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Specifics of Cluster Policy in Russia

JEL Classification: *O32; O38; L14*

Keywords: *cluster policy; Russian regions; innovations; quality of management; cluster management team*

Abstract: *The article presents the results of management quality survey in Russian clusters that reveals specifics of cluster support policy in Russia. We compare 22 Russian clusters, supported by the Government, using series of indicators measuring cooperation intensity of cluster participants and activity of cluster management teams. We introduce a description of the typical Russian innovative territorial cluster, based on the average values of the indicators.*

Our analysis revealed that international communications, information about funding and training courses are highly useful tools to improve collaborations among cluster participants. This paper proposes a methodology for measuring cluster performance by the cluster scale index, cluster development index and cluster management efficiency index.

In conclusion, we formulate recommendations for cluster policy improvement in Russia, based on our analysis of indicators' correlations and comparison between the results of our research and the similar researches in other countries.

This analysis will be useful for researchers and policymakers from countries, where cluster policy has recently become a popular topic.

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Introduction

According to M. Porter, cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field that are linked by commonalities and complementarities (Porter, 2000, p. 16). Cluster policy is a useful tool for improving economic performance of former transition countries (Ketels, 2003, p. 1). The most successful clusters have mechanisms and entities for collecting and disseminating knowledge and accumulating social capital (Rosenfeld, 2002, p. 6).

Cluster policy in Russia has recently become a popular topic. The Russian Government in its attempt to foster development of innovations and commercialization of technologies decided to support «territorial innovative clusters». The foreign best practices had been thoroughly studied, and experience of cluster development in Germany and France had been significantly explored. In the beginning of 2012, the Ministry of Economic Development of Russia initiated a competition of regional cluster projects. Russian regional administrations submitted about 100 applications, and from among them 25 applications were selected for support from the federal budget. At the beginning of the program, selected clusters could spend federal subsidies mainly on improving an infrastructure in territories of their location (Abashkin *et al.*, 2012, pp. 16-26).

Selection process was aimed at choosing high-tech clusters with high innovative potential. Most of the selected clusters were based on former large Soviet enterprises which survived during the transition period in 90th. These enterprises operate in such spheres as biotechnology, aerospace industry, nuclear power medicine and informational technologies. The main problem of these clusters is that they lack a tie with small companies and have an insufficient level of cooperation (Borisenko, 2012, pp. 143-148). That is why this initiative looks like a revitalization of the Soviet system of territorial production complexes, when several large companies from connected industries (like charcoal production, metallurgy and heavy machinery) were energetically and technologically integrated in regional boundaries. The Ministry of economic development is now addressing this shortcoming by organisation of special centres for cluster management that will provide soft infrastructure services – facilitation of interactions between cluster participants, provision of educational services, assistance in marketing and branding cluster participants, etc.

Figure 1. Regions of location of 22 Russian territorial innovative clusters

Source: own work.

According to (European Cluster Excellence Initiative, 2012) the quality of management is an important prerequisite not only in business, public and government organisations, but it is also an important component for a cluster organisation that is aimed at facilitating common projects among cluster participants.

The aim of this paper is to evaluate the efficiency of cluster management organisations in Russia and outcomes of their work during the 2012–2013 years.

For these purposes, the authors used the results of the survey of 25 Russian innovative territorial clusters. A survey was designed according to the questionnaire of the European Cluster Excellence Initiative. The survey was conducted by the Association of Innovative regions of Russia in February 2015. The survey was designed by means of Survey Monkey software1. Such a survey was conducted in Russia for the first time.

Among 25 surveyed clusters, management in 22 clusters gave responses (the response rate is 88%). Invitation to participate in survey was sent on behalf of Russian development institution – Association of Innovative Regions of Russia (AIRR). About 60 questions in the survey address different aspects of cluster management functioning. In particular, the questions address such topics as structure of the cluster, cooperation of cluster participants, initiation and management of cluster activities, strategy of cluster development and its implementation plan, recognition of the cluster in the internet, press and media.

The map on the Figure 1 shows regions, where 22 surveyed Russian innovative territorial clusters are located.

The names of the surveyed clusters, their abbreviations and region of their location are presented in the table 1.

Table 1. Russian innovative territorial clusters

Abbreviation	Name of the cluster and its specialization	Region of location
SIC	Shipbuilding innovative regional cluster	Arkhangelsk region
FBK	Pharmaceuticals, biotechnology and biomedicine cluster	Kaluga region
CIW	Complex processing of coal and industrial waste	Kemerovo region
MFR	Medical, pharmaceutical and radiation technology cluster	Leningrad region

[1] URL: https://www.surveymonkey.com

Table 1 continued

Abbreviation	Name of the cluster and its specialization	Region of location
ICZ	Innovative regional cluster of Zelenograd	Moscow
PHH	Phystech XXI	Moscow region
BIC	Biotechnological Innovation Cluster of Pushchino	Moscow region
NFN	Innovative regional cluster of nuclear physics and nanotechnology in Dubna	Moscow region
API	Industrial innovation cluster of the automotive and petrochemical industries	Nizhny Novgorod region
NBI	IT&BIO cluster	Novosibirsk region
FOT	A cluster of fiber-optic technologies "Photonics"	Perm region
RIC	Innovative regional cluster of rocket engine	Perm Region
PIC	Petrochemical innovative regional cluster	The Republic of Bashkortostan
ILM	Energy-efficient lighting and intelligent lighting control systems	The Republic of Mordovia
KIC	Kamsky innovative regional production cluster "Innokam"	The Republic of Tatarstan
ACS	Innovative regional aerospace cluster	Samara region
IES	Development of information technology, electronics, instrumentation, communications, and information & telecommunications	Saint Petersburg
MPR	A cluster of medical, pharmaceutical and radiation technologies	Saint Petersburg
TCS	Titanium Cluster	Sverdlovsk region
PMI	Pharmaceutics, medical equipment and information technology	Tomsk reiogn
NCD	Nuclear Innovation Cluster of Dimitrovgrad	Ulyanovsk region
ASH	Innovative regional cluster of aerospace and shipbuilding	Khabarovsk region

Source: Ministry of Economic Development of Russia.

The results of the survey were analysed using statistical and econometrical methods. We provide a characteristic of a typical Russian innovative territorial cluster, based on survey indicators.

The rest of the paper is structured as follows. Section 2 provides a brief description of the methodology of the research. Section 3 is devoted to the characteristic of functioning of Russian innovative territorial clusters and their management teams. Section 4 presents the correlation analysis results of clus-

ter performance indicators. Section 5 contains the conclusion of the research. Finally, the appendix contains a matrix of correlation coefficients and description of variables.

Research Methodology

The article is based on the results of the cluster management survey in 22 Russian innovation territorial clusters. We used correlation analysis in order to identify relationships between the 52 survey indicators (description of the indicators presented in the Appendix A.1). We also created a portrait of a typical (standard) Russian innovative territorial cluster based on the average values of selected indicators. For the description of the whole sample of the Russian clusters, we presented the minimum and maximum values for selected indicators, their averages and a standard deviation.

For the purpose of comparison of clusters development performance and efficiency of cluster management organizations, we have built several rankings based on indicators both gathered during the survey and calculated on the basis of the collected data.

Following the methodology for constructing index of knowledge economy (Chen & Dahlman, 2005, p. 17)., we have built the ranking of clusters by their scale, level of development and efficiency of cluster management.

Using expert method, we select k most relevant indicators (from full dataset, consisting of n = 52 indicators (*x1*…*x52*)) for the purpose of cluster description at each of the mentioned spheres[2].

For every selected indicator x_k we calculate the rank index R_i for cluster i = 1..21 according to the following expression:

$$R_i = \frac{R_{low}}{R} \times 10,$$

where R_{low} is a number of clusters with a lower rank, R is the total number of clusters.

By construction $0 \le R_i < 10$.

[2] For example in the case of cluster scale ranking, we use indicators: x1, x4, x14, x15, x16, x22, x24, x28, x36. These indicators are highly correlated with the number of registered cluster participants (x1) and almost not correlated with each other.

After that we define average rank index (AR_i) for cluster I = 1..21 by the following expression:

$$AR_i = \frac{\sum_{i=1}^{k} R_i}{k},$$

where k – is the number of selected indicators[3].

We use the same procedure to obtain AR_i indices for scale of cluster (AR_i^{scale}), its level of development (AR_i^{dev}) and efficiency of cluster management organizations (AR_i^{man}).

In the case of scale ranking construction we use raw data from our survey (*x1*..*x52* indicators).

To obtain input data for cluster rankings on level of development and efficiency of cluster management we standardize raw data by dividing corresponding indicators by the number of registered cluster participants (N_{part}) and number of cluster management staff (N_{team}).

In doing so for n = 1..52 we obtain:

$$x_n' = \frac{x_n}{N_{part}} \text{ and } x_n'' = \frac{x_n}{N_{team}}.$$

Then we calculate AR_i indices using x_n' and x_n'' input data.

