are as follows: the PSC (positive social change) model, the MCO (motivation—capability—opportunity) mechanism, the ARA (activities—resources—actors) model, and social capital in its three dimensions: structural, relational, and cognitive. The aforementioned concepts are first introduced. Our theoretical considerations are based on the method of analysis and criticism of the literature. Literature review leads us to proposition of five hypotheses and the overall theoretical framework, which we are going to test in the further stages of our research project.

24.2 Positive Social Change

The basic requirement for a company's true commitment to sustainable development is to change the attitudes and values of employees in a way that fosters their authentic engagement in achieving goals related to it [31, 58, 61]. Employees' values and their attitudes towards sustainable development goals affect how they perceive various activities undertaken by the organizations in that respect. Consequently, this impacts their behaviours contributing to the achievement of sustainable development goals [18, 40].

In order to identify mechanisms leading to building employee behaviours that demonstrate the internalization of values related to sustainable development, we propose to adopt the PSC (positive social change) model. Stephan et al. [57, p. 1252]

define positive social change as "the process of transforming patterns of thought, behaviour, social relationships, institutions, and social structure to generate beneficial outcomes for individuals, communities, organizations, society, and/or the environment beyond the benefits for the instigators of such transformations". The aforementioned beneficial effects of the process, for instance, increased involvement in rational resource management, higher tolerance for social diversity, higher health consciousness, increased care for the environment, can relate to both internal (i.e. inside the organization) and external communities (society). According to the authors of the PSC concept, it primarily refers to external changes, i.e. changes in the attitude of society. However, we propose to explore the positive social change within the company, as expressed by the behaviour of employees.

Positive social change includes two levels of impact: (1) a superficial positive social change, and (2) a profound positive social change [57]. The first one assumes that the impact targets (e.g. employees) react quasi-automatically to applied external motivators (incentives and pressures) and to the changed decision context. People change their behaviour relatively quickly because of the awards (e.g. increased personal image or financial awards) or under social pressure or coercion (e.g. group pressure, conformism, and threat of negative consequences). Such a change of behaviour, though positive, is temporary, limited to the place of control and conditioned by the presence of external motivational factors. A lasting change is only possible through true internal transformation and requires close involvement of change targets. The profound positive social change is usually geared towards more complex and persistent behaviour than a superficial change. Modifying employee behaviours are based on changing their beliefs, attitudes, and values, thus are motivated by their own will.

The effectiveness of the PSC process depends to a large extent on determinants related to an organizational culture and dominant organizational climate [18, 31]. If ethical culture and climate prevail, there will be the predominance of employees' sense of concern for others, i.e. co-workers, external stakeholders, the organization, the environment, etc. The role model of organizational leaders is also crucial in this regard. Employees, who identify themselves with their leaders, are more likely to take over their values and duplicate their behaviours, including ones in the area of sustainable development [31].

In practice, there is a shortage of organizations' efforts to encourage employees to engage in sustainable development [58]. Such engagement can be optimized through appropriate employee training, which, by increasing knowledge, skills, and competencies, leads to changes in employee attitudes, motivation, and commitment to sustainable development [40, 45, 61]. Ji et al. [40] show the impact of this type of training on employee attitudes towards the natural environment. However, it is significant not only to convince employees that sustainability is beneficial for everybody [61]. Organizational conditions and processes should also be created so that they could enable employees to facilitate the integration of sustainability aspects into their actions [53, 58]. In this respect, we propose to adopt MCO: motivation—capabilities—opportunities mechanism.

24.3 MCO Mechanism

The process of change in employee behaviours towards positive social change can be analyzed based on the motivation—capabilities—opportunities model (MCO). The model has its roots in a proposition of Bailey [5] who extended Blumberg and Pringle's [10] and Vroom's [59] motivation theory that performance is the function of capacity to perform, willingness to perform, and opportunity to perform. Bailey proposes the model in reference to the high-performance work systems (HPWS). In some propositions, MCO model is presented as AMO (ability—motivation—opportunity) while ability and capability stand for equal effects [42]. MCO/AMO framework is considered as the "black box" of human resources management practices [12, 22, 28]. It means that in order to achieve high performance, employees must be able to do so, motivated and their work environment must provide supporting opportunities [4, 46]. Ability may be developed through training of different kinds; motivation is achieved by extrinsic incentives, social activities, work-life balance, or collaborative climate. Opportunity, in turn, can be created by employee involvement and empowerment, knowledge sharing or job design [46]. It is said that MCO/AMO components are complementary, i.e. they have to appear together in order to support employees' work [13]. However, specific links and relations among those components are not as yet successfully explained.

