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RESEARCH CONTRIBUTION TO THE COMMUNITY DEVELOPMENT

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Abstract. Today all countries are adopting development strategies based on the knowledge economy. Cities become promoters of innovations by offering an innovative ecosystem following the connections that arise between all actors, thus adopting the concept of Smart City. This article argues the importance of the research component generated by universities and research institutes for the community development. The cluster approach is an effective tool to take into account the interests of the scientific and educational environment and the business community needs, creating conditions for knowledge and innovations transfer into the real economy. Particular attention was paid to the role of government policies to stimulate clusters development and to stimulate the participation of science component within partnerships of universities and research centers with business sector.

Keywords: *economic development, innovation economy, innovative cluster, innovation ecosystem, knowledge transfer, smart city.*

Introduction

Today all countries are adopting development strategies based on the knowledge economy. Cities become promoters of innovations by offering an innovative ecosystem following the connections that arise between all actors, thus adopting the concept of Smart City.

A smart city is a concept of urban development that integrates technologies and systems to efficiently and securely manage the resources of a city, in order to improve the citizens' quality of life, to develop the community and to protect the environment. These include, but are not limited to: Local IT departments, Transportation systems, Hospitals, Water distribution networks, Waste management, Schools, Libraries, Public agencies, other community services.

Smart city projects are extremely complex, and the role of research (generated by universities and research institutes) is enormous. In order to achieve the objectives of an intelligent city, on the one hand, local authorities rely on information technology and these are the *hard strategies* - the smart technology of the urban infrastructure, and, on the other hand, the development of human capital through education, culture, social inclusion and social innovation is realized and this are *soft strategies*. Human capital enables technology adoption and the innovation process and relies on all levels of education – it includes the technical and managerial skills involved in a variety of innovation activities - from R&D, design and engineering, to technology transfer and networking.

Today, a strong technical and vocational, basic and higher education system should provide basic science, technology, engineering, mathematics and management skills. With new technologies certain skills have become more essential -(problem solving, creativity, teamwork and ICT skills).

Research and innovation systems are complex ecosystems that require multiple elements to function optimally. These include a strong public scientific base that produces high quality results, an intense participation of enterprises in innovation activities, fluid and abundant knowledge flows between actors in the field of research and innovation (RI), and good framework conditions to enable innovation to develop in companies.

Innovation systems develop over time, co-evolving with their political, economic, social and environmental contexts. Thus, it is not possible to affirm that there is a single way of building and managing innovation systems that can be replicated between countries. All innovation systems, however, share common features which can be classified into three domains: actors, connections and the framework conditions and environment enabling knowledge transfer and technology development. Local economic development demands effective specialization and respecialization, driven by innovation, entrepreneurship, and strong institutions.

Innovation ecosystem: actors and existing linkages, role of research component

The connections and relationships between actors is a vital component of any innovation system. Effective innovation allow organizations to translate new knowledge into innovations and enhanced productive capacity, enabling adoption of technology, learning, and new technology development. Such collaborations within supply and value chains, including organizations financing innovation and the final users of new technologies, ensure that innovation responds to demand on behalf of industry or business sector.

Actors participating in innovation eco-system are multiple. To better understand the functioning of the innovation eco-system there is a need to recognize the roles and capabilities of all key actors:

- **Private sector representatives** have the capacities to learn, absorb, innovate and commercialize new knowledge and innovation technologies.
- **Research institutes and universities** have the capabilities to learn, absorb and develop new applied knowledge (directed to needs of real sector), and to supply human capital to the innovation system.
- **Civil society and citizens** have the capabilities to challenge non-inclusive and unsustainable practices, form alliances to lobby for change, mobilize and drive innovation process.
- **Government** has the capabilities to mediate innovation priorities, direct public resources into priority areas, support capabilities and connections in the innovation eco-system, define and enforce regulations and standards, create favorable framework conditions through public policies.

All actors in the innovation system, however, should build capabilities to engage in different forms of collaboration, ranging from information exchanges, to forming innovation partnerships or clusters which can become actors on their own.

The research systems are vital for innovation ecosystems. Researchers can offer various supporting services, from testing new technologies to fully transfer research and innovation activity into practice.

On the other hand, universities improve the quality of human capital available to firms, governments and research institutions. A modern education system should be relevant to the changing needs of private sector, industries and consumers, and to the challenges of the Sustainable Development Goals.