After that, we obtain integral rank of the cluster i by the following expression:

$$IAR_i = \frac{AR_i^{scale} + AR_i^{dev} + AR_i^{man}}{3}.$$

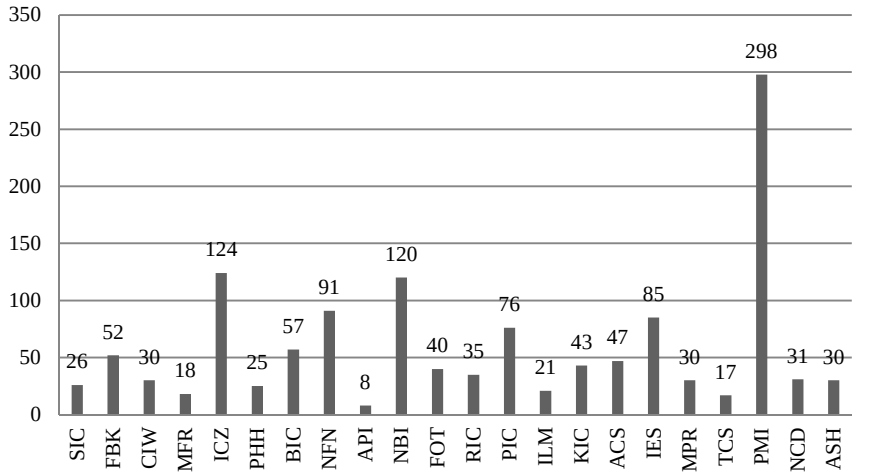
All used variables and correlation matrixes are in the Appendixes A1 – A8.

[3] In the case of cluster scale ranking number of selected indicators (*x1, x4, x14, x15, x16, x22, x24, x28, x36*) counts nine.

Description of Russian Innovative Territorial Clusters

According to the survey, there is a high differentiation in the size of the clusters. The highest number of participants registered in the PMI cluster (Pharmaceutics, medical equipment and information technology of Tomsk region) – about 300. The lowest number of participants belongs to the API cluster (Nizhny Novgorod industrial innovation cluster of the automotive and petrochemical industries). The average number of cluster participants is 68 and standard deviation equals to 72 (Figure 2). Comparing to other European clusters (Lundequist & Power, 2002), the Russian innovative clusters can be characterized as highly concentrated and less diversified. The number of cluster participants is related to the industrial specialization. The medical industry in Russia is highly dispersed, there are many more small innovative companies than in traditional machinery or chemical clusters, where large soviet factories prevail. Unfortunately, the survey could not help to reveal the size (number of workers, sales, etc.) of the cluster members. Also the regional location does matter, because in the university centre (for example, Tomsk region), there are many more small businesses than in traditional industrial regions (such as Yekaterinburg or Bashkortostan).

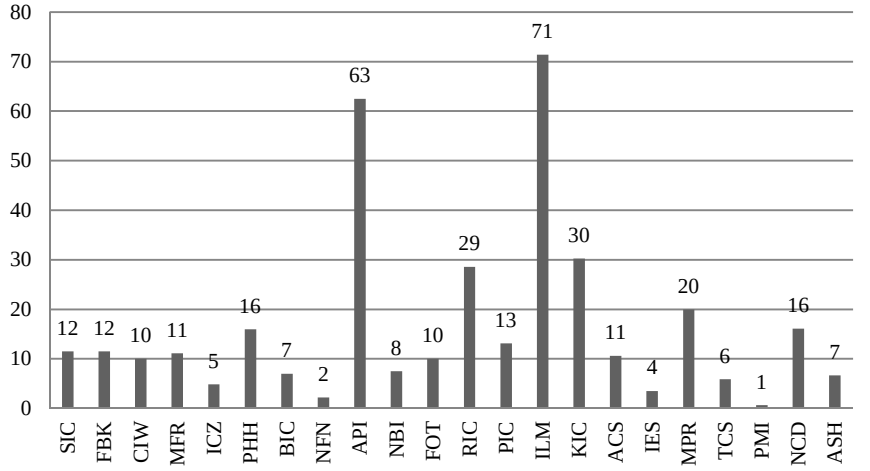
Figure 2. Number of participants in the Russian territorial innovative clusters



Source: own calculations based on the AIRR cluster survey.

The number of cluster management staff per cluster participant is an important characteristic of potential services, which can be provided in the cluster. The highest number of cluster management staff per 100 cluster participants is in the ILM cluster (Energy-efficient lighting and intelligent lighting control systems in Mordovia region) – about 71 managers per 100 cluster participants. The lowest number is in the PMI cluster (Pharmaceutics, medical equipment and information technology of Tomsk region) – 1 manager per 100 cluster participants. The average number of management staff per 100 cluster participants is 15 and the standard deviation is 17 (figure 3).

Figure 3. Number of cluster management staff per 100 cluster participants



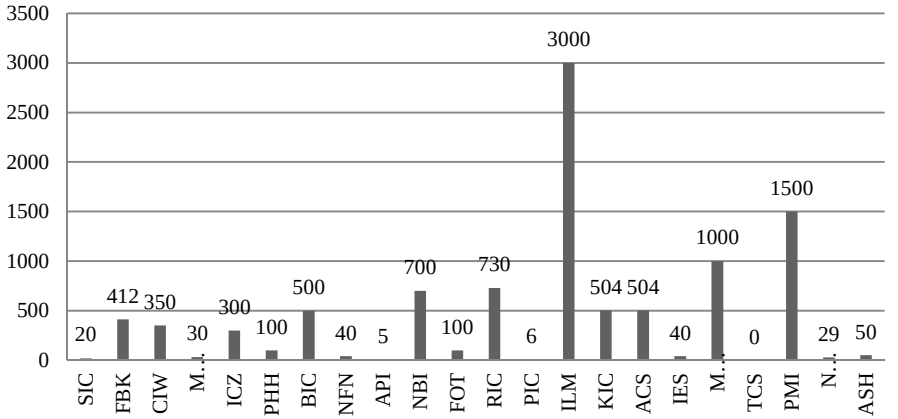
Source: own calculations based on the AIRR cluster survey.

It seems that the high number of cluster management staff per cluster participants influence positively the intensity of communications between cluster management organisation and cluster participants. The correlation coefficient between two variables is 0.51. The leader in terms of the number of communications between the cluster management team and cluster participants is the ILM cluster (Energy-efficient lighting and intelligent lighting control systems of Mordovia region) – about 3000 interactions during the last two years. So, the high number of management staff gives payoffs in terms of intensity of interactions with cluster members. The lowest number of interactions was reported by the API cluster (Nizhny Novgorod industrial innovation cluster of the automotive and petrochemical industries) – only 5 during the last two years. At the same time, the API has the second highest number of cluster

management staff (63 managers per 100 cluster members). It means that the efficiency of the API staff work is low in terms of interactions with cluster participants.

The average number of interactions between cluster management team and cluster participants is 441 for the two years period and the standard deviation is 648 (Figure 4).

Figure 4. Number of personal interactions between cluster management staff and cluster participants during 2013–2014 years

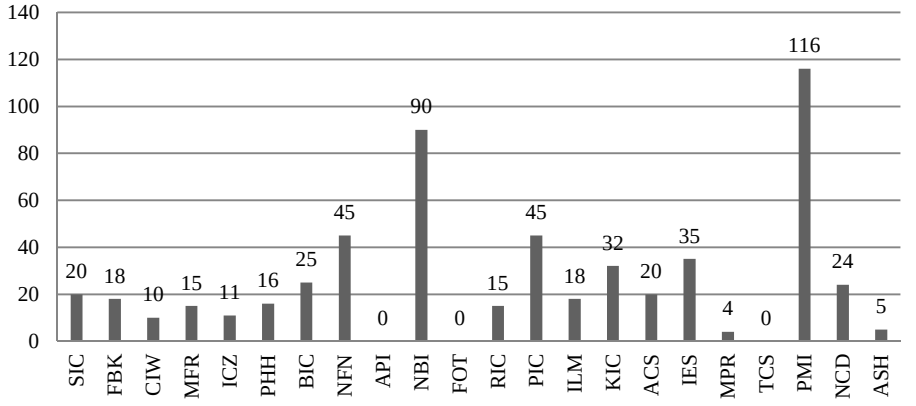


Source: own calculations based on the AIRR cluster survey.

Collaborations among cluster participants is an important indicator of the trust level within the cluster. Collaborated projects create synergy effect in terms of higher revenues and profits to its participants. Moreover, it is empirically proved that collaboration is one of the main factors of cluster efficiency and regional performance (Delgado *et al*., 2014).

The highest number of cluster participants that were involved in joint projects (collaborated) during the 2013–2014 years is 116 in the PMI (Pharmaceutics, medical equipment and information technology of Tomsk region). The lowest number of cluster members that were involved in common activities is four in the MPR cluster (Cluster of medical, pharmaceutical and radiation technologies of St. Petersburg). The average number of cluster members that collaborated is 37 for the sample of 22 Russian innovative territorial clusters during the two year period and the standard deviation is 50 (Figure 5). Comparing to the results of cluster policy in other European countries, it is rather modest result, but Russian cluster policy is just at the stage of introduction.

Figure 5. Number of cluster participants involved in joint projects during 2013–2014 years

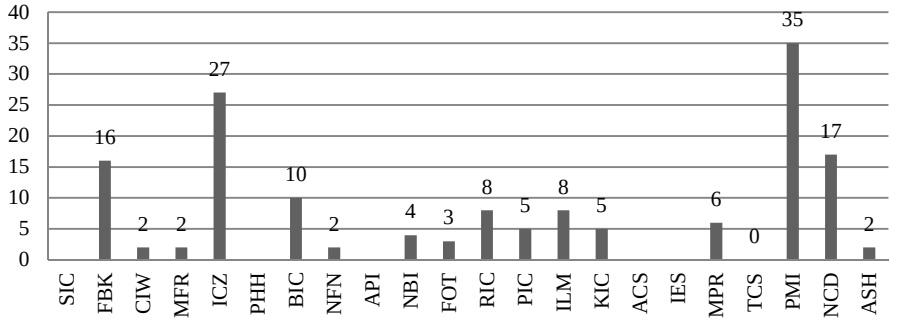


Source: own calculations based on the AIRR cluster survey.

