YDK 334.724.4:332

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CLUSTERS AND THEIR IMPACT ON INNOVATIVENESS OF ENTERPRISES

Проаналізовано результати вибору кластера для дослідження, щоб оцінити,як впливає на кластери інноваційність підприємств, які є складовою цих кластерів. Теоретичні аспекти інноваційної діяльності (у тому числі визначення та класифікація), атакож питання, що стосуються функціонування кластерів та аналіз джерел і варіанти введення інновацій у кластери.

Ключові слова: інноваційні типи, кластер, співробітництво.

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The article analyzes a selection of cluster research results in order to assess how clusters affect innovativeness of enterprises that are members of those clusters. The theoretical aspects of innovation (including definitions and its classification) as well as the issues concerning the functioning of clusters is followed by the analysis of sources and options for introducing innovation in clusters.

Key words: innovation types, cluster, cooperation.

Introduction. The development of modern day economy involves constant commercialization and distribution of knowledge. This requires special skills that are useful in the process of creating innovation, both from the people and the organization. Innovation, in a knowledge based economy, has become a key factor in shaping the competitiveness of enterprises.

Innovation, as a learning process, is the application of improved solutions that result in economic benefits. The increasing importance of services and gradual diminishing of importance of the production sector causes not only the need for product and process innovation, but also for organizational and marketing innovation, to grow.

The fast scientific and technological progress in different fields causes innovation to be more and more complex. Sole enterprises often do not have the appropriate competences and resources to innovate. Therefore, in order to innovate the enterprises have to not only develop their own potential in the field of knowledge and competences, but also they must support it with resources that other units have, especially the competition and their suppliers.

This is why more and more often special networks, within which the cooperation between entrepreneurs, research and development institutions and service providers, are set up among different sectors of the economy. Cooperation within such networks allows their mutual potential to be turned into innovation and commercialization.

A cluster is an example of such a network. The most important element for creating innovation within clusters is the mutual cooperation of companies associated in a cluster and the cooperation between

the world of science and business. It allows the acquisition, and exchange of knowledge, as well as initiation, creation and use of innovation.

European, as well as Polish, research on clusters suggests that this type of organization of business processes has high innovation potential.

Innovation. The word innovation comes from Latin and it stands for "process of creating something new"[1]. Therefore, most definitions of innovation state that it is a process of transforming the existing possibilities into new ideas and then their application. The term was introduced into economics by J. A. Schumpeter, who claimed that innovation is a significant change in production which is an effect of combining different production factors[2]. At some point it was noticed that this term can be applied not only for products and the way they are produced[3], but also for the way some organizations operate. According to P. Drucker "innovation does not have to be material".[4] S. Altshuller, who noticed the need of creative process in innovation and noticed that it is strictly connected with creativity, stated "it is a complex phenomenon that requires a certain set of skills, a different method of organization, synthesis and knowledge expression, as well as perception of the world and new ideas, perspectives reactions and products"[5].

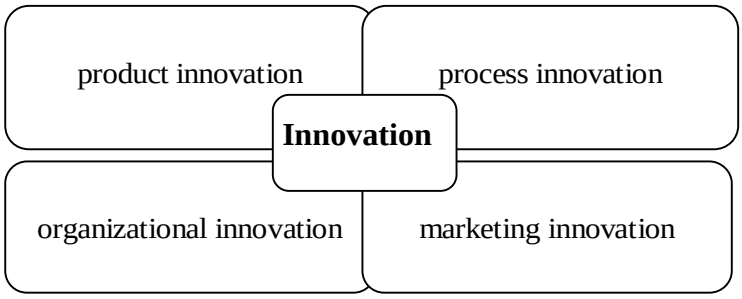
Innovation is a result of the innovation process, which in turn is the effect of learning, gathering knowledge and skills, which can be defined as a creative activity that involves creation, design and implementation of new ideas and solutions[6]. "Innovativeness" as an instrument of a modern economy can be introduced at the enterprise, country and world level. However, more demanding standards have to be applied depending on what level the innovation is new.

