Evgeniy Kutsenko, Ekaterina Islankina
Vasiliy Abashkin, Elena Popova

TOWARDS AN 'IDEAL' CLUSTER SUPPORT PROGRAM: BLENDING THE APPROACHES

Evgeniy Kutsenko,[1]Ekaterina Islankina,[2]

Vasiliy Abashkin,[3]Elena Popova[4]

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Clusters have become a major element of innovation and industrial policies in many countries worldwide. Over the years, targeted cluster support programs have been designed and implemented, each featuring a variety of approaches to the selection of clusters, terms and prerequisites for funds allocation, the areas of support, etc. Such approaches have both the advantages and drawbacks, which leads to a conception of an 'ideal' support program mix that could consider the best practices and ignore some unsuccessful solutions.

The working paper aims at suggesting such an 'ideal' approach to designing a cluster support program, based on the synchronization of the most effective elements of various such programs in Russia. Over the past decade, cluster policy has occupied an important position in the agenda of the Russian Government. Two federal Ministries – the Ministry of Economic Development and the Ministry of Industry and Trade initiated several cluster support programs for innovative and industrial clusters. Nowadays, there are more than 118 clusters in Russia, and over a half of them benefit from current public support measures – 27 innovative clusters, 42 industrial and 12 leading clusters. The comparative analysis of federal support programs revealed several benefits and limitations in both approaches in terms of subsidy allocation principles, areas of support and cluster selection criteria. In particular, among the key advantages of innovative clusters programs are the focus on cluster management development, and identifying the strongest clusters through one-time selection procedure. The successful features of industrial clusters program are permanent application process, reduction of budget risk due to compensation principle of funding, and stimulation of cooperation through special requirements for joint projects. The major disadvantages of innovative cluster support programs are budget risks caused by advanced financing of cluster activities, and a lack of project focus; the probability to support low-quality projects and neglecting the issue of cluster management development are the key weaknesses within the industrial clusters program. The paper suggests a 'smart' synchronization of approaches to cluster support, which blends the best practices of different ministries.

Keywords: cluster policy, innovative clusters, national cluster support program, industrial clusters.

JEL classification: D04, O18, O19, O38, R58

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[1]Director, Centre 'Russian Cluster Observatory', Institute for Statistical Studies and Economics of Knowledge, National Research University Higher School of Economics, Russian Federation. E-mail: ekutsenko@hse.ru

[2]Research Fellow, Institute for Statistical Studies and Economics of Knowledge, National Research University Higher School of Economics, Russian Federation. E-mail: eislankina@hse.ru

[3]Senior Research Fellow, Institute for Statistical Studies and Economics of Knowledge, National Research University Higher School of Economics, Russian Federation. E-mail: vabashkin@hse.ru

[4]Expert, Institute for Statistical Studies and Economics of Knowledge, National Research University Higher School of Economics, Russian Federation. E-mail: ezaurova@hse.ru

[5]The working paper draws back to the research "A Decade of Cluster Policy in Russia: a Comparative Outlook" [Kutsenko et al. (2017)]

Introduction

Clusters experienced a considerable growth long before their theoretical conceptualization. Take, for instance, the pre-industrial era when "specific localized industries paved the way to various modern division labor process and business administration models in industry" [Marshall, 1920 p. 268-269]. The term 'cluster' was first used to describe the geographic concentration of value chains and institutions, only in the 1970s [Czamanski and de Albas, 1979; Gorkin and Smirnyagin, 1979]. The EU studies suggest that, "50% of employment, higher productivity and patenting are in economic sectors that 'cluster'" [Ketels, 2014]. According to US statistics, clusters in traded industries provide 36 % of employment, 50 % of revenues and nearly 96 % of patent applications in the US national economy [Harvard Business School, 2014].

In the mid-90's cluster initiatives began to emerge. Unlike 'natural' clusters which are seen mainly as "geographical proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and externalities" [Porter, 1998], cluster initiatives are defined as "coordinated efforts of the state, business and scientific and research organizations for cluster development". Global Cluster Initiative Survey, conducted in 2003, identified 509 cluster initiatives [Sölvell et al., 2003]. In 2013, 2,580 cluster initiatives were revealed all over the world [Lindqvist et al., 2013].

In the past two decades, cluster initiatives have become a key element of innovation and industrial policy in different countries, such as France, Germany, Canada, Sweden and the Republic of Korea. There are numerous examples worldwide of public cluster support through the competitive selection of cluster program and targeted budget financing. For instance, the French national program 'Pôles de Compétitivité' aimed at providing assistance to the best R&D collaborative projects, implemented in public-private partnerships. Key results of this program were 1,500 R&D projects, which received public aid, 1,000 new patents and 200 new start-ups. Between 2006 and 2009, the total funding of 'Pôles de Compétitivité' was 2.5 billion euros. The similar approach was used in Swedish VINNVÄXT program initiated by the Swedish Agency for Innovation systems – VINNOVA. The program focus was boosting collaborative research projects with high innovation potential. The main requirement for the applicants was at least 50% of regional financing. The total amount of federal financing, which allocated in 2003 and 2004, was 65 million euros on 8 projects [OECD, 2007].

In 2005, the Korean government agency, Korea Industrial Complex Corporation, introduced clusters support national program, which was aimed at reaching the competitiveness of industrial clusters through stimulation of cooperation between companies, research organizations and universities. The total number of supported clusters was 79. [TCI Network, 2015]

One of the core national cluster support programs in Germany – the 'Spitzencluster-Wettbewerb' (Leading Edge Clusters) – was implemented by the Federal Ministry of Education and Research (BMBF) and aimed to support clusters in knowledge-intensive industries by encouraging cooperation between industry and science. As part of this support tool, an open competition of cluster projects was held every two years; the winners are determined by an independent commission. From 2008 to 2012, 1,300 projects were accepted and received federal financing, which was accounted for 600 million euros [BMBF 2014].

In 2018, under the Canadian national program 'Innovation Superclusters' five superclusters receive up to 950 million euros for technologies commercialization and reinforcement of global market positions [Government of Canada, 2018].

In most cases, these programs are designed for long-term implementation, which is one of the key success factors of the cluster policy. The evolution of cluster initiative to mature cluster is a long-term and multi-stage process: the emergence of cooperative linkages between the regional enterprises, the attraction of and communicating with other institutional players – universities, public authorities and development institutions among others. After reaching a critical mass of participants, partnerships with other market players and other clusters begins. The impact of such approach can appear only in a long-term period [Christensen et al., 2012, HSE, 2013; Kutsenko et al., 2017-a].

Cluster-related efforts can improve the efficiency of economic agents via reinforced cooperation between companies, universities and R&D organizations; or between SMEs and corporations; or between private companies and infrastructure units. These efforts can help attracting foreign direct investment and integrating national producers into the global high-tech markets [Kutsenko, 2012]. For example, during the implementation of pilot innovative clusters support program in Russia between 2013 and 2015, the cluster member export revenues on average are 20% higher that the regional average[6]. Cluster members interact more closely with research organizations, which are located in close proximity to other firms. Such a cooperation prevents actors from market failures caused by inconsistent investment decisions of economic agents, market conditions, and policy instruments [Andersson et al., 2004], decelerating or even rejecting innovation [Pro Inno Europe, 2011].

Furthermore, the efficiency of public expenditures increases due to the prioritization of state support beneficiaries (i.e. stakeholders acting in the areas with the maximum potential for development), which is extremely important in the context of financial restrictions. In the European Union, cluster policy has been commonly used for the development of emerging industries over the last years [European Cluster Observatory, 2012, 2015; Ketels, Protsiv, 2014].

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[6]According to the Ministry of Economic Development of Russia data.

The efficiency and consistency of national cluster policies improve the pull of complex support programs, conducted by federal and regional authorities, or development institutions.