Further on, we investigate the specific aspects of collaborations inside the Russian innovative territorial clusters such as joint R&D projects, training and coaching, funding support services, cluster presentations, external networking, communication events.

The prospects of cluster future development depend significantly on collaborations among its participants. Especially important collaborations are in the sphere of R&D and development of new products. The highest number of joint R&D or innovation projects between cluster participants per year is 35 in the PMI cluster (Pharmaceutics, medical equipment and information technology of Tomsk region). The lowest number is only two in the Innovative regional cluster of aerospace and shipbuilding of Khabarovsk Krai (zero numbers were not analysed, because they could be missing answers). The average number of cluster collaborative R&D or innovation projects is 12 and the standard deviation is 13 (Figure 6). In other words, an average rate of R&D collaboration is 1,1 per 10 cluster participants. This value depends on the cluster specialization, and it is much higher in the most innovative spheres (such as pharmaceutics, microelectronics or nuclear technologies), where small firms or even one big firm cannot make a new product without collaboration.

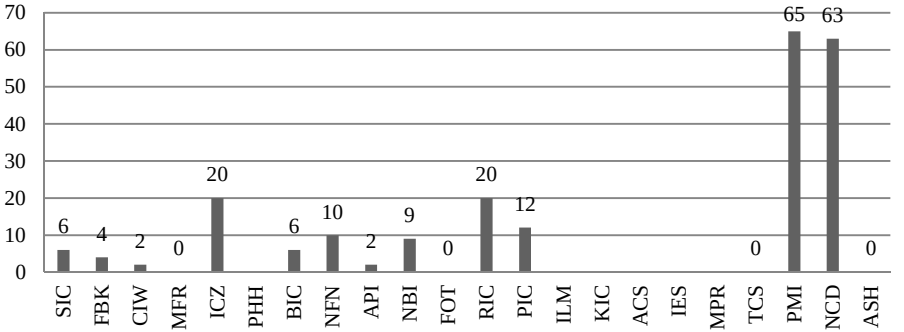
Figure 6. Collaborative R&D or innovation projects between cluster participants (2014 year)



Source: own calculations based on the AIRR cluster survey.

For successful development of the cluster, it is very important to stimulate the growth of the number of small companies. Consulting and coaching services helps to increase start-ups' survival rate. The highest number of consulting and coaching events for entrepreneurs was held in the PMI cluster (Pharmaceutics, medical equipment and information technology of Tomsk region) – 65 events during 2014. And the lowest number was zero – in the FOT (Cluster of fibre-optic technologies "Photonics" of Perm region) and the ASH clusters (Innovative regional cluster of aerospace and shipbuilding of Khabarovsk Krai). For some other clusters, it is not clear whether absent values mean zero or missed data. The average number of consulting and coaching events for entrepreneurs is 16 and the standard deviation is 21 (Figure 7), the average rate of consulting assistance was 1.7 per 10 cluster participant.

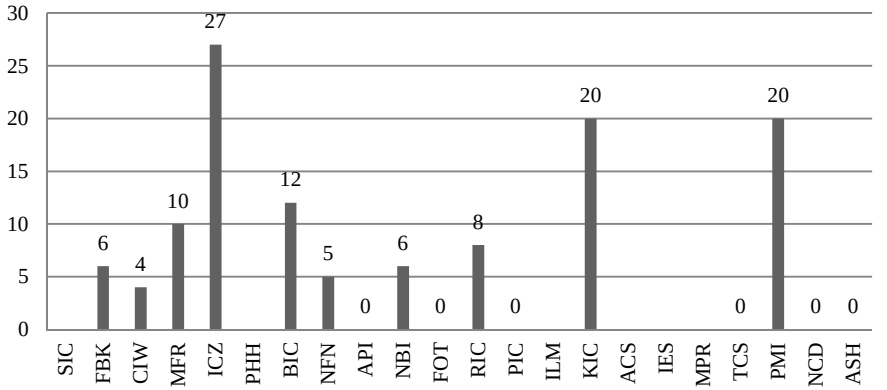
Figure 7. Consulting and coaching events for entrepreneurs (2014 year)



Source: own calculations based on the AIRR cluster survey.

Access to funding is an essential factor for growth of small business enterprises represented in clusters. One of the core activities of a cluster management organisation is to provide support for start-ups and entrepreneurs in attraction of financial resources. The highest number of cluster companies which were assisted in fundraising was 27 in the ICZ cluster (Innovative regional cluster of Zelenograd in Moscow region). The lowest non-zero number of supported companies was in the CIW cluster (Complex processing of coal and industrial waste of Kemerovo region), where only 4 companies were assisted in acquisition of financial resources. The average number of assisted companies was 10 in 2014 and the standard deviation is 11 (Figure 8). The average rate of financial assistance was 0.9 per 10 cluster participants.

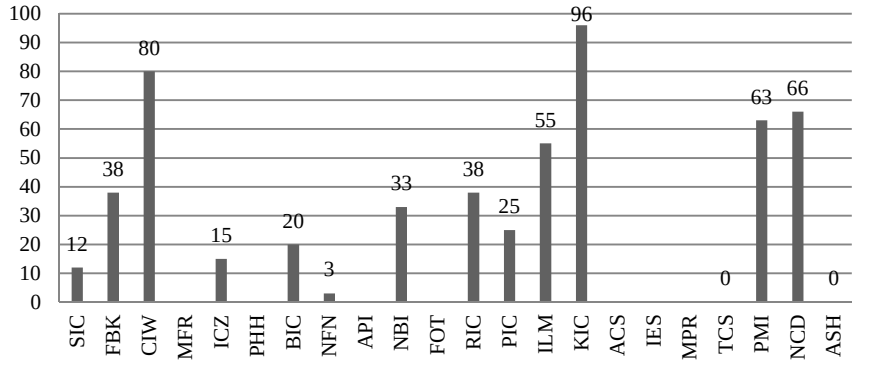
Figure 8. Number of companies supported in acquisition of financial sources (venture capital, banks, public funds etc.), 2014



Source: own calculations based on the AIRR cluster survey.

Training of cluster participants is helpful in terms of increasing the level of cooperation and trust in the cluster. The highest percentage of trained cluster members was in the KIC (Kamsky innovative regional production cluster "Innokam" of Tatarstan region), where 96% cluster members' representatives completed common educational courses. The smallest non-zero share is in the NFN cluster (Innovative regional cluster of nuclear physics and nanotechnology in Dubna of Moscow region), where only 3% cluster members had joint educational training. The average portion of trained cluster participants was 39% and standard deviation is 29% (Figure 9).

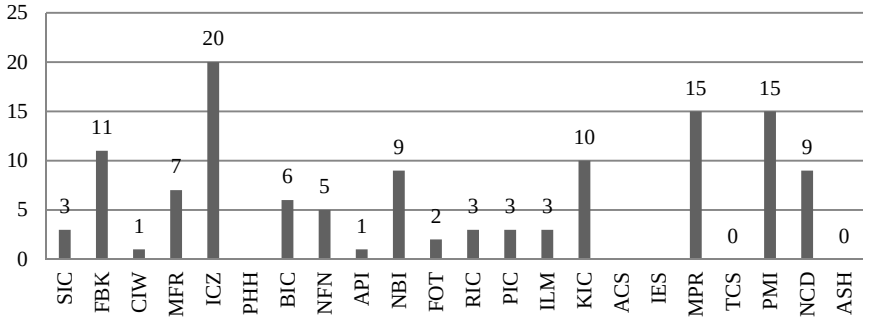
Figure 9. Percentage of trained cluster participants (2014 year)



Source: own calculations based on the AIRR cluster survey.

Promotion of cluster and its participants in trade fairs and exhibitions is helpful for increasing recognition of cluster members and creation of external links. The highest number of presentations of cluster and its participants was made by the ICZ cluster (Innovative regional cluster of Zelenograd in Moscow region), which conducted 20 such events in 2014. The lowest non-zero number was 1 presentation in the CIW cluster (Complex processing of coal and industrial waste of Kemerovo region) and the API cluster (Nizhny Novgorod industrial innovation cluster of the automotive and petrochemical industries). The average number of cluster presentations is 7 and the standard deviation is 6. (Figure 10).

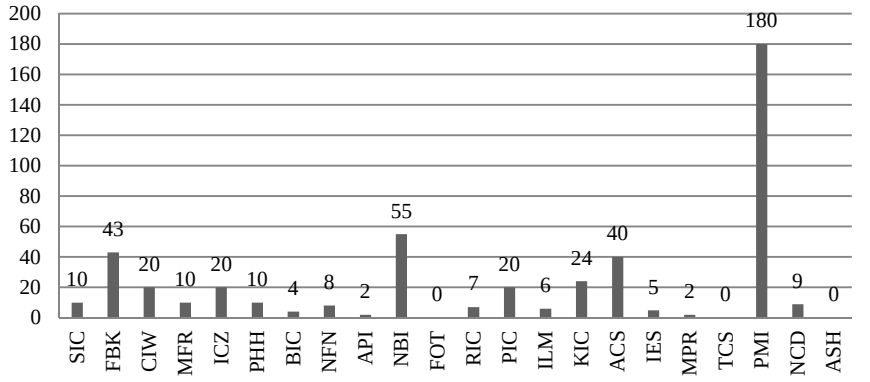
Figure 10. Presentation of cluster and its participants on trade fairs / conferences / etc. (2014 year)



Source: own calculations based on the AIRR cluster survey.