In case of an enterprise innovation can be treated as an action whose aim is to introduce new solutions in different areas of its activity. The actions should bring economic benefits and should not be considered typical in the given field. This aspect of innovation was discussed by M. Porter, who described it as "positive exploitation of new ideas".

Perhaps the scope of innovation is best show in the Oslo Manual, which states:

"Innovation is the implementation of a new or significantly improved product (good o service), or process, a new marketing method, or a new organizational method in business practices, work-place organization or external relations"[7].

This approach allows us to make the following classification of innovation types (Picture 1).



Picture 1. Types of innovation
Source: P. Niedzielski, Zarządzanie klastrowł siecił wartości jako źródło przewagi konkurencyjnej, in: M. Frankowska, Tworzenie wartości w klastrze, Polska Agencja Rozwoju Przedsiębiorczości, Warsaw, 2012, p. 80

[1] http://mfiles.pl/pl/index.php/Innowacja (rerieved on 23.04 2013 r.).
[2] http://www.stim.org.pl/czym_jest_innowacja/(rerieved on 23.04 2013 r.).
[3] The most often classifications included: product innovations (related to goods and services) and technological innovations related to production methods and ways to achieve clients with products
[4] http://www.pi.gov.pl/Firma/chapter_86450.asp (rerieved on 23.04 2013 r.).
[5] http://www.stim.org.pl/czym_jest_innowacja/(rerieved on 23.04 2013 r.).
[6] *Innowacje i transfer technologii*, K. B. Matusiak, Polska Agencja Rozwoju Przedsiębiorczości, Warszawa 2011, p. 55.
[7] *The Measurement of Specific and Technological Activities*, Oslo Manual Guidelines for Collecting and Interpreting, Data 3 rd Edition, European Commission OECD/EUROSTAT 2005.

Product innovation is the creation of new products (goods, services) or making changes in the ones that have been produced up until now. The innovative changes should include new product features, materials, new functions and solutions. Product innovation may be implemented on the basis of newly produced knowledge or technologies, but also it may be implemented by using the already existing knowledge and technologies in a new way.

Process innovation involves changes in the process of creation and distribution of goods and services. It is mainly connected with improving the technique of production and upgrades of software. The aim of introduction of such innovation is in most cases connected with lowering the production cost or faster delivery of a new, or improved, product. Innovation of this type is in most cases involves automation of production lines and significant improvements in production and equipment, use of computers in the design process, as well as new logistical solutions (new methods and instruments for delivering and allocating resources, as well as for delivering the products to the users). Process innovation also includes the use of software for support work – such as sales and accounting management and the improvement of information and communication technologies.

Organizational innovation is the improvement of organizational methods used. This includes modification of organizational structures, implementation of new management techniques, the introduction of new, or trimmed, strategies and the economic practice, including the changes made both in the workplace and relations with the environment. The aim of these changes is to improve the performance of the organization – cost optimization (both on the organizational and transactional level), optimization of work, gaining access to some resources (experience, specialist knowledge).

Marketing innovation is a new solution in the field of marketing methodologies. This includes changes in the marketing concept such as the design of the product, its packaging, promotion strategy, the way of thinking about the product, price and distribution policies. The aim of marketing innovation is to adapt the product to the needs of the client, entry onto new markets and gaining market share.

In economic reality it is not always possible to differentiate between the types of innovation as some changes that are made involve many levels of the company's activity and thus may have features of a couple of innovation types. The most important requirement for an innovation to occur is that the product, process, marketing method has to be significantly upgraded.

Preparation and launching of new or upgraded materials, products, devices, services, processes and methods that will be introduced to the market, or will be used in some other area is an example of innovative activity of an enterprise.[8] It can be defined as a process that involves a series of actions starting from the creation of an idea, through its development, implementation, promotion, sales to its further development in time[9]. The process involves the use of the company's potential and produces new competences which are the result of the Staff learning while being involved in the innovation process[10].