The cluster approach encourages policymakers at both regional and national levels and professional communities to participate in strategic discussions which has a positive impact on decision making due to the additional expertise from competing cluster members. According to the World Bank, one of the key functions of cluster initiatives in developing countries is to provide feedback from private companies to public authorities, which can partly accommodate potential drawbacks from implementing reforms [World Bank, 2009].

Finally, a structured professional community is both a prerequisite and an instrument to implement smart specialization regional strategies that allow defining key future market niches, relevant to available competences, and paving the way to success [Ketels, 2013]. Given the fact that markets are global, while labor force is usually spatially concentrated, clusters can be regarded as local 'assemblage points' in global market networks. Cluster approach not only aids to identifying regional smart specialization, but also provides an efficient allocation of the labor force and economies of scale for cluster members [Andersson et al., 2004, Hantsch et al., 2013].

In Russia, clusters are maturing in compliance with the European approach [Sölvell et al., 2003, OECD, 2011], implying the identification and support of geographical concentrations of enterprises, educational and research organizations, which work on joint projects and identify themselves as a cluster initiative. The paper is based on a similar understanding of a cluster: a territorial concentration of companies, research organizations, universities and related infrastructure, which is coordinated by a cluster organisation and aimed at joint project implementation and reinforcement of market position. Clusters are distinguished from technology parks by a broader membership and their specializations and a project focus. Compared with consortia and business associations, clusters tend to be more involved in regional economic development. According to the research of 227 cluster initiatives in Russia, which emerged between 2008 and 2015, the federal cluster support programs influenced the number of cluster initiatives. Some of them have disappeared (170), others continue to exist (61), and many (46), appeared between 2013 and 2015 [Kutsenko et al., 2017-b].

Currently, cluster policy in Russia is implemented by two federal authorities: The Ministry of Economic Development and The Ministry of Industry and Trade.

In 2012, the Ministry of Economic Development of Russia initiated the first and also largest national program to support Pilot Innovative Clusters (PIC) with a total budget of over 90 million euros from 2013 to 2015. The program was targeted to enhance the cooperation among enterprises, research and educational organisations of clusters, and foster the development of their home regions.

In 2016, the Ministry of Economic Development of Russia launched the priority project 'Promoting Development of Innovation Clusters – Global leaders in Attracting Investment' (The Priority project, leading clusters). The Priority project aims at establishing national economic growth points; fostering innovation development and national competitiveness; increasing the export of high-tech products and technology commercialization, labor productivity, and creating high-performance jobs [Ministry of Economic Development of Russia, 2017-a].

Since 2015, the Russian Ministry of Industry and Trade launched a specific program for industrial clusters. Cluster members that meet dedicated requirements, can apply for co-financing operational costs (up to 50%) on joint projects of import-substituting production.

Over the years of each Russian cluster support program's implementation, their successful and unsuccessful solutions have become tangible (for cluster practitioners and policymakers). They partly derive from general approaches to designing support tools that the ministries use. We presume that the features of different cluster programs, such as subsidy allocation principles, areas of support and cluster selection criteria, are worth comparing to come up with policy implication of how to make an 'ideal' cluster program, blending the best practices and eliminating the failing ones. Attempts to define what a perfect cluster policy is have been made in the European studies [Christensen et al., 2012]. In this working paper, we scrutinize the case of Russia and raise the following questions:

1) What are the advantages and drawbacks of approaches of two federal ministries to support innovative and industrial clusters?

2) How could the best features of each program be compiled into one, 'ideal' approach to designing a cluster support program?

The research uses a comparative analysis of three cluster support programs in Russia, based on expert assessments (the authors took part in designing and implementing all the programs and bear the insights about each case). Since cluster support programs in Russia took after some of the best European approaches to cluster support (mostly German and French, which were also benchmarks for many countries worldwide), their features are quite general. Therefore, we presume that the results of our search for an 'ideal' approach to cluster support program design can be applied far beyond Russian cluster policy context.

The working paper is split into two major sections. Firstly, we compare federal programs, reveal their features and the most prominent results of supported clusters. Furthermore, based on the results of the programs' comparison, their key benefits and main drawbacks are outlined, and policy implications are suggested.

Federal cluster support programs in Russia: key features, main achievements and results

This section describes the three cluster support programs, which have been implemented by Russian federal authorities since 2012. The empirical base of the research is comprised of the relevant legal acts of the Russian Government, the Ministry of Industry and Trade, the Ministry of Economic Development, programs of innovative and industrial clusters, the Cluster Map of Russia database.

In order to provide detailed description of each program and allow comparison, the following indicators were used: legal framework, requirements to cluster membership, cooperation and management, selection approach, type, recipient, terms and areas of public support. The key results are compiled in table 1.

Table 1. Comparative analysis of cluster support programs of the Ministry of Economic Development and the Ministry of Industry and Trade

Comparison criteria	Pilot Innovative Clusters (the Russian Ministry of Economic Development program)	Innovative clusters – leading clusters (the Russian Ministry of Economic Development program)	Industrial clusters (the Russian Ministry of Industry and Trade program)
Legal acts	1. The instruction of the President of the Russian Federation on the results of the State Council Presidium mitting of the Russian Federation in 11.11.2011 (Minutes No. Pr-3484GS of 22.11.2011). 2. Instruction of the Government Commission for Advanced Technology and Innovation in 30.01.2012 г. 3. Order of the Government of the Russian Federation dated 28.08.2012 No. DM-P8-5060.	1. The decree of the Ministry of Economic Development of Russia of 27.06.2016 № 400 – The Priority project 'Promoting development of innovation clusters – global leaders in attracting investment'.	1. Order of the Government of the Russian Federation dated 31.07.2015 № 779 'Industrial clusters and the cluster organizations of industrial clusters'. 2. Order of the Government of the Russian Federation dated 26.01.2016 № 41 'On approval of the regulations for granting federal subsidies on part compensation of joint cluster projects aimed at the import substitution.'
Membership and the number of participants	The following members are required: enterprises, universities and research institutes or other organizations of R&D sector. (the requirements are not strictly regulated)	At least 40 participants, including scientific and educational organizations, industrial enterprises, including those exporting products (services).	– At least 10 industrial enterprises, including those engaged in final production; – at least one university or college; – at least two infrastructure units in the technology sphere, including technology parks and industrial parks
Cooperation and effectiveness	Qualitative requirements: – The existence of research and production chain between cluster members in key economic sectors – Coordination and cooperation of cluster members activities – Synergy effect existence (improving the economic efficiency and effectiveness of each participant activity).	Qualitative characteristics of cluster models : – Innovative cluster - the worldwide center for research and science – Cluster of innovative leaders - medium and large high-tech enterprises	Threshold requirements: – At least 20% of manufactured goods should be purchased by the other cluster members (except for end producers); labor productivity in cluster should be above the average in the region – At least 50% of jobs are high-productive
Cluster organization requirements	The required founders (or co-founders): - the region of the Russian Federation; - municipal entity, where the cluster is located - an organization, founded by the regional authorities	The legal entity with at least five full-time employees, who are responsible for innovative cluster development	– legal entity form: commercial partnership, corporation, autonomous non-profit organization or association (including a non-profit partnership and a self-regulating organization); – At least a half of cluster members