The key duty of cluster management organisation is to organize and facilitate cooperation and interactions among cluster participants and internal and external partners through communication activities. The highest number of communication activities was organized in the PMI cluster (Pharmaceutics, medical equipment and information technology of Tomsk region) – 180 activities. The lowest non-zero number of such activities was in the MPR cluster (Cluster of medical, pharmaceutical and radiation technologies of St. Petersburg) – only 2. The average number of communication activities was 24 and the standard deviation is 39 (Figure 11).

Figure 11. Number of communication activities (2014 year)



Source: own calculations based on the AIRR cluster survey.

Based on aggregate data of the AIRR survey of cluster management organisations, we have designed a portrait of a typical Russian innovative territorial cluster. For this purpose, we calculated average values for the survey indicators. In this article, we call it as the Russian standard cluster.

The Russian standard cluster has about 70 participants (SMEs, large companies, universities, research institutions, government bodies, business incubators and technoparks). Among them, 50 cluster participants were registered during the last two years (71%).

About 80% of cluster participants are located at the distance lower than 150 km or 1 hour and a half time of travelling. In average a cluster management organisation started to work in 2011 and its staff consists of 6 people responsible for cluster management activities. That staff was trained for two weeks in 2014 and one week in 2013 in order to accomplish their goals, 37% of cluster management staff involved in continuous training programs. About 70% of the budget of cluster management organisation is financed by gov-

ernment bodies (regional or federal) and 30% comes from private sources (membership fees, service payments, etc.).

During the last year about 220 interactions were initiated between cluster management staff and cluster members (on average, 3 interaction per cluster member per year) and 18 cluster participants were involved in joint projects (26% of all cluster members). About 40% of cluster members participated in various training programs during 2014 year.

A representative cluster management organisation distributed among cluster members information about 12 funding programs and possibilities in 2014. It also organized seven task forces and working groups, and two of them were devoted to innovations. Average cluster management organisation supported 10 entrepreneurs in acquisition of financial resources. It made seven presentations of cluster and its participants on trade fairs and conferences, issued 18 press releases, send 126 informational letters to cluster participants, and organized 24 communication events. As a result, the cluster was 26 times mentioned in media and internet during 2014 year.

Correlation Analysis of Cluster Performance Indicators

At the next step of our analysis, we examined pairwise correlation coefficients (r) between different indicators of the AIRR survey. The list of examined variables presented in the Appendix A.1. For this set of variables, we calculated pairwise correlation coefficients using the Stata 11.0 software[4]. We picked only those correlation coefficients that were significant at level 5% and whose value exceeded 0.7. The matrix of selected correlation coefficients is presented in the Appendix A.2. Correlation analysis helps us to identify relationships and propose policy measures that can improve performance of the Russian innovative territorial clusters.

According to (Biggiero & Sammarra, 2010, pp. 283-305), constant personal interactions and exchange of knowledge are essential to stimulate spread of innovations and spur competitiveness of companies in clusters. The number of cluster participants which were involved in joint projects during 2013–2014 years (*x14*) is significantly correlated with the number of thematic and business or commercial-based events and workshops (*x25*) for cluster participants (*r(x14;x25)=0.73),* and in general with the number of communication activities (*x52*) inside the cluster (*r(x14;x52)=0.83).* Correlation coefficients also show that the number of collaborating cluster participants is proportionate to the size of the cluster (*r(x14;x1)=0.85, r(x14;x1)=0.80).*

[4] URL: http://www.stata.com/

Our analysis provides evidence that cluster management organisation could stimulate collaborations among cluster participants via organisation of communication activities, in particular, commercial-based events and workshops.

Firms at clusters should be at the forefront of science in order to be successful and that stimulates them to collaborate with universities and research institutions (Häussler & Zademach, 2006, pp. 2-19).

Correlation analysis reveals that the number of collaborative R&D and innovation projects of cluster participants *(x24)* is highly correlated with the following indicators:

- the number of specific training courses related to cluster development for cluster participants *(x30), r(x24;x30)=0.82;*
- the number of distributions of information about funding programs and possibilities for cluster participants *(x21)* , *r(2x4;x21)=0.80;*
- the number of internal newsletters or web-based information and information exchange *(x44), r(x24;x44)=0.78;*
- the number of training days of cluster management staff *(x5), r(x24;x5)=0.75.*

According to our analysis, for increasing the number of collaborative R&D and innovation projects it is important to distribute information about funding programs among cluster participants, stimulate information exchange between them and initiate training courses for cluster participants and cluster management staff.

Clusters have great potential for profitable interactions between their participants, but miss many opportunities because their members often lack relevant information. The set of knowledge failures, network failures, collaboration failures and coordination failures of cluster participants lead to the innovation failure of the cluster *(*Ketels *et al.*, 2012, pp. 33-34). That is why the role of cluster management organisation is so important – it helps to improve the competitiveness and growth of cluster by establishing a communication field within it.

International cooperation of cluster management organisation is now becoming its crucial function as in Russia and worldwide. Transnational cooperation of cluster management organisation helps to bring new ideas to SMEs that lack foreign contacts. Because of this, international cooperation of cluster management organisation is considered as a suitable approach for decreasing the risk of cluster degradation due to a "lock-in" effect (Europe INNOVA, 2008, p. 48).

Correlation analysis reveals that different aspects of international activity of cluster management organisation are strongly related to each other. For instance, issuing information about cluster in foreign languages *(x45),* partici-

pation of cluster organisation in foreign trade fairs and conferences *(x46),* and the number of its offices abroad *(x47)* are highly correlated with each other.

What is more important, all three indicators *(x45, x46, and x47)* are strongly correlated with the participation of cluster management organisation in regional policy development *(x39).* International contacts help to increase the skills and experience of cluster managers and excellent management is considered as a main prerequisite for a cluster organisation to make a high impact on the regional legislative framework (Müller *et al.*, 2012, p. 31).

Summing up, correlation analysis revealed several important facts that could be helpful for cluster policy.

Primarily, international collaborations should be a high priority for cluster participants and cluster management team. International collaborations stimulates active participation of cluster in transforming institutional environment of its functioning, spur dissemination of new ideas and technologies via organisation of innovation workshops and initiation of innovative projects.

Secondly, spread of information about funding among cluster participants stimulates initiation of collaborative R&D projects between them. This is because the main source of additional funding in Russia is government grants to small companies and the necessary condition for receiving most types of such grants are collaborations and R&D focus.

Finally, training courses are highly useful both for cluster participants and for cluster management team. Training courses spur communications between cluster members, stimulate development of trust and increase collaborations. Information about funding possibilities also can be disseminated via training courses. The more trained cluster management staff is, the better it provides specialized services for cluster participants.

Basing on the findings, we recommend to regional and federal authorities responsible for cluster policy to co-finance international exposure of clusters, assist in spreading information about funding possibilities and subsidize training courses for cluster participants and cluster management team.

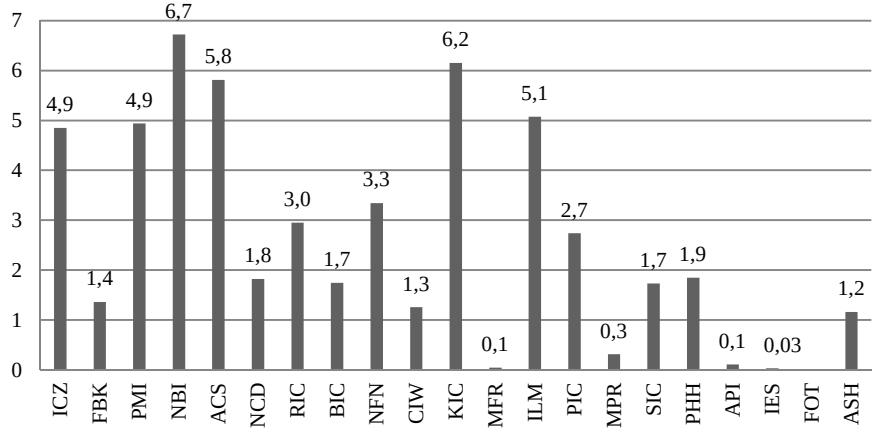
Ranking of Russian Clusters Due to Their Scale, Stage of Development and Efficiency of Cluster Management

Russian territorial innovative clusters received, in total, 62.5 million euro of subsidies from the federal budget with a condition of their co-financing from regional budgets (5-30% of federal subsidy). Federal government allocated funding unequally among clusters (Figure 12). The amount of federal budget subsidy was calculated on the basis of the projects that each cluster proposed.

Federal subsidies can be spent on training of cluster participants, investment consulting, participation in trade fairs and conferences, development of engineering centres and purchasing equipment.

The highest amount of financing from federal budget was received by the NBI cluster (IT&BIO cluster of Novosibirsk region) – 6.7 mln euro. The lowest amount of federal budget funding got the IES (Cluster for development of information technology, electronics, instrumentation, communications, and information & telecommunications of Saint Petersburg) – 0.03 million euro. The average amount of federal subsidy equals to 2.7 million euro and the standard deviation is 2.1 million euro. Because the funding was allocated mainly to the projects proposed by clusters it is not clear how the amount of funding relates to a scale of cluster, its stage of development and efficiency of management.

