

Networks of Enterprises as Innovation Drivers—the Real Cooperation Activities

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Abstract—The principal aim of this study is to provide a theoretical and empirical analysis of importance of enterprise networks in the context of innovative activities. The investigations presented in the paper focus on different aspects of popularization of the network structures in organizations, the essence of innovativeness of enterprises, problems of open innovations which contribute to extension of the range of enterprise operation and the essence and scope of cooperation between enterprises in the area of innovative activities.

Index Terms—networks of enterprises, innovation, cooperation between enterprises

I. INTRODUCTION

Contemporary economies are becoming more and more network-based. The structures which are characterized by strong concentration of their potential and high level of cooperation are increasingly important. The entities which are able to cooperate and connect their competencies and resources have additional potential that allows for generation of value added. Achievement of competitive advantage often depends on the level of innovativeness of business activities. Formation of adequate competitive position requires continuous seeking new business opportunities, discovering new markets, transformation of present resources and entering the market niches with new products.

II. POPULARIZATION OF THE NETWORK NATURE OF ORGANIZATION

The problem of network nature of the organizations is considered and analysed in various publications and scientific research studies, concerning management, economy, sociology and psychology. Investigations of networks are often coinciding within individual disciplines within management sciences, such as strategic management, marketing or logistics. Therefore, networks represent an interdisciplinary object of research.

This multitude of analytical views on the above problems is followed by the multitude of definitional interpretations. Despite many efforts, a single generally accepted definition of the network organization has not been developed yet. The literature contains a variety of definitions concerning business relations with the

character of networks. The terms which are often used include: interorganizational networks, network organizations or network structures.

Nevertheless, the essence of the economic network is based on the relationships between the entities included in the structure of the network. In general terms, one can adopt the interpretation of H. B. Thorelli, who regarded network as a system of two or more organizations involved in a long-term relation [1]. Similar abbreviated definition of the concept of networks was provided by W. Czakon, who pointed to a group of actors connected with a set of relationships. This author also indicated that the interorganizational relationships can have a character of friendship, counselling, liking and also business cooperation [2]. Analysis of these problems in market context helps adopt the opinion of C. Jones who defined the network model of organization as a purposive, constant and structured set of autonomous entities which, based on default agreement without time limitations and coordination of transactions are involved in the process of manufacturing goods and services. The agreements between the entities are conducive to adaptation to unpredictable changes in the environment [3].

There is a view present in the literature which says that networks are created by nodes, that is, concrete enterprises with interrelations between each other [4]. M. Bratnicki approaches network organizations in the context of a "bunch" of separate enterprises, coordinated with market mechanisms [5]. Similar approach to the problems discussed in this study was presented by PP. Dwojacki and B. Nogalski, who defined the networks as a group of units with a relatively constant character, the group of entities or enterprises which, based on the market principles, take part in cooperation with each other [6]. Furthermore, J. Lichtarski argues that a network is a multi-entity and complex structure, with different degree of stability, coherence and openness [7].

J. Witkowski points to transformation of the definitional approach to networks. In primary terms, this concept meant a set of independent entities that form a common structure in order to carry out specific activities. At present, the concept of networks is regarded as any system of relationships, both with internal entities in a particular organization and its environment [8].

Therefore, the economic network can be viewed as specific interactions that consist in coordination of common goals, created by separated and mutually

interrelated entities. With a broader interpretation of the interorganizational networks, they can be defined as one of the methods of regulation of correlations between the entities, which differs both from hierarchical coordination and market coordination [9]. Similar approach to the problems of network organization was presented by K. Fuks and A. Kawa, who cited the studies by W.W. Powell which indicated that besides market and hierarchy, network should be regarded as third economic form of enterprise organization [10]. Considering the view of W. Czaron, network relates to a specific method of coordination of cooperation as a result of setting specific relations that consisted e.g. in organization and control of this cooperation [2].