Clusters and their role in facilitating innovation. There are many research papers that define clusters. The one that is most frequently referred to, and thus the most renowned is the work of M. Porter, which defines clusters as a "A cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities, as well as organizations that are connected with those businesses and support common institutions (universities, research centers, R&D institutes, legal institutions, sector associations and authorities)"[11].

Desktop study and cluster research resulted in identifying the features of clusters that make it different from other methods of organization of production, the conditions that are needed for clusters to be created and developed. It also allowed the identification of benefits that organizations of this type bring to the entrepreneurs, regions and the whole economy. Generally, the features of clusters are: spatial

[8] Act on support for some innovation activities July 29 2005., Dziennik Ustaw [Journal of Laws]. No. 179, item. 1484, as amended.

[9] M. Dolińska, *Innowacje w gospodarce opartej na wiedzy,* PWE, Warszawa 2010, p. 8.

[10] G. Schiuma, A. Lerro, *Knowledge-based dynamics of regional development: the intellectual capital innovation capacity mode,* "International Journal of Knowledge-Based Development"2010, Vol.1, No.1/2, p. 41.

[11] M. Porter, *Porter o konkurencji,* PWE, Warszawa 2001, p. 81.

concentration of enterprises operating in the same or associated sector, interactivity and functional contacts between companies, common developmental objectives, competitiveness and cooperation[12]. In order for a cluster to be created there needs to be a certain amount of enterprises acting in the same area that will create the critical mass that is needed for the cluster to be launched[13].

The current development of clusters is much more rapid than in the case of other enterprise organizations. It is a result of globalization process which is best visible in international knowledge and production networks that are extending their area of activity. Also, the development of regionalization can be noticed as enterprises share their human and material resources. A cluster is a type of a network which is set up by enterprisers and institutions that support those enterprises it has certain geographic boundaries and should advocate modern economic ideas, this includes organization, process and effectiveness. This form of organization of activity has some advantages for the enterprises that join the cluster[14].

One of the most significant advantages of a cluster is the fact that it facilitates innovativeness of its member enterprises as it gives them the opportunity to cooperate with the scientific community and other businesses. It also allows them to extend and exchange knowledge which is the foundation of innovation.

Innovation in a cluster gives the members of a cluster the following benefits: risk sharing, access to new markets and technologies, development of innovative skills and competences, intellectual rights protection, access to complementary resources, including knowledge and financing of innovation. Cluster structures also facilitate the promotion of innovation, their use in enterprises and its popularization on the market[15].

The most important source of information about clusters, in line with the conception of a modern innovation process, also referred to as system, or interactive, model[16], is not the knowledge itself but the interconnections between different agents that have different information assets as well as mutual learning[17].

The innovative system of a cluster has the following set of interconnections[18]:

- business – business, joint R&D activities, mutually developed products and patents,
- business – science, and/or public institutions that facilitate technology transfer (joint R&D),
- market technology transfer, diffusion of knowledge and innovation through acquisition of machines, equipment and licenses (indirect R&D expenses),
- worker mobility and transfer of hidden knowledge.

Innovation processes that are implemented within a cluster by competitive companies, as well as partners are possible thanks to[19]:

1. Acquisition of knowledge originating from outside of the cluster[20]; Companies learn from each other thanks to cooperation within a cluster thus reinforcing the value of the knowledge that they have. The knowledge then becomes a driver for the innovative ideas, their development and implementation. Very

[12] *Innowacje i transfer technologii,* red. naukowa B. Matusiak, PARP, Warszawa 2011, p. 137.

[13] S. Szultka, *Klastry – innowacyjne wyzwania dla Polski*, IBnGR, Gdańsk 2004, p. 7.