Figure 12. Federal budget subsidies to clusters, million euro (2014 year)



Note: the data is presented only for 22 clusters that took part in the survey, while federal subsidies were allocated among the 26 clusters.

Source: own calculations based on the AIRR cluster survey.

In order to investigate this issue, we combine the data of the AIRR survey with the data about federal funding and analyse how an amount of budget subsidy relates to such characteristics of a cluster as its scale, stage of development and efficiency of cluster management. In order to perform the comparison we rank clusters by the mentioned above characteristics and compare the results with their funding ranking. The detailed description of composition of the rankings is presented in the chapter “Methodology”.

Cluster scale ranking

The scale of the cluster reflects how large the cluster is and how many interactions it has. So, the scale ranking compares clusters on their ability to influence regional economy. For this purpose, we have constructed a cluster scale index.

Among the 52 indicators of the AIRR survey, we chose the number of registered cluster participants *(x1)* and the number of cluster management stuff *(x4)* as the main indicators for the cluster scale index. Than we selected indicators that are significantly correlated with the two main variables (at the α-level less than 10% and correlation coefficient more than 0.6) and not correlated with each other (in the cases of multicorrelation, we selected the most informative one). As a result, for constructing the cluster scale index we used the following set of nine indicators (the correlation matrix is presented in the Appendix A.3):

1. Number of registered cluster participants *(x1),*
2. Number of cluster management staff *(x4),*
3. Number of cluster participants that were involved in joined projects during 2013-2014 years *(x14),*
4. Number of innovation & business infrastructure organisations and financial institutions among cluster participants *(x15),*
5. Number of strategic alliances with innovation & business infrastructure organisations and financial institutions *(x16),*
6. Number of task forces and working groups organized by cluster participants *(x22),*
7. Number of collaborative R&D and/or innovation projects initiated without participation of the cluster management: between participants / by participants *(x24),*
8. Number of consulting and coaching activities for entrepreneurs *(x28),*
9. Number of presentations of the cluster and its participants on trade fairs and conferences / etc. *(x36).*

For each of these indicators, we constructed the rank index and calculated the resulting cluster scale index as a simple average of ranks of the nine mentioned above indicators (the detailed data are presented in the Appendix A.4). The leader of the cluster scale ranking is the PMI cluster (cluster of pharmaceutics, medical equipment and information technology of Tomsk region), it has rank index equal to 7.4. This cluster has the highest number of participants, many of them are intensively collaborate, especially in the sphere of R&D, and in the cluster are well presented innovation & business infrastructure organisations and financial institutions.

Cluster development ranking

This ranking reflects the level of integration of cluster participants – how intensive and efficient the interactions between them are, and how many cluster policy measures affect every participant. In this case, we divided 52 indicators from the AIRR survey by the number of cluster participants where it is possible and mark them with a single apostrophe (‘). Then, we chose the main indicators among them. They are: the number of cluster participants that were involved in joined projects during 2013–2014 years per 100 cluster participants *(x14’),* the number of distributions of information about funding programs and possibilities for cluster participants per 100 cluster participants *(x21’),* and the number of activities like innovation workshops, technology scouting and/or road mapping campaigns/projects, etc. per 100 cluster participants *(x23’).*

As the next step, we select those indicators that correlate with the three main ones (at the α-level less than 10% and correlation coefficient more than 0.6) and not correlated with each other (in the cases of multicorrelation we selected the most informative one). As a result, for constructing the cluster scale index we used the following set of ten indicators (the correlation matrix is presented in the Appendix A.5):

1. Number of cluster participants that were involved in joined projects during 2013-2014 years per 100 cluster participants *(x14’),*
2. Number of collaborative R&D and/or innovation projects initiated without participation of the cluster management: between participants / by participants per 100 cluster participants *(x24’),*
3. Number of collaborative B2B projects (no R&D, innovation as a minor issue) initiated between participants / by participants per 100 cluster participants *(x27’),*
4. Number of consulting and coaching activities of entrepreneurs per 100 cluster participants *(x28’),*
5. Number of recruitments of specialists, executive managers, and other human resources by the cluster participants where cluster management gave assistance per 100 cluster participants *(x32’),*
6. Number of presentations of the cluster and its participants on trade fairs and conferences / etc. per 100 cluster participants *(x36’),*
7. Number of specific events and workshops organized by the cluster organisation to present the cluster and its participants to external parties per 100 cluster participants *(x37’),*
8. Number of internal (for committed cluster participants only) newsletters/web-based information and information exchange per 100 cluster participants *(x44’),*

9. Number of offices or permanent representations of the cluster abroad per 100 cluster participants *(x49')*,
10. Number of communication activities (internal and external communication) were carried out during 2014 year per 100 cluster participants *(x52')*.

For each of these indicators, we constructed the rank index and calculated the resulting cluster development index as a simple average of ranks of the ten mentioned above indicators (the detailed data are presented in the Appendix A.6). The leader of the cluster development ranking is the FBK cluster (cluster of pharmaceuticals, biotechnology and biomedicine of Kaluga region), it has rank index equal to 7.4. This cluster has the highest number per participant of collaborative R&D and innovation projects, issued newsletters and web-based information releases, offices or permanent representations of the cluster abroad, and communication activities.

Cluster management efficiency ranking

The efficiency of cluster management mainly reflects the intensity of work of cluster management staff – basically, how many activities one member of the management team leads. We divided 52 indicators from the AIRR survey by the number of cluster management staff where it was possible, and marked them with a double apostrophe (").

Among the available indicators, we chose the number of registered cluster participants per management team member *(x1")* and number of cluster participants trained per management team member *(x31")* as the main indicators for the cluster management efficiency index. As in previous rankings, we than selected indicators that are significantly correlated with the two main variables (at the α-level less than 10% and correlation coefficient more than 0.6) and not correlated with each other (in the cases of multicorrelation, we selected the most informative one). As a result, for constructing the cluster management efficiency index we used the following set of ten indicators (the correlation matrix is presented in the Appendix A.7):

1. Number of registered cluster participants per management team member (*x1")*,
2. Number of cluster participants trained per management team member (*x31")*,
3. Number of training days of cluster management staff during 2014 year (*x5)*,
4. Number of personal interactions between cluster management team and cluster participants during 2013-2014 years per management team member (*x13")*,

5. Number of innovation & business infrastructure organisations and financial institutions among cluster participants per management team member (*x15"),*
6. Number of activities like innovation workshops, technology scouting and/or road mapping campaigns/projects, etc. per management team member (*x23"),*
7. Number of support activities for acquisition of financial sources (venture capital, banks, public funds etc.) for and/or on behalf of entrepreneurs per management team member (*x29"),*
8. Number of curricula initiated and/or courses carried out by cluster management organisation for cluster participants per management team member (*x33"),*
9. Number of issued press releases about cluster and its participants per management team member (*x35"),*
10. Percentage of increase of private and public financial support for the cluster management during 2014 year (*x41).*

For each of these indicators, we constructed the rank index and calculated the resulting cluster management efficiency index as a simple average of ranks of the nine mentioned above indicators (the detailed data are presented in the Appendix A.8). The leader of the cluster management efficiency ranking is again PMI cluster (cluster of pharmaceutics, medical equipment and information technology of Tomsk region), it has rank index equal to 7.7. This cluster has the high number of participants per management team member (many of them participated in training programs) and it also characterised by significant percentage increase of private and public financial support for the cluster management team.

The cluster scale index, cluster development index and cluster management efficiency index are highly correlated with each other (correlation coefficients are equal are above 0.6).

At the final step of our analysis, we construct the integral index of cluster performance as a simple average of its three components (scale index, cluster development index and cluster management efficiency index). According to the integral ranking, the first place is won by ICZ (Innovative regional cluster of Zelenograd), which showed relatively strong performance on the all three dimensions of cluster behaviour (Table 2).

Correlation coefficient between the integral index of cluster performance and the budget funding equals to 0.6. This means that in general the most prosperous clusters received federal budget support.