In our approach, we propose the MCO model as the explanation of how corporate projects for sustainable development may support positive social changes. Motivation can be achieved if the project is embedded in a local context, linking a project to a local community, because this will enable workers to experience problems to solve as something personally meaningful and significant [32]. Opportunity-building can be achieved through organizational practices empowering employees, showing them a wider context of social problems and making them aware of the possible impact they may make on those problems [57]. Employee capabilities are developed if through those projects they can link the problems to be solved with variety of skills, involving the right people, gaining alliances, and cohesive leadership [57]. Therefore, we hypothesize that *company projects for sustainable development lead to the creation of motivation and capabilities of employees if the nature of these projects involves actual contact between employees and the problems the project is focused on* (*H1*) (see Fig. 24.1). Observations of business practice lead to a conclusion that company projects for sustainable development, in most cases, take a form of corporate volunteering.

However, if projects leading to motivation–capability–opportunity mechanism are to launch in a company, there must be something triggering their appearance. We propose that such trigger is created within a company's external relations. To analyse these relation we propose to use ARA (activities—resources—actors) model.

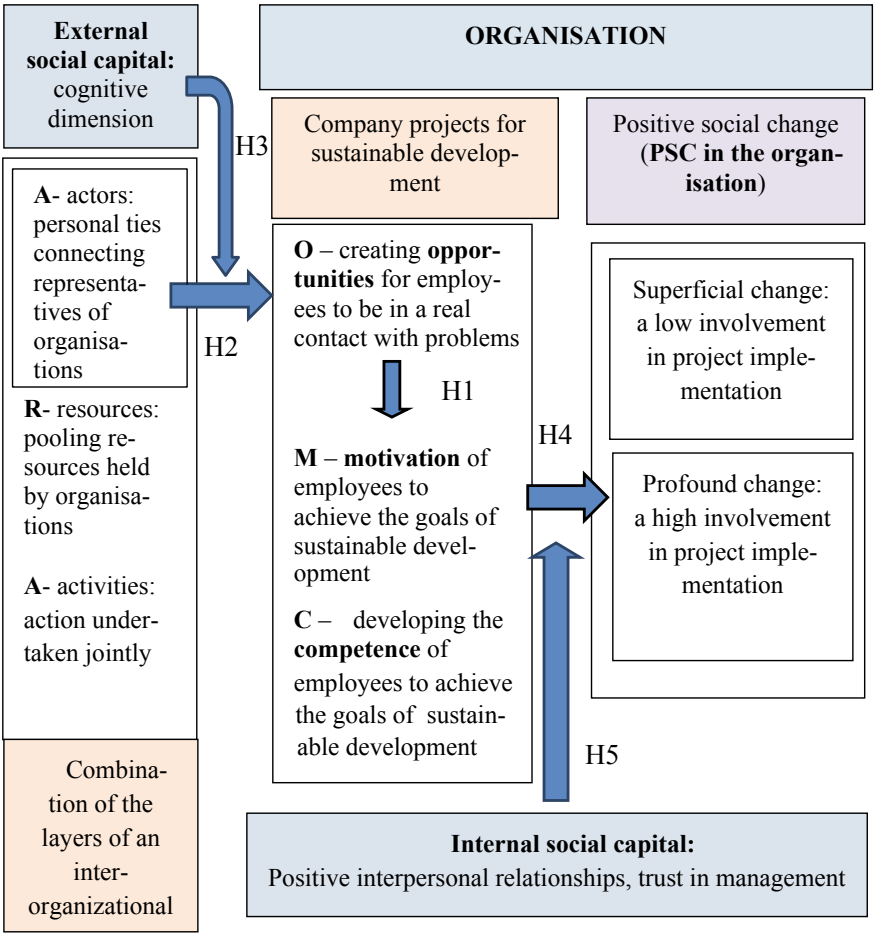

Fig. 24.1 Theoretical framework for company involvement in projects for sustainable development