The research component (universities and research centers) participates in ecosystem development through the following activities: commercialization of research results, involvement of researchers, support for start-ups, creation and growth, access to finance, entrepreneurial education of students and creation of entrepreneurial climate within universities and research centers.

International studies have shown that the most valuable services provided by the RI systems (RIs) for ensuring the innovative development of an ecosystem are research marketing, entrepreneurship education and academic engagement (see figure 1).

The most common and traditional type of interaction for researchers with business is by means of *publications*. A carefully managed publication strategy of a research institute may increase the impact of RIs on the community economic development, of course in conditions of not compromising the other strategic objectives pursued by the RIs related to commercialization of their proprietary IP.

Conventional means of disseminating scientific results such as through *workshops, communications at various scientific events, forums and networking formats with industrial partners* should not be underestimated as a potential means of interaction with business community.

Training on demand of business community also is an efficient means of knowledge and know-how transfer and can bring important benefits for industrial partners. On the other side, training of researchers in business or industrial sector is also a way of science and business interaction, allowing the access of human potential to necessary infrastructure for the development of applied knowledge, as well as transfer of innovations for the community development, including provision of necessary specialists and expertise. Although it must be said that this type of interaction is limited to a relatively small group of high-tech, high value added companies and the results of such an interaction have the potential to be transferred into high value added and high growth for industrial partners.

Another type of interaction of research community is through *joint research projects with industry*. This type of interaction requires a dedicated funding mechanism, including a mechanism that identifies and selects the topics and partners for future research. It is important to balance out the scientifically challenging research with industrial needs for the maximization of the research impact for the community development. There should be developed specific activities to engage industry partners and other organizations, while *the research institutes should be placed at the centre of the ecosystem through open and collaborative leadership*. Researchers should collaborate with industry and business community to identify future skills and technology needs, and invest in such projects within the universities and research institutes.

Interaction through *licensing of intellectual property* represents a more conventional type of technology transfer, which is usually carried out by a dedicated department within a research institute or university.

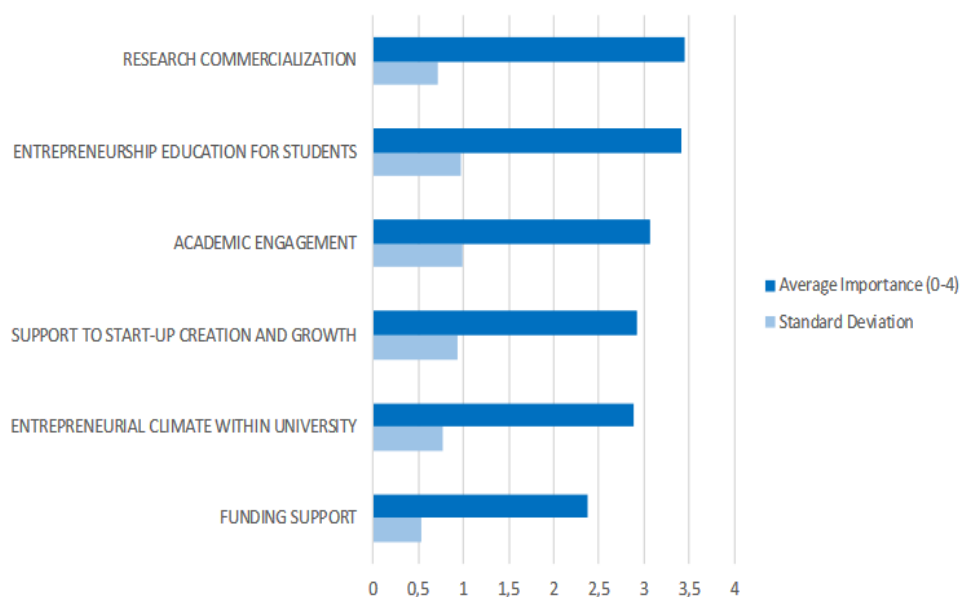


Figure 1. Research contribution to innovation eco-system.

Source: made by authors

Technology Transfer (TT) happens more likely in the formation or development stages: here TT runs in a “co-solution” mode, where scientific and industrial partners develop solutions on shared problems, often under the very pressing deadlines.