Table 2. Ranks of clusters

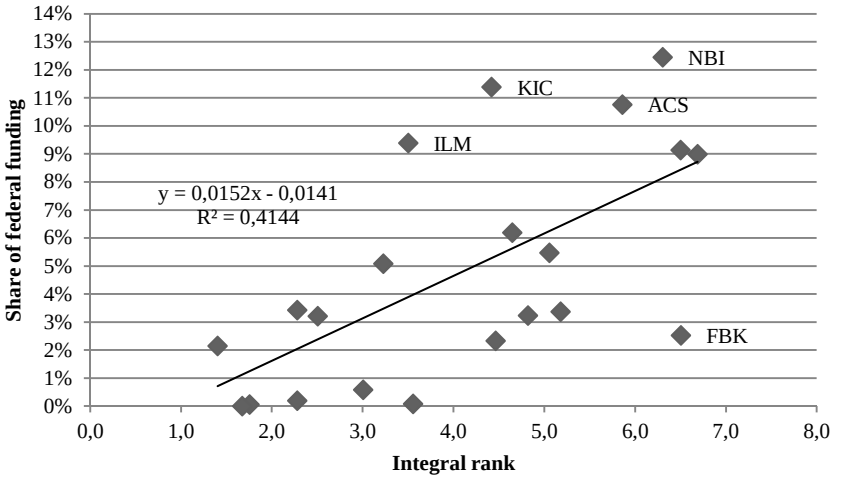
Cluster	Ranks				
	Scale	**Development**	**Efficiency**	**Integral**	**Funding**
ICZ	6.8	6.5	6.8	6.7	7.0
FBK	5.6	7.4	6.6	6.5	3.0
PMI	7.4	4.4	7.7	6.5	7.5
NBI	6.2	5.9	6.8	6.3	9.5
ACS	4.8	6.0	6.8	5.9	8.5
NCD	4.4	6.7	4.5	5.2	4.5
RIC	5.4	5.0	4.7	5.1	6.0
BIC	4.6	3.7	6.1	4.8	4.0
NFN	3.7	4.2	6.0	4.6	6.5
CIW	2.9	4.2	6.3	4.5	2.5
KIC	5.4	4.2	3.6	4.4	9.0
MFR	1.4	4.0	5.3	3.6	0.5
ILM	2.6	5.4	2.4	3.5	8.0
PIC	4.9	3.2	1.6	3.2	5.5
MPR	3.0	3.6	2.4	3.0	1.5
SIC	1.7	3.4	2.3	2.5	3.5
PHH	2.6	1.3	2.9	2.3	5.0
API	1.2	3.4	2.2	2.3	1.0
IES	2.6	0.5	2.1	1.8	0.0
ASH	0.6	1.3	2.3	1.4	2.0

Source: own calculations based on AIRR survey.

Figure 13 depicts the relationship between the integral rank and share of federal budget funding for each cluster. It is clear that some clusters were excessively financed relative to their performance (ILM, KIC, ACS, NBI) while others were underfinanced (for instance, FBK).

Amount of federal funding has the closest correlation with the cluster scale rank (0.7), while its correlation with development rank is 0.5 and with efficiency rank is 0.4. That means that the recent cluster support policy in Russia is oriented mainly at the large group of companies, while the level of collaborations between them and the quality of management of cluster organisation are relatively less important topics. According to this, we recommend to the federal officials responsible for the cluster support policy to pay more attention to the quality of cluster performance, as it directly relates to the future success of clusters.

Figure 13. The relationship between the integral rank and the share in financing



Source: own calculations based on AIRR survey.

Conclusions

In this article, we have described a typical Russian innovative territorial cluster basing on aggregate characteristics of 22 surveyed Russian clusters. For evaluation reasons, it is important to compare performance of a Russian innovative territorial cluster against foreign benchmarks. For this purpose, we chose the minimum European Cluster Excellence Baseline (Hagenauer, 2011, pp. 1-5), which provides a set of critical values for cluster performance.

According to the European Cluster Excellence Baseline, mature cluster should have no less than 90% of participants which are committed (registered in the cluster), and half of them should represent business in the relevant industry of cluster functioning. Universities and research institutions are the obligatory part of the mature cluster. A cluster management organisation should function for more than 2 years and it should yearly contact with minimum 20% of cluster participants. At least 15% of cluster participants are engaged in collaborations with each other.

Our analysis provides evidence that the standard Russian innovation territorial cluster meets the criteria for a mature cluster. At the same time, the range of analysed Russian clusters is very diverse, and some of them show relatively strong performance, while others are lagging behind.

Correlation analysis revealed the importance for the development of lagging clusters introduction of such measures as increasing their international exposure, spreading information about funding opportunities and subsidizing courses for cluster members and cluster management team.

There is a considerable room for improvement in the cluster support policy in Russia. Funding criteria should include such cluster characteristics as efficiency of cluster management and development of cluster tiers among its participants. In the paper, we have proposed an approach for evaluation and comparison of clusters according to the quality of their management and strength of cooperation among their members.

The direction for further research could be correlation analysis of performance indicators for clusters that operate in familiar industries.

References

Abashkin, V., Boyarov, A., & Kutsenko, E. (2012). Cluster Policy in Russia: From Theory to Practice. *Foresight-Russia*, 3.

Biggiero, L., & Sammarra, A. (2010). Does Geographical Proximity Enhance Knowledge Exchange? The Case of the Aerospace Industrial Cluster of Centre Italy. *International Journal of Technology Transfer and Commercialisation*, 9(4). DOI: http://dx.doi.org/10.1504/IJTTC.2010.035397.

Borisenko, O. (2012). Development of clusters in Russian Regions. *Vestnik MGTU*, 15(1).

Chen, D. H., & Dahlman, C. J. (2005). The Knowledge Economy, the KAM Methodology and World Bank Operations. *World Bank Institute Working Paper*, 37256.

Delgado, M., Porter, M. E., & Stern, S. (2014). Clusters, Convergence, and Economic Performance. *Research Policy*, 43(10). DOI: http://dx.doi.org/10.1016/j.respol.2014.05.007.

Europe INNOVA (2008). *The Concept of Clusters and Cluster Policies and Their Role for Competitiveness and Innovation: Main Statistical Results and Lessons Learned. Commission Staff Working Document SEC (2008)2637*. Luxembourg: European Communities.

European Cluster Excellence Initiative (2012). The Quality Label for Cluster Organisations – Criteria, Processes, Framework of Implementation. Retrieved from http://www.cluster-excellence.eu/ (8.02.2015).

Häussler, C., & Zademach, H. M. (2006). Cluster Performance Reconsidered: Structure, Linkages and Paths in the German Biotechnology Industry, 1996-2003. *SFB/TR 15 Discussion Paper*, No. 188.

Ketels, C., Lindqvist, G., & Sölvell, Ö. (2012). *Strengthening Clusters and Competitiveness in Europe. The Role of Cluster Organisations*. The Cluster Observatory.

Ketels, C. (2003). The Development of the Cluster Concept–present Experiences and Further Developments. In *NRW Conference on Clusters Vol. 5*. Duisburg. Germany.

Lundequist, P., & Power, D. (2002). Putting Porter into Practice? Practices of Regional Cluster Building: Evidence from Sweden. *European Planning Studies*, 10(6). DOI: http://dx.doi.org/10.1080/0965431022000003762.

Müller, L., Lämmer-Gamp, T., Meier zu Kôcker, G., & Alslev Christensen, T. (2012). Clusters are Individuals. New Findings from the European Cluster Management and Cluster Program Benchmarking. Updated report. VDI/VDE Innovation + Technik GmbH (VDI/VDE-IT); The DanishMinistry of Science Innovation and Higher Education.

Porter, M. (2003). The Economic Performance of Regions. *Regional Studies*, 37(6-7). DOI: http://dx.doi.org/10.1080/0034340032000108688.

Porter, M. E. (2000). Location, Competition, and Economic Development: Local Clusters in a Global Economy. *Economic Development Quarterly*, 14(1), 15-34. http://dx.doi.org/10.1177/089124240001400105

Rosenfeld, S. A. (2002). Creating Smart Systems: A Guide to Cluster Strategies in Less Favoured Regions. *Regional Technology Strategies*, 6.

Appendix A.1. The list of examined variables of the AIRR cluster survey

x1 – Number of registered cluster participants;
x2 – Share of cluster participants that are located within 150 km distance or 1hour and a half travel time;
x3 – Number of cluster management staff per 100 cluster member organisations;
x4 – Number of cluster management staff (absolute value);
x5 – Number of training days of cluster management staff during 2014 year;
x6 – Number of training days of cluster management staff during 2013 year;
x7 – Participation of cluster management staff in a continues training (binary variable: yes – 1, no – 0);
x8 – Availability of the budget for further cluster management staff trainings (binary variable: yes – 1, no – 0);
x9 – Number of cluster management staff that left their positions during 2013-2014 years;
x10 – Number of newly registered cluster participants during 2013-2014 years;
x11 – Did the head of cluster management organisation leave his or her position 2013-2014 years (binary variable: yes – 1, no – 0);
x12 – Number of registered cluster participants that left their positions during 2013-2014 years;
x13 – Number of personal interactions between cluster management team and cluster participants during 2013-2014 years;
x14 – Number of cluster participants that were involved in joint projects during 2013-2014 years;
x15 – Number of innovation & business infrastructure organisations and financial institutions among cluster participants;
x16 – Number of strategic alliances with innovation & business infrastructure organisations and financial institutions;

x17 – The availability of financial resources for the future years (binary variable: yes – 1, no – 0);
x18 – Share of private sources in the budget of cluster management organisation;
x19 – Availability of a document of how cluster management organisation plans to support cluster development in short term, medium term and long term (binary variable: yes – 1, no – 0);
x20 – Availability of measurement system of quality of work of cluster management organisation (binary variable: yes – 1, no – 0);
x21 – Number of distributions of information about funding programs and possibilities for cluster participants;
x22 – Number of task forces and working groups organized by cluster participants;
x23 – Number of activities like innovation workshops, technology scouting and/or road mapping campaigns/projects, etc.;
x24 – Number of collaborative R&D and innovation projects initiated without participation of the cluster management: between participants / by participants;
x25 – Number of thematic and business or commercial-based events and workshops for cluster participants only;
x26 – Number of internal cluster participants matching;
x27 – Number of collaborative B2B projects (no R&D, innovation as a minor issue) initiated between participants / by participants;
x28 – Number of consulting and coaching activities of entrepreneurs;
x29 – Number of support activities for acquisition of financial sources (venture capital, banks, public funds etc.) for and/or on behalf of entrepreneurs;
x30 – Number of specific training courses related to cluster development for cluster participants;
x31 – Percentage of cluster participants trained;
x32 – Number of recruitments of specialists, executive managers, and other human resources by the cluster participants where cluster management gave assistance;
x33 – Number of curricula initiated and/or courses carried out by cluster management organisation for cluster participants;
x34 – Number of electronic or paper sources of up-to-date print or web materials about cluster and its participants;
x35 – Number of issued press releases about cluster and its participants;
x36 – Number of presentations of the cluster and its participants on trade fairs and conferences / etc.;
x37 – Number of specific events and workshops organized by the cluster organisation to present the cluster and its participants to external parties;
x38 – Number of specific matchmaking / networking events with external parties and other clusters where participated only a cluster organisation (without cluster members), organized by third parties;
x39 – Number of contributions to relevant policies (regulations, funding schemes, etc.);
x40 – Number of contributions of cluster management organisation to regional development;
x41 – Percentage of increase of private and public financial support for the cluster management during 2014 year;

