TRENDS AND PROSPECTIVE MODELS FOR THE FORMATION OF INNOVATIVE CLUSTERS IN THE RUSSIAN FEDERATION

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Abstract

Paper deals with the dynamics of clusterization of the Russian economic space, reveals the main stages and prospects for the generation of the "fourth wave" of clustering. The purpose of this research is to offer a quantitative approach to identify regional clusters and their further parametrization within the framework of an integrated model of clustering the region's economic space. Particular attention is given to organizational aspects of the clusters of microelectronics and information technologies in the Russian regions. The paper offers models for the organizational development of clusters based on the values of the Herfindahl-Hirschman Index and the concentration coefficients. The result of the analysis shows: successful cluster initiatives combine a developed innovative core, an essential industrial basis and a significant number of small and medium-sized forms of innovative entrepreneurship. Promising for the development of the high-tech industry in the Russian Federation is the conclusion that it is possible to synthesize organizational forms of economic development of forest industrial clusters and existing territorial production complexes in regions. Modeling of the development processes of innovative clusters made it possible to conclude that the state support of cluster policy remains relevant. The findings of the study are of scientific and practical interest in the framework of the problem of improving sectoral and regional clusterization strategies.

Keywords: industrial clusters, innovative multiclusters, cluster policy, regional economy, economic development

JEL classification: O1, R58

1. Introduction

Innovative cluster is an interbranch territorial complex of industrial enterprises, localized within one or several regions. Localization of innovative industries of related industries within a certain territory makes it possible to identify points of economic growth in the region. In modern Russian conditions, the cluster form of the spatial organization of the forestry sector becomes one of the key areas of rational nature management. The relevance of the chosen direction of research is evidenced by considerable attention to the clustering of the forest industry of the Russian Federation by the Federal Center and state authorities of the subjects of the Russian Federation.

In modern conditions the formation and development of innovative clusters remains the main direction of increasing the competitiveness of developing economies. The development of the cluster concept, as a rule, is linked with the work of M. Porter (Porter, M. 2003). . M. Porter justifies the need for industrial specialization, carried out in accordance with historical assumptions in contrast to the prevailing at that time in the US development goals, which consist in supporting a diversified economy. M. Dunford notes the role of organizational structures of the cluster, neoclassical transaction costs, non-commercial interdependence, organizational and managerial networks (Dunford M., 2003) . According to E. Bergman and

E. Fether «cooperative competition» is typical for small and medium-sized enterprises in the cluster as a means of counteracting the pressure exerted by large companies using the advantages of internal economies of scale (Bergman E.M., Feser E.J., 1999). B. Arthur showed that the sectoral orientation of the cluster depends on the previous history of technological development and the sequence of previously adopted state decisions (Arthur B., 1989).

2. Model of innovative multicluster

At the same time, the problems of practical realization of the cluster concept for Russia actualized by the necessity of accelerated implementation of the import substitution policy and increasing the output of high-tech products (Achenbach Y.A., 2012).. The optimal solution to these problems is possible with the support of existing territorial production complexes and some large enterprises that are not part of the cluster (Hopf C.G. and G.A. Tularam, 2014).. A key feature of the developed by the author model of «innovative multicluster» is the possibility of synthesizing organizational forms of economic development of regional clusters and territorial production complexes.

Scientifically justified systematization of the main directions of the clustering of economic systems of the Russian regions, depending on their specialization in the following bigger types of economic activities:

1 "Agriculture, hunting and forestry", which represent the main areas of environmental management and creating the basis for the formation of natural resource-based multiclusters;

2. "Fisheries", which have special characteristics and in the coastal regions of the Russian Federation;

3. "Mining", which forms the raw material profile of a number of Russian regions and updated formation for production processing of raw materials, as well as technologies for the rational subsoil;

4. "Manufacturing", which are the basis of economic growth of the national economy and the main consumers of innovative technologies;

5. "Production and distribution of electricity, gas and water", forming the basis for the energy of the "new industrialization" of economic systems of the Russian regions within the framework of import substitution policies;

6. "Hotels and restaurants", forming the potential of domestic tourism development in the Russian regions and the development of tourism clusters.

