

Ternopil National Economic University, Ukraine

Matej Bel University, Slovakia

University of Łódź, Poland

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Edited by

Andriy Krysovaty, y,

Yevhen Savelyev

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REVIEWERS:

I. Mytsenko – Head of the Department of International Economic Relations, Central Ukrainian National Technical University;

I. Khadzhynov – Vice-Rector for scientific activity, Professor of the Department of International Economic Relations, Donetsk National University named after V. Stus.

EDITORS:

A. Krysovaty – Rector of Ternopil National Economic University;

Y. Savelyev – Professor of the Department of International Economics, Ternopil National Economic University.

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CHAPTER 5.
**Clustering in the formation
of a creative economy:
European vectors, Visegrad Four,
Ukraine**

Yevhen SAVELYEV,

Yuriy KOZAK,

Yevheniy KURYLYAK

5.1. Theoretical approaches to the creation
of cluster systems

Economic thought of the past evolved mainly point-wise. Researchers focused on certain forms and methods of economic relations, dismissing the processes beyond them. The latter could be ignored as they did not have a decisive impact on the subject and object of research. In a similar way the concept of clusters evolved during the last decades of the 20th century, when it became

obvious that ignoring the place of location of production was detrimental to competitive struggle and economic growth. This has become particularly evident after appearance in 1990 of the theory of national, regional and local competitiveness introduced by Porter.⁴⁶ This theory focused on the cluster-based model of production, leading to the development of spatial economic systems.

Today, it is hard to explain why, but the concept of Porter produced the largest impact on economic theory and especially practice. In our opinion, in the conditions of dominating global solutions and «repressed» role of regions which leads to accumulation of numerous problems of local nature, cluster-based approaches were welcomed by local elites as «a magic wand». It seemed that nearly all tasks of accelerated or, at least, catching-up development could be solved by setting up clusters. This vision was quickly adopted by Ukrainian specialists as well. Thus, one of the first Ukrainian fundamental publications on clustering, which was authored by Sokolenko,⁴⁷ states: «The time for network economy has come, uniting technologies, enterprises, large, medium and small structures into networks. Networks unite people, attracting their skills, knowledge and intellect. In practice, it becomes possible to integrate into a network any sphere of human activity – industry, science, education, agriculture, transport, healthcare, recreation industry, and other areas».

The beginnings of any new successful tendency are accompanied by a somewhat exaggerated perception of its significance for the overall process. This was true for clusters as well. By this time, however, there has been enough experience accumulated to allow for systemic analysis of the content of cluster-based forms of industrial organisation and their place in the processes of social division of labour at various levels of the world, national and regional economies.

⁴⁶ Porter, M. E. (2000). Location, competition, and economic development: Local clusters in a global economy. *Economic Development Quarterly*, 14 (1), pp. 15–34.

⁴⁷ Kvit, S. (2014, July 9). Ukrainian IT industry should crowd out metallurgy. [Interview of Serhiy Kvit, Minister of Education and Science, to Forbes web-portal. Retrieved from <http://www.mon.gov.ua/ua/comments/34944-sergiy-kvit-ukrayinska-it-galuz-povinna-vitisniti-metallurgiyu> (in Ukrainian).

The nature of modern globalisation processes is characterised by inclusion of absolutely all processes, their subordination to global laws, regularities and tendencies. However, this does not mean that global economic structures are all built to one design. Modern economies exhibit striking processes which can well fit into the philosophical category of «negation of the negation».

During earlier centuries, world economy consisted mainly of the economies of duchies, tsardoms and imperia. From the second half of the 20th century, it has started to acquire the features of globalisation at an increasing pace. This was expressed in the growing volumes of international activity, leading to creation of new forms of international political, economic, financial, and socio-cultural relations.

Nevertheless, the global economic space has not become a big «caserne» for enterprises obliged to follow the same rules set for everyone. Globalisation intensified the development of spatial shifts that strengthened the processes of regionalisation, which have acquired global attributes. At that, regions are not secondary, insignificant entities. According to Ohmae⁴⁸, in the conditions of globalisation, it becomes obvious that regions are true sources for economic energy. In view of this, it would be logical to conclude that regions in a broad sense (both international and intra-national) dismiss national political and economic units, whose role is declining. In Ohmae's opinion⁴⁹, the leading role in the world economy will be played not by the nation states, but by transnational companies.

Thus, spatial components of economic activity are of different scale and territorial characteristics. Their administrative-territorial components are manifest in global and regional entities. Transnational companies grow to organise global production of goods and services. Regional organisational units function within different

⁴⁸ Ohmae, K. (1985). *Triad power. The coming shape of global competitions*. New York, Free Press.

⁴⁹ Ohmae, K. (1990). *The borderless world: Power and strategy in the interlinked economy*. New York, Harper Business.

kinds of international economic unions, agglomerations and clusters. Their role and popularity in the world economy are constantly changing. However, within the existing regional entities, clusters are most widespread. They absorb the advantages of international economic organisations, transnational companies, international economic unions, national economies, agglomerations, and territorial-administrative structures. On the other hand, clusters can make up the deficiencies of traditional structures, i. e. take over the functions which were ineffectively performed by other entities. Among them are innovations, inter-industry development, development of peripheral and depressive economies, settlement of social problems in administrative-territorial districts, etc.

When determining the place of clusters in overall architecture of the world economy, it should primarily be noted that, today, they **are a new element of the world's spatial economy.**

In spite of their novelty and proliferation, clusters did not crowd out other forms of industrial organisation. On the contrary, they complemented and enhanced the existing production entities. This is true for Euro-regions, national regions and agglomerations. Finally, clusters serve as a form of national and global economic development and as a mobile element of globalisation processes and regionalisation. In the system of global economic architecture, clusters have not become a superstructure that would be a burden to organisations. They evolved as a quality of the linkage structure, which enhances the overall economic architecture (Figure 5.1).

The internal structure of clusters in its classical version consists of groups of interconnected companies. Legally, they operate independently and can have different forms of ownership. Economically, a network of cluster participants mirrors the process of reproduction, including production, distribution, exchange, and consumption of material goods and services. However, companies participating in a cluster do not duplicate separate stages of this process, but take responsibility only for certain operations as per division of labour. On the market, they act as a single competitor, which induces

each company's individual leadership with similar companies outside the cluster, as well as mutual support in achieving higher results compared with external competitors.

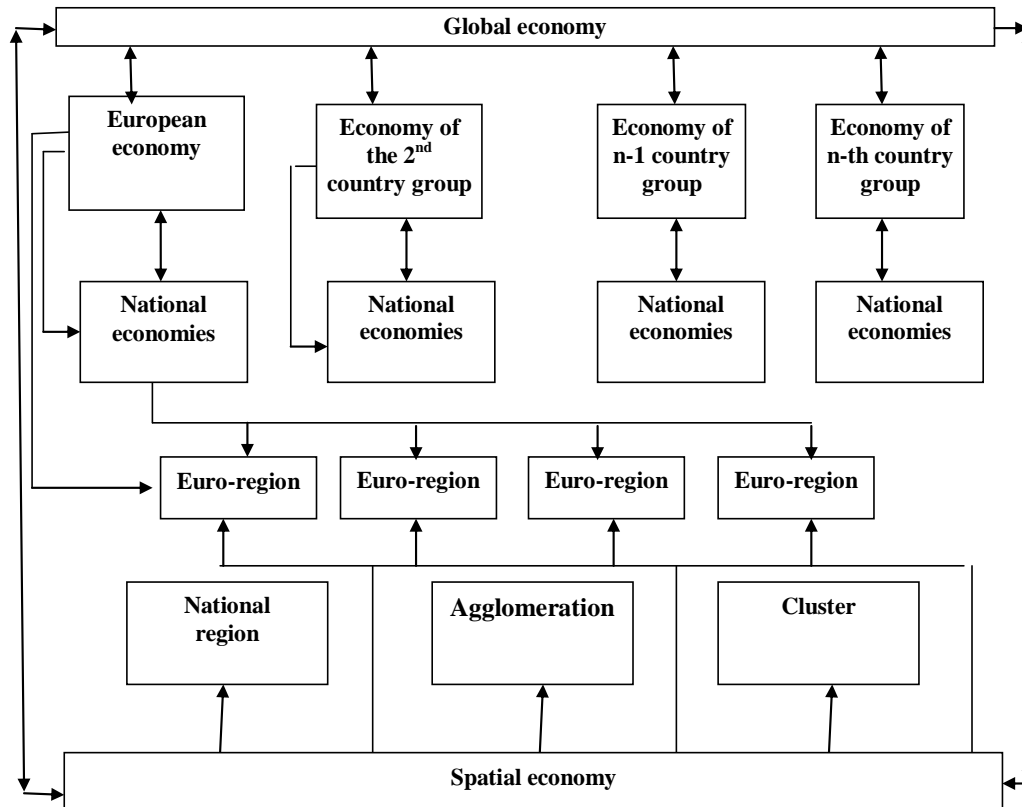


Figure 5.1. Architecture of the world spatial economy

Source: Developed by the author

When considering clusters as networks of companies and organisations, it should be noted that networks are kept together by the availability of common markets and final customers. However, each member of the cluster, being a legally independent participant, can simultaneously operate in other market niches, which do not fall within the circle of interests of the cluster. This type of cluster involvement is particularly typical of research centres, universities, financial institutions, and intermediary firms. Similarly, public authorities, which participate in clusters, do not reduce their activity in other spheres. They participate in clusters mainly to lobby the interests of their regions by providing assistance to clusters in matters of organisation, lands and resources.

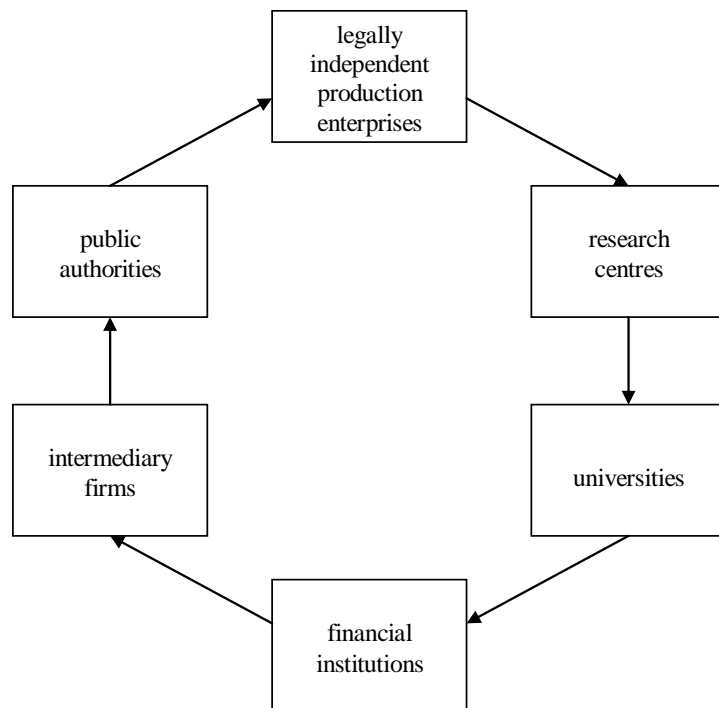


Figure 5.2. Internal structure of the cluster

Source: Developed by the author based on analysis of Porter, M. (2003). *Competition*. Moscow, Williams Publishing. (in Russian); Porter, M. (1993). *International competition*. Moscow, Mezhdunarodnye Otnosheniya. (in Russian); Yamawaki, H. (2002). *The Evolution and Structure of Industrial Clusters in Japan*. *Small Business Economics*, 18, pp. 121–140.