			– Management bodies include representatives of at least half of the industrial cluster participants.
Clusters selection approach	– Expert evaluation of clusters development programs (22 quantitative and 24 qualitative characteristics which represent the current level and further perspectives of cluster development; the set of the measures for cluster program realization) – The first stage – online expert assessment; the second – critical design review of cluster development programs; – Non-recurring list of pilot innovative clusters. Treaty amendment procedure is not strictly regulated	– Expert evaluation of clusters operational performance (23 indicators); – First stage – expert reports preparation; Second – critical design review of cluster development strategies; – Non-recurring list of leading clusters; – Treaty amendment procedure is not strictly regulated	– The first stage – applications expert assessments for compliance with established requirements; the second – expert assessment and critical design review of joint projects (Since 2018 the competitive selection will be held once per year) – Cluster registry made up on an applicative and continuing basis
Type, recipient and terms of support	Subsidies for constituent entities of the Russian Federation on co-funding cluster development program arrangements, which are approved by regional legal acts Performance measures for cluster programs : – the number of employees who completed professional or advanced training courses in the field of innovation management; – the increase in the average wages of cluster employees who completed professional or advanced training courses in the field of innovation management; – the increase in the amount of research projects, conducted by cluster members or by cluster members in cooperation with foreign partners, from the beginning of the implementation in the current financial year and during the next 2 years; – the increase in capital outlays, incurred by cluster members except for the costs on acquisition land	State financial support is not intended so far. Cluster support is provided from regional budgets under the scope of the constituent entities of the Russian Federation priority projects, which is aimed to provide a background for innovative clusters to reach the worldwide level of competitiveness and investment attractiveness. Strategies for cluster development are evaluated by potential ability to reach key performance indicators of leading clusters support program till the quarter of 2020: – the number of high-performance jobs, which were created or modernized by cluster members between 2016 and 2020; – the value of investment, attracted from non-budgetary sources - at least 4,7 billion euro; – the amount of research projects, conducted by cluster-members, including in cooperation with foreign partners – at least 1,6 billion euros between 2016 and 2020;	Co-financing the operational costs of the joint projects initiators (up to 50%), which result from the project implementation, aimed at import substitution. The project should be complained the following criteria : – focus on import substitution; – development of cooperation links between cluster participants; – the existence of at least one project initiator (provides project vehicle) and project stakeholder (responsible for purchasing manufactured goods); – at least a 15% increase in the number of high-productive jobs for the 5th year; – reaching one of the following indicators: at least a 10% reduction of costs for purchasing inventory materials from external organizations; least a 10% increase in costs for purchasing inventory materials, produced

	– properties, civil engineering, admission utility lines – increase in productivity per worker in cluster; – the increase in the volume of shipped own-produced products and services provided by innovative clusters – the increase in the total revenue from sales in external markets.	– at least three times increase in the number of patents, obtained by cluster members in comparison with 2016; – the expected number of technological start-ups, attracted the investment, will be at least 300; – the double increase in total profit from non-primary products distribution, received by cluster members in comparison with 2016 – at least 20% increase in the average proportion of added value in cluster members operational profit, compared with 2016	by project initiator(s); at least a 10% increase in value added level, created by project initiator(s); at least a 10% increase in product proceeding to external organizations; – reaching one of key performance indicators of The Russian Federation state program «Industry development and improving its competitiveness»
Areas of government support	– cluster organization functioning; – professional retraining, advanced training, internships for cluster members; – cluster members counseling in the field of implementing innovative capital investment projects – holding exhibitions and fairs; – innovative, educational, transport, engineering and social infrastructure development –	– raining arrangements for cluster management teams for spatial cluster development; – creation cluster management system, that meets international standards; – facilitating access for spatial support programs, including state support and development institutions' programs; – promoting interaction with companies with state participation; – development of regional venture ecosystem; – support for access to foreign markets, including export, attraction of investments; – assistance in cooperation with international partners; – informational support in mass media.	– leasing payments; – technological equipment acquisition; – software purchasing; – tender documentation developing; – prototyping.

Source: compiled by the authors based on [Government of the Russian Federation, 2015-a; Government of the Russian Federation, 2015-b; Government of the Russian Federation, 2017; Ministry of Economic Development, 2016].

Federal support programs of innovative clusters

Before the launch of federal cluster policy, only a few Russian regions reported on their own cluster-related efforts to apply for clusters support. The basic principles of cluster policy were established in 2008 in Long-term Socio-Economic Development Concept for the Russian Federation through 2020 [Government of the Russian Federation, 2008]. This document argues that clusters, targeted at high-tech industries in priority areas of business (energy generation, feed processing), serve as a key element of economic modernization and the competitiveness of the regions. Strategy for Innovation Development of Russia until 2020, [Government of the Russian Federation, 2011] also pays attention to the relevance of cluster initiative support.

Since 2010, the Ministry of Economic Development has provided subsidies to Russian regions to support the establishment and activities of Cluster Development Centers (CDC) [Ministry of Economic Development of Russia, 2010, 2015]. Between 2010 and 2016, the total funds of the program were approximately 20.3 million euros.

The program resulted in the establishment of 34 centers in 33 regions. The key activity of CDC is to provide support for cluster initiatives via consulting, organizational and marketing services to SMEs; assistance in the arrangement of training, communication and exhibition events, business planning services; strategic and policy documents drafting, etc. These centers are also aimed to provide the assistance in launching small pilot joint projects to demonstrate to cluster members the benefits of the cluster cooperation model.

In 2012, the Ministry of Economic Development launched a program to support pilot innovative clusters (PIC). The program was targeted to enhance cooperation among enterprises, research and education organizations, and the development of areas with the highest scientific, technological and industrial potential.

A total of 25 PIC were selected in a two-stage competition out of 94 initial applications. The list was subsequently expanded to 27 PIC. They are located in the regions with a high level of innovative development, where the science cities (naukograds[7]) and special economic zones (SEZ[8]), closed administrative territorial units (CATU[9]) have been formed.

In compliance with their industrial specialization, the PIC belong to one of the following six areas: Nuclear and Radiation Technologies; Aerospace and shipbuilding; Pharmaceuticals,

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[7]Naukograd – municipal entity (ME), which characterized by significant scientific and technological potential. The status of a science city is obtained by those MEs, which are established based on city-forming enterprises, whose production funds make up at least 50% of all funds and output is at least 50% of the total volume of research and technical products. At present time, there are 14 science cities in the Russian Federation [Federal Law, 1999]

[8]SEZ is a region with a specific economic and legal status, which residents can purchase a land plot ownership if they start production activity. This status provides special tax and custom preferences and the access to advanced engineer, logistics and business infrastructure [Federal Law, 2005]

[9]CATU is "a municipal entity with administrative territorial formation with local self-government bodies established to ensure the safe production, operation and dispose of weapons of mass destruction, process radioactive materials and other objects of an increased hazard for anthropogenic nature. This entities have a special living regime that protect secret information and securing national defence." [Federal Law, 1992]

biotechnology and medical production; New materials; Chemistry and petrochemistry; Information technology and electronics [HSE, 2013].

Between 2013 and 2015, the Russian regions where the pilot clusters are localized received federal subsidies of more than 90 million euros for the implementation of cluster programs and projects [Government of the Russian Federation, 2015-a]. The following activities were financed:

– The development of innovation and educational infrastructure;

– The development of cooperation, promotion of products in national and foreign markets (business missions, exhibitions and other communication events)

– Social and engineering infrastructure development

– Advanced professional training, methodical, organizational, information services and expertise (Figure 1).