A broad review of definitional approach to interorganizational networks present in the literature was provided by J. Niemczyk and B. Jasiński, who emphasized the principal characteristics of networks which manifested in a number of interpretations of this term. According to the above authors, the main determinants of the interorganizational networks include e.g. [11]:

- Striving for cooperation,
- Using the mechanisms of market coordination of actions,
- Partnership of objectives,
- Natural market flexibility of the whole network and its nodes.

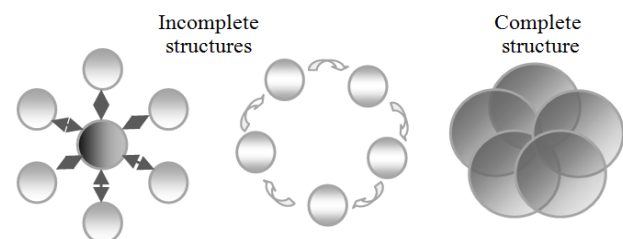
It is emphasized in the literature that the causes of creation of network organization in the economy can be considered mainly from the perspective of the resource-based theory of enterprise [12], which regards any organization as a unique set of resources and skills which, if properly used, lead to generation of core competencies in this organization [13]. This concept is consistent with the assumption that no enterprise is perfect in terms of their resources since they are unable to hierarchically control all the resources necessary for generation of value [2]. In this case, management is oriented at looking for the access to resources necessary for organization's operation which can be used for achievement of the goals. It is essential for development of business cooperation to identify the resources and competencies of the entities that operated in the network. The form of network organization allows for reduction of overall necessary outlays on introduction of the offer of new product in the market while helping change orientation of the internal resources towards creation and supporting competitive advantage. As demonstrated in the literature, this type of interrelations between enterprises might offer benefits to both sides in long-term perspective [14].

Among the socio-economic factors connected with the network economy, one should emphasize the increased competition in individual markets, liberalization of commerce and internationalization of business activities, dynamics of technological changes, individualization of the needs and innovations in terms of organization and management (including management of innovations) [15]. A key phenomenon present in the network is the "network effect" i.e. positive or negative effect of the

network on its individual members (organizations, enterprises). The literature mostly lists positive effects of networks, including [15]:

- Strategic dependence which consists in limitation of strategic choices to network participants,
- Selection of partners which result from network fit,
- Diffusion of knowledge within networks (concerning good practices, particularly concerning management),
- Minimization of technological risk (participation in the network offers more opportunities of utilization of leading technologies),
- Positive feedback, which means e.g. using the economies of scale.

However, apart from positive aspects, networks also generate threats in the form of the "contagion" effect that consists in transfer of economic disturbances which are likely to cause e.g. financial perturbations [16]. This is particularly noticeable in a turbulent environment the contemporary enterprises operate in. The investigations carried out by F. Allen and D. Gale are important and worth emphasizing as they indicate that building a complete networks of correlations increases the probability of the contagion effect [17]. Substantially fragmented structure is a complete structure which limits the risk connected with the contagion effect. Furthermore, the incomplete structures increase the susceptibility of the system to risk (Fig. 1).



Source: based on [18]

Figure 1. Networks of correlations between enterprises

The potential pathway of contagion is expressed by a chain of interrelations between enterprises and other financial institutions where the first enterprise is the debtor of the second, the second is the debtor of the third, the third is the debtor of the fourth etc. Furthermore, the centralized network occurs if one or several enterprises play an important role in the network with respect to other participants [19]. The process of contagion in the centralized network is similar to the above mentioned spatial transmission of centre-peripherals. This coincidence shows that the enterprise dominant in the network might pass contagion to other enterprises or stop spreading the contagion if the infected entity has sufficient amount of financial resources to cover the loss.

In the network economy, market events that affect one entity might have a direct effect on other entities that operate within the network. Therefore, the network structure under conditions of crisis might become a channel for spreading or contagion in enterprises, leading in extreme cases to bankruptcy. It should be emphasized

that the economy based on the network is one of the basic characteristics of the contemporary enterprises.