[14] More on the issue in: A. Walczyk, *Redukcja kosztów transakcyjnych jako jedna z korzyści funkcjonowania w klastrach,* in: J. Buko, M. Frankowska, Klastry – wiedza- innowacyjność – rozwój, Uniwersytet Szczeciński, Szczecin 2012, p. 328.

[15] Ch. Dilk, R. Gleich, A. Wald, J. Motwani, *State and development of innovation networks* "Management Decision"2008, Vol.46, No.5, p. 699.

[16] J. A. Johannessen, *A systemic approach to innovation: the interactive innovation model,* "Cybernetics" 2009, Vol.38, Iss1/2, p. 158 – 176.

[17] A.M., Kowalski, *Znaczenie klastrów dla innowacyjności przedsiębiorstw w Polsce*, in: J. Buko, M. Frankowska, *Klastry – wiedza- innowacyjność – rozwój*, Uniwersytet Szczeciński, Szczecin 2012, p. 179.

[18] I. Czajkowska, *The influence of economic clusters on enterprises Innovation Economy and Management.*, 2010, no. 1.

[19] M. Dolińska, *Wpływ klastrów na rozwój wiedzy i zastosowanie innowacji w przedsiębiorstwach*, in: J. Buko, M. Frankowska, *Klastry – wiedza- innowacyjność – rozwój*, Uniwersytet Szczeciński, Szczecin 2012, p.69 – 71.

[20] The knowledge base of enterprises are built through contacts with their clients, R&D institutions, universities, distribution channels for the innovation, the entrepreneurs operating in the same sector, benchmarking, market analysis of the technology and its use by the consumer, participation in exhibitions, adaptation of standards, patents, publications, desktop researches and implementation of R&D projects.

often the knowledge a cluster has and the possibilities of its use expand with the number of creative employees.

2. Creation and development of the enterprise's knowledge within the cluster[21]. The process of knowledge development involves the acquisition of new skills, development of new products, solutions in the field of technique and technology, management and improvement of existing processes. The cooperation of companies within the cluster supports this as special task teams, consisting of specialists from many cluster companies, are set up (for project/process) for reaching certain objectives.

3. Knowledge transfer within the cluster. It is done by means of units that specialize in transfer of knowledge, documents, human resources, databases, software, or sale of innovation within the cluster.

4. Use of knowledge in the process of innovation production. Knowledge is a result of mutual learning and constitutes the potential skills and competences. It can be used by certain enterprises within the cluster for mutual projects that involve mutual development and implementation of innovation in practice and its distribution and sale afterwards.

Innovation within clusters. There is a variety of activities undertaken by enterprises that operate within clusters. It is mainly focused on achieving different goals that improve the competitiveness of the company. M. Porter claims that clusters shape the competitiveness of its members in three following ways[22]:

- Increases of the efficiency of its members,
- Increases the ability of its members to innovate,
- Facilitates starting of new companies.

Table 1

Innovative activities and benefits drawn from cooperation within a cluster (n=350)

Innovative activities and benefits drawn from cooperation within a cluster	Cooperation with other members of the cluster					
	Total		Including			
			Scientific organizations		Others	
	No. of enterprises	Enterprise share (%)	No. of enterprises	Enterprise share (%)	No. of enterprises	Enterprise share (%)
Extended learning opportunities within the cluster	176	50,3	117	33,4	131	37,4
Access to specialized services (consulting, expertise)	163	46,3	111	31,7	115	32,9
Mutual R&D projects	142	40,6	94	26,9	97	27,7
Exchange of specialized staff and access to specialists	49	14,0	33	9,4	32	9,2
Access to mutual resources and laboratories	38	10,9	35	10,0	9	2,6
Access to the partners' know-how	7	2,0	5	1,4	3	0,9

Source: A. M. Kowalski, Znaczenie klastrów dla innowacyjności przedsiębiorstw w Polsce, w: J. Buko, M., Frankowska, (scientific editing) Klastry – wiedza- innowacyjność – rozwój, Uniwersytet Szczeciński, Szczecin 2012, p. 105.

