Conditions for smart specialization of regional innovation clusters

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Abstract. The article considers the possibilities of implementing the concept of smart specialization in relation to regional innovation clusters in the Russian Federation. The geographical structure of the regions that meet the requirements of smart specialization is presented. Groups of leading regions for innovative development and levels of specialization development are identified. The article discusses the possibilities of implementing the strategy of smart specialization for regional innovation clusters. The sequence of steps for the development of innovative strategies of regional innovation clusters based on the principles of smart specialization is determined. Examples of successful implementation for the smart specialization concept of regional innovation clusters in the Russian Federation are given. The characteristics of smart specialization and the fundamental approaches to the implementation of the specialization concept are considered. The classification of broad specialization regions as multisectoral and regions of narrow specialization with a concentration on specific areas of activity and industries is presented. The necessity of implementing innovative strategies of regional innovation clusters based on the principles of smart specialization is justified.

1. Introduction
In modern conditions of economic development, the importance of digitalization is increasing. Digitalization is the transition process of an enterprise or an entire economic industry to new models of business processes, management and production methods based on information technologies. The conditions for the functioning of economic systems at all levels are changing [1–4].

There is an increasing need for economic actors to adapt to the new conditions and requirements of the digital economy. In order to adapt economic systems to the new realities of digitalization, strategies based on the principles of smart specialization have been actively promoted and implemented in European countries over the past decade. The key principles of smart specialization are reflected in the strategies of innovative economic development in some Latin American countries, Australia, and South Korea. Smart specialization has become widespread in Russia in the development and implementation of innovation policies, strategies for innovative development of regions and clusters.

The term “smart specialization” appeared in the early 2000s, the disclosure of the concept regarding economic systems was presented in the Concept of smart specialization at the end of 2009 by the expert
group “Knowledge for Growth” by the Directorate for Research and Innovation of the European Commission. The concept contains recommendations on the choice of priorities for innovative development, in relation to different management entities, included in a single guide. The concept of smart specialization is aimed at concretizing tools, algorithms, and models for different levels [5-7].

In accordance with the official definition of the European Parliament and the Council, the smart specialization strategy sets priorities for creating a competitive advantage for the region. Smart specialization is determined based on the identified correspondence between scientific and technological potential and business needs, ensuring a coordinated response to emerging opportunities and market trends [8,9]. The rationalism of smart specialization is that any region can find its own unique and reasonable way of development, relying on the accumulated potential, scientific developments and intellectual capital. To do this, it is necessary to focus efforts and resources on a limited set of areas that exist or arise at the intersection of economic activities and scientific and technological areas in which leadership can be achieved. Uniqueness is achieved by a combination of internal and external factors of the economic system.

An important attribute of smart specialization is considered to be multi-level management with a well-established communication system and a clear division of functions between different levels of government. At the national level, common organizational principles for strategizing and verifying priorities are set, and unified databases for analytical comparisons are formed. At the regional level, development priorities are determined, regional development strategies are developed and implemented, and appropriate coordination structures are created [10].

Smart specialization strategies are documented and regulated by the methodological guidelines for the development of innovative smart specialization strategies. The implementation takes place on an interactive platform for smart specialization, operating on the basis of the Joint Research Center of the European Commission. The smart specialization platform contains a large number of analytical and organizational tools that help to develop sound strategies taking into account the unique competitive advantages of the territory.

2. Priorities of regions and industries innovative development
For the first time in Russia, a comprehensive assessment of regional specialization was conducted based on the approaches developed by the Harvard Business School and the European Cluster Observatory [11-15]. The assessment was conducted by the HSE Research Institute in 2018 in seven constituent entities of the Russian Federation in order to identify priority areas of specialization. The following features of the methodology developed by the HSE scientists are identified:

- Use of data on employment and wages, which are devoid of the excessive volatility inherent in cost indicators. This helps to assess the dynamics of the development of industries and compare the specializations of regions at the interregional and international levels.
- Exclusion of local activities that are limited by local demand. Focus on tradable industries focused on national and international markets [16-18].
- Restructuring of the official industry classifier. Industries are formed on a functional basis, including both industry and the service sector.
- On the basis of the developed methodology, three types of specialization branches are identified in the regions of Russia:
  - industry, national and local significance, are characterized by high number of people employed in Russia, and in particular the subject of the Russian Federation (for example, "Automobile" in the Samara region and the Republic of Tatarstan).
  - industry of national importance – visible at the country level, however, the share of these industries in regional employment may be relatively small (for example, "Pharmaceutical products" in Moscow)
  - industries of local regional significance (for example, "Tourism" in the Republic of Crimea).
3. At the intersection of regions and industries innovative development

For Russia, the key direction of implementing the concept of smart specialization at the federal level is the structuring of territorial development priorities, the development of innovative strategies and programs. At the regional level, the implementation of the smart specialization concept will increase the interest in supporting high-tech technologies and innovations, focus innovative development on specific markets of the future, and attract investors by focusing on the unique competencies and advantages of each region [19]. The drivers of innovative development in most regions are territorial innovation clusters. The formation of unique advantages within the framework of regional innovation clusters based on the principles of smart specialization is advisable to implement within the framework of special smart specialization strategies [20-24].

The sequence of steps to develop innovative strategies based on the principles of smart specialization is important for the economic development of a regional cluster. The key aspects of implementing a smart specialization algorithm are compliance with the system approach and integrity.

1 step. Selecting a limited number of key priorities.

2 step. Involving stakeholders and communities in the process of developing and implementing priorities for the development of innovation clusters in the region. The main stakeholders of the innovative development of the region are "business", "science", "state".

3-6 steps. Developing a smart specialization strategy includes standard elements and processes:
• forming a vision
• selecting and evaluating alternatives
• integrating the actions of the cluster participants to implement the smart specialization strategy
• monitoring and evaluating.

Examples of successful implementation of the smart specialization concept are territorial innovation clusters: the cluster of pharmaceuticals, biotechnologies and biomedicine in the Kaluga region; the cluster "Zelenograd", Moscow; the cluster of nuclear physics and nanotechnology in Dubna; the Sarov Innovation Cluster of the Nizhny Novgorod region; the innovative territorial cluster of information and biopharmaceutical technologies in the Novosibirsk region; energy-efficient lighting and intelligent lighting control systems, the Republic of Mordovia; the Kama Innovative territorial production cluster in the Republic of Tatarstan; innovative territorial aerospace cluster in the Tomsk region; pharmaceuticals, medical equipment and information technologies in the Tomsk region; the nuclear innovation cluster of Dimitrovgrad in the Ulyanovsk region; new materials, laser and radiation technologies in Troitsk; the petrochemical territorial cluster, the Republic of Bashkortostan; the titanium cluster, the Sverdlovsk region; the consortium "Scientific, Educational and Production Cluster "Ulyanovsk-Avia" in the Ulyanovsk Region.

An important characteristic of smart specialization is the integration of the state efforts, business and science with a built-up system of communication and interaction [25-28]. The interaction of the state, business and science is characteristic of cluster structures.

There are 2 approaches to specialization:
• broad specialization implies focusing on several areas, industries;
• narrow specialization is aimed at concentration, limiting the areas of operation, industry priorities.
• The study of the results in the development of specialized industries in the regions of the Russian Federation helped to identify 2 groups of regions:
• regions of broad specialization or multi-industry;
• regions of narrow specialization with a concentration on specific areas of activity and industries.

Taking into account the specifics of the regions and clusters development, the coincidence of the presence of regions smart specialization and formed territorial innovation clusters is determined. The following groups of regions and territories for regional innovation clusters are identified:
• 20 subjects of the Russian Federation belong to regions of broad specialization, where cluster initiatives are implemented in various fields of activity.
• 20 subjects of the Russian Federation with an average level of specialization, cluster initiatives are implemented at the regional level.
• 7 subjects of the Russian Federation with a narrow specialization, the territories of clusters with a concentration on specific areas of activity.
• 33 subjects of the Russian Federation with a low level of specialization that do not implement cluster policy.