With regard to the above negative effects, one can, however, indicate that the explanation for the phenomenon of popularization of networks both in theoretical studies and practice of management is observation of a number of benefits connected with creation of organizations with network character.

III. INNOVATIONS IN ENTERPRISES

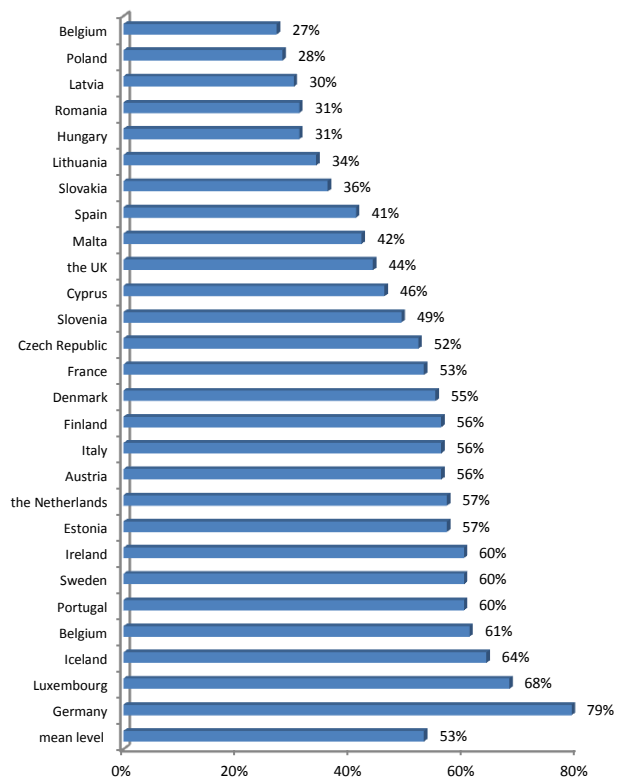
Innovativeness is necessary for competition in the contemporary world economy. One of the fundamental factors which affect the effectiveness of business activities is technological advances. In order to be competitive, enterprises have to continuously adjust to changes that occur in the market. On the other hand, they need to have the ability to stimulate these changes. This is achievable through improving innovativeness in different areas of operation.

Innovative activities contribute to creation of value added and reinforcing competitive ability in micro- and macroeconomic scale. Particularly in the era of rapid technological changes, innovativeness has become a key element that improves efficiency and economic growth [20].

It should be stressed that innovations might have varied aspects and character. They concern new products and manufacturing processes as well as innovation in the social domains of the enterprise, which involves relations with other market participants and values that can be provided to customers [21].

The related literature presents three basic approaches to innovations which view them as concepts, results or processes [22]. Innovation viewed as a concept relates to a specific effect of human activity which has the aspect of an idea, thus adopting the immaterial form which is difficult to be measured or evaluated. Innovations approached as a result represent a final effect of particular activities and processes, which consequently lead to creation of new products, services, manufacturing methods, management concepts or stimulation of new attitudes and behaviour of customers, employees and owners. With the process approach, innovation should be considered from the perspective of changes of the methods of obtaining products or methods of involvement of capitals and resources. Therefore, they are expressed by the changes in the algorithms of transformation of input streams into output streams during a particular process.

Therefore, it can be indicated that innovative activity of enterprises is a very broad concept which relates to activities with scientific, technical, organizational and financial character. The principal goal of these activities is implementation of innovations. The diagram below presents the percentage of European enterprises which performed innovative activities in 2008-2010.