The existence of a dedicated mechanism for identification of commercially viable ideas and their targeted support through *spin off creation, business incubation and acceleration services* represents a powerful means of stimulating economic spill-overs of RIs. Participation within networks comprising of diversified actors (idea generators, incubators, finance, marketing etc.) will allow research institutes enhance the entrepreneurial ecosystem. There should be organized teaching and research activities so that they provide multiple spin-off benefits to other actors in the ecosystem.

There are numerous forms of cooperation with indisputable benefits, but the reasons for cooperation between research component and business or industry are very diverse. Cooperation with the industry enables universities or research centers to supplement funds for their own research, to solve technical and design problems, develop new processes and products, improve product quality, conduct research, and other activities [4].

At the same time, this cooperation provides universities with opportunities to build their entrepreneurial role; get business opportunities; have access to equipment and data; and also get opportunities for student internship and job placement. Interactions with industry provide learning opportunities for universities through new knowledge and insights on industry; feedback from industry; information about problems faced by industry; application possibilities of research; and becoming part of the industry network [10]. Cooperation with universities, in turn, provides the industry with expertise, access to fundamental scientific research results obtained at universities, cooperation in research and development, and cooperation in the conduct of the education process.

Research-Industry cooperation represents a basis for reaching innovations, developing new products, improving research and development (R&D), producing new knowledge, faster transmission of discoveries of research from lab settings onto the market, as a source of competitive advantage. Therefore, cooperation has a significantly positive impact on

economic development and performance of associated organizations, as well as on their innovations' productivity and knowledge creation [10].

Role of innovational clusters for connecting research community with business

The effective means to connect research to business environment is through clusters associations. The cluster approach is an effective tool to take into account the interests of the scientific and educational environment and the business community, as there are created premises for conditions for the production and implementation of innovations. Today, companies exist in a much more complex system, where business strategies, interests of the state and regions, information flows, access to the latest technologies, distribution channels and much more are intertwined. In conditions of global competition, the possibilities of single companies are limited. Therefore, they are trying to come forward with the Government, science and business on a united direction.

In more general terms, clusters can be defined as a group of firms, related economic actors, and institutions that are located near each other and have reached a sufficient scale to develop specialised expertise, services, resources, suppliers and skills [1].

A common element of most cluster definitions is the aspect of a concentration of one or more sectors within a given region as well as the emphasis on networking and cooperation between companies and institutions.

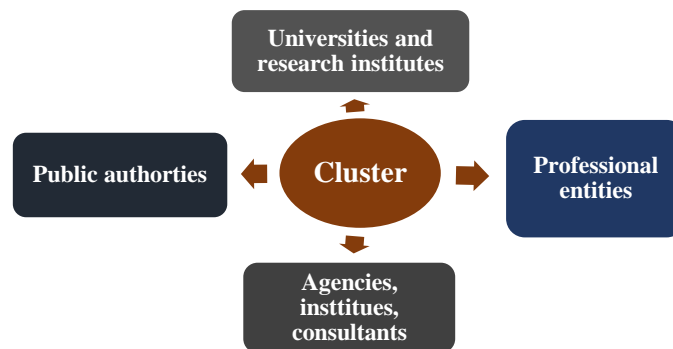


Figure 2. Cluster Four Clover Model.

Source: [1, p. 14].

The cluster is a good platform for dialogue and interaction of participants with business. The ability of regions to support the creation of young, high-growth firms seems to be particularly important, as these are the vehicles for innovation and the quality job creation that results [7].

An innovative cluster has a significant difference from its industrial counterpart. Its essential characteristic is close cooperation not only between companies, customers and suppliers, but also cooperation with large universities and research centers generating innovations (see figure 2). Thus, it is possible to coordinate investments in the development of new products and market them using new technologies. The peculiarity of the innovation cluster also lies in the fact that its products are mainly exported, since it is competitive in the world market.

Among the factors motivating the integration of organizations within an innovation cluster, are:

- increasing the ability of enterprises, including SMEs, to attract investment and grants;
- ensuring compliance with the requirements of enterprises to the level of education and qualifications of graduates;

- expanding access to information about market needs and promoting small business products and services to the market of large enterprises;
- improving the efficiency of research activities by providing a high material and technical base.

It is assumed that the main actors of the innovation cluster will be:

- 1) direct producers of innovative products and services - employees, students and graduate students, as well as scientific organizations;
- 2) consumers of innovative services, providing conditions for innovative and educational activities;
- 3) regional and municipal authorities, expert territorial community, defining the boundaries of the cluster and involving him in solving social problems of the region;
- 4) investors and venture funds;
- 5) education managers, organizing the relationship of the subjects of this cluster.