The economic literature usually ignores certain aspects of the relationship between clusters and agglomerations (Figure 5.2). However, both of them achieve synergy effects. The agglomeration effect was limited mostly to formation of conglomerates, which has become more or less evident in conditions of intensifying economic activity in the 20th century. Having developed within the agglomeration structures, clusters initially generated synergy effects thanks to better realisation of the benefits of industrial concentration based on spatial concentration and division of production processes. Networks are traditionally represented by such territorially concentrated industries as auto industry in the USA, Germany and Japan, production of watches in Switzerland, flower industry in the Netherlands, etc. Typical examples from the sphere of services include Hollywood industry and financial centres in London and New York.

The biggest impact on economic development produce clusters that emerge in line with the continuing proliferation of knowledge-based economy in the world and national economies. Some of them have already acquired classical forms and become the role models. Well recognised are such clusters as the Silicon Valley in the USA; mobile telecommunications clusters in Stockholm, Tokyo and Helsinki.

In conditions of the knowledge economy, it becomes typical to set up international clusters, which allow to realise competitive advantages related to internationalisation of production. Their models can be presented on the example of clusters that exist in biotechnology and natural sciences, for example, Biovalley within the French-German-Swiss border⁵⁰ and Medicon Valley of Denmark and Sweden.⁵¹ To tell the truth, the creation of knowledge-based entities can hardly be imitated, which has been proven by failure to create a copy of the Silicon Valley in the Russian town of Skolkovo. The development of clusters in the knowledge-based economy seems to require not as much of the imitation, but rather the creation of entities based on fundamentally new ideas – be they organisational or purely scientific in nature.

Analysis of the evolution of modern network-based systems of local industrial organisation shows that they tend to shift towards acquiring new contents in response to changes in the processes of globalisation. In view of the broad proliferation of cluster-based systems, it is worth to acknowledge that in new forms of fragmentation are developing in the global economy, with integration processes intensifying within them. At first, they encompassed groups of national economies and found most expression in the creation of the European Union, where foreign economic relations among member states oriented mostly at the cooperating partners. However, the

⁵⁰ Mikula, N. A. (n.d.). (Ed.). Recommendations on implementation of new forms of transborder cooperation. Lviv, Institute for Regional Studies, National Academy of Sciences of Ukraine, pp. 75–78. Retrieved from http://eep.org.ua/files/MR_NewForms.pdf (in Ukrainian).

⁵¹ A Story on how Denmark and Sweden were building a Medicon Valley. (2012, October 15). Retrieved from : <http://babansky.livejournal.com/4944.html>. (in Russian).

boundaries of such formations are also rather broad and must be supplemented with local integration unions, as it is not possible to achieve worldwide conjunction of interests with regard to production and distribution of goods and services.

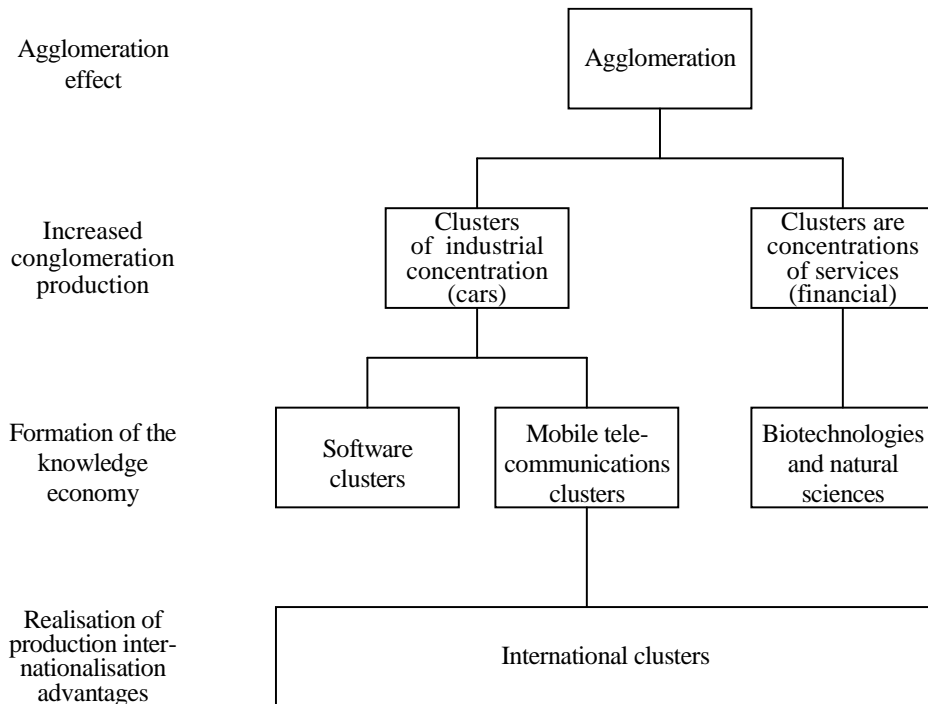


Figure 5.3. Evolution of clusters within the agglomeration framework

Source: Developed by the author based on analysis of Chuzhykov, V. I. (2013). (Ed.). Technological modernisation in the European economy. [Monograph]. Kyiv, KNEU. (in Ukrainian).

Taking advantage of national economic openness sets certain preconditions for companies, which are forced to choose those locations for their business activity that offer better business environment for their needs. The larger the global markets, the higher the probability that material, financial and intellectual resources will be allocated in more attractive areas, stimulating the formation of local specialization and creation of local science and industry associations, primarily clusters. The latter, having gained higher competitiveness, create new clusters to cover their needs in additional services or to provide services to other specialised entities. Centres for industry and science and technology activity can be initiated by members of the

existing associations who develop their personal scientific and productive ideas and developments.

At that, it should be noted that in many countries, cluster policy began to emerge at the regional level earlier than at the national level. For example, such lands as Baden-Württemberg, Bavaria, North Rhine-Westphalia in Germany initiated the programmes aimed at fostering networks for science and business integration back in 1980s.

In contrast, federal government initiated the first programme of this kind in the mid 1990s⁵². This testifies to the fact that it is economically and administratively strong regions, such as the lands of Germany, that can serve as a trigger mechanism for development of important directions, not the centre.

It will be a mistake if decentralisation is only reduced to forming state and regional budgets. Urgent and radical economic reforms should obviously reproduce a new strategy of development over the long term with a focus on the increased role of regions and their responsibility for socio-economic outcomes. Under such conditions, clustering shall become an important form of new regional policy of Ukraine.

The development of cluster initiatives in the system of regional policy of Ukraine could be supported by using the invaluable experience of France, which developed and effectively introduced different approaches that were gradually implemented with care, risk-awareness and application of financial levers. Involvement of the state in the development of network-related policies is largely connected with a need to finance joint projects. Usually, it reduced to stimulation of self-organization and formation of clusters in regional economies. This can be illustrated by the example of the programme in France which aimed at providing support for the development of local production systems. It provided a possibility for LPS to receive

⁵² European Cluster Observatory. (2008). Cluster policy in Europe. A brief summary of cluster policies in 31 European countries, p. 17. Retrived from: <http://www.clusterobservatory.eu/system/modules/com.gridnine.opencms.modules.Eco/providers/getpdf.jsp?uid=100146>.

subsidies of 37.5 thousand Euros on average. The conditions of financial support were relatively soft: formation of a cluster-based organization, which would consolidate its founders.⁵³ They could spend money on a wide range of expenditures, including branding, export support, self-organisation of companies, universities and local authorities; gaining experience for future implementation of large-scale programmes.

When introducing state programmes of cluster support, it is important not to miss the moment of their obsolescence. Thus, in France, the above-mentioned approaches to providing state support for local production systems contributed to their proliferation. However, the final outcomes of government – business interaction have not always positively affected the strengthening of international competitiveness. That is why in 2006–2008 the programme on local production systems development was replaced with the programme «Competitiveness clusters» with a budget of €1.5 bn, which significantly expanded the range of support for cluster initiatives. It was used to finance specific cluster programmes which have already been set up and proved effective.

Strong regionally located clusters spread globally by attracting personnel, technology and investments. They cooperated with other clusters, additionally contributing to global value chains, and successfully entered foreign markets. Finally, specialisation deepened in local spaces. In case regions are too slow to get involved in this process, they not only face higher risks of lagging behind in terms of economic and social development, but can also fall into depression.

When assessing the development of cluster-based systems in developed countries, it should be noted that, on one hand, they promoted economic development in view of the global conditions of the last decades, but on the other hand, they needed to adapt to the challenges faced in the second decade of the 21st century. However, the

⁵³ Martin, P., Mayer, T., Mayneris, F. (2010). Public support to clusters: A firm level study of French «Local productive systems». [Mimeographed]. University of Paris I, p. 4. Retrieved from <http://perso.uclouvain.be/florian.mayneris/rsue.pdf>.

statistical studies of Teresa Bal-Woźniak⁵⁴ proved that clusters did not yield significant advances in the context of innovativeness, especially in the new EU member countries. There is a hypothesis that during the transition from resource-based network economy to knowledge economy, the leading role is played by the factor of clusters' innovativeness.

The aim of the current Strategy «Europe 2020» was to enhance the economic power of the European Union and the well-being of its citizens. As stated in the conclusion of the European Council: «Our efforts should be more focused on the development of EU competitiveness, productivity, growth potential and economic convergence. The new strategy concentrates on the key areas: knowledge and innovation, more sustainable economy, higher employment level and social inclusion»⁵⁵.

In order to maintain high living standards and improve them further, Europe launched a search for new organizational forms for clusters that would ensure the progress in innovations. Europe needs these new forms to become more productive in generating new ideas and to reduce its gap with the U.S. and Asia in terms of innovative development. Thus, European clusters develop towards transformation into powerful catalysts of this process, acting as inter-connected territorial centres.

Current views on the role of clusters were put forth in the «European Cluster Memorandum», which defines them as «regional centres for concentration of specialized companies interconnected by multiple channels, which creates favourable environment for innovations. They enable «open innovations», that is, the creation and improvement of new ideas in a network consisting of companies and organizations that cooperate with each other. These groups of com-

⁵⁴ Bal-Woźniak, T. (2011). Economic networks as effective mechanisms of innovation activity coordination. *Mizhnarodnya Ekonomichna Polityka*, 12–13, p. 152 (in Ukrainian).

⁵⁵ Eurobulletin. (2010, Number 4). European Council approved the Europe-2020 Strategy.

panies and organizations facilitate the removal of barriers to transformation of new ideas into new products and generation of maximum benefits from globalization»⁵⁶.

Generalisation of the above-mentioned modern clustering practice in developed countries gives an opportunity to present a classification of cluster-based forms of industrial organisation according to territorial, evolutionary, organisational, and qualitative parameters (Figure 5.4).