Source: author's own elaboration based on [23]

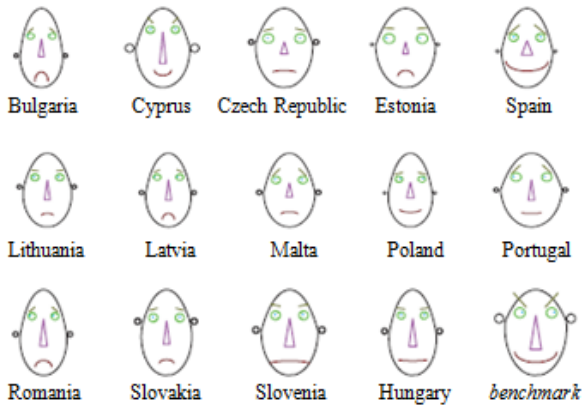
Figure 2. Percentage of European enterprises which performed innovative activities in 2008-2010.

The data presented in the Fig. 2 show that, among 27 countries presented, one can distinguish between the groups characterized by varied contribution of innovatively active enterprises. These include: innovation leaders, very good innovators, medium innovators, poor innovators. Undoubtedly, the dominant position in this ranking was taken by the enterprises from Germany and Luxembourg. 79% and 68% of enterprises in these countries perform innovative activities. The European mean level is 53%. This level was reached by the enterprises from 14 countries. The lowest percentage of innovative enterprise occurs in Bulgaria and Poland.

The contribution of innovative enterprises to the overall number of enterprises that operate in a country represents one of the most essential dimensions of innovativeness in a particular national economy. It should be emphasized that the level of innovativeness of business entities is a resultant of a number of variables. They include in particular: the goals adopted by the enterprises, areas of innovative activities of enterprises, outlays incurred on innovative activities as well as availability of public support for innovative activities.

It should be emphasized that innovativeness of enterprises is a multi-thread and multi-dimension problem. Therefore, it is important that it should be evaluated and the conclusions should be made while using a multi-dimensional analysis. A survey carried out to order of the Polish Agency for Enterprise Development (Polska Agencja Rozwoju Przedsiębiorczości, PARP) illustrated the problems of innovative activities in

selected European countries based on the diagram with Chernoff faces which allows for analysis of multi-dimensional data. The source of this survey was the data from Eurostat (Community Innovation Survey 2010) [24] (See Fig. 3).



Source: [24]

Figure 3. Visualization of innovative activities of enterprises in selected European countries.

If the interpretation of the chart proposed in the above survey is adopted, one can indicate that individual variables from the area of innovative activity in enterprises were represented by human faces in a manner that determines the size and position of various elements of faces. This presentation allows for graphical representation of several areas of innovative activities in a particular country.

With presented approach, the width of a face represents a percentage of enterprises which perform innovative activities in general. In a country with high percentage of innovative enterprises the face is wide. A slim face corresponds to a low contribution of innovative enterprises in a country. The level of ears represents the percentage of entities that carry out internal R&D activities. Faces with ears high are the representation of the countries with substantial percentage of enterprises which run internal R&D activities. Furthermore, high radius of a ear points to a high percentage of the enterprise for which the essential importance in innovative activities is from information obtained from customers and consumers. Extended nose shows that the objectives of innovative activities in the enterprise are of social character i.e. improvement in health or safety of employees, reduction in harmful effect on the environment or reduction of the costs of materials and energy per production unit. Width of the nose reflects the value of revenues generated by the enterprises on sales of new products. Shape and length of mouth represents such variables as: total outlays on innovative activities and incomes of innovative enterprises on sales of new products. Furthermore, a country depicted by a face turned to the right is characterized by substantial outlays on innovative activities. Position, inclination and length of eyebrows inform about the areas of innovative activities. High position of eyebrows represents the percentage of enterprises that use a method of stimulating

creativity of the employees. Raised eyebrows characterize the country with high contribution of enterprises cooperating with other entities. Length of eyebrows points to the outlays on internal R&D activities.

A model that represents maximum values of individual variables that characterize innovative activities was also created in order to illustrate a "perfect face". Graphical analysis of variables represented by facial features allows for illustration of a great variety of the countries in terms of innovative activities. Naturally, this reflects tendencies present among enterprises from individual countries.