Figure 1. Distribution of subsidy funds provided in 2013-2015 from the federal budget to the Russian regions for the pilot innovative clusters development programs implementation 2013-2015, by costs, %
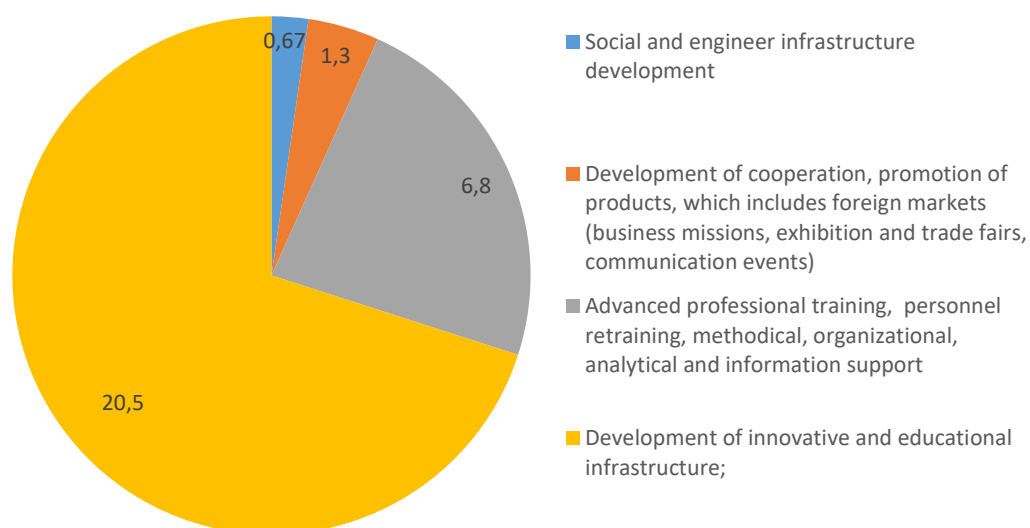
Source: compiled by the authors based on [Ministry of Economic Development of Russia, 2017-a]

The PIC support program contributed to the economic performance of cluster members. From 2013 to 2015, the combined output of clusters increased from 6.7 billion euros to 31 billion euros. Despite the negative context of the national economy, cluster enterprises demonstrated positive dynamics for some important indicators: the output per employee in real terms increased by 10% (from 41,000 euros in 2013 to 45,000 euros in 2015); the number of high productive jobs created rose more than one third (from 27,200 units in 2013 to 36,100 units in 2015); 40,000 employee's professional development programs. The development of PICs has become a significant factor in the growth of investment activity: in three years, both public and private investment exceeded more than 1.5 and 5.6 billion euros respectively [Ministry of Economic Development of Russia, 2017-a].

The key performance indicator for pilot innovative clusters was total research and development expenditure. There was a considerable growth in scientific cooperation from 2013 to 2015, the number of joint research projects exceeded 1.2 billion euros (Figure 2).

Figure 2. Indicators of R&D projects, carried out by pilot innovative cluster members [10]

The total amount of expenditures on R&D by cluster members, million euros

- 400   - 4000   -10000

«Troitsk» (Moscow region)

Smart lighting Cluster (Mordovia republic)

«Zelenograd» cluster (Moscow region)

IT and Biopharmaceuticals Cluster (Novosibirsk region)

Novy Zvezdny Cluster (Perm region)

Petrochemical cluster (Bashkortostan republic)

Dimitrovgrad Nuclear Cluster (Ulyanovsk region)

IT and Ragio-Electronics (Saint Petersburg)

Dubna Cluster (Moscow region)

«Phystech 21»(Moscoow region)

Medicine and pharmaceuticals Cluster (Saint Petersburg)

Aerospace cluster (Samara region)

Zeleznogorsk Cluster (Krasnoyarsk krai)

Sarov Cluster (Nizhny Novgorod region)

Puchino Biotechnology Cluster (Moscow region)

Ulyanovsk Avia Cluster

Pharmaceuticals Cluster (Kaluga region)

Pharmaceuticals and IT cluster (Tomsk region)

Altai Biopharmaceuticals Cluster (Altai region)

Aircraft and Shipbuilding Cluster (Khabarovsk region)

Coal and Anthropogenic Waste Processing Cluster (Kemerovo region)

«INNOKAM Cluster» (Tatatrstan Republic)

Automative and Petrochemical cluster (Nizhny Novgorod region)

Shipbuilding Cluster (Archangelsk region)

Titanum cluster (Sverdlovsk region)

Expenditures on R&D projects, conducted by two or more cluster members or in cooperation with foreign partners in 2016, million euros

Aggregate annual average growth rate of expenditures on R&D projects, conducted by two or more cluster members or in cooperation with foreign partners, 2014-2017, %

Source: compiled by the authors based on the Ministry of Economic Development data

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[10] Annual growth rate was calculated as compound Annual Growth Rate of total amount of expenditures on R&D by cluster members from 2014 to 2017. Due to the lack of statistic data Mechanical Engineering Cluster of Udmurtia Republic is not represented. The figures of Troitsk Cluster are given for 2013-2014.

In 2016, the Ministry of Economic Development moved to a new level of cluster initiative support, based on project management principles. Leading clusters were the next step in the work of the Ministry to support innovative clusters. The project is dedicated to the provision of outperforming growth rates of economic activity through advanced mechanisms of innovation support, integrating national companies into global value chains.

Similar to PICs, the list of 11 leading clusters was formed through competitive selection from 22 applications from 21 regions of the Russian Federation. In 2017, it was extended to 12 clusters.

Leading clusters are formed around research and educational centers and use the maximum of the potential of universities and research institutions, or they consolidate medium-sized and large innovative companies, and are characterized by their leading role of business.

The priority project considers the experience of the PIC support program, with an emphasis on their priority areas:

- the advancement of cluster management system

- facilitation in accessing the existing forms of spatial development support, including budget instruments and development corporations, the use of the special economic zone (SEZ) and the territory of advanced socio-economic development status(TASED);

- assistance in integration into the state-owned enterprise suppliers programs;

- supporting access to foreign markets access, attracting investment, facilitating cooperation with foreign partners. [Ministry of Economic Development of Russia, 2016].
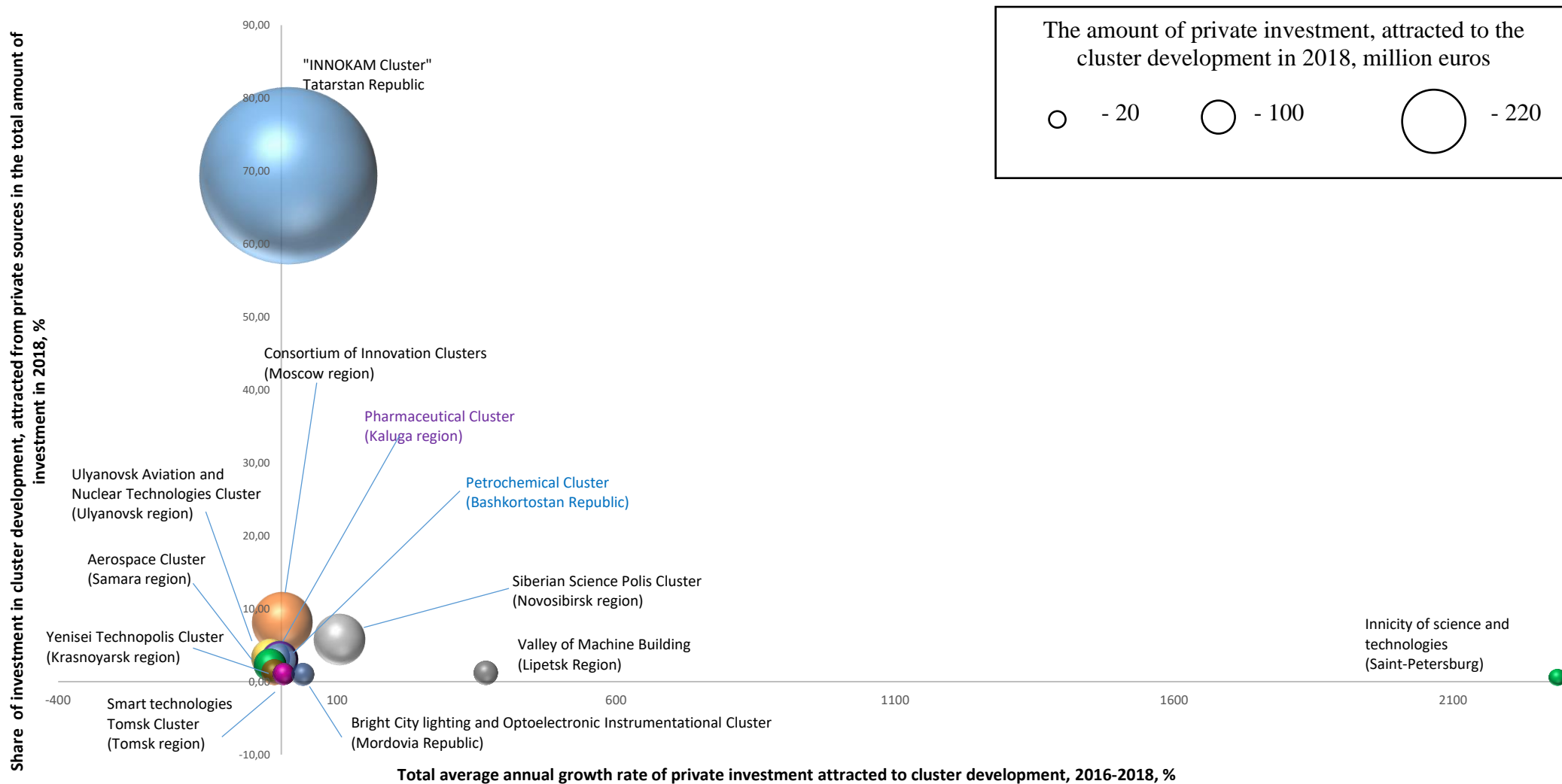
The Priority project implementation started with the development of cluster road maps for 2020. Such an instrument provides an opportunity for cluster members to identify the deviation from key goals of the cluster strategic documents and to take additional measures to eliminate them. The road maps contain a detailed description of arrangements with the planning period at least once in two weeks for a wide range of directions, such as cluster management systems, technology commercialization, the development of technological entrepreneurship and innovation infrastructure, export and international cooperation, investment attraction, modernization of key enterprises, talent management, and the improvement of the quality of life. The key performance indicators, financing sources and responsible officials were identified [Ministry of Economic Development of Russia, 2017-b].