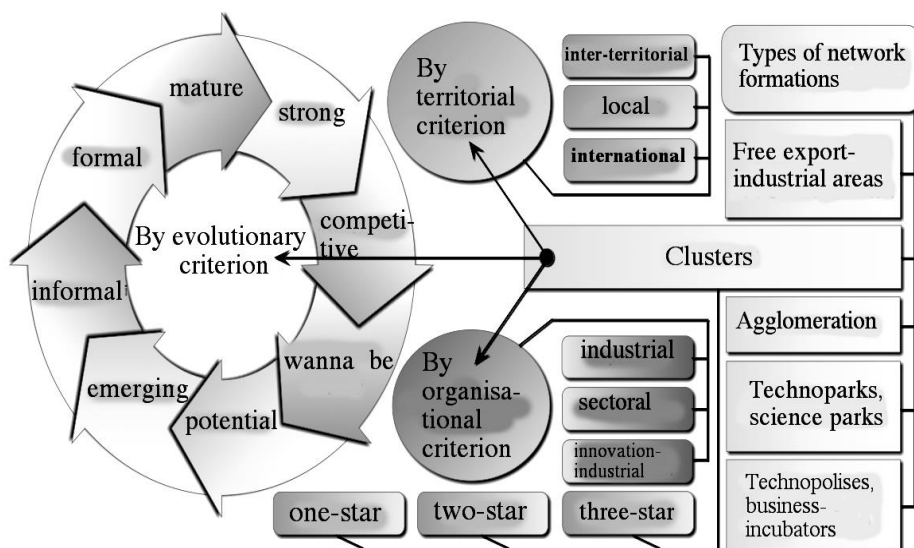


Figure 5.4. Classification of cluster-based forms of industrial organisation and their position in networked territorial entities

Source: Developed by the author based on Chuzhykov, V. I. (2013). (Ed.). *Technological modernisation in the European economy*. Kyiv, KNEU. (in Ukrainian); Sokolenko, S. I. (2004). *Clusters in the global economy*. Kyiv, Logos. (in Ukrainian); TACTICS (2012). *Where the cluster winds are blowing in Europe*. Brussels, European Commission. Retrieved from <http://abclusters.org/wp-content/uploads/2013/12/Where-the-cluster-winds-are-blowing>.

According to territorial criterion, clusters develop as local, inter-territorial and international. In the evolutionary aspect, it is worth to distinguish among potential, emerging, wannabe, informal,

⁵⁶The European Cluster Memorandum. Promoting European Innovation through Clusters: An Agenda for Policy Action. Prepared by The High Level Advisory Group on Clusters, chaired by Senator Pierre Laffitte. Retrieved from http://www.vinnova.se/upload/dokument/VINNOVA_gemensam/Kalender/2008/Klusterkonferens_jan08/European%20Cluster%20Memorandum%20Final.pdf.

formal, mature, strong, and competitive clusters. In the organisational sense, clusters can be classified into industrial, sectoral, and innovation-industrial. By the criterion of sustainability and sophistication, clusters can be assigned stars, as it is done for hotels: three stars, two stars and one star.

5.2. Clusters and science parks as a moving force for the formation of a creative economy

The development strategies until 2020, which were adopted by the EU and the majority of countries falling under the European Neighbourhood Policy aim at transition to innovation economy. Science parks play an important role in achieving this goal. Their creation and functioning in Ukraine are carried out in accordance with the Law of Ukraine No.1563-VI «On Science Parks» of June 25, 2009⁵⁷. Science parks are defined as legal entities created by initiative of higher education institutions and/or scientific institutions by consolidating the contributions of its founders with the aim of organizing, coordinating, and controlling the process of development and implementation of the projects of scientific parks. Its partners may be business entities that have to sign the corresponding agreement. The priority directions for science parks should be economically- and socially-induced scientific, technical and innovative activities that are consistent with the goals of their creation, take into account the needs of the region and comply with the laws «On Priority Directions for Development of Science and Technology» and «On Priority Directions for Innovative Activity in Ukraine».

Research of the problems of science parks development is carried out by many Ukrainian and foreign scientists. Among them, we would like to mention B. Andriyanov (theoretical foundations of science parks)⁵⁸; M. M. Ivanov, S. R. Kolupaev (methods of science and

⁵⁷ Law of Ukraine «On science parks». Retrieved from <http://zakon3.rada.gov.ua/laws/show/1563-17>. (in Ukrainian).

⁵⁸ Andriyanov, V. Science parks. The south-eastern version. *Vneshnyaya trgovlya*, 9, pp. 33–35. (in Russian).

innovation management in the U.S.)⁵⁹; A. G. Karataev (operation of science parks in the developed capitalist countries)⁶⁰; V. K. Vasenko (world experience of the strategy and development of free economic zones in Ukraine)⁶¹; V. I. Lyashenko, A. I. Zemlyankin, I. J. Pidorycheva, T. F. Berezhna (infrastructure of science parks)⁶²; O. A. Mazur (Ukrainian and international experience of technology parks)⁶³; V. Semynozhenko (parks and experience of innovation economics)⁶⁴; D. V. Tabachnyk (Ukrainian and international experience of technology parks)⁶⁵, and others. However, the practice of creating science parks has not become widespread enough, although some experience has already been accumulated, which provides grounds for creation of their network in the future.

In practice, science parks are designated with different names, in particular «scientific-technological parks» and «technoparks», even though their meaning is the same – the creation of a science and production complex, which integrates a research centre and the surrounding industrial area, where science-intensive firms are located on rental or other terms. Educational structures are an important element of science parks, which provide the latter with human resources and engage students, professors and lecturers of higher educational establishments in performing science and production functions (Figure 5.5).

⁵⁹ Ivanov, M. M., Kolupaev, S. R. (1990). The USA: Management of science and innovations. Moscow, Nauka. (in Russian).

⁶⁰ Karatayev, A. (1990). Science parks of developed capitalist countries. *Vneshnyaya trgovlya*, 9, p. 13–15. (in Russian).

⁶¹ Vasenko, V. K. (2004). Free economic areas: Strategy of development. [Monograph]. Sumy, Dovkillya. (in Ukrainian).

⁶² Lyashenko, V. I., Zemlyankin, A. I., Pidorycheva, I. Yu., Berezhna, T. F. (2012). Perspectives of science parks development as elements of small innovative business infrastructure in Ukraine. *Visnyk Ekonomichnoyi Nauky Ukrayiny*, p. 89–109. (in Ukrainian).

⁶³ Mazur, O. A., Shovkalyuk, V. S. (2009). Technological parks. World and Ukrainian experience. Kyiv, Prok-biznes. (in Ukrainian).

⁶⁴ Semynozhenko, V. (2004). Technological parks in Ukraine: First experience of forming the innovation economy. *Ekonomika Ukrayiny*, 1, p. 6. (in Ukrainian).

⁶⁵ Tabachnyk, D. V. (2004). (Ed.). Technological parks. World and Ukrainian experience. Kyiv, Vydavnytstvo Tp IEZ. (in Ukrainian).

The first science park «Kyiv Polytechnics» was created on the basis of National Technical University «Kyiv Polytechnical Institute» by the Law of Ukraine No 523-V dated December 22, 2006, «On Science Park «Kyiv Polytechnics'» with the aim of organising massive innovation activity to intensify the development, production and commercialisation of high-technology products on the internal and external markets, to increase state and local budget revenues, and to accelerate innovative development of the economy of Ukraine. The law was actually of pilot significance for elaboration of normative rules and principles of science park operations.

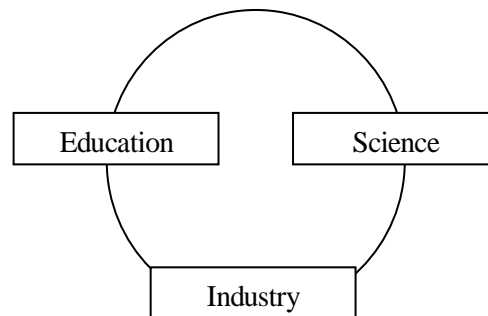


Figure 5.5. Territorial-functional structure of a science park

The creation of the science park «Kyiv Polytechnics» attracted 55 foreign and local technology companies, almost 100 research groups and laboratories of Kyiv Polytechnical Institute producing competitive know-how, more than 20 engineering faculties offering high-quality personnel for companies, several venture and investment funds, which if necessary invest in start-up projects. The science park attracts ever more students that not only work for its companies, but also create their own small enterprises for commercialization of their own inventions and projects within the framework of the scientific park's business incubator.⁶⁶

During 2005–2010, the participants of the technopark «Kyiv Polytechnics» commercialised more than 150 new products and technologies. Among the achievements of the park one can mention

⁶⁶ Dzerkalo Tyzhnya. (2011, No.2). Research universities as centres for innovative development of the country. [Interview of the Rector of National Technical University «Kyiv Politechnical Institute» to journalist of Dzerkalo Tyzhnya]. Retrieved from <http://www.dt.ua/articles/73711#article> (in Ukrainian).

the following: a complex of computer technology instruments that protect users from indirect electromagnetic radiation; strategic planning and systemic management of sustainable development of megacities of Ukraine; energy-efficient Eco-house with complex use of renewable and alternative energy sources; technology of production of new dietary foods of sanative and preventive action; micro-satellite; technologies of low-cost titanium production, etc.

Organization and activity of the park is realized in accordance with three main elements of the «triple helix» model, which was developed in 1996 by Henry Etzkowitz, professor of Stanford and Edinburgh universities, and includes such elements as universities, business and the state.⁶⁷ In the case of the science park «Kyiv Polytechnics», only two elements are actively involved – the university and the manufacturing sector (American companies Netcracker, USPolytech, EPAMSystems; «European Institute of Innovation Technologies» (London), German Research Center «Eurocentrum»; Ukrainian companies – Group DF, «Datagroup», «Technologies of nature», «UAVIA», Kherson enterprise «Sudmash», concern «Ukrpozhservis», Kyiv enterprise «Meridian» and others). In its turn, **the state did not show any interest in the work of the country's first science park.** Although it could place orders for creation of high technologies in such critical areas, as resource and energy saving; biotechnology for food and agricultural sectors; information systems for effective management of different parts of society, etc. Such a policy could have contributed to reduction of the respective high-technology imports to Ukraine.

The network of science parks is currently expanding in Ukraine, but their influence on formation of innovation economy cannot yet be realised. In order to track the processes of science

⁶⁷ Dezhina, I. G., Kiseleva, V. V. (2007). State, science and business in the innovation system of Russia. Moscow, Institut Ekonomiki Perekhodnogo Perioda (in Russian).

parks' functioning, it would be feasible to delineate their network. Scientific literature describes the following science parks:⁶⁸

- «Airspace Innovation Technologies» created in 2010 under the auspices of the EU project «Support to science-intensive and innovative enterprises and technology transfer in Ukraine» on the basis of National Aviation University (Kyiv);

- «Kyiv T. Shevchenko University», which was created at the end of 2010 by the research institutions of the National Academy of Sciences of Ukraine (Institute of Archeology; Institute of Bioorganic Chemistry and Petrochemistry; O. Palladin Biochemistry Institute; Institute of Geochemistry and Mineralogy named after M. P. Semenkov; E. O. Paton Electric Welding Institute; Institute of History of Ukraine; Institute of Metal Physics named after G. Kurdyumov; Institute of Microbiology and Virology named after D. K. Zabolotny; Institute of Organic Chemistry, Institute of Applied Physics; Institute of Materials Science named I. M. Frantsevich; Institute of Information Registration; Institute of Theoretical Physics named after M. M. Bogolyubov) and higher educational establishments of the IVth level of accreditation (Kyiv National T. Shevchenko University and National University of Food Technologies);

- «AGROECO» created on the basis of the Institute of Agroecology and Environmental Economics of the National Academy of Agrarian Sciences of Ukraine (IAEE NAAS of Ukraine) with the participation of the Institute of Agroecology and Environmental Economics NAAS of Ukraine; Institute of Sugar Beet and Energy Crops NAAS of Ukraine; Institute of Hydraulic Engineering and Land Reclamation NAAS of Ukraine; National Scientific Centre «Institute of Agriculture» NAAS of Ukraine; National Scientific Centre «Institute of Mechanization and Electrification of Agriculture» NAAS of Ukraine; Institute of Agricultural Microbiology NAAS of Ukraine; National Scientific Centre «Institute of Agrarian Economy» NAAS of

⁶⁸ Lyashenko, V. I., Zemlyankin, A. I., Pidorycheva, I. Yu., Berezhna, T. F. (2012). Perspectives of science parks development as elements of small innovative business infrastructure in Ukraine. *Visnyk Ekonomichnoyi Nauky Ukrayiny*, p. 104–105. (in Ukrainian).