It should be noted that innovative activities carried out by economic enterprises can, depending on the final effect, have varied character. This might be the activities completed with successful implementation of innovations, being implemented or abandoned before the implementation of innovations.

Considering the fact that innovations should lead to principal changes in the current status of the enterprise into a new one which improves the enterprise performance, a variety of roles can be attributed to innovations in enterprise's operation. Therefore, the way of viewing innovation by the entity that implements innovation is essential. (See: Table I)

TABLE I. IMPORTANCE OF INNOVATIVE ACTIVITIES TO ENTERPRISES

Role of innovation	
external	✓ formation/adaptation to new values
	✓ creation/utilization of market opportunities
	✓ formation/adaptation to conditions of functioning of other market participants
	✓ reinforcing/maintaining competitive position
internal	✓ ensuring internal flexibility of operation under unstable conditions of environment
	✓ vertical and horizontal integration of the processes in the enterprise
	✓ ability to adapt internal processes to requirements of the environment
	✓ enterprise's learning

Source: Author's own elaboration based on [25]

Due to current turbulent conditions of operation of enterprises, changes in importance attributed to innovation in more stable environment started to be noticed. Therefore, instability of the environment affects the role played by innovations in contemporary enterprises that operate in global markets [25]. The changes concern not only the context of perception of innovation but also shorter time of its creation and absorption.

IV. THE CONCEPT OF OPEN INNOVATION AS AN EXTENSION OF ENTERPRISE LIMITS

A number of various criteria for division of innovations are present in the management theory. One of them is division introduced by H. Chesbrough who distinguished between open and closed innovations [26]. This classification concerns the place of origins and application of innovations. Therefore, it allows for separation of innovations that were created inside the enterprise and carried out within its own activities and

innovations that come from the outside of the enterprise, resulting from cooperation and co-work [27].

In the primary form, innovative activities carried out by the enterprises were based on the principle of full internal control over the whole innovative process. According to this approach, organizations developed, implemented, launched in the market, popularized, financed and supported their innovative initiatives on their own [20]. The principal aim of that concept was a belief that market success and competitive advantage is connected with primacy in launching innovative products or technologies in the market.

However, innovative activities often occur within complex structures which are frequently unavailable to an individual enterprise. The research and organizational potential in enterprises which plan to perform innovative activities is often insufficient for independent implementation. Therefore, it has become a prerequisite that openness of enterprises to cooperation and co-work should be increased. Therefore, the concept of open innovation started to become more and more important, with its basic assumptions based on not only the enterprise's own knowledge and experience but also on using innovative solutions used in other enterprises. The principle differences in approaching innovation of closed and open type are presented in Table II.

TABLE II. PRINCIPAL DIFFERENCES BETWEEN CLOSED INNOVATION AND OPEN INNOVATION

CLOSED INNOVATION	OPEN INNOVATION
Best experts work for the enterprise	Not all the best experts work for the enterprise: the cooperation with the best experts from other organizations is necessary
R&D activities should be carried out independently in order to generate value added	External sources of R&D should be used in order to generate value added
The enterprise is first to launch innovative solutions in the market	The enterprise uses the solutions proposed by other enterprises
Market success depends on the speed of market launch of innovative solutions	It is essential to create a good business model rather than strive for primacy in launching innovations
Success of the enterprise lies in generation of as much innovation as possible	Success is possible by using the ideas that are created inside and outside the enterprise
Intellectual property should be protected in order not to be used by competitors	The benefits of making intellectual property available to other entities should be derived and the outside knowledge should be used if it is supported by a business model of the enterprise

Source: author's own elaboration based on [28] and [20]

Innovative activities using the approach of open innovation are based on network cooperation of enterprises. Using this approach helps utilize not only internal but also external ideas and resources. The determinants of the open innovation model include generation of value added and minimization of the risk and time necessary for launching new product in the market. Furthermore, the lowest importance in this case is

attributed to protecting the innovation process from competitors [28].