The primary goal of the Priority project is cluster members integration into global value chains. In 2018, the volume of non-primary products exported by clusters was $ 12.7 million, and by 2020, it is anticipated to grow by 52% compared with 2016. In 2018, more than 33,000 high-performance jobs were recreated or modernized. By 2020, this is expected to increase to 100,000. Leading

clusters are focused on expanding the volume of research and development projects, implemented in cooperation projects. While in 2018, the production costs of the projects were estimated at approximately 584 million euros, by 2020 this indicator will reach 1.35 billion euros. In 2018, cluster members received 238 foreign patents, which is also projected to rise up to 300 patents by 2020 [Ministry of Economic Development of Russia, 2017-a].

According to the Priority project requirements, the main performance indicator for leading clusters is the amount of external private investment. In 2016, the amount of private investment was 2.6 billion euros and, it is projected to rise by 69 % by 2020. (figure 3)

Figure 3. Private investment, attracted to the development of leading clusters[11];[12]

The amount of private investment, attracted to the cluster development in 2018, million euros

○ - 20   ○ - 100   ○ - 220

"INNOKAM Cluster" Tatarstan Republic

Consortium of Innovation Clusters (Moscow region)

Pharmaceutical Cluster (Kaluga region)

Petrochemical Cluster (Bashkortostan Republic)

Ulyanovsk Aviation and Nuclear Technologies Cluster (Ulyanovsk region)

Aerospace Cluster (Samara region)

Siberian Science Polis Cluster (Novosibirsk region)

Yenisei Technopolis Cluster (Krasnoyarsk region)

Valley of Machine Building (Lipetsk Region)

Innicity of science and technologies (Saint-Petersburg)

Smart technologies Tomsk Cluster (Tomsk region)

Bright City lighting and Optoelectronic Instrumentational Cluster (Mordovia Republic)

Share of investment in cluster development, attracted from private sources in the total amount of investment in 2018, %

Total average annual growth rate of private investment attracted to cluster development, 2016-2018, %

[11] For the currency equivalents (roubles – Euros) the average annual exchange rate of the Central Bank of Russia was used. For 2018 the average exchange rate was 74,13 roubles per 1 euro.
[12] Due to almost the similar rates for Kaluga Pharmaceuticals Cluster and Petrochemical cluster of Bashkortostan Republic, the differences between values is shown in colour

State support of industrial clusters

In 2015, the Ministry of Industry and Trade launched a new cluster support program, which is aimed at import substitution through the completion of value chains in industrial clusters.

Public support is provided to clusters which meet the requirements are in the Ministry of Industry and Trade industrial clusters registry. From 2016 to September 2018, 42 cluster applications were accepted. The approved clusters operate in the following industries: The production of machinery and equipment; Microelectronics and instrumentation; Optics and photonics; Chemical industry; Industrial biotechnology; Forestry and woodworking; Pulp and paper production; Aircraft building; Construction; Chemical production; Pharmaceuticals and medical industry; Food industry.

The members of the selected clusters received federal subsidies for co-financing joint projects. The condition for the support provision is the approval of the cluster project by the expert commission [Government of the Russian Federation, 2017]. In 2016-2018, 19 joint projects of 9 industrial clusters were approved; their expected cost until 2020 is 62 million euros. Nine joint projects, selected in 2018, have already receive the state aid of 12.75 million euros. The total amount of federal subsidies to industrial clusters from 2016 to 2018 is over 21 million euros.

The most in-demand types of expenditures claimed for subsiding were:

- control, measurement and testing;
- production of prototypes, samples, experimental lots;
- design engineering;
- interest payments;
- technological equipment acquisition;
- software purchasing and configuration;
- certification and licensing;
- training and advanced training of engineering staff;
- methodology and regulatory documentation development.

Figure 4. The structure of financial aid for industrial cluster joint projects from 2016 to 2019[13]

Control, measurement and testing; production of prototypes, samples, experimental lots

Design ingeneering

Credit interests payments

Technological equipment acquisition

Software purchasing and configuration

Certification and licensing

Training and advanced training of engineering staff

Methodology and regulatory documentation development
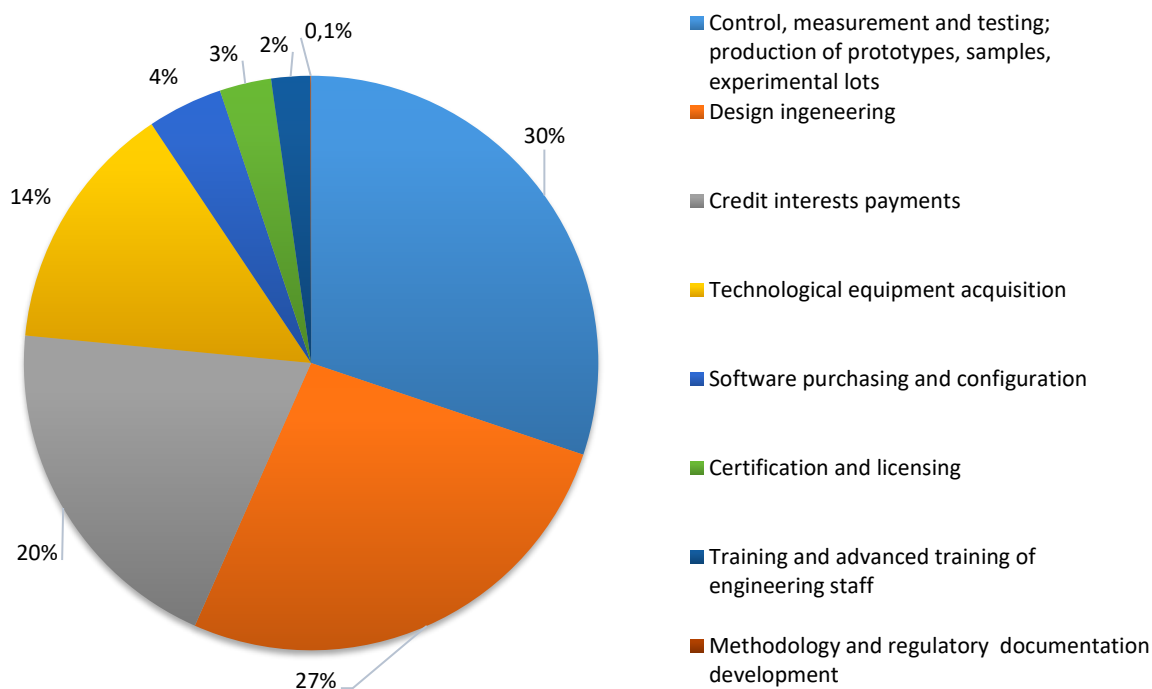
Source: compiled by authors based on industrial cluster programs