24.4 Inter-organizational Relationship as a Trigger of Company Projects for Sustainable Development

Inter-organizational relationships have been extensively described in management studies since the 1980s. They are considered a fundamental factor in achieving company's long-run success [9, 35, 48, 63]. They strengthen the competitive position of the company, mainly because of mutual learning of relationship among partners and gaining access to resources [56]. Both the research and observations of business practice show also that inter-organizational relations can give the impulse for the realization of projects for sustainable development. This is, especially, true when cooperation between an organization and its partners has been already established, i.e. it has been lasting for some time, and the satisfying results of the cooperation have

been already obtained. Existing relationships foster development of mutual knowledge and trust between partners, so that further joint projects in the field of sustainable development are being undertaken, leading to creation of strategic partnership [41].

Inter-organizational relationships can trigger or hinder process, progress and outcomes of projects for sustainable development. Therefore, failing to invest in those relationships can negatively affect the policy and implementation of such projects [37]. Furthermore, building inter-organizational relationships fosters sustainable development because such concerns as climate change and global poverty cannot be solved by companies in isolation and requires collaboration [8, 20, 36, 52]. It is also beneficial if the cooperation is established between organizations representing various sectors, including non-profit organizations [6, 41, 62]. Within such cooperation, resources owned by particular parties, such as different experience and knowledge are combined, and solving the complex problems of sustainability becomes possible and more effective. Often the scope of activities undertaken in the field of sustainable development does not coincide with the statutory activity of the company but might overlap (totally or partly) with the activities of other organizations. For this reason, cooperation brings better results than acting independently [41].

Specific inter-organizational relationships differ from each other. Moreover, each relationship evolves over time: their content, strength, and nature change in the process of interaction between parties [35]. Researchers attempting to define and operationalize inter-organizational relationships follow the approach proposed by Håkansson and Snehota. They describe inter-organizational relationships as a combination of two dimensions: substance and function. The substance of a relationship consists of three main layers: (1) activity links (i.e. the links between actions undertaken by relationship parties); (2) resource ties (i.e. the links between resources the parties possess), and (3) actor bonds (i.e. the personal ties connecting employees representing the two sides of the relations). In the ARA concept of Håkansson and Snehota, relationships are the effect of the interaction process in which the parties (actors, i.e. employees representing their organizations) interact within a relationship (undertake actions) and involve the needed resources (knowledge, tangibles, technology, etc.) in order to solve shared problems and exploit opportunities [35]. All three layers of relationships are closely interrelated, but the way they are combined, their strength and weight vary [35].

Out of the aforementioned layers, the actor bonds are considered as the basis for development of strong, active, and resourceful connections [35]. Trust and commitment between the relationship parties, necessary for the sustainability of the relationship, is neither established nor developed between the organizations involved in the relationship, but between their employees [26, 60]. In fact, employees decide how the other partner of the relationship is perceived and treated and what kind of actions is taken [34, 35]. The mutual trust of individual actors representing the relationship parties is both the effect and the foundation for its duration and development, and thus for achievement of the intended benefits [30, 43].

In sum, in our theoretical framework, we hypothesize that inter-organizational links contribute to the fact that the partner organizations are inclined to take joint action beyond the economic interest, aimed at achieving the objectives of sustainable

development in its three aspects, i.e. economic, ecological, and social. Therefore, we propose the following hypothesis*: The actor bonds facilitate undertaking projects in companies that give employees the opportunity, motivation, and ability to engage in sustainable development* (*H2*) (see Fig. 24.1).

The discussion presented above suggests also that inter-organizational relations lead to common projects for sustainable development if the relation is supported by social capital, including mutual trust and positive interpersonal relationships. The next section elaborates this issue.

24.5 Social Capital in the Process of Undertaking the Company Projects for Sustainable Development

Bourdieu [14] defines social capital as the aggregate of the actual or potential resources, which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition. In a similar way, social capital is defined by Nahapiet and Goshal [50], who concerns this notion as the sum of actual and potential resources embedded within, available through, and derived from the network of relationships possessed by individuals or social units. Coleman [19], in turn, considers social capital to be an important resource that influences the ability of people to act and defines it as a set of attributes of a social organization such as trust, norms, and interpersonal relationships that enhance their collective action by allowing them to achieve certain goals that would be impossible to achieve otherwise [19].