The model of clustering of the economic space realizes the dialectic law of denying negation: the policy of cluster development comes to replace the previous concept of territorial production complexes, but in practice, it uses the industrial and infrastructural basis established within it. This denial of negation forms an institutional synthesis, which is one of the conceptual foundations of the model for the formation of regional clusters, developing on the basis of a conglomerate of territorial production complexes. Within the framework of complex clusterization model for the regional economy, clusters are considered as a fundamental segment of innovative multiclusters. In addition, multicluster development appears as one of the directions for differentiating the priorities for the development of multi-unit economic systems in Russian regions. Innovative and industrial clusters formed during the implementation of state programs can be considered within the framework of the author's model of systematic integration into the multicluster of the three echelons of clusters presented in Table 1.

Table 1 : Directions of integration of innovative and industrial clusters in multicluster formations in the conditions of the Russian economy

Innovative clusters that	Clusters of innovative	Clusters of high-tech

develop breakthrough technologies of the next technological order	technologies and means of production that initiate multiplicative effects	products, massively replicating innovative technologies
Clusters of new composite and polymeric materials	Clusters of additive technologies and digital modeling tools	Clusters of heavy and medium engineering
Clusters of sensorics and mebiotics	Cluster of robotics	Clusters of precision engineering
Clusters of quantum communication and cryptography	Clusters of new communication technologies	Clusters of personal security systems
Clusters of new and portable energy sources	Clusters of distributed energy technologies	Clusters of energy-efficient lighting equipment
Clusters of genomics and synthetic biology	Clusters of biopharmaceutical technologies and biomedicine	Clusters of personal medicine
Clusters of nuclear physics research	Clusters of radiation technologies	Clusters of nuclear engineering
Nanotechnology clusters	Radioelectronic clusters	Clusters of microelectronics and instrument engineering
Photonics clusters	Clusters of laser and fiber optic technologies	Clusters of industrial and medical equipment
Clusters of neuroethologies	Clusters of technologies of virtual and augmented realities	Clusters of artificial components of consciousness and psyche
Clusters of artificial intelligence and Big Data	Clusters of distributed registry systems	Clusters of information technology, decentralized financial systems
	Clusters of unmanned aerial vehicles, maritime transport without crew, vehicles without a driver	Clusters of aerospace technologies, shipbuilding clusters, automobile clusters
Innovative-nature-use clusters	Clusters of technologies for the protection and restoration of the environment	Timber clusters and clusters of subsoil use
	Agrotechnological clusters	Clusters of personal production and food delivery
	Clusters of intelligent water supply and wastewater technologies	Clusters of production and purification of drinking water

Alternative methodological approaches focuses on the construction of cluster organizational schemes development (Dzhindzholia A., E. Popkova and L. Shakhovskaya, 2015), (Boush, G.D., O.M. Kulikova and I.K. Shelkov, 2016). Among these approaches, the basic organizational model of O. Solvell's cluster, developed on the basis of the balance of supply and demand (Sцlvell O., 2009), the E. Feather model of cluster and regional specialization (Feser E.J., 1998), the institutional model of the cluster of K. Ketels and J. Lindquist (Ketels Ch., Lindqvist, G. and Sцlvell, O., 2012)., should be singled out. Also in the Russian economic literature, the current trends in the formation of clusters with mixed industry specialization and territorial clusters are practically not considered. For the purposes of this article we have studied the scientific papers of Goula M., Ladias C., Gioti-Papadaki O., Hasanagas N. (2015), Alabanos N., Thodoropoulos S. (2016), Amitrajeet A. Batabyal (2017).

3. Data and method

As a criterion of specialization of the regional economic system in certain types of economic activity, it is proposed to use the localization coefficient of production (LC) (Matafonova Yu.A., 2016). Given that unlike territorial production complexes, clusters are characterized by both localization of production and its organizational deconcentration, the use of the Herfindahl-Hirschman Index (HHI), traditionally used to assess the degree of monopolization of production within a certain industry, is justified. For identifying the objective prerequisites for the formation of regional clusters deserves the coefficient of concentration of economic activity – «concentration ratio» (CR), which is calculated as the sum of market shares of three (four) largest economic agents of the territory (Kleiner G.B., 2015)..