A region's schools, universities, and research centers determine the quality of workers and the amount of local innovation. A region's physical and digital infrastructure shapes how workers connect with businesses and how businesses connect with each other. And the networking, information exchange, and collective action enabled by civic institutions—such as chambers of commerce, business leadership organizations, and industry associations—can shape a region's resilience to shocks by galvanizing and activating leadership networks to address shared challenges [5].

The meaning of the functioning of the innovation cluster is to obtain the synergy effect from the connection in one innovation cycle of research, educational, innovative, industrial activity. It is recommended to divide such special functions into three blocks: scientific-innovative, educational and industrial.

Within the production block, it is possible to single out the development of new types of products and expanding the assortment, raising the technological level of production and modernizing the material and technological base, and manufacturing prototypes of equipment.

All three blocks of functions are closely interconnected and complement each other, forming a system for the dissemination of knowledge and the reproduction of human and intellectual resources.

Increased demands on universities and research centers to support the innovation process are partly a consequence of changes in the nature of innovation patterns in the business sector that have limited the ability of private firms to support basic research. Under competitive pressure to introduce new products, processes and services more quickly, many large companies have restructured their R&D operations to link research programs more tightly with product development processes. [11].

University-industry interactions take many forms, which can be roughly classified into two groups [10]:

a) Training and teaching activities:

- active participation of industry in planning and designing university study programmes;
 - support from industry in form of equipment donations, student scholarships, teaching grants etc.;

- participation of experts from industry at universities as part-time or visiting professors, or lecturers.

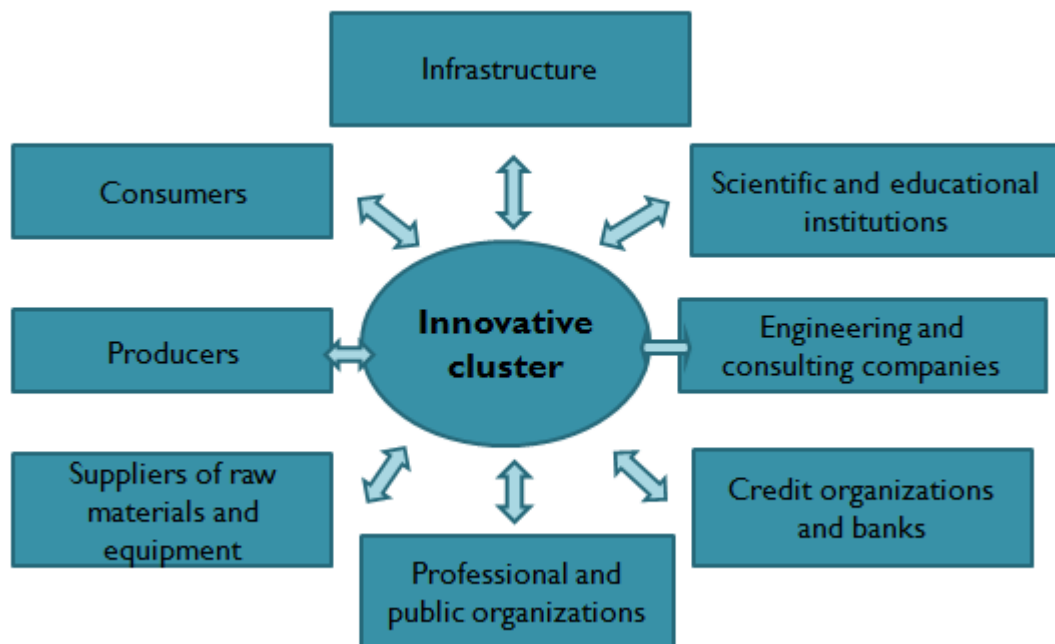


Figure 3. Innovative cluster.

Source: made by authors

b) Research activities:

- tangible industrial support to the university: research contracts, research grants, direct funding of research institutes or university departments, equipment donations, opportunity to use industry research facilities, etc.;
- exchange of knowledge: industry projects with the participation of students by writing theses or seminar papers; joint research; hiring of research-oriented students; student volunteers' internship, industrial consulting by university staff; bilateral staff exchange, etc.;
- technology transfer: patent sale or licensing, joint ventures for the commercialization of joint research, creation of spin-off firms;
- creation of business incubators, centers of excellence, technology networks and platforms, convergence laboratories and technology centers and parks).