Ukraine; Darnytsya center for assistance of investments, innovation and high technology; Kyiv Regional State Administration; National University of Bioresources and Environmental Science of Ukraine.

It is worth to admit that the use of different terminology in creation and operation of science parks can generate complications in their legal functioning. In particular, some technoparks cannot qualify for privileges, which are granted to natural persons participating in associations that were given the legal status of «science parks»⁶⁹. Among them are such technoparks as «Kyiv Polytechnics»; «Textile» based at Kherson National Technical University; «Agro-technopark» at the National University of Food Technologies, and «Yavoriv» at National University «Lviv Polytechnics».

The dynamic development of technoparks in the EU encouraged comprehensive best-practice studies of their functioning. Worthy of attention is the experience of Poland, where, thanks to support provided by structural funds of the EU, a tendency has started since 2004 towards dynamic development of technoparks within the framework of operational programmes. In view of the heterogeneity and ambivalence of these processes, a consortium of companies F5 Konsalting Sp. z. o. o. performed a study of a group of technoparks titled «Organising and performing benchmarking of technoparks in Poland»⁷⁰ to the order of the Polish Agency for Enterprise Development and Polish Trade and Industry Chamber of Advanced Technologies (Polska Izba Gospodarcza Zaawansowanych Technologii). Eighteen technopark agreed to undergo benchmarking analysis, one of which refused upon acquaintance with project documentation.

The mentioned research was instrumental in development of basic recommendations. The Polish experience proves that it is necessary to increase the efficiency and productivity of the available as-

⁶⁹ Nemets, L., Hryshchenko, N. (2010). On the issue of technoparks' functioning in the world and in Ukraine. *Chasopys Socialno-Ekonomichnoyi Geografii*, 8, p. 62 (in Ukrainian).

⁷⁰ Benchmarking of technoparks in Poland. General Report. Retrieved from http://www.pi.gov.pl/PARPFfiles/file/OIB/Benchmarking_parkow/Benchmarking_of_TP_Report_vRussian.pdf. (in Russian).

sets by increasing the quantity and quality of services and rationalising the expenditures. The field of contacts available to technoparks allows them to increase cooperation with enterprises, science institutions and financial organisations, thus achieving an additional number of patents and implemented innovations, as well as developing their tangible and intangible resources. The performed benchmarking analysis also corroborated the feasibility of increasing the number of spin-offs (new, autonomous enterprises created by an employee or employees of a parent company or a scientific organisation) and start-ups (newly created academic enterprises created by students or university graduates). Researchers' estimates also show that residents attract insufficient venture and greenfield investments for their development.

The «choke point» of the Polish economy is a small number of patents and trademarks protected by the law. The development of partner marketing is very promising in view of the evolving knowledge economy. The EU stepped in with an initiative to create a single educational and scientific space in Europe. In 1995, the European Commission founded a network of Innovation Relay Centres (IRC), the aim of which was to create a European platform for stimulating international technology transfer and provision of services in the sphere of innovations. Similar organisations are already in place in Ukraine. In particular, several centres for technology transfer were set up in Ukraine, in particular on the basis of «Nauka» Concern and at national technical universities.

Besides, the Ukrainian Network for Technology Transfer and National Technology Transfer Network are in place, which were designed according to the methodology and model of the European Network of Relay Centres⁷¹. Today, there is high need to perform benchmarking analyses of the centres for technology transfer in order to develop recommendations aimed at facilitating the development and implementation of innovations.

⁷¹ National Technology Transfer Network. [Official web-site]. Retrieved from <http://www.nttn.org.ua/?idm=1&lng=1>. (in Ukrainian).

5.3. European vectors of regional innovation development

By forming the association with the EU and its member states, Ukraine receives a unique opportunity to adopt the European Strategy «Europe 2020» as a reference for its own development. This concerns both the goals and the means of their achievement. The main goal of the European Union for the second decade of the twenty-first century is to regain the positions lost in result of the crisis. «Europe needs to get back on track. Then it must stay on track»⁷², said J. M. Barroso in the preamble to the European Commission’s report on the European strategy for 2010–2020. Titled «European Strategy for Smart, Sustainable and Inclusive growth», this strategy determines five priority directions for activity of the European countries: employment; research and innovations; climate change and power engineering; education; poverty reduction.

Figure 5.6 shows that Europe can go beyond the pre-crisis development trajectory only if it follows the path of sustainable growth.

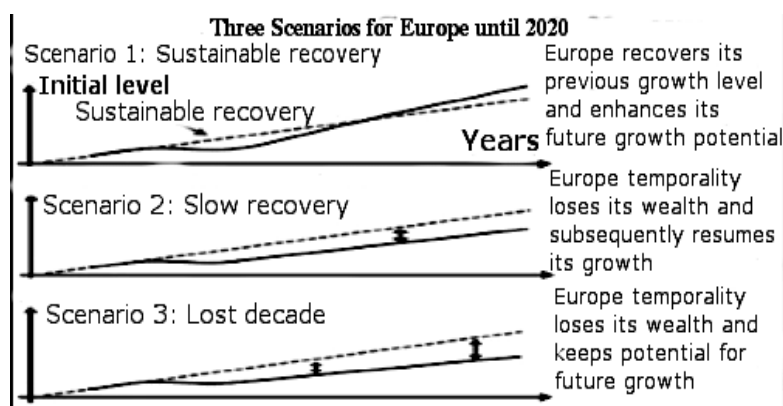


Figure 5.6. Scenarios for successful realisation of the European strategy⁷³

Slow recovery will generate small base for economic growth, leading to lower growth trajectory than that of the pre-crisis period.

⁷² Europe 2020: a European strategy for smart, sustainable and inclusive growth, p. 3. Retrieved from <http://ec.europa.eu/research/era/docs/en/investing-in-research-european-commission-europe-2020-2010.pdf>.

⁷³ Source: Europe 2020: a European strategy for smart, sustainable and inclusive growth, p. 7. Retrieved from <http://ec.europa.eu/research/era/docs/en/investing-in-research-european-commission-europe-2020-2010.pdf>.

The third scenario predicts that Europe will gradually lose its wealth and potential for future growth. Thus, the strategy of sustainable recovery is an ideology, which should lay the basis for economic policy in the countries exiting from the crisis. Ukraine should adopt it as an important component in the development of its new strategy of socio-economic development.

In view of its geopolitical and geo-economic positions, Ukraine can use networked forms of industrial organisation to reach smart, sustainable and inclusive growth, starting with rejuvenation of the military-industrial complex. The general approach stipulates that the main task is to give a «second wind» to those science and research, education, test, and manufacturing enterprises, which perform the development, production and armament of military and special-purpose machines, ammunition, and armament. At the same time, new enterprises should be created in order for the country to have a closed loop in production of competitive armour.

The priority for clustering in the defence industry is preconditioned by the need to defend the country in the conditions of the «hybrid war» which has started in 2014, as well as satisfies the task of supplying military forces in the current and future periods. However, this is not the only argument, as the majority of modern weaponry can also be acquired through importing. No less important is the fact that the economy of armament intensifies science and technology research, using it in production processes primarily to satisfy the needs of the army, and only later for the civilian sphere.

The solution to the problem of achieving leadership positions in global economic space can be found in the area of knowledge-based development. The political-economy debate names it «taking a «decent» place in the global competitive environment». In the conditions when Ukraine is forced to fight the unannounced war on its territory and when traditional trade flows with the Russian Federation are disturbed, it is primarily necessary to settle the problems of business reorientation from the countries of the Customs Union, es-

pecially the Russian Federation, towards the markets of other countries. In this respect, the Association Agreement between the EU and Ukraine creates favourable institutional conditions by opening access to European markets.

It is beyond doubt that European customers will have a demand for Ukrainian products of agriculture, food industry, and eventually power engineering. Today, these are the most successful Ukrainian products on the world market. In the future, Ukraine should develop a strategy for promoting itself on the markets for innovation products.

For the foreign markets, «of particular interest are new industries, since the future is theirs. IT, education and healthcare can give rise to inward medical tourism in Ukraine. We can already have such a complex product of Ukrainian land: not only chernozem, but people as well». ⁷⁴

The orientation of the cluster component of Ukrainian reforms towards knowledge economy is the exclusive condition for Ukraine to achieve real Europeanization, – which is understood as adoption of modern values of the world civilisation, – in the observable future. The concentration of effort on generation of knowledge and formation of new technological processes and industries is the most complicated but also the least risky way towards leadership, since economic growth based on production of traditional and standardised products brings no global recognition. African and especially Asian countries are good examples of this practice. Thus, in 2005–2012, world exports grew at an average growth rate of 3.5%, whereas North America had the growth rate of 3.5%, Central and Southern America – 1.5%, Europe – 2%, CIS countries – 3%, Asia – 7% (China 11%, India 10%, Japan 2.5%), Australia – 3.0%. ⁷⁵

⁷⁴ Pavlo Sheremeta held a meeting with representatives of economic services at local authorities. [Press service of the Ministry for Economic Development]. (April 14, 2014). Retrieved from <http://www.me.gov.ua/News/Detail?title=PavloSheremetaProvivNaraduZPredstavnikamiEkonomichnikhSluzhbmistsevikhOrganivVladi>. (in Ukrainian).

⁷⁵ WTO: International trade statistics 2013. Retrieved from http://www.wto.org/english/res_e/statis_e/its2013_e/its13_world_trade_dev_e.htm.

Ukraine, being the country that integrates with the European economic space, should select the European Union as its main strategic benchmark. It is quite understandable that government authorities and businesses should primarily study thoroughly the processes of knowledge economy development that take place in Europe.

The reformers of Ukraine should take into account the fact that out of the five key goals of the EU Strategy until 2020, the EU set its target share of expenditures on research and development in the GDP at 3% (for the EU-27 countries). In 2011, this indicator was 2.03%, while in 2010 it was 2.01%. These indicators (average for the EU-27 as a whole) are lower than R&D expenditures in many developed countries. Thus, according to recent statistical data published by the State Statistical Service of Ukraine in 2013, the share of R&D expenditures was 2.01% in Japan, 4.0% in South Korea, and 2.87% in the USA (2009), but higher than in China (1.7% in 2009). Among the countries of EU-27, the R&D intensity exceeded the strategic target indicator of the USA only in Finland (3.78%), Sweden (3.37%) and Denmark (3.09%). In such states as Germany, Austria, Slovenia, Estonia, France, the Netherlands, and Belgium, the R&D intensity was above the average for the EU-27, but still lower than the target value of 3% (2.84%, 2.75%, 2.47%, 2.38%, 2.25%, 2.04%, and 2.04% respectively)⁷⁶.