There are two main sources of social capital: internal and external (e.g. [2, 16, 17, 21, 49, 51]). Internal sources of social capital involve the team's internal social structure that defines relationships among team leaders, team members, and subgroups [17]. Internal social capital refers to the symptoms of various links and relationships within the organization, developing teamwork, climate for collaboration, knowledge sharing, conflict resolution, etc. In this context, the organization is a relatively dense network that builds common standards and goals within organizational culture as well as understanding of employees' roles and behaviours [7]. In contrast to internal sources, external sources highlight the extended social structure that outlines extrinsic linkages to other social units located outside the boundary of focal group [17]. External social capital refers to the quality of the organization's links with other market players such as customers, suppliers, partners, as well as with local and regional political bodies and representatives of the public [7]. Similar to internal social capital, external social capital determines the development of goals and standards of inter-organizational cooperation, and thus its effectiveness.

Characteristics of social capital can be categorized into three dimensions: structural, relational, and cognitive [50]. The structural dimension refers to the properties of the social system and the network of relations as a whole. It refers, e.g. to a general pattern of bonds among actors, network configuration, relationship density, and

structural gaps in the network. The relational dimension, in turn, describes the type of personal relationships that have evolved during the interaction. Key aspects of this dimension include trust and credibility, respect, responsibilities, expectations, and identity [50]. The cognitive dimension is related to a system of meanings, values, and norms and their mutual understanding. It translates into a common vision and goals shared among relationship partners which strengthen the relation [47]. In case of common projects for sustainable development which go beyond economic interest, the cognitive dimension of social capital seems to be crucial. Without societal cohesion and focus, it is very difficult to make significant positive changes [64]. Therefore, we pose the following hypothesis: *Inter-organizational relationships are an impulse for companies to implement projects for sustainable development if the bonds connecting the actors of the relationship create social capital in cognitive dimension* (*H3*) (see Fig. 24.1).

Regardless of external initiative for the projects for sustainable development, their success depends on participant engagement. For the same reasons as stated above, i.e. the importance of sharing common vision and goals, we propose that internal social capital be the factor determining employee engagement in those projects. We therefore hypothesize: *The strength of internal social capital influences the engagement of employees in company projects for sustainable development* (*H4*).

The true organizational culture supporting projects for sustainable development is impossible to create without internal social capital [11]. Strong ties among individuals in a company, an atmosphere of trust and mutual respect and the willingness to make a contribution to sustainable development are particularly valuable resources. Trust in managers plays especially important role in this regard influencing employees' belief of fairness and reasonableness of undertaken activities [31]. In addition, employee engagement is enhanced by their mutual positive relationships that create sustainable energy for performing the projects [29]. We claim that: *The most important elements of internal social capital that fosters profound positive social change are (a) trust in managers and (b) positive relationships among employees* (*H5*).

All in all, we propose the theoretical framework of company involvement in projects for sustainable development as it is depicted in Fig. 24.1. The framework combines all the concepts and hypothesis described above.

According to this framework, the overall process can be described as follows:

Inter-organizational relationships provide an impulse for a company to conduct projects related to sustainable development goals. It is supported by a common understanding of sustainable development values, goals, and tasks manifesting the cognitive dimension of social capital created through the relationships. The bonds among relationship actors facilitate undertaking projects in companies that give employees the opportunity, motivation, and capabilities to engage in them. However, projects for sustainable development can lead to genuine employee engagement if their nature involves actual contact between employees and beneficiaries and/or the problems being solved. Internally in a company, employee's engagement in projects for sustainable development is supported by internal social capital, notably by trust shown to managers and positive relationships among employees.

24.6 Conclusions

Our framework contributes to theory development by opening new research avenue regarding involvement of business in sustainable development. It is, especially, important that in the framework, we combine concepts and constructs that are already operationalized or can be operationalized. The main limitation of the study is general and theoretical nature of our proposal, which requires more in-depth elaboration. Nevertheless, we consider the framework as a good base for further empirical research which can result in theory development, as well as in useful managerial implications. The acquired knowledge can provide business people with practical guides for successful implementation of projects for sustainable development, including how to motivate employees to reach profound positive social change in the company.