In 2018 the number of high-productive jobs in industrial clusters was 152,645, while it is expected to rise for 45 clusters in 2019. The volume of exports from 37 industrial clusters 14 was 1.87 billion euros in 2018. The cost of imported raw materials and end production commodities was approaching 2.1 billion euros (23% of the total expenditure).

The most important indicator characterizing industrial clusters is the total output of industrial goods and services.[15] In 2018 total output of industrial goods and services was 18.4 billion euros. According to industrial cluster programs, in 2020 the indicator is projected to rise up to 21 billion euros (figure 5[16]).

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[13] This graph shows the total share of each category of costs, claiming federal subsidies from 2016 to 2019.

[14] The indicators, characterized the volume of export of own-produced goods were proposed in 37 of 42 industrial clusters strategic documents.

[15]Products and services, according to OKVED codes, indicated in import substitution plans in following sectors: automotive, civil aviation, children`s products industry, light industry, timber and medical industries, mechanical engineering for food processing, petroleum engineering, production of road-building, municipal and ground airport equipment, industry of conventional arms, electronic and machine-tool industries, agricultural and forestry machinery, building materials and building construction, shipbuilding and transport engineering, heavy machinery, chemical and pharmaceutical industries, ferrous and non-ferrous metallurgy, power engineering, cable and electrotechnical industries) included in import substitution plans.
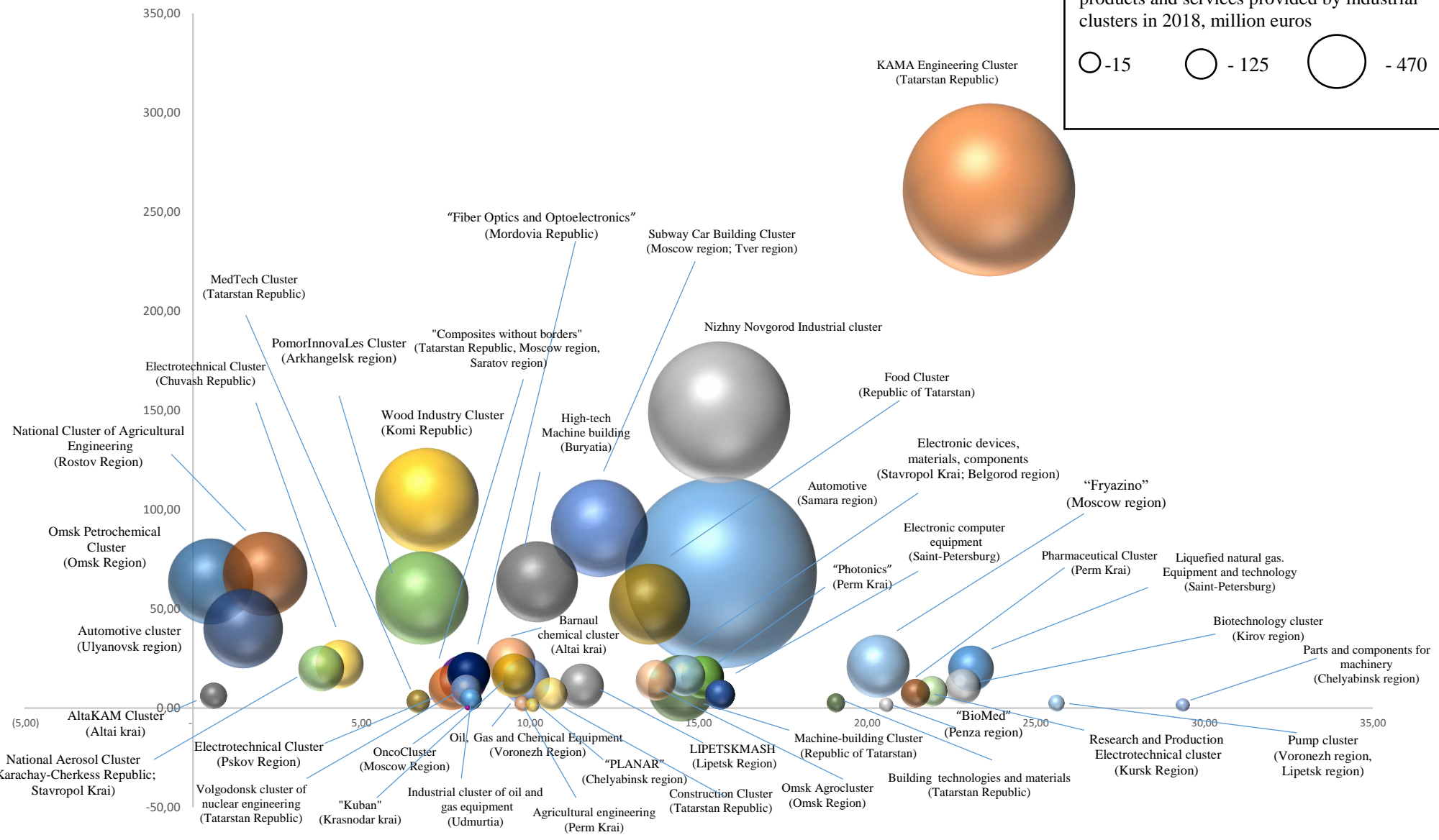Source: https://gisp.gov.ru/plan-import-change/

[16]According to the Ministry of Industry and Trade of Russia and industrial clusters development programs

Figure 5. Products and services of industrial clusters

The total amount of shipped own-produced products and services provided by industrial clusters in 2018, million euros

○ -15   ○ - 125   ○ - 470

Average annual growth rate of own-produced products and services provided during the implementation of the industrial cluster development programmes, million euros

The amount of own-produced products and services provided per cluster member in 2018, million euros

KAMA Engineering Cluster (Tatarstan Republic)

"Fiber Optics and Optoelectronics" (Mordovia Republic)

Subway Car Building Cluster (Moscow region; Tver region)

MedTech Cluster (Tatarstan Republic)

"Composites without borders" (Tatarstan Republic, Moscow region, Saratov region)

Nizhny Novgorod Industrial cluster

PomorInnovaLes Cluster (Arkhangelsk region)

Electrotechnical Cluster (Chuvash Republic)

Wood Industry Cluster (Komi Republic)

High-tech Machine building (Buryatia)

Food Cluster (Republic of Tatarstan)

National Cluster of Agricultural Engineering (Rostov Region)

Electronic devices, materials, components (Stavropol Krai; Belgorod region)

Automotive (Samara region)

"Fryazino" (Moscow region)

Omsk Petrochemical Cluster (Omsk Region)

Electronic computer equipment (Saint-Petersburg)

Pharmaceutical Cluster (Perm Krai)

Liquefied natural gas. Equipment and technology (Saint-Petersburg)

"Photonics" (Perm Krai)

Barnaul chemical cluster (Altai krai)

Automotive cluster (Ulyanovsk region)