R&D intensity in Ukraine is at a much lower level than in the developed countries and countries of the EU. In 2012, it accounted for 0.75% of the GDP, even though in 1990 it reached 2.3%.⁷⁷

Irrespective of the fact that in 2011 such a level was characteristic of some post-socialist countries (Slovakia, Latvia, Bulgaria, and Roma

⁷⁶ State Statistical Service of Ukraine. (2013). Science and innovation activity in Ukraine. [Compilation of Statistics]. Kyiv, pp. 150, 153. Retrieved from <http://www.ukrstat.gov.ua/>. (in Ukrainian).

⁷⁷ On compliance with legislature on the development of science and technology potential and innovation activity in Ukraine. (2004). [Decree of the Supreme Council of Ukraine]. Vidomosti Verkhovnoyi Rady Ukrayiny, 43-44, p. 494. Retrieved from <http://zakon4.rada.gov.ua/laws/show/1786-15>. (in Ukrainian).

nia), as well as Malta and Cyprus,⁷⁸ the existing state of scientific research and development creates no basis for the development that would be adequate to geo-economic and geostrategic place of Ukraine in Europe. To tell the truth, compared with less populated countries of the EU, Ukraine has an advantage in terms of absolute R&D expenditures, which reach \$2.4 bn. However, the circle of EU countries whose R&D expenditures are lower than in Ukraine is limited to Latvia, Bulgaria, Estonia, Lithuania, Slovakia, and Romania.

On the whole, in terms of R&D expenditures, Ukraine is by far the biggest laggard compared to other European countries. The countries which rank closest to Ukraine include the Czech Republic (whose R&D expenditures exceed those of Ukraine by the factor of 2.2), Poland (2.4), Denmark (2.6), Finland (3), Belgium (3.5), Austria (4), and the Netherlands (5.9). At the same time, France spends 20.1 and Germany spends 37.2 times more on R&D than does Ukraine.

The analysis of R&D expenditures in Ukraine allows making at least two conclusions. First of all, the collapse of the country's economy due to creation of an oligarchic model in the conditions of weak state governance and exploitation of assets inherited from the Soviet times by private business people that were in power or in management of state enterprises, has brought the country close to being recognized as underdeveloped country. Second, in spite of numerous problems that have accumulated in the economy of the country, the government should adopt a programme for accelerated R&D development. The European target indicator of 3% of the GDP should lay its basis. If the existing level of expenditures is increased by 0.25 points every year, by 2020 Ukraine could reach the level stipulated in the strategy «Europe – 2020».

Achieving the 3%-level of R&D intensity will make the share of R&D expenditures in the GDP equal to \$10 bn. This will place

⁷⁸ State Statistical Service of Ukraine. (2013). Science and innovation activity in Ukraine. [Compilation of Statistics]. Kyiv, p. 150. Retrieved from <http://www.ukrstat.gov.ua/>. (in Ukrainian).

Ukraine at one level with such developed countries as Austria, Belgium, Denmark, the Netherlands, Finland, and Sweden in terms of both total financing volumes and per capita expenditures.

Finally, this strategy can transform Ukraine within a short period of time into a knowledge-based economy and remove the burden of oligarchic economic model. Truly speaking, there will be no alternative for the oligarchs other than to get involved in the processes of transforming national economy into the knowledge economy or gradually fade away. The capital, which has initially been accumulated by collecting rent on corruption, must be channelled to qualitatively new industries, productions and products. Otherwise, the power of oligarchic capital and of the post-Soviet type of business people⁷⁹ will be lost and used by new entrepreneurs. The focus is on the new generation of business managers which is being formed today and, most probably, will be developing in the near future based on the chain reaction principle.

The idea of transforming Ukrainian economy into the knowledge economy can be successfully realised only if investment is undertaken in the R&D, which, first, will be of industrial importance and second, will contribute to forming a modern innovative national economic complex. For that, it would be feasible to adopt the German experience of harmonised implementation of the innovation strategy by the government and private businesses with the help of «competence networks» (Kompetenznetze), which are regional associations generating new knowledge based on concentration of industrial competences (Figure 5.7). Competence networks are created in order to search for new science and technology solutions involving target financing from the government. The grant application procedure is based on open competitive selection of projects prepared by regional consortia comprising academic institutions and private companies.

⁷⁹ On the whole, huge doubts arise as to the capability of the majority of oligarchic capitalists to successfully operate in a new way without regulatory capture. It is highly probable they will undergo the processes of natural transformation, some kind of «dispossession of the kurkuls», with the help of the market.

German specialists view the current stage of innovation policy development as a stage of transition. It is characterised by increased demands on the integrity of science and technology developments, which is expressed in attention paid to aspects of external environment, healthcare, transport, etc.⁸⁰ In the new conditions, one could also use the idea of using cluster forms in building the innovation capacity of enterprises, the practice which proved worthwhile in the world economy.

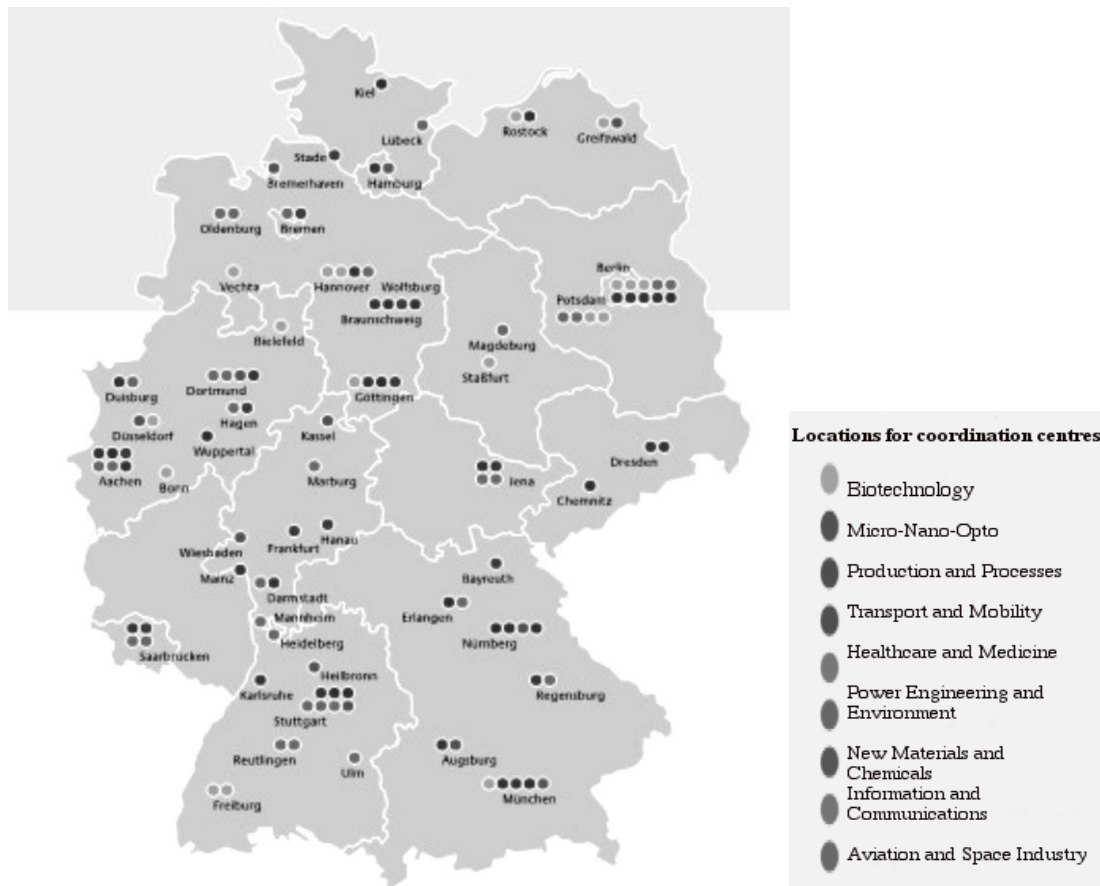


Figure 5.7. Location of coordination centres of competence networks in Germany⁸¹

However, the approach of M. Porter to geographic concentration of companies and research institutions within one industry or technological field has been extended. New approaches give preference to

⁸⁰ Evaluation: Instrumente für eine bessere Politikgestaltung. [Jahresbericht 2013]. (2014). Berlin. Institut für Innovation und Technik, p. 11. Hantsch S., Kergel H., Lämmer-Gamp T., Meier zu Köcker, G., Nerger, M. (2013). Cluster Management Excellence in Germany – German clusters in comparison with European peers. Berlin: Institut für Innovation und Technik, p. 37.

⁸¹ Source: Initiative «Kompetenznetze Deutschland»: Die innovativsten Netzwerke im Überblick. [Jahresbericht-iit-2013]. Retrieved from KO-NETZ-2007_11_endfassung.pdf.

creation of networks of industrial and scientific structures, which adopt cluster principles in their organisation and management without necessarily binding them to a certain territory. They have an overarching, that is, territorial and institutional autonomy and encompass the groundbreaking developmental issues⁸². In Europe, such networks are called «cluster initiatives», which are financed by cluster support programmes.

The overall framework for creating competence networks can be described on the example of the first federal initiative titled Bio-Regio programme (www.bioregio-stern.de). It was directed at new clusters, which have not yet grown stiff from long-term «fixating» on traditional approaches. Seventeen applications were submitted for programme participation, of which only three were selected. The winners received €90 mn upfront, with the level of support later increasing by another €1 bn thanks to excellent results of programme realisation.

No less important in the competence network initiative is the assessment system for submitted applications, since winners of the competitions are awarded considerable amounts of research and development financing. Poland, for example, can attract €100 mn for five years to cluster support only from the all-European Fund of the Operational Programme for Innovation Economy (Program Operacyjnego Innowacyjna Gospodarka)⁸³.

It is also worth to assign an important role to small and medium business in the structure of cooperation relations. The mechanism of its inclusion in realisation of national projects should be flexible and provide support both from the bottom-up and from the top-down. On the side of the government, it will be necessary to focus on adoption of a legislative package ensuring real possibilities for and encouraging the creation and functioning of clusters in the system of competence networks.

⁸² Hantsch S., Kergel H., Lämmer- Gamp T., Meier zu Köcker, G., Nerger, M. (2013). Cluster Management Excellence in Germany – German clusters in comparison with European peers. Berlin: Institut für Innovation und Technik, p. 14; Evaluation: Instrumente für eine bessere Politikgestaltung. [Jahresbericht 2013]. (2014). Berlin. Institut für Innovation und Technik

⁸³ Rekomendacje dla Polski / Portal innowacji klastry. Retrived from http://www.pi.gov.pl/klastry/chapter_86438.asp.

5.4. Development of cluster systems in the Visegrad countries

The formation of a cluster network in the Visegrad countries is based on two approaches: as a result of national and regional initiatives and spontaneously, that is, without state support. However, within each approach certain national peculiarities must be singled out. Even when examining the experience of the Czech Republic and Slovakia, which had a common historical development, researchers set out their own conceptual approaches. In particular, Slovakia has a milder support for cluster initiatives in comparison with the Czech Republic⁸⁴.

In the Czech Republic, the Operational Program Enterprise and Innovation (OPEI) and the COOPERATION-Clusters (2007-2013) program focused on the development of innovative potential, the use of new technologies on the basis of cooperation between industrial enterprises and research institutions in the long term. (CzechInvest, 2013). At the same time, participation in international projects was foreseen (for example, ERA-NET, CORNET). After the OPEI, the Operational Program for Enterprise & Innovations for Competitiveness 2014-2020 (OPEIC) was implemented, with the COOPERATIONCLUSTERS program. In order to receive funding for cluster initiatives, the applicant had to prove that the result of the activity would be innovation, to improve the quality of R&D infrastructure and to establish links between enterprises and R&D institutions.