[21]The development of knowledge within a cluster is performer both by individual and mutual learning (improving qualifications and competences of the staff, performing R&D projects, application of creative thinking and problem solving).

[22] M. E. Porter, *Porter o konkurencji*, PWE, Warszawa 2001 p. 265-266.

The unified potential of companies joint in the cluster and cooperation with authorities and scientific/economic institutions facilitate taking up decisions and improving innovativeness. This can be seen in Table 1.

As illustrated in the aforementioned data, the main incitement for taking up decisions and reaching innovation objectives in a cluster is the possibility of accessing specialized knowledge and mutual R&D effort.

The potential of the whole cluster causes its members to implement innovation more commonly on their own. The data in Table 2 shows the involvement of European companies that are members of clusters in innovative activities as opposed to companies not being members of clusters.

The fact that a big group of cluster structures was analyzed in the research and that in economically stable countries of Europe clusters have been present for a couple dozen years is a confirmation of the fact that these structures facilitate innovativeness of companies.

Moreover, data presented in table 2 shows that European clusters introduce mostly product and process innovations.

It's worth to ask the following questions here: in which sectors do Polish enterprises innovate most? What type of innovation do they perform? The answer to these questions can be found in the data presented in table 3.

Table 2

Comparison of innovative activities of European enterprises

Type of innovation	Within clusters (%)	Not in clusters (%)
Introduction of an upgraded, or new, service, or product	78	74
Introduction of an upgraded, or new, production process	63	56
Market research performed in order to introduce a new product or service	53	33
Registration of a single (or more) trademarks	29	14
Requests for a patent (one or more)	29	12

Source: B. Mikolajczak, A. Kurczewska, J. Fila, Klastry na świecie, Difin, Warszawa 2009, p. 38.

Table 3

Innovations introduced by enterprises as a result of cooperation within a cluster, by type of activity (n=350)

Type of innovation	No. of enterprises	Share of enterprises(%)
Product innovation	61	17,4
Process innovation	42	12,0
Marketing innovation	79	22,6
Organizational innovation	60	17,1
No innovation that would be the result of cooperation within a cluster was implemented	233	66,6

Source: A. M. Kowalski, Znaczenie klastrów dla innowacyjności przedsiębiorstw w Polsce, in: J. Buko, M. Frankowska, Klastry – wiedza- innowacyjność – rozwój, Uniwersytet Szczeciński, Szczecin 2012, p. 103.

The most common type of innovation introduced in Polish enterprises as a result of their membership in clusters are marketing innovations. The target of those innovations is the trimming of the enterprise's offer to the client's needs, entry onto new markets and gaining of the product market share, which allows increase in sales. The second most common type of innovation are product innovations which includes new products (commodities and services) and modifications made to the already existing ones by adapting new knowledge or technologies or by applying the previously used knowledge and technologies in a new way.

On the other hand, it is worth to note that innovation of enterprises in Polish clusters is still rather modest. This can be explained with the fact that clusters have been present in Poland for a relatively short period of time and because of this they have less experience than their foreign counterparts.

Conclusions. Dynamic development of clusters is caused by an increase in specialization of business activities that are taken up in a variety of areas. They are set up in different sectors of the economy and in various areas. This includes both traditional and hi tech sectors. Their surge shows that indeed they provide conditions for effective business activities which in seems to be harder to get in a turbulent environment.

The analysis of the research on clusters and of the long term observation leads us to the conclusion that this type of organization, more than any other allows facilitation of competitiveness of enterprises through commercialization and creation of innovativeness. The innovation processes are an element for creating value and shaping competitiveness not just of its members but also of its whole structure.

The basis for innovation is clusters is the mutual cooperation of companies that join them and cooperation with the scientific and business community. It is this cooperation that allows the acquisition, exchange and creation of common knowledge databases, which in turn contributes to the development of innovation related competences.