There is a high number of factors that affect collaboration between universities and research institutes and the industrial sector in knowledge transfer. The most common factors are motivation, social networks, organizational culture, communication, project management and knowledge management. In addition, factors with lower frequency include trust, funding, size, geographical location, evaluating potential partners' technological capabilities, absorptive capacity, information and communication technologies (ICTs), etc. [10].

Policy incentives on connecting research component with business activity

Local authorities should take the following actions to create a greater flexibility and responsiveness between research and business sectors, which include:

- Deciding jointly with academics what is meant by consultation;
- Building more effective mechanisms for advocacy, fund-raising, consciousness-raising, public relations, and including the private sector in community development;

- Telling communities what municipality help is available, and what are municipality expects;
- Increasing transparency of outgoing research projects, or projects within consortiums.

Also, local authorities, working with academics, should set research guidelines for the maximization of the research impact for the community development. The guidelines would help decide what outside resources the community needs, it would also set out the role of the researchers, the people being researched, and would address the question of ownership of research. Government should set criteria and processes to determine what research should be funded. Communities often find it difficult to see how research, in particular long-term research, has a practical impact. If the community cannot see a benefit from the research, then the community will not allow the research. Research project proposals should include an evaluation process, and research funds should include money for development of proposals. It would be welcome a manual which listed funding sources by organization which included a description of the eligible projects. It would also be useful to have a directory of past and current research. They should also receive guidelines to determine appropriate roles and responsibilities of everyone involved in the research.

For example, at the provincial level of Canada, cluster policy receives active support in the form of funding for research, educational programs, attracting foreign investment and the provision of related services. The leading role here is played by regional development agencies, which are management companies under the provincial government. The most significant role in the implementation of the cluster policy is exercised by local governments. Their tasks include a wide range of issues - from creating educational programs to updating all key infrastructures for clusters [2].

To maximize the potential economic benefits of the R&I ecosystem, businesses need to operate in an environment that allows them to effectively turn knowledge into economic benefits. This depends not only on the quality and quantity of the scientific and technological achievements, but also on the framework conditions in which they operate. Therefore, it is essential to create a favorable environment for R&I investments, as well as for entrepreneurial activities through structural reforms and effective policy instruments. In addition, other framework conditions, such as the tax system, financial development, availability of skilled labor, efficiency of public administration and the rule of law can have an impact. The set-up of cluster organizations or networks is often supported by a clear mandate and public funding from authorities at regional level or more spontaneously initiated within the triangle of universities, incubators and finance, in view to overcome obstacles to cooperation and allow trust building between partners. When mature and successful, cluster organizations tend to raise the majority of their operating costs themselves by membership and service fees, participation fees for training and conferences, sponsoring, etc. [9]. Both returnees and future researchers usually contribute to increasing the quality of scientific results as a result of their exposure to other methods of conducting research and their contribution to an international research network. Therefore, for the countries most affected by exodus, it is essential to implement policies to reintegrate researchers into their home system or to attract international-level researchers. This may also encourage those who remain to increase their productivity. In some Member States benefiting from a high quality public R&I system, cooperation between the scientific and business environment may remain limited because of the mismatch between public research capacity and the needs of the

economy. An essential lever for the cooperation between the scientific environment and the business environment is, therefore, represented by the design and implementation of "smart specialization strategies" that concentrate resources on the areas where there is potential for absorption by companies.

In many Member States, although such a strategy exists, it is not being implemented effectively. In addition, governments can also use a set of policy tools that contribute to better channeling public research capacity to the needs of industry and the economy.

To stimulate the participation of science in clusters, the following measures can be distinguished:

- increased funding for basic research and priority scientific and technological areas, implemented mainly in the framework of state programs;
- diversification of a set of tools and mechanisms of public-private partnership in research and development.

Many cluster strategies fail because regions spread resources that would barely be sufficient to develop one cluster across four or five. Determining which one or two clusters in a region have the most growth potential and best align with economic development goals matters because, as the case studies accompanying this paper demonstrate, supporting a cluster can be expensive and time-consuming.

Most regions assume that the "right" clusters can be identified through analysis of employment and output data. In reality, cluster identification is more art than science [6].