The formation and development of cluster forms in Slovakia largely occurred without special regulatory materials. Only in 2009, the Slovak Innovation and Energy Agency identified 7 clusters in the country in the course of a study. Thus, the system of financial support for clusters from the state budget was created. The Scheme de

⁸⁴ Pavelková1 D/, Martina Sopoligová V., Bednář P. Impact of Cluster Policies on Structure and Management of Cluster Organisations in Czechia and Slovakia.-. URL: http://www.ramp.ase.ro/en/_data/files/articole/2017/29-01.pdf

minimis devoted to industrial COs was launched only in 2013. Table 5.1 and Table 5.2 show statistics on funds allocated in the Czech Republic and Slovakia to promote cluster activities. Czech Republic has relatively large funds dedicated to COs in comparison with the support of COs in Slovakia.

Table 5.1. Review of cluster-supported operational programs in Czechia (status in 2016)

Operational programme	Cluster supporting programme	Allocation (in 1000 EUR)	Min.-max. budget per project (in 1000 EUR)	No. of application	No. of supported cluster projects	Total amount of support (in 1000 EUR)
OP Industry & Enterprise	CLUSTERS, Mapping	17390	8-40	67	41	1260
2004-2006	CLUSTERS, Establishment & Development		120-1800	18	12	7921
OP Enterprise & Innovation 2007-2013	COOPERATION Clusters 1st call	40000	120-1800	30	17	22910
	COOPERATION Clusters 2nd call	30000	120-3200	20	22	28533
	COOPERATION 28 535 Clusters 2nd call-prolongation	20000	240-2400	43		
OP Enterprise & Innovation for Competitiveness 2014-2020	COOPERATION Clusters 1st call	18505	19-593	52	n/a	n/a
	COOPERATION Clusters 2nd call	1480	19-555	3	n/a	n/a
	COOPERATION Clusters 3rd call	15185	19-1480		n/a	n/a
Total amount					92	60 626

Source: Pavelková1 D., Martina Sopoligová V., Bednář P. Impact of Cluster Policies on Structure and Management of Cluster Organisations in Czechia and Slovakia.-. URL: http://www.ramp.ase.ro/en/_data/files/articole/2017/29-01.pdf

In the early 2000s, the national government of Hungary actively supported the development of corporate cooperation and clusters. The basis of such a policy was the idea of forming a strategy for regional economic development using cluster forms. To this end, in the spring of 2001 in the Pannonia region there were several competitive sectors of the economy with a large number of employees and a significant proportion of small and medium-sized enterprises, grouped around several large companies. This model is called "bottom-up"⁸⁵.

Table 5.2. Review of programmes supported COs from the state budget in Slovakia (status in 2016)

Cluster supporting programme	Allocation (in 1000 EUR) planned	Min.-max. budget per project (in 1000 EUR)	No. of applications	No. of supported cluster projects	Total amount of support (in 1000 EUR)
Subsidy for scientific and technical services 2012	250	20 - 80	n/a	5	250
Regional Operational Programme (2007/2013)	86	136 - 285	n/a	4	86
The Scheme of aid de minimis DM 3/2013	200	10 - 40	n/a	6	161
The Scheme of aid de minimis DM 18/2014	113	10 - 20	7	7	128
The Scheme of aid de minimis DM 18/2014, app. forf.y. 2015	130	10 - 20	12	7	130
The Scheme of aid de minimis DM 18/2014, app. forf.y. 2016	280	10 - 50	10	7	242
Total amount				36	997

⁸⁵OECD Science, Technology and Industry Outlook 2014. URL: https://read.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-industry-outlook-2014_sti_outlook-2014-en#page91

Source: Pavelková1 D/, Martina Sopoligová V.,Bednář P. Impact of Cluster Policies on Structure and Management of Cluster Organisations in Czechia and Slovakia.-. URL: http://www.ramp.ase.ro/en/_data/files/articole/2017/29-01.pdf

The first cluster in the Central and Eastern Europe region is believed to be PANAC (Pannon Automotive Cluster), which was created using such a model. It consists of four major automakers, several small businesses, three large suppliers, one university, two banks and several organizations able to provide consulting services, including the Regional Development Council.

During 2007-2013, Hungary developed a three-tier cluster program that included: start-up cooperation, establishment of clusters; developing clusters (at least 1 year track record); accredited clusters. In awarding grants priority was given to accredited clusters that met the following criteria: significant impact on employment; outstanding depth of cooperation between members; national or cross-border impact of cooperation among members; international market entry potential, and significant innovation potential.

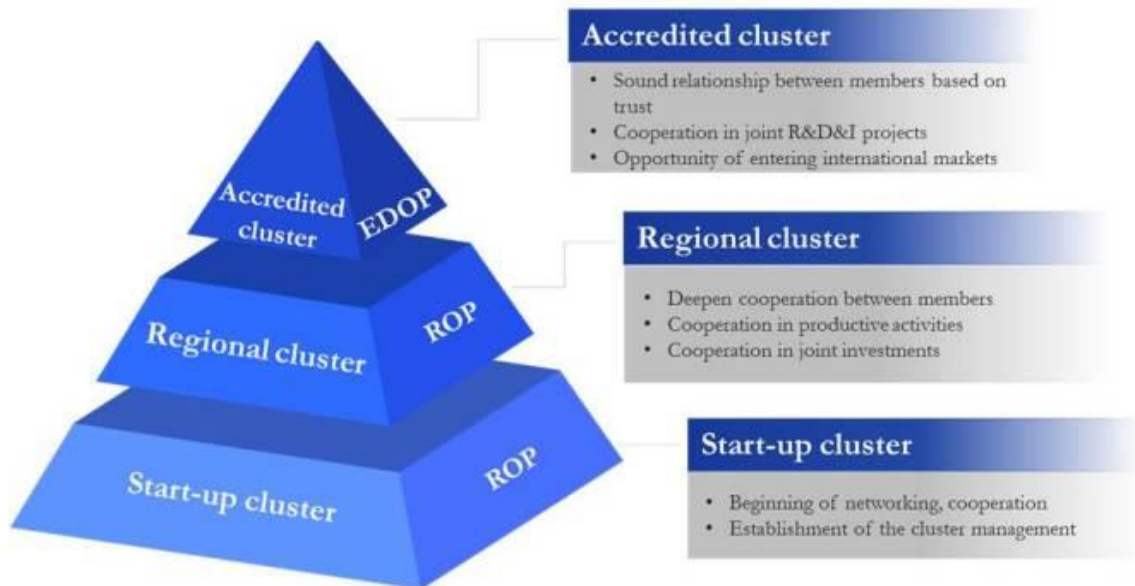


Figure 5.8. Three-level cluster development model 2007-13 in Hungary

Source: Evolution of cluster policy in Hungary - 2000-2020. URL: <https://www.clustercollaboration.eu/news/evolution-cluster-policy-hungary-2000-2020>

In 2013, 34 clusters had the Accredited Cluster label. Altogether, they had 1261 members of, which there were 1140 business organizations. The 34 clusters employed around 117,000 people and their aggregate income was over 9,500 billion HUF, one quarter of which came from export activities.

The 3-level cluster development model (Figure 5.8) and the available calls for clusters and for their members led to an explosion of the number of Hungarian clusters in the 2007-13 period (Figure 5.9).

The generalization of the 2007-2013 experience allowed Hungary to develop a new cluster strategy for 2014-2020. It was taken into account that only one third of 176 running and developing clusters could successfully use the received grants. The other clusters did not perform any real activities after the project implementation period. In the new environment, great importance is attached to international cooperation.



Figure 5.9. Supported Hungarian clusters 2007-2013

Source: Evolution of cluster policy in Hungary - 2000-2020. URL: <https://www.clustercollaboration.eu/news/evolution-cluster-policy-hungary-2000-2020>

Hungary's cluster policy till 2020 is determined by the following four components: cluster concentration, internationally visible clusters; implementation of successful and market-oriented projects; increasing international presence; strengthening regional clusters. New approaches to the preparation and implementation of a cluster policy developed by the Ministry of National Economy is presented on Figure 5.10.

Notably, Hungary is better than many OECD countries in the level of development of university science and R&D, in particular in the field of networking. There are extensive links between innovative firms, state research institutions and higher education institutions in the country. However, such connections are unevenly spread among the individual regions.

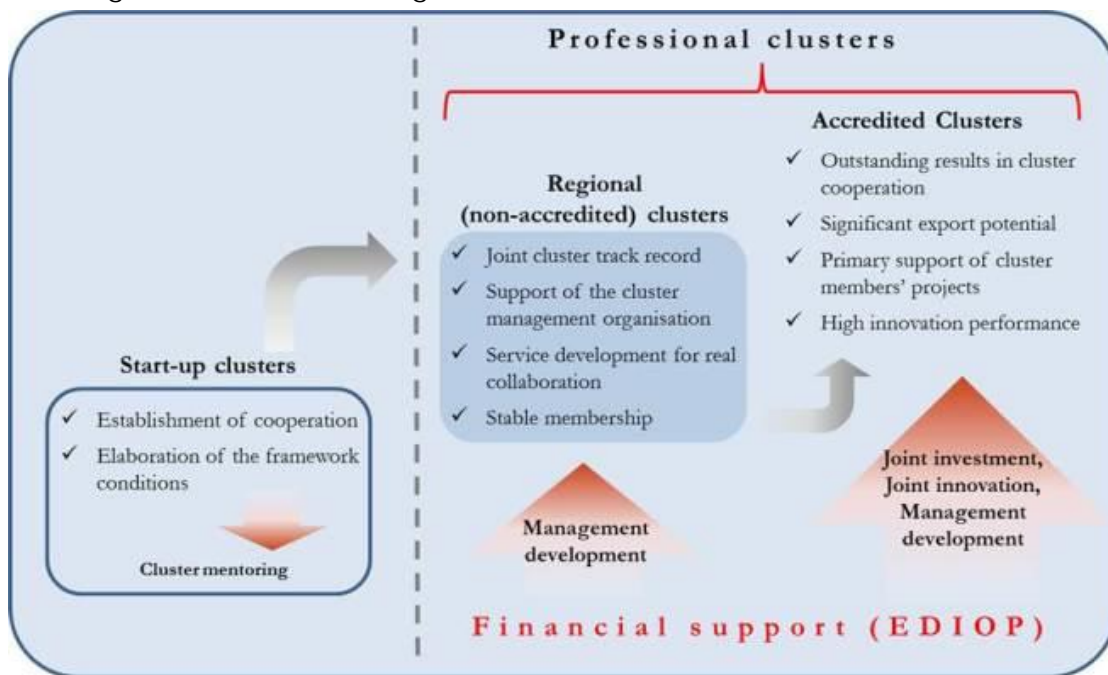


Figure 5.10. Cluster development model 2014-2020

Source: Evolution of cluster policy in Hungary - 2000-2020. URL: <https://www.clustercollaboration.eu/news/evolution-cluster-policy-hungary-2000-2020>

In general, Hungarian experience indicates that innovation policy is impossible without strengthening the links between inter-sectoral structures and research institutions at different levels. Such

connections should be more varied than merely traditional cooperation between industry and science in research and development. During the creation of cluster networks, the strengthening of cooperation between production and science can be done through building institutions that will specialize on tasks that are in line with the development of a cluster organization..