x42 – Percentage of increase of personal in the cluster management during 2014 year;
x43 – Percentage of increase of committed cluster participants during 2014 year;
x44 – Number of internal (for committed cluster participants only) newsletters or web-based information and information exchange;
x45 – Number of print and web information documents in foreign languages about cluster and its participants;
x46 – Number of participations of the cluster organisation in trade fairs or conferences abroad with own booth or speech etc. to present the cluster and its participants;
x47 – Number of other activities managed/operated by the cluster organisation for intensifying international contacts and cooperation with foreign partners or clusters;
x48 – Number of participations of cluster management staff in the organisation of trade missions, international meet-the-buyer events, inward investment visits etc. and the facilitation of the participation of cluster participants in such activities;
x49 – Number of offices or permanent representations of the cluster abroad;
x50 – Number of acquisition initiations and deliveries of international innovation projects that were mainly initiated by the cluster management;
x51 – Proportion of the performance targets of the cluster organisation that were achieved;
x52 – Number of communication activities (internal and external communication) were carried out during 2014 year.

Appendix A.2. Correlation matrix of cluster performance indicators

Variable	x24	x26	x29	x30	x33	x37	x39	x45	x47	x48
x14										
x24										
x25										
x30	0.82									
x33										
x36			0.80							
x38						0.72				
x39		0.71								
x40			0.74							
x41			0.82							
x43				0.73						
x44	0.78									
x45							0.73			
x46							0.79			
x47							0.92	0.79		
x48					0.72		0.70		0.86	
x49							0.87	0.75	0.83	
x50					0.95					0.87
x52										

Note: all correlation coefficients are significant at α-level of 5%.

Source: own calculations based on AIRR cluster survey.

Appendix A.3. Correlation matrix of components of the cluster scale index

Indicator	**x1**	**x4**	x14	x15	x16	x22	x24	x28	x36
x1 – Number of registered cluster participants	1,00								
x4 - Number of cluster management staff		1,00							
x14 – Number of cluster participants that were involved in joined projects during 2013-2014 years	0,85*		1,00						
x15 – Number of innovation & business infrastructure organisations and financial institutions among cluster participants	0,64*		0,46*	1,00					
x16 – Number of strategic alliances with innovation & business infrastructure organisations and financial institutions		0,43		0,51*	1,00				
x22 – Number of task forces and working groups organized by cluster participants	0,51*	0,39	0,46*	0,46		1,00			
x24 – Number of collaborative R&D and/or innovation projects initiated without participation of the cluster management: between participants / by participants	0,45					0,47	1,00		
x28 – Number of consulting and coaching activities for entrepreneurs	0,61*		0,55*					1,00	
x36– Number of presentations of the cluster and its participants on trade fairs and conferences / etc.	0,53*			0,45			0,57*	0,49	1,00

Note: correlation coefficients that are marked with * are significant at α-level of 5%, all others are significant at α-level of 10%.

Source: own calculations based on the AIRR cluster survey .

Appendix A.4. Cluster scale index and its components

Cluster	Region	Abbreviation	x1	x4	x14	x15	x16	x22	x24	x28	x36	Rank index
Pharmaceutics, medical equipment and information technology	Tomsk reiogn	PMI	9,5	5,7	9,5	8,6	1,9	7,6	9,0	7,1	7,6	7,4
Innovative regional cluster of Zelenograd	Moscow	ICZ	9,0	5,7	2,4	8,1	7,1	6,2	8,6	5,7	8,6	6,8
IT&BIO cluster	Novosibirsk region	NBI	8,6	7,6	9,0	4,8	6,2	6,2	4,3	4,3	5,2	6,2
Pharmaceuticals, biotechnology and biomedicine cluster	Kaluga region	FBK	6,2	5,7	4,8	2,4	5,2	8,1	7,6	2,9	7,1	5,6
Innovative regional cluster of rocket engine	Perm Region	RIC	4,3	8,1	2,9	7,1	7,1	5,7	6,2	5,7	1,9	5,4
Kamsky innovative regional production cluster "Innokam"	The Republic of Tatarstan	KIC	5,2	9,0	7,1	6,7	8,1	1,4	4,8	0,0	6,2	5,4
Petrochemical innovative regional cluster	The Republic of Bashkortostan	PIC	7,1	8,1	8,1	0,0	0,0	8,6	4,8	5,2	1,9	4,9
Innovative regional aerospace cluster	Samara region	ACS	5,7	2,9	2,9	4,8	2,9	7,1	9,5	1,4	6,2	4,8
Biotechnological Innovation Cluster of Pushchino	Moscow region	BIC	6,7	2,9	6,7	4,3	2,9	3,3	7,1	3,3	4,3	4,6
Nuclear Innovation Cluster of Dimitrovgrad	Ulyanovsk region	NCD	3,8	4,8	6,2	0,5	2,9	1,4	8,1	6,7	5,2	4,4
Innovative regional cluster of nuclear physics and nanotechnology in Dubna	Moscow region	NFN	8,1	0,0	8,1	0,5	2,9	3,3	1,9	4,8	3,8	3,7
A cluster of medical, pharmaceutical and radiation technologies	Saint Petersburg	MPR	2,4	5,7	1,0	0,5	2,9	1,0	5,7	0,0	7,6	3,0
Complex processing of coal and industrial waste	Kemerovo region	CIW	2,4	1,4	1,9	7,1	6,2	3,3	1,9	1,4	0,5	2,9
Energy-efficient lighting and intelligent lighting control systems	The Republic of Mordovia	ILM	1,0	9,5	4,8	0,5	0,0	0,0	6,2	0,0	1,9	2,6
Development of information technology, electronics, instrumentation, communications, and information telecommunications	Saint Petersburg	IES	7,6	1,4	7,6	4,8	1,9	0,0	0,0	0,0	0,0	2,6
Phystech XXI	Moscow region	PHH	1,4	2,9	4,3	6,2	5,2	3,3	0,0	0,0	0,0	2,6
A cluster of fiber-optic technologies "Photonics"	Perm region	FOT	4,8	2,9	0,0	2,4	0,0	3,3	3,8	0,0	1,4	2,1
Shipbuilding innovative regional cluster	Arkhangelsk region	SIC	1,9	1,4	5,7	0,0	0,0	1,4	0,0	3,3	1,9	1,7
Medical, pharmaceutical and radiation technology cluster	Leningrad region	MFR	0,5	0,0	2,9	2,4	0,0	0,0	1,9	0,0	4,8	1,4
Industrial innovation cluster of the automotive and petrochemical industries	Nizhny Novgorod region	API	0,0	4,8	0,0	2,4	0,0	1,4	0,0	1,4	0,5	1,2
Innovative regional cluster of aerospace and shipbuilding	Khabarovsk region	ASH	2,4	0,0	1,4	0,0	0,0	0,0	1,9	0,0	0,0	0,6

Source: own calculations based on the AIRR cluster survey

Appendix A.5. Correlation matrix of components of the cluster development index

Variable	x14’	x24’	x27’	x28’	x32’	x36’	x37’	x44’	x49’	x52’
x14 – Number of cluster participants that were involved in joined projects during 2013-2014 years per 100 cluster participants	1									
x24 – Number of collaborative R&D and/or innovation projects initiated without participation of the cluster management: between participants / by participants per 100 cluster participants		1								
x27 – Number of collaborative B2B projects (no R&D, innovation as a minor issue) initiated between participants / by participants per 100 cluster participants			1							
x28 – Number of consulting and coaching activities of entrepreneurs per 100 cluster participants			0.5622*	1						
x32 – Number of recruitments of specialists, executive managers, and other human resources by the cluster participants where cluster management gave assistance per 100 cluster participants			0,4		1					
x36– Number of presentations of the cluster and its participants on trade fairs and conferences / etc. per 100 cluster participants		0,38				1				
x37– Number of specific events and workshops organized by the cluster organisation to present the cluster and its participants to external parties per 100 cluster participants	0.4941*					0.5369*	1			
x44– Number of internal (for committed cluster participants only) newsletters/web-based information and information exchange per 100 cluster participants		0.7852*						1		
x49– Number of offices or permanent representations of the cluster abroad per 100 cluster participants		0.4770*						0.4803*	1	
x52– Number of communication activities (internal and external communication) were carried out during 2014 year per 100 cluster participants	0,4									1

Note: correlation coefficients that are marked with * are significant at α-level of 5%, all others are significant at α-level of 10%.

Source: own calculations based on the AIRR cluster survey.