Biotechnology cluster (Kirov region)

Parts and components for machinery (Chelyabinsk region)

AltaKAM Cluster (Altai krai)

"BioMed" (Penza region)

Electrotechnical Cluster (Pskov Region)

OncoCluster (Moscow Region)

Oil, Gas and Chemical Equipment (Voronezh Region)

LIPETSKMASH (Lipetsk Region)

Machine-building Cluster (Republic of Tatarstan)

Research and Production Electrotechnical cluster (Kursk Region)

Pump cluster (Voronezh region, Lipetsk region)

National Aerosol Cluster (Karachay-Cherkess Republic; Stavropol Krai)

Volgodonsk cluster of nuclear engineering (Tatarstan Republic)

"Kuban" (Krasnodar krai)

Industrial cluster of oil and gas equipment (Udmurtia)

Agricultural engineering (Perm Krai)

"PLANAR" (Chelyabinsk region)

Construction Cluster (Tatarstan Republic)

Omsk Agrocluster (Omsk Region)

Building technologies and materials (Tatarstan Republic)

350,00
300,00
250,00
200,00
150,00
100,00
50,00
0,00
-50,00

(5,00)   -   5,00   10,00   15,00   20,00   25,00   30,00   35,00

20

Looking for a balanced approach: comparative analysis of the key features of cluster support programs

This section scrutinizes the major differences in innovation and industrial cluster support programs, which were revealed in the comparative analysis above (see Table 1):

1) Allocation of funds (i.e. the terms and conditions, under which policymakers provide financing, including the direct recipients of the public money);

2) Subject of support (i.e. the form of cluster cooperation, which is a transformed into an application for funding);

3) Attitude to cluster organizations (i.e. whether the development of cluster management is a focus of support program or not);

4) Cluster selection and financing period (i.e. whether the competition among clusters to get support is held one time only or repeatedly, and how the funds are allocated over time).

The landscape of Russian clusters is becoming more diversified. There are more than 110 clusters, including over three thousand organizations (the average number of cluster members is 23) providing nearly 1.3 million workplaces [HSE, 2017-a]. Most clusters operate in high-tech industries and this indicates substantial innovative potential. Figure 6 illustrates the geographic distribution of clusters that received federal support under the one of the federal programs.

Figure 6. Russian cluster initiatives, supported within various federal programs (as of the November 1, 2018)

Source: *compiled by authors based on Cluster Mapping project [HSE, 2017-a]*

Most clusters (11 industrial, 11 PICs, 5 leading) are located in the Volga Federal District. The Central Federal District is the base of six PICs, nine industrial clusters, three leading clusters. In

21

the Siberian Federal District, there are three PICs, two industrial clusters, one leading cluster. One pilot innovative cluster and two industrial clusters are located in the Ural Federal District. Two industrial clusters are situated in the North Caucasian District, while in Far Eastern Federal District only one PIC and one industrial cluster base.

More than a third of cases (8 out of 22), the regions hosting industrial clusters coincide with the PIC regions. In several regions (the Moscow region, Samara region, Tatarstan and Mordovia Republics) all three types of clusters (PIC, leading clusters, industrial clusters) are located.

In terms of GRP per capita and Russian Regional Innovation Scoreboard position[17] [HSE, 2017-b], the strongest regions are Tatarstan Republic, Moscow, St. Petersburg, and Krasnoyarsk region. PIC are located in all of these regions and in three of them leading clusters are also situated – Tatarstan republic, Moscow, and St. Petersburg. The maximum number of industrial clusters (four) are located in Tatarstan Republic.

Through the evolution of cluster policy tools in Russia, their focus is changing from testing (PIC program) and seeding (CDC) to project-based. The primary goal for innovative clusters is attracting investment, while for industrial clusters it is the implementation of joint projects for import substitution.

There are several tangible differences between ongoing federal programs, which can be explained by dissimilar approaches of the two nationwide ministries.

1) Allocation of funds

The key feature of the industrial cluster support program is the co-financing of incurred costs. This experience was adopted from the previous support measures of the Ministry of Industry and Trade. For instance, in the context of sectoral subprograms in the state program 'The development of industry and improvement its competitiveness', the subsidies are allocated to the enterprises for partial reimbursement of R&D, interest payments, production support, the implementation of engineering and industrial pilot projects and the acquisition of specialized engineering software [Government of Russian Federation, 2014-a]. Additionally, subsidies are granted to enterprises implementing new investment projects [Government of the Russian Federation, 2014-b], and performing R&D in the field of complex capital investment projects in priority areas of civil industries [Government of the Russian Federation, 2013][18].

The compensative approach to support measures allocation mitigates financial risk for the Ministry of Industry and Trade, which acts as the chief budget administrator. However, public

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[17]Top regions by Russian Regional Innovation Index, according to the methodology of Russian Regional Innovation Scoreboard.
[18]State program of industrial parks and technology parks support is only the one program, there financial aid is provided for regional budgets. This program is aimed at co-financing of industrial parks infrastructure development through tax liabilities of their residents to federal budget. [Government of the Russian Federation, 2014-c].

support to cluster developing centers and PIC is based on the expenses advancement. Thus, budget risks are reduced by directing subsidies to regional budgets, and delegating the responsibility to supervise financial discipline of clusters members to regional officials.

The Ministry of Economic Development reduces potential budget risks through changing the recipients of public support, i.e. the financing is provided to regional authorities instead of private enterprises. Such an approach leads to stronger financial discipline among the cluster members. In the case of co-financing the regional commitments, there were no requirements for the amount of private investment in joint projects [Government of the Russian Federation, 2015-a] as well as for co-financing the costs of paying for services rendered by the CDC for cluster members. [Ministry of Economic Development of Russia, 2010]. Furthermore, after several years of CDC support program, the Ministry of Economic Development set the requirements for a 5% private co-financing of subsequent requests for SMEs. [Ministry of Economic Development of Russia, 2015]. Such transfers are more beneficial than business financing, especially in the case of SMEs due to the reduction of commercial and management risks.

2) Subject of support

The Ministry of Industry and Trade concentrates on the co-financing of joint projects, constructing a specific toolkit for cluster policy. Public support of joint projects stimulates cooperation between enterprises, which improves production capacity, regional localization of cluster members, reduces import costs and increases industrial value added. There were no specific criteria for innovative cluster project estimation. The measures of the Ministry of Economic Development support regional development programs (PIC program) or strategies (leading clusters program), which may include several joint projects, but it is not a compulsory condition for receiving state aid. As a result, only a few number of the projects were included in cluster development programs in the applications for subsidies.

However, this approach may hold risks of the mechanical assembly of joint projects. Complex measures of federal programs and strategies are intent on combining activities in key areas to stimulate innovation within the cluster and the region. Consequently, these programs could be potential assemblage points for the synchronization of support measures of federal authorities, development institutions, and state-owned enterprises. The examples of such measures may be subsidy assistance of cluster members: enterprises and educational organizations, soft loans, special fiscal regime, international business activity support, and regional venture ecosystem development.

The idea of synchronization is fully realized in the Priority project of leading clusters. This displaces financial support measures: in 2016-2017, leading clusters did not receive financial support, but they had priority access to a wide range of policy instruments for cluster arrangements.

3) Attitude to cluster organizations

Traditionally, innovative cluster programs focus on cluster management development. Since 2010, the financial support has been provided to CDC. From 2013 to 2015, the subsidies were allocated to support the services of PIC cluster organizations – the second most in-demand activity for receiving budget financing after innovative and educational infrastructure development. In most cases, cluster organizations served as finance administrators for the cluster. The creation of an effective cluster management system is apriority area for the Priority project. [Ministry of Economic Development of Russia, 2017-a]. To formalize the qualification requirements for cluster managers; in 2017 special methodological materials were developed. They include the profile competency of cluster managers, recommendations for competitive selection and the necessity of additional training. [Ministry of Economic Development of Russia, 2017-b].