Table 1. Specializations of regions and territorial innovation clusters.

| 1st group regions with a broad specialization | 2nd group regions with an average level of specialization | 3rd group regions with a narrow specialization | 4th group regions with a high level of specialization |
|-----------------------------------------------|-------------------------------------------------------|---------------------------------------------|-----------------------------------------------------|
| the Moscow oblast                             | the Lipets region                                      | the Republic of Crimea                       | the Republic of Khakassia                           |
| Saint-Petersburg                              | the Ryazan region                                      | the Kaluga region                            | the Republic of Tyva                               |
| the Republic of Tatarstan                     | the Kostroma region                                    | the Tambov region                            | the Altai Republic                                 |
| the Kemerovo region                           | the Tver region                                        | the Kursk region                             | Kamylia                                             |
| the Novosibirsk region                        | the Volgograd region                                   | the Bryansk region                           | the Kemerovo region                                |
| the Krasnoyarsk region                        | the Nizhny Novgorod region                             | the Murmansk region                          | the Orel region                                     |
| the Lipets region                             | the Chelyabinsk region                                 |                                             |                                                     |
| the Khabarovsk region                         | the Tyumen region                                      |                                             |                                                     |
|                                               | the Khabarovsk region                                  |                                             |                                                     |

Broad specialization of clusters in the home regions

Cluster initiatives have been implemented in several industries in the home regions

Narrow specialization of clusters in the home regions

Cluster initiatives are insignificant, clusters are at the initial stage of formation in the home regions

- the Zelenograd cluster, Moscow; the nuclear physics and Nanotechnology cluster in Dubna; the cluster of information and biopharmaceutical technologies of the Novosibirsk region; the Kama Innovative Territorial Production Cluster in the Republic of Tatarstan; new materials, laser and radiation technologies in Troitsk;
- the Sarov Innovation cluster of the Nizhny Novgorod region; the innovative territorial innovation aerospace cluster of the Samara region; the petrochemical territorial cluster, the Republic of Bashkortostan; the titanium cluster, the Sverdlovsk region; consortium "Scientific, Educational and Production Cluster "Ulyanovsk-Avia" the Ulyanovsk region; pharmaceuticals, medical equipment and information technologies, the Tomsk region; the nuclear innovation cluster of Dimitrovgrad, the Ulyanovsk region; the energy-efficient lighting equipment and intelligent lighting control systems, the Republic of Mordovia;
- the cluster of Pharmaceuticals, Biotechnologies and Biomedicine, the Kaluga region;
- the biomedical cluster of the Kemerovo region; the scientific and Industrial Cluster of Instrumentation and Electronics of the Orel region; the territorial innovation cluster of navigation-telematics and geoinformation systems using GLONASS/GPS satellite technologies in the territory of the Orel region.
The key goal of smart specialization is to identify the unique specialization of the region and form clusters with the concentration of participants in specific areas of activity. The uniqueness of the regional innovation cluster is formed due to the internal potential of the cluster’s home territory and the creation of conditions for the development and deepening of the smart specialization for the cluster participants [29,30].

4. Conclusion
Improving the innovative strategies of regional clusters based on the principles of smart specialization is possible by increasing the interest, cluster initiatives, and systematic involvement of regional business participants, science, education, and consumer communities in the processes of determining and implementing strategic priorities. A comprehensive study of current and future specialization shows that traditional regional innovation strategies in Russia meet most of the criteria for smart specialization. Promising smart specialization strategies are implemented within the integrated structures of regional innovation clusters. The clusters concentration with elements of smart specialization is concentrated in the European part of Russia. At the same time, it is difficult to build a smart specialization strategy at the level of an individual region, since this requires information about the current and future specialization of other regions, as well as about global technological trends.

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