Appendix A.6. Cluster development index and its components

Cluster	Region	Abbreviation	x14’	x24’	x27’	x28’	x32’	x36’	x37’	x44’	x49’	x52’	Rank index
Pharmaceuticals, biotechnology and biomedicine cluster	Kaluga region	FBK	3,33	8,1	6,67	5,24	7,62	7,14	8,57	8,1	9,52	9,52	7,38
Nuclear Innovation Cluster of Dimitrovgrad	Ulyanovsk region	NCD	8,57	9,05	9,05	9,52	7,14	8,57	9,05	0	0	5,71	6,67
Innovative regional cluster of Zelenograd	Moscow	ICZ	0,95	7,14	8,57	7,14	9,52	6,67	4,29	9,05	8,57	2,86	6,48
Innovative regional aerospace cluster	Samara region	ACS	2,38	9,52	5,24	3,81	4,29	7,62	5,24	9,52	9,05	3,33	6
IT&BIO cluster	Novosibirsk region	NBI	7,62	2,38	4,29	4,76	8,57	3,81	6,19	6,19	8,1	7,14	5,9
Energy-efficient lighting and intelligent lighting control systems	The Republic of Mordovia	ILM	9,52	8,57	5,71	0	5,71	6,19	8,1	5,24	0	5,24	5,43
Innovative regional cluster of rocket engine	Perm Region	RIC	4,76	7,62	8,1	9,05	9,05	4,29	3,81	0	0	3,81	5,05
Pharmaceutics, medical equipment and information technology	Tomsk reiogn	PMI	3,81	5,71	4,76	7,62	0	2,86	3,33	7,14	0	8,57	4,38
Innovative regional cluster of nuclear physics and nanotechnology in Dubna	Moscow region	NFN	5,71	1,9	9,52	6,19	5,24	3,33	2,38	5,71	0	2,38	4,24
Kamsky innovative regional production cluster "Innokam"	The Republic of Tatarstan	KIC	7,14	5,24	0	0	6,67	8,1	7,14	0	0	8,1	4,24
Complex processing of coal and industrial waste	Kemerovo region	CIW	2,86	3,33	6,19	4,29	6,19	1,43	0	8,57	0	9,05	4,19
Medical, pharmaceutical and radiation technology cluster	Leningrad region	MFR	9,05	4,76	0	0	0	9,05	9,52	0	0	7,62	4
Biotechnological Innovation Cluster of Pushchino	Moscow region	BIC	5,24	6,19	3,81	5,71	3,81	4,76	5,71	0	0	1,9	3,71
A cluster of medical, pharmaceutical and radiation technologies	Saint Petersburg	MPR	1,43	6,67	7,62	0	4,76	9,52	4,76	0	0	1,43	3,62
Shipbuilding innovative regional cluster	Arkhangelsk region	SIC	8,1	0	0	8,1	0	5,24	6,67	0	0	6,19	3,43
Industrial innovation cluster of the automotive and petrochemical industries	Nizhny Novgorod region	API	0	0	0	8,57	8,1	5,71	0	7,62	0	4,29	3,43

Appendix A. 6. continued

Cluster	Region	Abbreviation	x14’	x24’	x27’	x28’	x32’	x36’	x37’	x44’	x49’	x52’	Rank index
Petrochemical innovative regional cluster	The Republic of Bashkortostan	PIC	6,19	2,86	0	6,67	0	1,9	2,86	6,67	0	4,76	3,19
A cluster of fiber-optic technologies "Photonics"	Perm region	FOT	0	4,29	7,14	0	0	2,38	0	0	0	0	1,38
Phystech XXI	Moscow region	PHH	6,67	0	0	0	0	0	0	0	0	6,67	1,33
Innovative regional cluster of aerospace and shipbuilding	Khabarovsk region	ASH	1,9	3,33	0	0	0	0	7,62	0	0	0	1,29
Development of information technology, electronics, instrumentation, communications, and information& telecommunications	Saint Petersburg	IES	4,29	0	0	0	0	0	0	0	0	0,95	0,52

Source: own calculations based on the AIRR cluster survey.

Appendix A.7. Correlation matrix of components of the cluster management efficiency index

Indicator	x1”	x31”	x5”	x13”	x15”	x22”	x29v	x33”	x35”	x41
x1” – Number of registered cluster participants per management team member	1									
x31” – Number of cluster participants trained per management team member	0.6043*	1	0.5098*	0.5499*	0.4864*	0,4				
x5” – Number of training days of cluster management staff during 2014 year			1							
x13” – Number of personal interactions between cluster management team and cluster participants during 2013-2014 years per management team member			0.4594*	1						
x15” – Number of innovation & business infrastructure organisations and financial institutions among cluster participants per management team member	0.4329*				1					
x23” – Number of activities like innovation workshops, technology scouting and/or road mapping campaigns/projects, etc. per management team member						1				
x29” – Number of support activities for acquisition of financial sources (venture capital, banks, public funds etc.) for and/or on behalf of entrepreneurs per management team member	0.4375*				0.5211*		1			
x33”– Number of curricula initiated and/or courses carried out by cluster management organisation for cluster participants per management team member	0,4							1		
x35” – Number of issued press releases about cluster and its participants per management team member	0,4	0.4630*			0.5953*		0.5537*		1	
x41– Percentage of increase of private and public financial support for the cluster management during 2014 year	0.4626*	0.7356*		0.4594*	0,4		0.4409*			1

Source: own calculations based on the AIRR cluster survey.

Appendix A.8. Cluster management efficiency index and its components

Cluster	Region	Abbreviation	x1”	x5”	x13”	x15v	x23”	x29”	x31”	x33”	x35”	x41	Rank index
Pharmaceutics, medical equipment and information technology	Tomsk region	PMI	9,52	8,57	9,05	9,05	0	8,57	9,52	4,76	8,57	9,52	7,71
Innovative regional cluster of Zelenograd	Moscow	ICZ	8,1	6,19	5,24	8,57	5,71	9,05	6,19	0	9,52	9,05	6,76
Innovative regional aerospace cluster	Samara region	ACS	6,19	9,05	9,05	6,67	7,14	7,14	7,62	7,14	3,81	3,81	6,76
IT&BIO cluster	Novosibirsk region	NBI	6,67	7,14	6,67	3,33	9,05	4,76	8,57	9,05	4,76	7,62	6,76
Pharmaceuticals, biotechnology and biomedicine cluster	Kaluga region	FBK	3,81	9,52	5,71	2,86	8,1	5,71	7,14	8,1	6,67	8,1	6,57
Complex processing of coal and industrial waste	Kemerovo region	CIW	5,24	3,81	7,14	9,52	5,71	6,19	9,05	0	9,05	7,14	6,29
Biotechnological Innovation Cluster of Pushchino	Moscow region	BIC	7,14	6,19	7,62	5,71	7,14	8,1	5,71	6,19	2,86	4,76	6,14
Innovative regional cluster of nuclear physics and nanotechnology in Dubna	Moscow region	NFN	9,05	0	2,86	5,71	8,1	7,62	4,76	9,52	7,62	4,76	6
Medical, pharmaceutical and radiation technology cluster	Leningrad region	MFR	4,76	5,24	2,38	7,14	9,52	9,52	0	0	5,71	8,57	5,29
Innovative regional cluster of rocket engine	Perm Region	RIC	1,43	7,62	6,19	5,24	4,76	5,24	4,29	5,24	3,33	3,33	4,67
Nuclear Innovation Cluster of Dimitrovgrad	Ulyanovsk region	NCD	2,38	8,1	0,95	2,38	4,76	0	8,1	6,67	7,14	4,29	4,48
Kamsky innovative regional production cluster "Innokam"	The Republic of Tatarstan	KIC	0,95	4,76	4,76	4,29	3,81	6,67	6,67	0	4,29	0	3,62
Phystech XXI	Moscow region	PHH	2,86	4,29	3,33	8,1	0	0	0	0	5,71	4,76	2,9
Energy-efficient lighting and intelligent lighting control systems	The Republic of Mordovia	ILM	0	2,86	8,57	1,43	0	0	3,33	5,71	2,38	0	2,43

Appendix A.8. continued

Cluster	Region	Abbreviation	x1”	x5”	x13”	x15v	x23”	x29”	x31”	x33”	x35”	x41	Rank index
A cluster of medical, pharmaceutical and radiation technologies	Saint Petersburg	MPR	1,9	0	8,1	1,9	4,29	0	0	8,1	0	0	2,43
Shipbuilding innovative regional cluster	Arkhangelsk region	SIC	3,81	0	1,43	0	6,67	0	3,81	0	7,62	0	2,33
Innovative regional cluster of aerospace and shipbuilding	Khabarovsk region	ASH	7,62	0	3,33	0	0	0	0	7,14	0	4,76	2,29
Industrial innovation cluster of the automotive and petrochemical industries	Nizhny Novgorod region	API	0,48	5,71	0,48	3,81	0	0	0	0	5,24	6,67	2,24
Development of information technology, electronics, instrumentation, communications, and information& telecommunications	Saint Petersburg	IES	8,57	3,33	1,9	7,62	0	0	0	0	0	0	2,14
Petrochemical innovative regional cluster	The Republic of Bashkortostan	PIC	3,33	0	0	0	3,33	0	5,24	4,29	0	0	1,62
A cluster of fiber-optic technologies "Photonics"	Perm region	FOT	5,24	2,38	3,33	4,76	0	0	0	0	0	0	1,57

Source: own calculations based on the AIRR cluster survey.