The formation and development of the Polish cluster policy coincided with the accession to the European Union and relied on the Lisbon Strategy to ensure the highest competitiveness by 2010, based on the construction of a knowledge-based economy. At the same time, in 2004 it became clear that such a task could not be solved by all EU members simultaneously with equal success. In these conditions, the emphasis was placed on increasing the role of local authorities in innovative development, in particular through creating conditions for cluster-based initiatives.

The first public references pointing to the need of cluster development in Poland were made in the programmes named *Sectoral Operational Programme. Increase of Economic Competitiveness for 2004- 2006* and *Operational Programme. Human Resources Development for 2004-2006*. The emphasis on supporting industrial cluster development and ensuring the conditions for network cooperation was included in the *Directions of improving economic innovation for 2007-2013*⁸⁶. This provided an opportunity for the intensive development of Polish clusters in 2006-2008 and the formalization of a series of structures in the 2009-2013, as part of the Polish cluster policy. The period featured provision of large financial resources for the creation and development of cluster initiatives, both in terms of national and regional programmes⁸⁷.

The development of cluster systems in Poland for 2014-2020 is characterized by an emphasis on supporting innovation and

⁸⁶ Ejsmont, A., Klemens, B., Moczala, A., (2016), *Klasy - kooperujące i konkurujące organizacje sieciowe*, Wyd. Texter, Warszawa. – P. 24

⁸⁷ Dyba, W., (2016), 'Współpraca i przepływ wiedzy w organizacjach klastrowych w _wieloletniej polityce klastrowej UE - przykład badania relacji _cz_cych przedsi_biorstwa z wykorzystaniem analizy sieciowej', [w:] *Prace Komisji Geografii Przemysłu Polskiego Towarzystwa Geograficznego*, nr 30(1). – S. 130.

knowledge transfer, as clusters constitute a natural field for this process on a large scale. At the same time, the causes of the failures of the past were eliminated. They consisted of the following: lack of management, **lack of the cluster members' activity**, **insufficient trust** or cooperation among members.

In addition, there were frequent cases where cluster were created in order to receive financial support, after which they ceased to function actively⁸⁸. At the same time, in the process of evolution, the goal was to exemplify the successful clusters and mechanisms for their functioning. Accordingly, programs of financial and organizational support for clusters were developed with the focus on so-called key clusters⁸⁹.

In 2015 a selection system for the Key National Clusters with a material importance for the national economy was introduced and characterized by high international competitiveness. Using this approach, 16 Key National Clusters were selected in 2015 -2016. These included: Aviation Valley Cluster, Interizon Cluster Metal Processing Cluster, Mazowieckie ICT Cluster, Polish Aluminium Cluster, Eastern Construction Engineering Cluster, "Green Chemistry" Zachodniopomorskie Chemical Cluster. The key national clusters in Poland that have to confirm their status in 2018 and 2019 are presented in Table 5.3.

The peculiarity of the Polish model for using clusters in the economic development of the country is that they are part of the Plan towards Responsible Development adopted in February 2016. According to this plan, in 2017, the Council of Ministers of the Republic of Poland adopted Strategy towards Responsible Development until 2020 (with a perspective until 2030), two of the three

⁸⁸ Klemens B. Cluster development policy in Poland. – URL: https://www.researchgate.net/profile/Brygida_Klemens/publication/326058593_Cluster_development_policy_in_Poland/links/5b35cbb90f7e9b0df5d8441f/Cluster-development-policy-in-Poland.pdf?origin=publication_detail

⁸⁹ Heffner, K., Klemens, B., (2016), 'Finansowanie struktur klastrowych w perspektywie 2014-2020 -wnioski dla klastrów na obszarach wiejskich', [w:] *Studia Obszarów Wiejskich*, tom 41, PAN IGIPZ, PTG, Warszawa. – S. 93

objectives of which deem clusters as a tool for the strategy's execution (Table 5.4).

Table 5.3. Key National Clusters in Poland - edition I and II

I competition for the KNC status (status valid until 30.09.2018):		II competition for the KNC status (status valid until 31.10.2019):	
Cluster name:	Discipline:	Cluster name:	Discipline:
Aviation Valley Cluster	aviation	Waste Economy and Recycling Cluster	environmental protection, renewable energy sources, recycling
Metal Processing Cluster	production of machinery, devices, tools	LifeScience Kraków Cluster	medicine, biomedicine, medical services, rehabilitation
Mazowieckie ICT Cluster	ICT	North-South Logistics and Transport Cluster	transport, logistics
Polish Aluminium Cluster	casting, metal processing	Sustainable Infrastructure Cluster	smart, sustainable construction engineering, energysaving and passive
Eastern Construction Engineering Cluster	construction engineering	MedSilesia - Silesian Medical Products Network	medicine, biomedicine, medical services, rehabilitation
“Green Chemistry” Zachodniopomorskie Chemical Cluster	chemistry	NUTRIBIOMED Cluster	LifeScience, food, pharmacy, cosmetology
		Silesian Aviation Cluster	aviation
		Eastern ICT Cluster	ICT

Source: Klemens B. Cluster development policy in Poland. – URL: https://www.researchgate.net/profile/Brygida_Klemens/publication/326058593_Cluster_development_policy_in_Poland/links/5b35cbb90f7e9b0df5d8441f/Cluster-development-policy-in-Poland.pdf?origin=publication_detail

The development of creative industries is an important area of clustering in the Visegrad countries. Their foundation is individual creativity, skills and talent in aspects that have a potential for wealth and job creation through the generation and exploitation of intellectual property. Creative industries emerged from the relationship between media and cultural sectors (Jeffcutt, 2000; Boggs, 2009).

The identification of creative and cultural clusters is based on the fact that they can specialize in these activities: music, print media

– books and press, object d’art – glass, ceramics, cutlery, crafts, jewellery, film, broadcast media, the “finer” arts – literary, visual and performance arts, architecture, design, advertising, games software, new media, libraries, museums, heritage, and photography⁹⁰.

Given the lack of statistical accounting, some characteristics of the development of creative clusters in the Visegrad countries can be obtained from the results of the sociological research conducted by the researchers Magdalena Bialic-Davendra, Pavel Bednář, Lukáš Danko, Jana Matošková at Tomas Bata University in Zlín⁹¹.

Table 5.4. Importance of clusters in the entries of the Strategy towards Responsible Development until 2020

Area of intervention	Purpose of area of intervention	Directions of intervention	Actions/tools
SPECIFIC PURPOSE OF STRATEGY: Constant economic growth based more and more on knowledge, data and organisational perfection			
Reindustrialisation	Improvement of the industry’s ability to cope with global competition	Development of modern industry	- Key National Clusters, - direct foreign investments clustering and networking the activity of enterprises
Development of innovative companies	Improvement of the innovation of enterprises on the domestic market and foreign markets	Mobilisation of private capital towards conducting R&D&I activity, improvement of the market potential of the conducted research and the degree of commercialisation of R&D work results	- increase in the topical focus of expenditure towards R&D&I based on National Smart Specialisations and Key National Clusters; - Animation of cooperation between the sectors of science and business as well as establishment of strategic business partnerships (broader use of the KNCs potential, among others)
		Stimulation of external demand for innovation by improving company abilities and eagerness to export and place direct investments abroad	- use of the structures of Key National Clusters as a platform for developing the export abilities of small and medium enterprises (KNC internationalisation)

⁹⁰ Bialic-Davendra M., Bednář P., Danko L., Matošková J., Creative Clusters in Visegrad Countries: Factors Conditioning Cluster Establishment and Development. P URL: https://publikace.k.utb.cz/bitstream/handle/10563/1006560/Fulltext_1006560.pdf?sequence=1&isAllowed=y

⁹¹ Ibid

Small and medium enterprises	Sector structural transformations New activity and cooperation forms	New activity models	Supporting existing and construction of new institutions integrating agricultural and food industry entrepreneurs and producers, especially of organisational structures supporting the investment, trade and innovative potential of entities (including clusters).
		Supporting local entrepreneurship drivers	- Supporting local and regional business environment institutions - cluster initiatives, professional services for agricultural holdings and entrepreneurs, also improvement of their accessibility to entrepreneurs from rural areas; - Supporting network cooperation between business environment institutions, entrepreneur
Expansion abroad	Improving the internationalisation of the Polish economy; Increase in the export of technologically advanced goods	Modernisation of the export offer	Integration of the state policy in terms of export promotion with activities aimed at the development of research, innovation and the cluster policy. “Internationalisation of Key National Clusters” strategic project.
SPECIFIC PURPOSE OF STRATEGY: Socially sensitive and territorially sustainable development			
Territorially sustainable development	Sustainable development of the nation, using individual potentials of particular territories; Strengthening regional competitive advantages; Improvement of the effectiveness and quality of incorporation of territorially-focused policies	Strengthening regional investment systems	Strengthening of pro-export oriented companies and economic clusters

Source: Klemens B. Cluster development policy in Poland. – URL: https://www.researchgate.net/profile/Brygida_Klemens/publication/326058593_Cluster_development_policy_in_Poland/links/5b35cbb90f7e9b0df5d8441f/Cluster-development-policy-in-Poland.pdf?origin=publication_detail

It was limited to Poland and the Czech Republic, as in Hungary and Slovakia at the time of the study the emergence of such clusters had only begun (Table 5.5).

Table 5.5. Creative clusters in Hungary and Poland (in 2013)

Cluster name	Country	City	Type of city	Year of establishment	Number of members	Creative sector	Level of cluster activity
Clusters which participated in the study							
Hungarian Mobility and Multimedia Cluster* ^a	Hungary	Budapest	M	2007	56	Multimedia	Bronze label
Wamp	Hungary	Budapest	M	2006	23	Design	Moderate
Creative Communication Cluster*	Poland	Warsaw	M	2011	25	Multimedia	Bronze label
Creative Cluster Locomotiva	Poland	Bielsko-Biala	NM	2011	50	Culture	Low
INRET Cluster	Poland	Cracow	M	2009	23	Culture	Low
PIOT Cluster	Poland	Lodz	NM	2010	43	Design	Low
Leszno Printing and Advertising Cluster*	Poland	Leszno	NM	2008	24	Printing and advertising	Bronze label
Silesian Design Cluster	Poland	Cieszyn	NM	2005	31	Design	Moderate
Clusters which did not participate in the study							
3D Creative Innovation Cluster	Hungary	Szeged	NM	2011	n/a	Multimedia	Failure
Av cluster	Hungary	Pecs	NM	2010	17	Multimedia	Low
Central Hungarian Printing Cluster	Hungary	Budapest	M	2001?	n/a	Printing and advertising	Low

Culture Creative Industry Cluster	Hungary	Pecs	NM	2007	32	Culture	Moderate
Creative Media Innovation Cluster	Hungary	Budapest	M	2008	30	Multimedia	Low
Advertising Cooperative	Poland	Poznan	M	2011	15	Printing and advertising	Low
BizArt	Poland	Elblag	NM	2011	16	Culture	Low
Creativro	Poland	Wroclaw	M	2011	21	Multimedia	Low
European Game Centre Cluster	Poland	Cracow	M	2008	20	Multimedia	Moderate
Furniture Design Cluster of Wielkopolska	Poland	Poznan	M	2011	16	Design	Moderate
LabDesign	Poland	Kielce	NM	2013	12	Design	Low
Lublin Cultural Cluster	Poland	Lublin	NM	2007	n/a	Culture	Low
Malopolska Graphic Cluster	Poland	Cracow	M	2012	20	Printing and advertising	Moderate
Mazovian Printing and Advertising Cluster	Poland	Warsaw	M	2007	19	Printing and advertising	Bronze label
Media Cluster	Poland	Lodz	NM	2007	59	Multimedia	Low
MultiCluster	Poland	Nowy Sacz	NM	2006	54	Multimedia	Bronze label
Printing Cluster ITTP	Poland	Cracow	M	2008	18	Printing and advertising	Low

Note: a *Cluster appointed a “bronze label” under ECEI, assessed by ESCA. b M - Metropolitan, NM - Non-metropolitan.