We also would like to note that we have already started a research project aimed at the framework verification (the project funded by the National Science Centre, Poland, on the decision number DEC-2017/25/B/HS4/01113). In our research plan, we assume conducting qualitative and quantitative studies of selected companies in order to identify the types of implemented projects for sustainable development (based on the MCO mechanism), the nature of inter-organizational relationships (based on the ARA model), and intra-organizational factors which determine genuine company involvement in sustainable development. In qualitative study, we intend to carry out in-depth individual and focus group interviews with people responsible for sustainable development projects and with employees involved and not involved in these projects, as well ethnographic study (observation and description of employee behaviours in the work environment). In quantitative study, we are going to conduct standardized (face-to-face or telephone) interviews using a questionnaire based on the results of qualitative research. The results will help us to develop, *inter alia*, a synthetic indicator based on a multi-criterion analysis method, which will transform various and most often incomparable variables describing complex phenomena into one measure (in this case: a positive social change in the organization). We hope to share soon the results of the project with the research community.

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Chapter 25
Political Will: Mechanisms of Stakeholder Management

Monika Kulikowska-Pawlak

Abstract This paper attempts the discussion on political will in strategic management. It provides insight into the range of political motivations that support stakeholder management. I present political will as a set of complementary dimensions, i.e., benevolence and self-serving, which are corresponding to fair and arm's length approaches to stakeholder management. I formulate propositions presenting relationships between political will and effectiveness of managers and between motivation of political will and participation of stakeholders in creation of value. This integrative model offers the necessary political mechanism for organization's value creation to be tested in the future research.

Keywords Political will · Stakeholder management · Organizational politics

25.1 Introduction

For managers to be effective, they must possess both political skill and political will [1]. Although political skill has received the most scholarly attention, the research in political will is rare. Political will is positioned as a construct operating at the societal or group levels. However, the leadership and personal investment on the part of individual actors that contribute to the generation and maintenance of political will at the collective level must be taken into consideration [2]. Individual-level political will in organizations is defined as "the motivation to engage in strategic, goal-directed behavior that advances the personal agenda and objectives of the actor that inherently involves the risk of relational or reputational capital." [3] Political will is viewed as an essential precursor for engaging in political behavior [4]. Political will understood that way helps employees achieve functional results. These are attitudes toward politics and engaging in politics—in contrast to personality traits—that are a good indicator for political will [5].

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Hidden political motivation of individual actors plays a crucial role in organizations [6]. These motivations form part of the negative image of politics in organizations [7]. Prevalent approach associates political motivation with a readiness to manipulate people in pursuit of selfish aims (e.g., [1]). Yet, political will also generates, maintain, or alter shared meaning, and promote justice, fairness, health, and well-being [8]. Therefore, a growing number of scholars regard considers political will as a more neutral approach. It has been argued that political will underlies behaviors of individuals [2, 9]. Different types of motivation of political will should result in various approaches toward others, and thus, may shape relationships with stakeholders who participate in value creation by the organization.

This paper aims at discussing political will as reflecting both self- and other-serving motivations and its relationships with effectiveness of managers and the participation of stakeholders in the creation of value. This is unique concept that offers hypothesized explanations for different motivations of political will and their connections with bargaining power of stakeholders. Presented considerations may be treated as a challenging proposal for future research.

25.2 Theoretical Background of Political Will and Its Importance for Managerial Effectiveness

Political will has remained an underdeveloped phenomenon. There are few attempts to conceptualize it. One of the most cited one is Treadway [3], who integrates the most critical aspects of individual motivation to influence others. As a result of these analyses, five dimensions of political will are distinguished: instrumental, relational, caring for oneself, caring for others, and personal risk [3].

The instrumental dimension reflects the extent to which employees are self-interested. Their behavior focuses only on the need to satisfy their own desires and goals. In particular, employees are more likely to use power when it is instrumentally beneficial. Thus, the instrumental dimension of political will refers to the traditional understanding of political behavior in a company, which emphasizes that people act to pursue their own interests.

In contrast to the purely economic and pragmatic nature of the instrumental dimension of political will, the relational dimension emphasizes interpersonal relationships with superiors, colleagues, and managers. Employees engage in political behavior to improve relationships with other employees. This dimension refers to the need for belonging as the core for existence and survival of employees, which arouses the pursuit of lasting and friendly interactions [10].