Use of the indicators discussed above is not self-sufficient and the only approach for making managerial decisions on supporting cluster initiatives at the regional level. The technique proposed by the author supplements existing approaches to assessing the effectiveness of cluster development, which also requires a detailed analysis of the specific socio-economic development of a particular territory. The advantage of using these indicators is the possibility of cluster development models in order to select the optimal strategy for clustering the economy for each particular territory, as well as differentiation of clusters from territorial production complexes and quasi-clusters (Kucenko, E.S., 2009).

Based on data from the Federal Service for State Statistics of the Russian Federation [1] for 2014 year, the values of the localization factor for production of 83 regions of the Russian Federation were calculated. Analysis of the relationship between the sectoral specialization of regional economic systems and the formation of innovative and industrial clusters in the Russian Federation focuses on enlarged types of economic activity and industrial production. The main reason for this choice is the economic essence of innovative multiclasters, which integrate production in related economic activities. Also for modern Russian conditions, clusters characterize the traditionally unrelated types of economic activity. The choice of 2014 as a period for calculating the values of the localization factor of production on the basis of official statistics is based on the following considerations. In 2014-2015, the largest number of cluster initiatives started during the entire period of implementation of the state policy of cluster development in the Russian Federation. Also in 2014, we can talk about the beginning of a full-fledged implementation of «third wave» projects for the formation of pilot innovation clusters as a relatively new form of economic development for Russia.

4. Results

Russian clusters are characterized by significant concentration of high-tech enterprises, high dynamics of growth in production volumes, the availability of research and educational organizations. In general, the analyzed clusters are located in areas with a high concentration of scientific, technical and production activities (Stricker, L. & Baruffini, M., 2017).. These include science cities and special economic zones, in particular the cities of Zelenograd, Dubna, Pushchino, Obninsk, Troitsk, Sarov, Zheleznogorsk, Dimitrovgrad. Industrial clusters are also located on the territory of large urban agglomerations of St. Petersburg, Novosibirsk, Nizhny Novgorod, and Samara (Gimadeeva, Je.N., 2015, Markov, L.S., 2015).

From the point of view of the territorial organization of industrial production, two models of cluster development can be distinguished:

1) localization of the cluster in clearly delineated territorial boundaries, almost coinciding with the boundaries of municipalities (Sarov, Zheleznogorsk, Troitsk);

2) localization within the network structures of large agglomerations (St. Petersburg, Novosibirsk and Tomsk regions).

The leading role of large-scale industrial production is characteristic for cluster strategies of the Republic of Tatarstan, the Republic of Bashkortostan, the Arkhangelsk and Nizhny Novgorod regions, and the Khabarovsk Territory. At the same time, cluster development is

[1] Regions of Russia Social and economic indicators, 2015. Statistical compilation. Moscow, Rosstat, 1266.

expected here due to a more intensive transfer of scientific and technical research results to the activities of existing industrial companies, as well as the creation of new small and medium-sized enterprises that are built into the value chains formed by large companies.

The development programs for clusters in Pushchino, Obninsk, Troitsk, Dimitrovgrad, are characterized by an orientation toward using the potential of the world-class scientific and educational organizations located on their territory (Napolskikh Dmitri Leonidovich, 2017). This involves attracting large Russian and foreign companies to the development of high-tech production due to the existing human resources and research infrastructure of clusters, as well as the active development of small and medium-sized innovative entrepreneurship through the commercialization of technologies developed here (Yalyalieva T.V., Napolskikh D.L., 2017).

Thus, the variety of models for the development of clusters determines the need to use the most flexible use of government support instruments, taking into account the specifics of each specific region (Enright, M. , 1996).. The organizational prerequisite for support of cluster infrastructure is adoption of regional and municipal programs for social and economic development and the provision of subsidies for development of technology parks. Technology parks is a complex of real estate and infrastructure that provides conditions for the efficient operation of a number of small and medium-sized industries. Technology park is managed by a single operator, the main service is to lease or purchase land and premises, as well as provide the necessary transport, logistics and telecommunications infrastructure (Larionova N.I., Yalyalieva T.V., Napolskikh D.L., 2015).