Therefore, it can be emphasized that participation of the enterprise in the process of open innovation substantially affects the limits of the particular entity. The character of these activities forces a departure from distinct autonomy of enterprises towards greater openness and cooperation with different segments of the environment. Therefore, the idea of open innovation leads to the need of "extending" the limits of the enterprises in different places and areas of activities [27].

It should be emphasized that implementation of innovative solutions in enterprises leads to establishment of various relations with the environment of the enterprise, thus leading to ensuring greater permeability and extending traditional limits of the enterprise.

V. COOPERATION BETWEEN ENTERPRISES IN TERMS OF INNOVATIVE ACTIVITIES

TABLE III. LEVEL OF ENTERPRISE'S INVOLVEMENT IN INNOVATION AND RELATIONS WITH THE ENVIRONMENT

Level of involvement of enterprise in the process of implementation of innovation		Importance and character of relations with the environment
0	The enterprise does not implement innovative solutions and its operation is based on well-trying and already developed solutions	Low importance of interactions, which have a stable and repeatable character
1	The enterprise implements innovations in limited scope, using primarily their own potential	Interactions have low importance and are mainly focused on replenishment of insufficiency in resources
2	The enterprise actively participates in creation of innovative and creative solutions created by other entities; this is possible through participation in selected stages of the innovative process	Interactions are very important, but the enterprise performs a role which is relatively easy to be replaced; they have easily available resources
3	The enterprise implements innovative solutions through cooperation with selected institutions or centres for support of innovations and technology transfer	Interactions have high importance but they concern only selected stages in the process of technology transfer
4	The enterprise implements innovative solutions using occasionally the results of scientific research and through cooperation in this field with scientific centres and other entities.	Interactions are very important and are developed both with the world of science, technology and business environment
5	Implementation of innovation and generation of technological advances based on scientific research represents the most important activity in the enterprise	Interactions with the world of science and technology are fundamental in the process of innovation and creative solutions

Source: author's own elaboration based on [29]

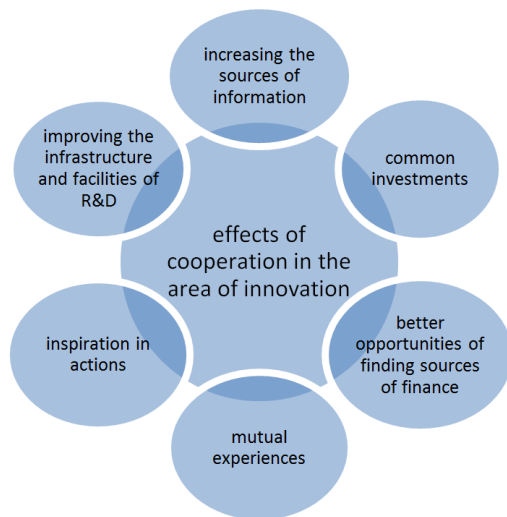
Due to its complexity, contemporary innovative activities necessitate cooperation of many different entities. In order to implement innovative activities, enterprises are often forced to cooperate and work with each other due to limited human, organizational,

technological or financial resources. Innovative activities are often becoming a highly interactive process of cooperation facing the increasing and varied network of enterprises. The enterprises connected in the network are able to benefit from numerous resources through e.g. partnerships, alliances or joint ventures. Cooperation in the network is becoming a means and method for extending the scope of developmental studies as well as supplementation of competencies of a particular enterprise.

M. Matejun distinguished between six levels of involvement of the enterprise in innovative activities in the aspect of importance and character of relations with the environment. (See: Table III)

It can be indicated that innovations emerge at the contact of different resources competencies of different entities. Cooperation is possible if the appropriate potential for cooperation is used. W. Sroka emphasizes that the basic bond that connects interorganizational network is synergistic potential of partners which allows for common achievement of strategic goals which would be impossible to be realized for individual activities [12].