The subsequent two dimensions are related to the place of concentration and refer to care for oneself or for others. While self-care is associated with behaviors that improve the conditions of action of a given employee, care for others aims to increase benefits that other employees achieve. Motivation resulting from caring for

others increases the propensity to invest personal capital to defend colleagues against abuses, to openly raise problems, or to join the supporters of change.

Components presented above are complemented by the dimension of personal risk, which acts as a buffer in which high personal risk reduces the likelihood of engaging in political behavior. Employees have motivation to act when expected benefits exceed personal risk associated with joining organizational politics. Thus, personal risk as a dimension of political will limits both the scope and likelihood of political behavior.

The first four dimensions create two continuums between personal and social interests. Taking into account not only egotistic, but also altruistic motives allow for abandoning only the dysfunctional understanding of organizational politics. The introduction of political motivation, potentially aimed at supporting others, explains how individual political will translates into collective actions in cases of organizational change. Clearly, no single employee is able to innovate or change a company since support from other employees is needed [11].

The problem of the dimensional character of political will is attempted to be solved by both quantitative (e.g., [2, 12]) and qualitative research. The results of the latter conducted by Doldor et al. [13] allow for the isolation of functional, ethical, and emotional dimensions, which characterize managerial attitudes toward organizational politics and engagement in the process. The functional dimension relates to anticipated positive effects of engaging in organizational politics. The functionality of organizational politics refers to shaping political will through the awareness of the need to engage in politics in order to achieve the company's goals to a large extent due to the fact that employees' support is obtained. The most frequently indicated benefits resulting from engaging in politics include building coalitions, acquiring resources, and raising reputation. However, some employees mainly see the shortcomings of such engagement such as manipulation games, pursuing their own interests at the expense of benefiting the organization, creating conflicts, and evoking discomforts and frustration of employees.

The ethical dimension of political will relates to attitudes to what is right or wrong and honest or dishonest. Organizational politics is regarded as a legitimate activity when functional benefits are seen for a company. However, a negative ethical attitude occurs when politics is mainly used to achieve individual goals. It is worth emphasizing that as a management team matures politically, a positive ethical attitude toward organizational politics increases.

The last dimension of political will emerged at the emotional level, indicating which components of politics were perceived as positive or negative by organizational members. Political experiences of organization become more frustrating on one hand, but increasingly rewarding and expedient on the other, the longer the time of involvement in politics and the bigger experience of the members. From the repertoire of ambivalent emotions two extremes stood out: cautiousness (involving frustration, discomfort vigilance, wariness) and playfulness (involving excitement, interest, comfort). To sum up, both emotionally rewarding and emotionally demanding aspects of political engagement were identified.

In sum, there are three core attitudinal dimensions relevant to understanding the managers' willingness to engage in politics, as informed by their own views and experiences about organizational politics and political engagement: functional, ethical and emotional. These three dimensions of political will are interconnected.

A recently conducted series of four subsequent empirical research has allowed for building a new scale of political will that includes two, self-serving and benevolent dimensions [2]. Self-service is a type of self-centered motivation that reflects development of personal authority as a source of influence on others in order to achieve personal interests. Benevolence is motivation that focuses on others and describes organizational benefits as a main driving force to engage in politics and specific self-sacrifice. The measurement of each dimension is based on four items, which gives a scale that has desirable psychometric properties.

The self-serving dimension is linked to the need for achievement and power, while the benevolent dimension mainly refers to the need for affiliation and, in general, internal motivation. Both of these dimensions are negatively correlated with risk aversion, whereas only self-service is associated with Machiavellianism. Self-service is closely related to political skill, whereas benevolence is significantly related to rationality and exchange as techniques of exerting influence. Both dimensions are associated with political behavior, and the techniques of exerting influence such as ingratiation (establishing oneself or someone else in the favor or good graces of someone), referring to superior goals, assertiveness, and building a coalition. Generally, political will complements the impact of political skills on organizational politics, although both constructs influence political behavior in different ways [14].

Organizational politics is considered an integral part of managerial roles [15]. Although organizational politics is often associated with negative organizational effects, the process is with regards to leadership, conceptualized as the constructive management of shared meaning, rather than the manipulative use of power [16, 17]. Managers may perceive politics as both a threat and an opportunity to achieve individual or organizational goals [18].