Source: Bialic-Davendra1 M., Bednář P., Danko L., Matošková J. Creative Clusters in Visegrad Countries: Factors Conditioning Cluster Establishment and Development. P URL: https://publikace.k.utb.cz/bitstream/handle/10563/1006560/Fulltext_1006560.pdf?sequence=1&isAllowed=y

The research showed that the highest number (9, i.e., 36%) of clusters was found in the area of multimedia, followed by clusters in the printing and advertising sectors (24%), culture/arts sector (20%), and design (20%).

Despite the fact that the first creative cluster was created in 2001, the real development of creative clusters started in 2005, after the EU accession. In Poland, 2011 was the peak of creative clusters emergence. As for Hungary, its specificity is to quantitatively reduce typical clusters through the formation of creative clusters in the metropolitan city of Budapest. 4 out of 7 clusters dominate in the Hungarian metropolitan city of Budapest. This is due to its population as well as its characteristic as the headquarters of the national economy. In Poland, on the contrary, these types of clusters are more spatially dispersed and are located in two west-east corridors, i.e., Wrocław - Cracow and Poznan - Lodz - Warsaw - Lublin, concentrated mostly in populated areas. Cracow has the highest number of creative clusters in Poland (4). Polish and Hungarian cultural clusters mainly locate in non-metropolitan cities, where their development is supported by public and non-profit organisations.

The peculiarity of creative clusters is different approaches to profitability. Non-profit clusters operating mainly in the cultural and artistic sector for government orders are highly dependent on state subsidies. The field of multimedia, printing and advertising are regulated by the market principles. In the design sector, creative cluster members focus on large businesses, low subsidies, small-scale and tailor-made production, where employees usually have flexible assignments.

The emerging trend in the development of a creative clusters network suggests that their creation is based on the "bottom-up" model. Cases of cluster creation following the "top-down" model are not frequent. As a rule, they arise as a result of cooperation with government organizations and foreign partners. One can also define the subordination of the motivational priorities for making creative clusters. The main ones are: the need for a creative search network,

combining competencies for R&D, use of legislation to grant cluster organizations subsidies, and other forms of financing activities and lobbying. At the same time, the further development of creative clusters calls for a creation of a mechanism for removing barriers, especially those that gain topopolmonary distribution. The barriers in the V4 countries include insufficient exchange of internal information and practical experience, lack of public interest in creative clusters, and administrative obstacles.

5.5. Clusters in the process of shaping a new Ukrainian economy

Using the experience of German competence networks in the Ukrainian conditions requires that priorities for science and technology policy be set. Even such a developed country as Germany cannot afford allocating financial support «to order»; thence, Ukraine should be especially careful with channelling funds to directions that can hamper the formation of the knowledge economy.

It would be logical to build this process according to the scheme «priorities – human and material providing – financing». However, in the modern conditions, this process should be reverse. The scarcest resource in Ukraine is finance; thence, it is primarily important to define the necessary and possible volumes of investment for competence networks, and in view of this to substantiate the priorities.

The priorities in the science and technology sphere of Ukraine should first be determined as alternatives for consideration. Recently, they have been indirectly discussed in connection with the forced re-orientation of export flows from the Russian market to the European market. They can be arranged in the following order:

1. Agriculture and food industry;
2. Medicine and medical tourism;
3. Machine- and ship-building;
4. Aviation and space industry.

It should be noted that fundamental research in agriculture, food industry, medicine, and medical tourism can have one inter-industry programme. At the intersection of these sciences, one should always expect the appearance of the most perspective directions for applied research, which will be adjusted to know-how in manufacturing and practical medicine. The respective methodology can lay the basis for the strategy of building a competence network, which would encompass machine- and ship-building and aviation and space industry. Such approaches allow to achieve maximum results with minimum expenses.

It is worth to anticipate that in the case if the competence network initiative is launched, there are high chances that a temptation may arise to monopolise access to finance based on the region's existing industry position. Thus, in machine- and ship-building, Dnipropetrovsk, Kharkiv, Mykolayiv, Odessa, and Kyiv might claim to have exclusive rights to shape the industry's science and technology policy. In order to prevent this, it is worth to choose a new geographic location for the coordination centre of the competence network, for example, the centre of the country. This will make it easier to attract new human resources than it is when the industry's largest enterprises and organisations are located in traditional places.

As shown in Figure 5.11, it is reasonable to select Central Ukraine as a place for the coordination centre of the competence network for agriculture and food industry. This could be South of Vinnytsya oblast, where the climate is similar to that in almost all regions of the country. The Centre for medicine and medical tourism could be Western Ukraine, which has comprehensive conditions for scientific research in the sphere of medicine and creation of new medical facilities based on using the factors of nature and climate. For coordination of new approaches in the machine- and ship-building industries, it is reasonable to consider Kyiv oblast (not the city of Kyiv), or the angle made by South of Kyiv oblast – North of Khmelnytskyi oblast – South-West of Cherkasy oblast. They are located close to leading science and technology institutions (Kyiv, Zhytomyr,

Poltava, Kharkiv, Dnipropetrovsk, Chernihiv). Locating the coordination centre of the competence network for aviation and space industries in the Land of Kirovohrad is feasible in view of the economic and political factors. This region is relatively far from the borders and is not densely populated, which contributes to better security of commercial secrets. Moreover, the Flight Academy of the National Aviation University is located in Kirovohrad oblast.



Figure 5.11. Locations for coordination centres of competence networks in Ukraine (project)

The creation of centres for competence networks will provide for development of their human and material assets, which will be responsible for key scientific problems and involve best clusters towards achievement of the end objective. With time, they will lay the basis for national science and industrial corporations with global strategic goals. Certain distance of the centre from main oblast cities will allow to avoid corruption in selection of personnel and to facilitate the settlement of everyday problems. For that, it will be necessary to allot territories for construction and development of scientific-industrial and housing complexes.

The prototype of such an approach can be found in the policy of cluster support in Great Britain, where the North East Process Industry Cluster (NEPIC) in the chemical industry was created in 2005 in Teesside as one of the most successful clusters in North-Eastern England.

The cluster turned out to be rather successful, especially in what concerns attracting new investment. Its staff was mostly local because chemical industry is a place for successful careers.

NEPIC evolved as a result of two regional cluster initiatives: Pharmaceutical & Speciality (P&S) Cluster and the Teesside Chemical Initiative (TCI). Their members came to conclusion that pharmaceutical and chemical industries are so interconnected that can generate mutual integration benefits.

The area of cluster's activity includes pharmaceuticals; biotechnology; chemicals, polymers, rubber, petrochemicals and other products. In these industries, the company has become a driving power of regional and national economic development. Companies of the cluster contribute nearly one billion pounds sterling annually to regional GDP (25%) and account for 20% of regional employment. In terms of output, petrochemical industry in Teesside ranks first in Great Britain and second in Europe.

The formation of new competence networks under the policy of transforming the national economy into the knowledge economy requires a systemic approach to selection of participants. It should be based on taking into consideration the socio-economic tendencies that are inherent to the country within the respective period in its development. It is especially important to perform the assessment of legal providing for development of long-term complimentary cooperation, which would make it impossible to break the network, that is, to exit from the system of important links, which can slow down or even hamper the achievement of the goal. The operation horizon for all project participants should be global so that to guarantee the high competitiveness of final products.

There is no need to prove that generation of new knowledge requires that research and education institutions be included in competence networks. However, in Ukraine, the mechanism of functioning of the former was «conserved» in the first half of the 20th century. The new Law on Higher Education approved by the Verkhovna Rada of Ukraine in June 2014 brings it closer to European standards. However, the search for a new organisation model for science and education activity cannot stop at this point. On the contrary, the approved law creates certain grounds for a new search process. At the same time, one should take into account the experience of granting new functions to academic centres, which developed after the World War II in the USA, in particular the pioneering experiments in organisation of business contacts performed by Massachusetts Institute of Technology (MIT) and Stanford University.

The commercialisation of scientific research becomes no less important for the new approaches than are science and education. According to Matusyak⁹², the task of higher educational institutions in the era of globalisation is to transform themselves into international centres for entrepreneurship and technology transfer so that to raise the quality of education and scientific research. Academic transformation is a specific combination of the ideas proposed by Humboldt (unity of education and scientific research) and Shumpeter (creative destruction).

The commercialisation of scientific activity should not be dependent only upon subsidies and various grants. No less effective can be the cooperation mediated by institutions specialising in organising direct contacts between science and business. Such practice is developing in Great Britain, where the Agency for Regional Development developed 9 programmes on creation of the Centres for Industrial Collaboration (CICs). They promote the adjustment of regional science and technology resources to the needs of entrepreneurs by facilitating their access to the most recent achievements of science

⁹² Matusiak, K. (2006). (Ed.). *Innowacje i Transfer Technologii – Słownik Pojęć*. Warszawa, Polska Agencja Rozwoju Przedsiębiorczości, p. 313.

and technology. The realisation of the programme allowed expanding the tasks of local universities towards marketing, market research, elaboration of pricing policy, negotiating, and contracting. The orientation of universities towards needs of the business is underscored by the fact that CICs locate their offices in the direct vicinity of universities' degree-granting departments.

The fact that enterprises cooperating with the CICs do not receive any grants made companies understand the value of research financed from their own funds. Apart from that, the inclusion in the CICs network enabled access to world-class scientists and industrial modernisation with installation of top-quality equipment. It is important that the orderer of research managed to ensure its implementation within the agreed time and within the specified budget⁹³. Thus, in Yorkshire & the Humber region, the CICs initiatives resulted in growth of sales, expansion of access to new markets and business development for hundreds of enterprises. CICs cooperated in performing 1700 projects together with enterprises for the total value of £40 mn, preserving 1300 jobs in the region⁹⁴.

Development of the state cluster programme must clearly determine the level at which it is aimed. Since cluster approach is primarily a managerial technique of integrating small and middle enterprises, it should be fundamentally targeted at raising the competitiveness of the region, where cluster participants are located. It is through the prism of the region that the influence of clustering on the development of industry and the state should be analysed.

The development of cluster policy has a multi-functional governance structure and depends on the profile of cluster's management subjects. It is feasible to differentiate clusters according to star methodology. This system was developed by the experts of the European Cluster Observatory by analogy with hotel classification. It has

⁹³ Sztern, Ł. (2013). Współpraca nauki z biznesem. Formy i narzędzia wspierania. In: Współpraca nauki i biznesu. Doświadczenia i dobre praktyki wybranych projektów w ramach Programu Operacyjnego Innowacyjna Gospodarka na lata 2007–2013.

⁹⁴ European Commission: Centres for Industrial Collaboration. Retrieved from https://www.google.com.ua/?gws_rd=ssl#q=Centres+for+Industrial+Collaboration+.

four grades – zero, one, two, and three stars, which are assigned to clusters based on indicators of size, specialization and location quotient.

In view of the peculiarities of cluster organisation, the priority directions within the cluster policy framework should be the orientation towards market challenges and leadership in the technology and product aspects, entrepreneurial activity; marketing and PR, internal communications; application of advances in science, generation of new knowledge, innovations, and unique value.