The adoption of government programs to support the development of clusters should include mechanisms for public-private partnership. In this case, the regions have the right to establish benefits for the payment of taxes and fees. The possibility of granting tax privileges at the regional level within the framework of the creation of special economic zones is an effective tool for the development of clusters (Napolskikh D.L., Yalyalieva T.V., Larionova N.I., Murzina E.A 2016).

One of the areas of support for the development of clusters is the identification and minimization of administrative barriers. Implementation of the principle of "one window" when obtaining a building permit and conducting state expertise of project documentation is an important factor in attracting investment in the cluster.

Dynamics of cluster formation in the regions of the Russian Federation is shown in Table 2. Table 3 shows the dynamics of the number of Russian regions that effectively implement cluster initiatives.

Table 2 : Dynamics of clusters formation in the Russian Federation (Compiled by Registry of clusters of the Russian cluster observatory of the Higher School of Economics)[2]

Years	Number of created clusters (units)	Number of participating organizations in 2016 for clusters created in the corresponding period (units)	Number of employees in 2016 for clusters established in the corresponding period (people)
1999-2007	1	66	20 838
2008	1	11	2 532
2009	4	125	35 130
2010	7	178	68 955
2011	4	48	33 175
2012	19	970	558 553
2013	11	295	129 407
2014	27	656	231 661
2015	23	599	161 488
2016	4	71	25 925
Total	101	3 019	1 267 664

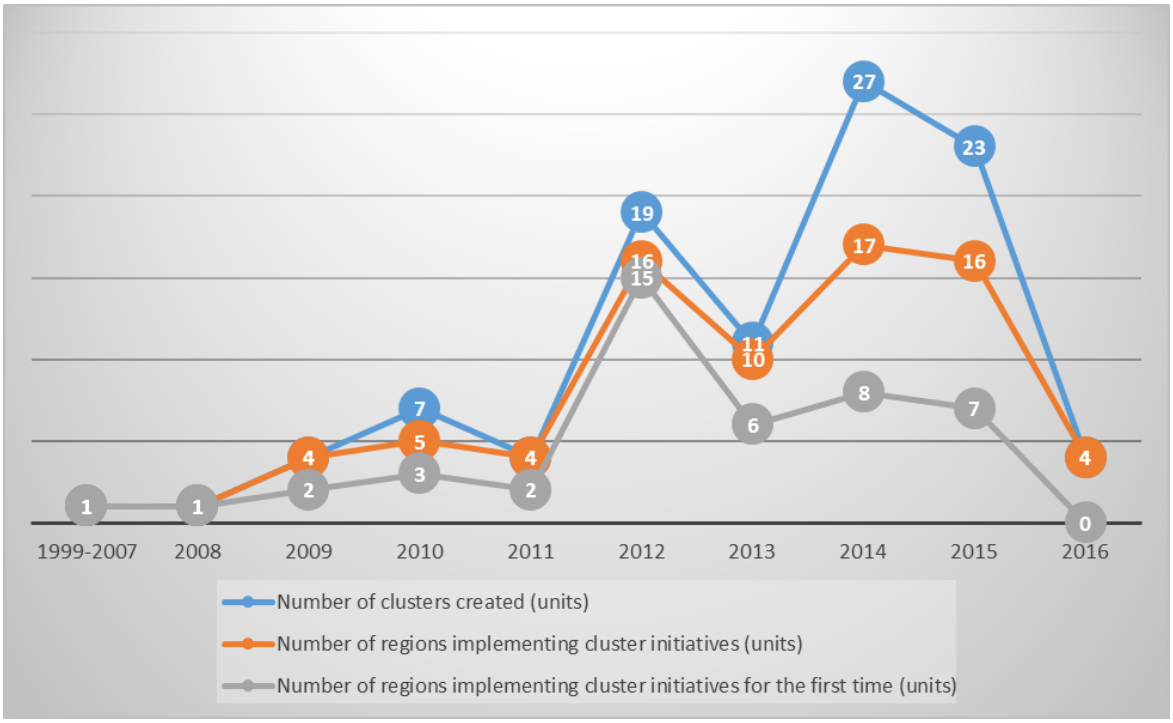
[2] Russian cluster observatory. [Electronic source] URL: http://cluster.hse.ru Access on: 20.08.2017. (Date of access: 01.11.2017)