The creation of transfer and diffusion channels for knowledge and technology inside the structure of a cluster allows innovation networks to be built. This network then evolves and builds up its competitive position on the market.

The access to a sufficient database, human capital and business support allows the entrepreneurs to implement innovations more often. In other words they more often improve their products, perform market and marketing research and reach out for financing of their activities.

By joining their effort the entrepreneurs operate more effectively and reach the goals they wouldn't be able to reach on their own.

1. Czajkowska I., The influence of economic clusters on enterprises Innovation, Economy and Management, 2010, no 1. 2. Dilk Ch., Gleich R., Wald A., Motwani J., State and development of innovation networks "Management Decision"2008, Vol.46, No. 5. 3. Dolińska M., Innowacje w gospodarce opartej na wiedzy, PWE, Warszawa 2010. 4. Dolińska M., Wpływ klastrów na rozwój wiedzy i zastosowanie innowacji w przedsiębiorstwach, in: J. Buko, M. Frankowska, Klastry – wiedza- innowacyjność – rozwój, Uniwersytet Szczeciński, Szczecin 2012. 5. (retrieved on 23.04 2013). 6. http://www.stim.org.pl/czym_jest_ innowacja/(retrieved on 23.04 2013). 7. http://www.pi.gov.pl/Firma/chapter_86450.asp (retrieved on 23.04 2013). 8. Innowacje i transfer technologii, K. B. Matusiak, Polska Agencja Rozwoju Przedsiębiorczości. – Warszawa, 2011. 9. Johannessen J. A., A systemic approach to innovation: the interactive innovation model, "Cybernetics" 2009, Vol.38, Iss1/2. 10. Kowalski A. M., Znaczenie klastrów dla innowacyjności przedsiębiorstw w Polsce, in: J. Buko, M. Frankowska, Klastry – wiedza- innowacyjność – rozwój, Uniwersytet Szczeciński, Szczecin 2012. 11. Niedzielski P., Zarządzanie klastrową siecią wartości jako źródło przewagi konkurencyjnej,w: M. Frankowska (scientific editing) Tworzenie wartości w klastrze, Polska Agencja Rozwoju Przedsiębiorczości, Warszawa 2012. 12. Oslo Manual The Measurement of Specific and Technological Activities Oslo Manual Guidelines for Collecting and Interpreting Data 3 rd Edition, European Commission OECD/EUROSTAT 2005. 13. Polskie Stowarzyszenie Doradcze i Konsultingowe: Klastry – w kierunku konkurencyjności i rozwoju, www.biznesklaster.pl/company/article/179-klastry-w-kierunku-konkurencyjności rozwoju (20.04.2013). 14. Porter M., Porter o konkurencji, PWE, Warszawa 2001. 15. Schiuma G., Lerro A., Knowledge-based dynamics of regional development: the intellectual capital innovation capacity mode, "International Journal of Knowledge-Based Development". – 2010. – Vol.1. – No.1/2. 16. Szultka S., Klastry – innowacyjne wyzwania dla Polski, IbnGR. – Gdańsk, 2004. 17. Act on support for some innovation activities July 29 2005., Dziennik Ustaw [Journal of Laws]. No. 179, item. 1484, as amended. 18. Walczyk A., Redukcja kosztów transakcyjnych jako jedna z korzyści funkcjonowania w klastrach, in: J. Buko, M. Frankowska, (scientific editing) Klastry – wiedza - innowacyjność – rozwój, Uniwersytet Szczeciński. – Szczecin, 2012. 19. Walczyk A., Wpływ struktury klastrowej Stowarzyszenie Producentów Komponentów Odlewniczych COM-KAST na rozwój brany odlewniczej w Regionie Polski Wschodniej, Zeszyty Naukowe. Ekonomiczne Problemy usług, Uniwersytet Szczeciński. – Szczecin, 2012.