To sum up the discussion on dimensionality of political will in terms of company's organizational performance, two dimensions of political will have to be distinguished: self-service and benevolence. Political will is a prime motivator that mobilizes personal and organizational resources to achieve political goals. Without political will, it is difficult to imagine both effective leadership and implementation of strategic changes [19]. Thus:

Proposition 1: Political will is a two-dimensional construct that includes self-service and benevolence.
Proposition 2: Political will directly and positively affect the effectiveness of managers.

25.3 A Look at Political Will in Terms of Stakeholder Management

A contemporary look at stakeholder management is based on the assumption that the concept of stakeholders refers mainly to the creation of value [20, 21]. Empirical evidence provided by behavioral economics and social psychology indicates that companies create bonds with the population of potential stakeholders, who include not only the so-called reciprocators who care for integrity, but also stakeholders who care only for themselves [22]. The results of research conducted in these two research fields show that motives for cooperation diversify actors. These motives affect collective ventures, such as the creation of value by the company.

According to Bridoux and Stoelhorst [23], self-interested actors take care of their personal benefits and value integrity as such. However, reciprocators tend to reward honest behavior and punish dishonest one, even when rewarding or punishing is personally costly. A fair approach is more effective in attracting, retaining, and motivating reciprocal stakeholders to create value. An arm's length approach is more effective in motivating self-interested stakeholders and in attracting and retaining stakeholders of this type, especially those who have strong bargaining power. Reciprocal stakeholders usually start with cooperation, but stop cooperation when other participants do not reciprocate. In contrast, self-interested stakeholders start cooperation when it increases their personal benefits. Key stakeholders influence the creation of company value for two reasons. First, they have the freedom to choose whether to participate in, stay in or leave the network of connections with the company. Second, stakeholders can contribute more or less to the creation of value by the company they are associated with.

To sum up, companies have contact with a population of potential stakeholders, which consists of both reciprocating and self-interested entities. In addition, fair and an arm's length approaches to stakeholder management may lead to sustainable creation of value as long as it is applied consistently over a longer period of time. At the end, the analogy between benevolence as a dimension of political will and a fair approach in stakeholder management is clearly visible. Similarly, there are significant similarities between self-serving motivation in the aspect of political will and the arm's length approach in stakeholder management.

Political will which is based on benevolent motivation leads to a fair approach, where interactions with stakeholders are characterized by the relationships of justice and nobility. These interactions are manifested in three ways. First, the benevolent motivation of political will directs the process of sharing the created value among stakeholders as well as the result of this process and the interpersonal treatment of stakeholders. It translates into organizational practices, such as openness, a fair exchange of information, and a tendency to solve problems through cooperation. Second, formal contracts connecting the company with its stakeholders are not very detailed because parties rely heavily on trust and reinforcement through social sanctions, rather than through legal enforcement. Finally, bonds with stakeholders tend to be a long-lasting relationship.

In the case of self-serving motivation of political will, interactions with stakeholders are based on bargaining power, and then the competitive advantage does not always translate into organizational effectiveness of the company [24]. This leads to three important differences compared with benevolent motivation. First, the relative bargaining power of stakeholders directs the process of sharing the created value between various stakeholders, as well as the outcome of this process and interpersonal treatment of stakeholders. Second, self-serving motivation is expressed in organizational practices such as the secrecy of information, the pursuit of company's information advantage in dealing with stakeholders, solving problems by means of confrontation, or opposing stakeholders in order to weaken their bargaining position. The arm's length approach rooted in self-serving motivation is distinguished by relying on economic and legal sanctions to ensure that obligations specified in formal contacts that include effectiveness standards and requirements are fulfilled. Third, links with stakeholders are usually short-term, for example, regular supplier turnover.

The types of motivation of political will affect the extent to which stakeholders are attracted by the company and, consequently, the degree to which they are willing to establish, maintain, and terminate links with the company. Companies that use one of the two approaches to stakeholder management in the long term ultimately lead to a set of stakeholders that is relatively homogeneous in terms of a motivation type. Such homogeneity positively affects the creation and maintenance of value by the organization.