State actions aimed at maintaining and developing clusters can be diverse:

- Conducting educational activities aimed at preparing for the implementation of cluster projects and managing them. For example, in Denmark, as part of the competitiveness program for each of the clusters, specific support measures have been developed during the dialogue between the firms that are part of the clusters and the authorities at various levels;
- Development and compilation of theoretical materials necessary for strategic cluster planning, as well as promoting institutional development of clusters: initiating and supporting the creation of a specialized organization for cluster development, as well as activities for strategic planning of cluster development, establishing effective information interaction between cluster members and stimulating enhanced cooperation between them;
- Providing financial assistance to increase the pace of cluster development. One of the most common methods of financial assistance in international practice is the provision of subsidies for the development of certain industries, the most beneficial for increasing the country's competitiveness. As a rule, the implementation of cluster strategies involves the existence of grant-forming funds (institutions, agencies) that support cluster initiatives. Funding structures must support more bottom-up, high-risk, emerging and breakthrough science and technologies with leading researchers working in an open innovation context ensuring that there is a greater space for emergent supply chains;
- Reducing the pressure of administrative barriers on enterprises forming clusters, for example, reducing the time for examination of documents, accelerating the decision on the results of inspections, etc;
- Providing tax incentives for enterprises included in the cluster as a measure of stimulating production and expanding the activities of organizations. At present, lowering the income tax rate is one of the most effective instruments for stimulating cluster growth and attracting investments;

- Creation of flexible and simplified funding mechanism to ensure synergies between European and national or regional public funding instruments for research and innovation;
- Creation of effective tools and mechanisms to allow for top-up funding of costs at universities, and the innovative blending of grant, loan and equity-based forms of investment. Funding instruments should require the establishment of an effective assessment system for the `health` of an ecosystem based on multiple factors, e.g. start-ups, growth, acceleration, retention of talent, through adaptive approaches designed to recognize open ecosystem strengths and weaknesses.

Conclusions

1. To maximize the potential economic benefits of the R&I ecosystem, businesses need to operate in an environment that allows them to effectively turn knowledge into economic benefits. This depends not only on the quality and quantity of the scientific and technological achievements, but also on the framework conditions in which they operate. Therefore, it is essential to create a favorable environment for R&I investments, as well as for entrepreneurial activities through structural reforms and effective policy instruments. In addition, other framework conditions, such as the tax system, financial development, availability of skilled labor, efficiency of public administration and the rule of law can have an impact.

2. The role of the Government is crucial in the promotion of knowledge-based economy – from establishing and development of policy priorities, directing resources towards these goals, to the creation of linkages in the innovation system, and promoting collaboration across government and with other key actors. Government should improve framework conditions through policy actions aimed at removing bureaucratic, regulatory or monopolistic obstacles to innovation; reducing the pressure of administrative barriers or providing tax incentives to enterprises that implement innovations and technology transfer, that create partnerships with research centers or universities. The policy and regulatory framework should provide incentives to established and emerging firms to invest in learning, knowledge and innovation.

3. The effective means to connect research to business environment is through clusters associations. The cluster approach is an effective tool to take into account the interests of the scientific and educational environment and the business community, as there are created premises for conditions for the production and implementation of innovations. The cluster is a good platform for the dialogue and interaction of research component with business.

4. The ability of regions to support the creation of young, high-growth firms seems to be particularly important, as these are the vehicles for innovation and the quality job creation that results. Many cluster strategies fail because regions spread resources that would barely be sufficient to develop one cluster across four or five. Determining which one or two clusters in a region have the most growth potential and best align with economic development goals matters because, as the case studies accompanying this paper demonstrate, supporting a cluster can be expensive and time-consuming.

5. To stimulate the participation of science in clusters, the following measures can be distinguished: increased funding for basic research and priority scientific and

technological areas, implemented mainly in the framework of state programs; diversification of a set of tools and mechanisms of public-private partnership in research and development.

6. Modern cluster development policy should follow a systemic approach that integrates different policies and programmes under a common joint strategy, combining the smart specialization approach. Thus, cluster policy should be seen as a strategic framework policy that is not limited just to offering support for networking activities and setting up cluster organizations that manage networking activities among companies. A successful community development through cluster approach cannot be achieved overnight, it requires a long-run period of strategic and consistent effort of state authorities.

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