Table 3 : Dynamics of the number of Russian regions successfully implementing cluster initiatives (Compiled by Registry of clusters of the Russian cluster observatory of the Higher School of Economics)[3]

Years	Number of regions implementing cluster initiatives		
	Total in this period (units)	Of them realizing for the first time (units)	The total number of regions, Implementing cluster initiatives Since 1999 (units)
1999-2007	1	1	1
2008	1	1	2
2009	4	2	4
2010	5	3	7
2011	4	2	9
2012	16	15	26
2013	10	6	32
2014	17	8	40
2015	16	7	47
2016	4	0	47

Accordingly, three "waves of clusterization" of the economic space of the Russian regions are singled out the first - 2009-2011, the second - 2011-2013, the third - 2013-2016. These clustering waves are shown in Figure 1 as an overlay of the data of Tables 2 and 3.

Fig. 1. Waves of clustering the economy of Russian regions (compiled by the author on the basis of the data in Tables 2 and 3)



Accordingly, the key task of the study is the development and parametrization of the organizational cluster development, which can become a factor in the generation of the "fourth wave" of clustering Russian regions. At the same time, the insufficient implementation of cluster policy instruments in the development of strategies and programs for regional development impedes the optimal use of the potential of innovative infrastructure facilities. The solution of the problems of economic development and modernization of the old industrial economic systems of the Russian regions actualizes the task of practical

[3] Russian cluster observatory. [Electronic source] URL: http://cluster.hse.ru Access on: 20.08.2017. (Date of access: 01.11.2017)

implementation of the model of perspective development of cluster initiatives within the framework of the innovation economy.

The author singles out two innovative multicluster integrating adjacent clusters of microelectronics, instrumentation and information and communication technologies within the region: "Innovative multicluster of the Penza Region", "Innovative multicluster of the Rostov Region". It is also necessary to note the Innovation cluster of information and biopharmaceutical technologies of the Novosibirsk region, which is a multicluster formation of the intersectoral type. At the same time, the Moscow and Leningrad regions are characterized by the formation of multicluster formations based on the intersectoral and territorial principle, which unite high-tech industrial enterprises created within the territorial production complexes and «science cities». Tendencies and prospective models for the formation of regional industrial clusters in the Russian Federation are examined on the example of the economic systems of the regions in which clusters are formed, the key specialization of which are the information technologies, microelectronics, instrumentation, optics and photonics. Table 4 presents the characteristics of these clusters.

Table 4 Organizational aspects of formation of clusters of microelectronics, instrument engineering and information technologies

Cluster	Region	HHI	CR_3	CR_4
Radioelectronic cluster of the Voronezh region	Voronezh region	1721	0,61	0,69
Cluster "Voronezh Electromechanics"		1828	0,63	0,75
Information Technology Cluster	Perm Region	2094	0,73	0,82
Innovative territorial cluster of fiber-optic technologies "Photonics"		1384	0,54	0,70
Cluster of integration of technologies «Zarechensky»	Penza region	2981	0,78	0,89
«Penza Instrument-Making Cluster "Security"		1709	0,63	0,73
The innovation-technological cluster "Southern constellation"	Rostov region	2603	0,84	0,90
Innovative territorial cluster of civil marine instrumentation "Marine Systems"		3302	0,89	0,93
Cluster of information and communication technologies of the Rostov Region		1734	0,61	0,77
Innovative territorial cluster "Zelenograd"	Moscow	1064	0,53	0,60
Cluster of high-tech components and systems of Omsk region	Omsk Region	1452	0,58	0,68
The Scientific and Industrial Cluster of Instrument Making and Electronics of the Oryol Region	Oryol Region	1666	0,61	0,74
Cluster of information technologies, radioelectronic and telecommunications	St.Petersburg	283	0,21	0,25
Energy-efficient lighting technology and intelligent lighting control systems	Republic of Mordovia	1637	0,64	0,74
Innovative cluster of information and biopharmaceutical technologies of the Novosibirsk Region	Novosibirsk region	1034	0,47	0,54
Cluster of Information Technologies of the Vologda Region	Vologda Region	1636	0,62	0,70
Cluster of Information Technologies of Novgorod Region	Novgorod region	6497	0,87	0,88
Information Technologies cluster of the Republic of Tatarstan	Republic of Tatarstan	4103	0,74	0,76