Turning to industrial clusters, the key feature of this program is a disregard of cluster organizations such as budget administrators and the main recipients of state aid. AccordingtotheRulesofgrantingsubsidiestoindustrialclustermembers, [Government of the Russian Federation, 2017], only the organizational costs (including industrial cluster organizations) on technological and design documentation can be reimbursed from federal budget resources. However, the generation and the coordination of efficient joint projects can cover extensive resources: timing, financial, human capital, whereas the leading role in this process resolves cluster organization.

Nowadays the Ministry of Industry and Trade industrial clusters registry consists of 22 clusters, while only six joint projects were qualified and received budget funding. More importantly, only two industrial clusters received state aid for several joint projects, which indicates that there is no flow of cluster project applications. One of the possible reasons for this issue may be the lack of commitment within a cluster: the second project was initiated by the same cluster members as the previous one. It is crucial to integrate several cluster members for more efficient project operation. These liabilities can lead to limitations and restrictions of cluster maturity when cluster activity falls after joint project implementation. Co-financing of the organizational costs of the cluster management team can improve the efficiency of joint project implementation.

4) Cluster selection and financing period

The support programs of innovative clusters are discrete, i.e. they are based on the principle of simultaneous selection of the best candidates for receiving state aid. Afterwards, the list of

selected clusters becomes exhaustive, due to the failure of the formal order of its reinvention. The advantage of this method is the opportunity to select the most matured clusters, but only from time to time. The main drawback is the limited selection of the most important and profitable projects, caused by the number of supported clusters. Regarding industrial clusters, within the framework of this program it is anticipated that the registry of industrial clusters will be formed permanently: a cluster can be included in the registry if it meets the basic requirements of the ministerial project. Consequently, the pool of industrial clusters is growing, which provides the opportunity to make an application for budget financing.

This approach is more flexible, but there are also some limitations, such as the possibility of providing subsidies for less qualitative projects rather than to defer the subsidization for more profitable ones. This is caused by the order of receipt cluster applications and the exhaustion of budget obligation limits in the current year. Considering these disadvantages, the Ministry of Industry and Trade switches from the permanent declarative order to competition order, which is held once a year. This approach was set in the new addition of the rules of subsidies allocation. [Government of the Russian Federation, 2017].

Turning to the financing period in innovative clusters support program, it was confined to a one-year period: every year PIC should submit the application for state aid. Financial support was provided on a competitive base. In this way, there was also the risk of non-delivery of budget financing for those projects, which were implemented for more than one year. However, in the industrial cluster support program, a five-year contract will be conducted with initiators of those projects, which meet the requirements of the Ministry. Consequently, there is a stronger motivation for new long-running joint project implementation.

Given the features of the three programs, the performance of clusters that received public support varies accordingly. The main gap between innovative and industrial cluster policies reveals in their core objectives.

Innovative clusters aim to facilitate innovation and technological growth, reach global recognition and integrate into global value chains in innovation-generated sectors (pharmaceuticals and medicine, IT-technologies, photonics). In both of innovative clusters support programs one of the key areas was reaching the effective cooperative relationships between cluster members, formulating positioning and differentiation points both on national and international levels. For instance, during the past two years The Ministry of Economic Development of Russia, Russian Venture Corporation (RVC) and Higher School of Economics have hosted regular events - strategic sessions - to which representatives of state-owned companies, development institutions, leading research organizations and private industry companies have been invited. The purpose of such events is to inform innovative clusters with ongoing contests, grants and support projects

implemented in the context of various industries, discuss issues of promoting goods and services, attracting investments in cluster projects and global markets expansion.

As for industrial clusters, the main goal of their support program is to increase production efficiency and import substitution in the basic Russian industries - agriculture, food industry, machine-building, forestry processing, construction, nuclear engineering. In this case, governmental support pays more attention to quantitative performance indicators (reduction of costs for purchasing raw materials, the decrease in the amount of import components, increase in value-added level and product proceeding to external agents), but less attention to cluster management and market strategy. This leads to the issue then both industrial clusters with a high level of organizational development and only emerging cooperation initiatives could be included in the list of industrial clusters, while only matured cluster initiatives were supported under innovative clusters support programmes.

Conclusion

The aim of the research was to suggest an approach to designing an 'ideal' cluster support program, which would blend the best practices derived from a comparative analysis of the key features and core results of cluster programs in the Russia over the last 10 years. During this time, the efficiency of cluster policy became one of the major issues for Federal Government. Public cluster support in Russia is accomplished in the way of competitive selection of subsidies' recipients for joint projects and cluster program implementation. Nowadays there are two key approaches to support cluster initiatives. The Ministry of Economic Development innovative clusters, which are aimed at international expansion in advanced industries. The Ministry of Industry and Trade approach focuses on import substitution.

Undoubtedly, all the reviewed cluster programs have both advantages and disadvantages. In our opinion, they all can be considered in the future of cluster policy development in Russia. One of the possible recommendations is a 'smart' synchronization of approaches used by different ministries based on the best practices exchange.

Firstly, the requirements for private financing are important. These sources create additional risk coverage from a projects non-completion and give more responsibilities to cluster members through the uncured costs. The key feature of cluster support programs in the world is the obligatory private funds in cluster projects.

Secondly, regional authorities should be involved in cluster policy. To support low-budget projects at the regional level can be more efficient than to administrate them at the federal level.

Furthermore, the regional government may provide several types of cluster support. This approach can be applied to cluster management. According to foreign experience (Czech Republic,

Sweden, Mexico, Spain, Austria), the major amount of budget financing is provided to cluster organizations through regional budgets. The matured cluster organizations can build a strong cluster brand, provide assistance to cluster members in project implementation, which is the subject of national-level support (including those, which are not limited by cluster peculiarities). For instance, in German 'BioRegio' program financing support was provided not only from its budget (90 million euros), but also from other national programs (Biotechnology-2000). As a result, clusters received financial support with the annual amount of more than 700 million euros. [OECD, 2007; Eickelpasch, Fritsch, 2005].

It is also important to facilitate the strategic vision and complex operation of cluster development programs with regard to joint projects. The quality of joint projects is more valuable than their quantity. Policymakers introduce their own approach to project selection. For instance, in France the innovative cluster project is estimated by the level of technological preparedness. Moreover, for the encouragement of cluster members, there is also need to ensure financial consistency. The financing period of 3-5 years (which concurs with the project implementation period) can be one of the ways for changing cluster priorities.

Furthermore it's crucial that the beneficiaries' selection may combine declarative order and competition: a free updating list of clusters, which get into consideration to public authorities and competitive selection of the projects, which will receive a grant. For instance, in the German program 'Leading Edge Clusters', oriented to R&D, provide a cluster competition among joint projects every two years, selected by the independent commission. During the first three rounds (2008, 2010 and 2012) 85 applications were submitted, and only 15 clusters became Leading Edge. Financial support is provided for all implementation periods of the projects, but no more than five years. The limit volume of funds is 40 million euros [BMBF, 2014].

One of the future steps forward the methodological synchronization may be the framed law of cluster policy (the current Federal law is more departmentally oriented).

To conclude, nowadays the Russian Federation demonstrates the noticeable potential for cluster development not only in high-tech industries but also in medicine, agriculture, energetics, and science-intensive services, creative and cultural industries. A special law of cluster policy could create a legal and regulatory framework for fulfilment, legitimize the cluster approach and facilitate the launch of new (including sectoral) support programs for clusters by the Ministry of Agriculture, the Ministry of Health, the Ministry of Energy and other federal executive bodies.

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Elena Popova
Expert, Institute for Statistical Studies and Economics of Knowledge, National Research University Higher School of Economics, Russian Federation. E-mail: ezaurova@hse.ru

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