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.

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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

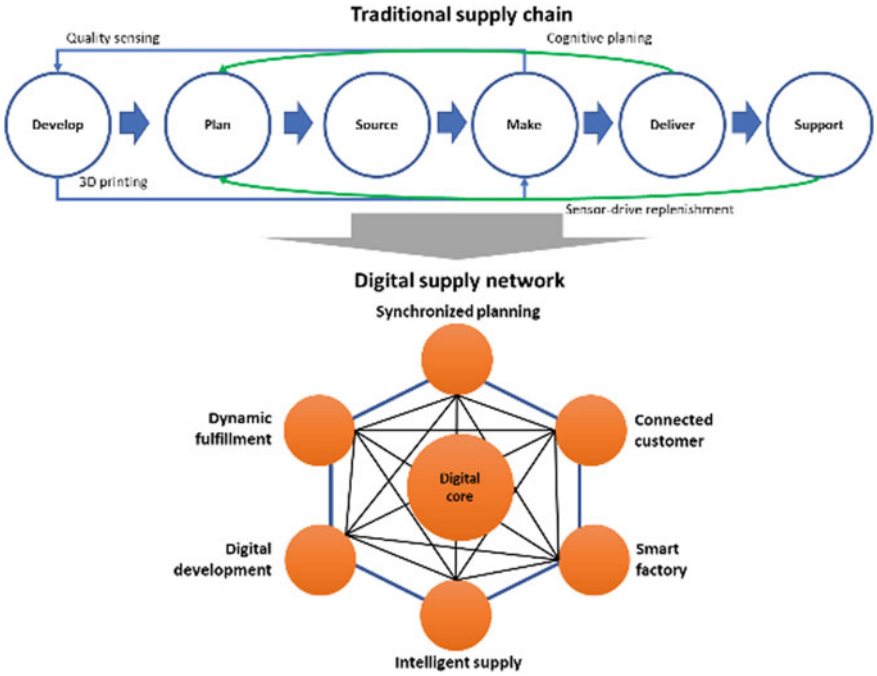

Fig. 7.1 Shift from traditional supply chain to digital supply network. Own based on [6]

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,

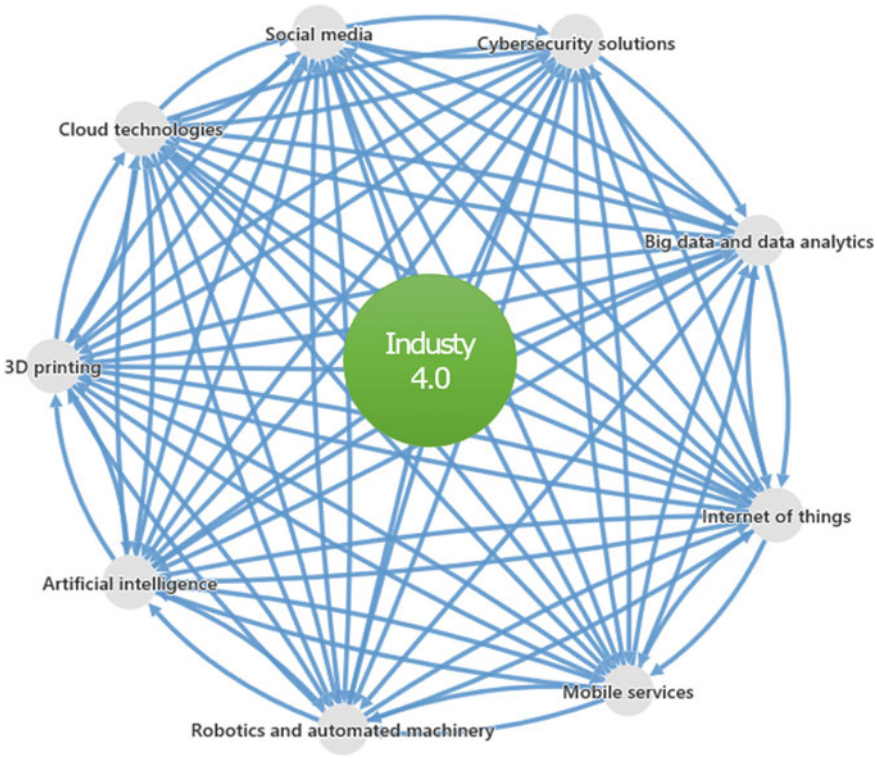

Fig. 7.2 Network structure of Industry 4.0. *Source* Own

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.

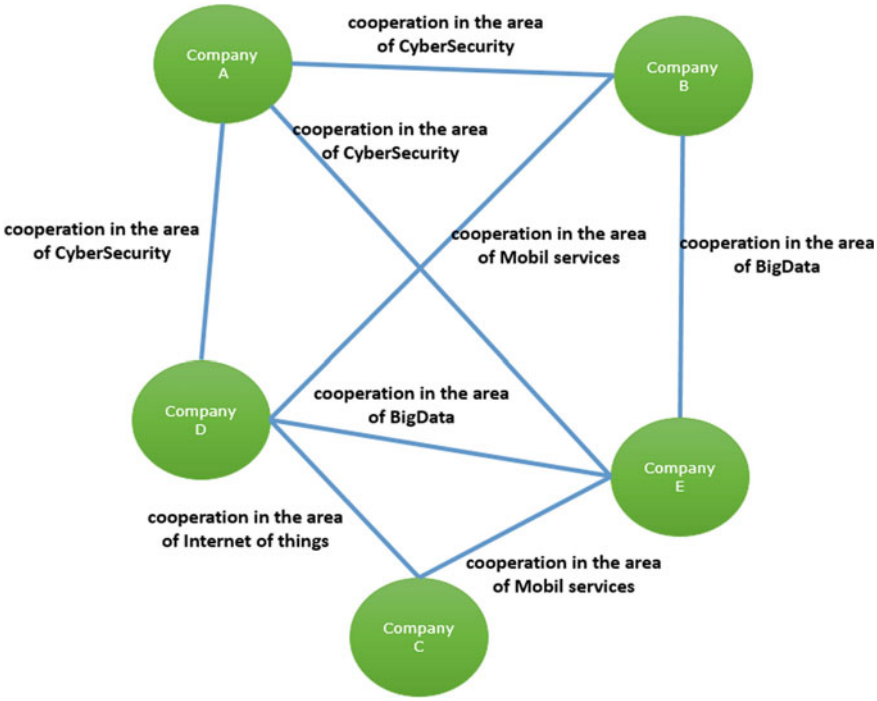

Fig. 7.3 Idea model of network in the Industry 4.0. *Source* Own

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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