From the list of enlarged types of economic activity and industrial production sectors were chosen that should influence the formation and development of clusters of microelectronics, instrumentation and information technologies.

From the list of enlarged types of economic activity and industrial production were chosen the ones that influence on the formation and development of clusters of microelectronics, instrumentation and information technologies of clusters. The values of the localization coefficient for these enlarged types of economic activity are presented in Table 5.

Table 5 The values of the localization coefficient of enlarged types of economic activity and industrial production in the regions of the Russian Federation on the territory of which are created clusters of microelectronics, instrumentation and information technologies

Region	Agriculture and forestry	Manufacturing plants as a whole	Food production	Woodworking	Machinery, vehicles and equipment	Manufacture of electrical, electronic, optical equipment
Penza region	2,43	1,21	2,37	1,31	0,93	2,47
Novosibirsk region	1,24	0,74	1,95	0,92	1,1	2,02
Rostov region	2,5	1,01	1,49	0,15	1,52	0,68
Moscow	0,45	1,16	1,67	1,46	1,1	1,11
St.Petersburg	1,33	1,39	1,69	2	1,77	1,72
Omsk Region	1,98	2,09	0,64	0,15	0,15	0,54
Voronezh region	3,17	0,78	2,47	0,15	0,95	2,3
Perm Region	0,62	1,74	0,33	1,08	0,78	0,91
Vologda Region	0,95	1,9	0,51	4,08	0,34	0,07
Novgorod region	1,55	1,94	1,52	6,77	0,52	0,75
Republic of Tatarstan	1,21	1,04	0,65	0,38	1,54	0,7
Oryol Region	3,31	1,05	2,47	0,23	1,19	1,67
Republic of Mordovia	2,45	1,29	2,52	1,15	0,61	3,09

Low values of the localization coefficient of manufacture of electrical, electronic, optical equipment for the regions examined due to the following factors:

orientation of information technology clusters in the Novgorod and Vologda regions to innovation and technological support for the formation of forest industrial clusters;

orientation of the cluster of high-tech components and systems of the Omsk region to manufacturing industries in general;

orientation of the information technology cluster of the Republic of Tatarstan to high-tech production in general, in particular: the production of machinery, vehicles and equipment, petrochemical production, etc.

The analysis of the interconnection of the industry specialization of regional economic systems and the formation of clusters of microelectronics, instrumentation and information technology in the Russian Federation made it possible to propose the following model of cluster development in this sector. Accordingly, the organizational aspect of the clusterization model of the economy of the Russian regions based on the formation of clusters of microelectronics, instrumentation and information technologies of clusters is presented in Table 6.

Table 6 Organizational aspect of clustering the economy of Russian regions on the basis of the formation of clusters of microelectronics, instrumentation and information technology

Parameter of clustering model of the regional economy	Level of cluster organizational development		
	Low	Medium	High
Number of participating organizations (units)	10< … <25	25< … <50	>50
2. Number of employees (people)	>500	>5000	>10000
3. Herfindahl-Hirschman Index (HHI)	>1800	<1800	<1000
4. Coefficient of concentration CR_3	<0,90	<0,60	<0,50
5. Coefficient of concentration CR_4	<0,95	<0,75	<0,60

The obtained parameters of the clustering model are based on the following data. According to the data of the Russian cluster observatory from the clusters considered «Innovation Cluster of Information and Biopharmaceutical Technologies of the Novosibirsk Region» (60 organizations, 12,869 employees) and «Cluster of information technologies, radioelectronic and telecommunications of St. Petersburg» (66 organizations, 20838 employees) are at a high level of organization development. «Innovative territorial cluster of fiber-optic technologies "Photonics"» (34 organizations, 15762 employees), «Innovative territorial cluster "Zelenograd"» (48 organizations, 7772 employees), «Information Technology Cluster of Vologda Region» (31 organizations, 6182 employees) and Cluster "Energy Efficient Lighting and Intelligent lighting control systems" (24 organizations, 9,866 employees) are at the medium level of organizational development. Accordingly, the values of the Herfindahl-Hirschman Index and the Coefficient of Concentration for these clusters are presented above in Table 4. The remaining clusters are located at the initial level of organizational development.