The creation and capture of value require not only motivating and selecting stakeholders, but also creating and using opportunities and counteracting threats occurring in the organization's environment. The literature argues that a fair approach to stakeholders provides a better basis for intelligent responses to strategic challenges than the creation of links with stakeholders based on maintaining distance. The benevolent motivation of political will supports the company in recognizing and taking advantage of opportunities through increased investment in the creation of value or overcoming the crisis because stakeholders are, in both cases, the supporters of corporate strategy. However, companies that apply the arm's length approach to their stakeholders cannot count on their support in identifying and creating opportunities and overcoming threats. Self-interested stakeholders will most likely reduce their engagement when the company has to make changes that will adversely affect the benefits achieved by the stakeholders.

Concluding, benevolent motivation makes stakeholders contribute to the creation of value more than self-serving motivation, as a result of which stakeholders primarily care for their own interests. Moreover, the benevolent motivation of political will requires a common approach toward various stakeholders. In turn, self-serving motivation makes stakeholders that care for themselves create more value when companies have an arm's length approach to them and use strong economic incentives to ensure the participation of stakeholders in the creation of value. Stakeholders with high bargaining power are attracted by companies guided by self-serving motivation because it allows stakeholders to use their bargaining power to ensure higher benefits. In addition, self-interested stakeholders with lower bargaining power prefer to

be treated fairly, as low bargaining power means little benefit when the company has an arm's length approach. The above discussion leads to presenting two additional propositions:

Proposition 3: Benevolent motivation of political will positively influences the participation of stakeholders in the creation of value, regardless of their bargaining power.
Proposition 4: Self-serving motivation of political will positively influences the participation of stakeholders in the creation of value when their bargaining power is high.

25.4 Conclusions

Organizational politics is widely recognized as a practical premise that reflects complex, dynamic, and informal processes in a company that challenge the current state or are focused on making desired changes [25]. Pfeffer [6] and Mintzberg [1] introduce two concepts, political skill and political will, which provide a better understanding of the nature and consequences of organizational politics in organizations. While number of studies on the subject of political skills as a critical resource that shapes the effectiveness of the management staff has significantly increased, research into political will has been less successful, probably because it is more abstract.

This paper attempts to fill this gap by conducting a critical review of the literature to explain the construct of political will. In particular, dimensions that reflect two fundamental aspects of motivation to engage in organizational politics are identified, namely self-service and benevolence. These two dimensions are linked with stakeholder management, taking into account the fair approach and the arm's length approach. All relationships are presented by four propositions.

The presented considerations are part of an increasingly lively stream of research related to the micro-basics of strategic management [26] which has been underexamined. The discussion on these micro-basics is associated with calls to expand behavioral theory of organization with cognitive, motivational, and affective elements [27]. The study assumes that an important aspect in explaining strategic management through bottom-up mechanisms is organizational politics [28] in terms of political will that is an element of motivation. The presented outline of the theory of stakeholder management in terms of political will ultimately leads to a set of four propositions which require empirical verification.

This paper contributes to the organizational politics literature through linking it with stakeholder's management theory. It explains how motivation of political will can be applied to explaining participation of stakeholders in value creation. Type of motivation of political will is of importance for the way in which stakeholders are treated. To sum up, I propose that benevolent motivation leads to fair treatment of stakeholders where relationships are based on trust and cooperation. On the other hand, self-serving motivation leads to confrontation with stakeholders and applies

economic sanctions to assure fulfillment if contracts. These two approaches result in different possibilities of value creation by stakeholders. Although benevolent motivation probably leads to stakeholder's participation in value creation regardless of their bargaining power, self- serving motivation limits this possibility. In such a case, value creation is more probable if the bargain power of stakeholders is high.

When undertaking research testing the propositions, it is worthwhile to use the measurement scale of political will developed by Kapoutsis et al. [2]. With the development of the political will scale (PWS), scholars can empirically test the interactive and combinative effects of political will as well as determine its effects [12]. Further research using the above-mentioned scale would also develop theory due to inconsistent results of its validation [29]. In contrast, stakeholder participation in value creation requires operationalization.

Although I am aware of the fact that presented inquiry cannot be perceived as exhaustive, I hope that it enables future researchers to expand the field of organizational politics and provide insights for the effects of political will in the context of stakeholder relationships.

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