A key role in this process is played by ability to connect the resources the enterprises have i.e. products, technologies or knowledge. Concentration of enterprises into interorganizational networks allows for common involvement in innovative activities. The main manifestations of the benefits in the field of innovation that results from network cooperation are presented in the Fig. 4.



Source: author's own elaboration

Figure 4. Benefits of network cooperation in the area of innovation

The Table IV presents business relations in enterprises with international approach concerning the cooperation with other enterprises in terms of innovative activities divided into the area of finding new customers (A), creation of new products and services for present customers (B), creation of new products and services for new customers (C), and cooperation in terms of increasing the effectiveness (D).

TABLE IV. COOPERATION OF ENTERPRISES IN INNOVATIVE ACTIVITIES: COMPARISON WITH SELECTED COUNTRIES (% OF ENTREPRENEURS)

Country	A	B	C	D
Austria	40.1	38.4	33.9	39.8
Belgium	12.8	11.4	5.3	19.7
Bosnia and Herzegovina	35.0	23.8	13.5	53.7
Croatia	51.3	39.5	36.8	59.8
Denmark	35.2	24.0	18.3	27.2
Estonia	60.2	42.0	40.8	48.2
Finland	38.3	27.2	22.8	57.6
France	22.1	14.6	16.7	43.4
Greece	36.9	33.3	29.4	38.0
Spain	23.7	14.1	13.9	25.2
the Netherlands	32.3	30.7	26.7	32.5
Ireland	43.0	27.8	29.7	46.1
Lithuania	31.8	27.3	24.7	39.5
Latvia	46.7	34.1	30.7	55.8
Macedonia	40.8	36.4	26.0	52.5
Germany	40.6	34.4	35.7	29.6
Norway	48.7	28.3	21.6	35.7
Poland	42.6	27.6	27.3	61.6
Portugal	28.3	25.5	22.6	32.7
Russia	33.0	no data	no data	no data
Romania	35.1	23.4	26.5	48.8
Slovakia	40.9	37.0	26.8	52.7
Slovenia	41.4	41.7	40.3	28.6
Switzerland	33.6	28.0	25.8	38.7
Sweden	47.0	31.5	40.9	27.7
Turkey	28.6	35.1	34.8	30.7
Hungary	39.0	31.4	28.8	41.3
the UK	32.3	21.4	18.1	29.5
Italy	52.6	33.9	37.7	53.3

Source: Author's own elaboration based on [30]

Entities in the countries analysed in the study showed varied willingness to cooperate in terms of innovative activities. The level of indices exceeded the level of 60%, that is, 60.2% of the Estonian enterprises cooperates in the field of finding new customers while 61.6% of the entities in Poland participate with other businesses in joint activities towards improvement of economic performance. Furthermore, cooperation in development of new products and services, both for current and new customers, is preferred in the most of the countries studied by at least 25% of the enterprises. Therefore, it should be concluded that the enterprises studied are largely characterized by the closed character of innovation, expressed with the lack of substantial cooperation in terms of innovative activities.

VI. CONCLUSIONS

Among a variety of forms and areas of cooperation in the enterprises, cooperation in terms of innovation is becoming essential. Contemporary enterprises, which are operating in highly competitive markets, must meet a variety of challenges which impose e.g. the necessity of innovative activities. The enterprises which cooperate increase their innovative potential. Integration of resources and skills through creation of the network structure is conducive to popularization of new solutions. On the one hand, grouping the enterprises into networks offers opportunities for focusing on core competencies of

the entity. On the other hand, it allows for using additional technological and system sources.

The view of open innovation is popularized in theoretical innovations as promoting participation of enterprises in innovative networks through cooperation between each other. However, the empirical investigations carried out in the study, concerning cooperation between enterprises in terms of different forms of innovative activities, demonstrated poor willingness to openness in these relations.

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