The systematization of the findings is presented in the form of models of organizational development of clusters of microelectronics, instrumentation and information technologies in Table 7.

Table 7 **Models of organizational development of clusters of microelectronics, instrumentation and information technologies**

Number of participating organizations (units)	Values of the Herfindahl-Hirschman Index (HHI) and the Coefficient of Concentration (CR_3 , CR_4)		
	HHI>1800, CR_3<0,90, CR_4<0,95	HHI <1800, CR_3<0,60, CR_4<0,75	HHI <1000, CR_3<0,50, CR_4<0,60
From 10 to 25	Cluster formed on the basis of territorial production complex. Priority: development of small and medium-sized innovative entrepreneurship.	Cluster with a clearly defined core. Priority: development of small and medium-sized innovative entrepreneurship.	Cluster with a developed competitive environment. Priority: development of innovative infrastructure.
From 25 to 50	Cluster formed on the basis of territorial production complex. Priority: the formation of points of growth in industrial production.	Cluster with a clearly defined core. Priority: development of innovative infrastructure.	Cluster with a developed competitive environment. Priority: development of innovative infrastructure.
More than 50	A cluster formed on the basis of territorial production complex. Priority: the formation of points of growth in industrial production.	A cluster that has a clearly defined core. Priority: development of an innovative cluster core	Cluster with a developed competitive environment. Development of the institutional environment of the cluster

Models of organizational development are based on the need for a cluster of "core" from large enterprises and the institutional environment for small and medium development Entrepreneurship, whose evaluation is based on the parameters presented in Table 6.

5. Conclusion

Analysis of the values of production localization coefficients in the regions in which the clusters are created allowed us to conclude that the high localization coefficient of production is a factor in the successful development of cluster initiatives. At the same time, it is necessary to emphasize that the localization of production is of fundamental importance for the effectiveness of cluster policy both within the key sector for the cluster and within the framework of the enlarged type of activity and related types of industrial production. It was noted that for the formation of innovative clusters developing technologies of the next technological order, the high value of the localization factor of production is not a critical success factor.

This trend is because innovative clusters form the technological core of modernizing the economic space of the region as a whole. Clusters, acting primarily as a supplier of innovative technologies, new materials and means of production, and form an institutional environment for the transmission of successful management practices. Consequently, an additional criterion for differentiating clusters from territorial production complexes is the development of non-traditional types of economic activity for the region, targeting not only large enterprises, but also small and medium-sized forms of innovative entrepreneurship.

As features of development of clusters of microelectronics, instrumentation and information technologies, it should be noted the possibility of implementing cluster initiatives outside of the link to the industrial base of large territorial production complexes. The research identified clusterization directions of Russian regions, whose interaction with clusters of microelectronics, instrumentation and information technologies have the potential to form innovative multicluster for implementing multiplicative effects within the framework of regional economic systems. The identified directions of clustering economic systems of the Russian regions include nuclear and radiation technologies, medical industry, biopharmaceutical technologies, aircraft building and space industry, machine and equipment manufacturing, new materials, automotive and auto components.

The approach proposed by the author to modeling the formation of industrial clusters complements the existing concepts of cluster development on the basis of the interrelation between the parameters of cluster organizational development and the localization of related economic activities. The objective limitations of the proposed approach are a quantitative approach to the identification of criteria for cluster development, which has a certain formality and mechanistic nature. Discussion of the findings is also because clusters are a new form of the territorial organization of production for the Russian economy. The obtained results served as a basis for further research into modeling of regional clusters, including spatial modeling based on geostatistics methods.

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