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**INTERNATIONALIZATION OF
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THEORETICAL AND EMPIRICAL
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INTERNATIONALIZATION OF REGIONAL CLUSTERS: THEORETICAL AND EMPIRICAL ISSUES²

Today regions are becoming independent actors able to compete globally as globalization of competition is consistent with the localization of competitive advantage. In many ways regional competitiveness is based on the clustering concept. Changes in the global economic environment are making cluster linkages more important, too. Clusters are not capable of long-term excellence and development unless their members are acting in global markets and involved in international knowledge transfer. Thus, internationalization of clusters has turned out to be a new subject of innovation policy and regional development agenda, however lacking strong scientific background in Russia. The paper aims at discovering theoretical and analytical basis for clustering concept and internationalization, the reviewing of best internationalization practices from the clusters worldwide as well as exploring empirical issues of regional clusters' internationalization in Russia and their comparison with the EU outputs. A special emphasis is put on the articulation of practical guide for cluster management organizations responsible for the development of global linkages.

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Key words: regional development, innovative clusters, internationalization, Russia, the EU

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Introduction

Glocalization [Robertson, 1992] increase has changed the role of regions in the national and world economy. Today regions are becoming independent actors able to compete globally as globalization of competition is consistent with the localization of competitive advantage [Enright, 2000]. Regional competitiveness is often based on the clustering concept suggesting the value of firms` agglomeration and the importance of linking human capital, knowledge and technology at a given location. Changes in the global economic environment are making cluster linkages more important. The effectiveness of regional strategies depends on the ability of clusters to evolve and fit into useful niches in global value chains [OECD, 2007]. This thesis is confirmed by the EU studies [Meier zu Köcker et al., 2007; 2010], stating that clusters are not capable of long-term excellence and development unless their members are acting in global markets and involved in international knowledge transfer. Internationalization of clusters has turned out to be a new subject of innovation policy and regional development agenda. It reflects the fact that no economy either at regional or national level can afford to ignore the globalization factor. As companies and other actors internationalize their activities, it is important that cluster initiatives and organizations, supporting them, internationalize, too.

Clustering concept of regional development has gained much popularity in Russia in the last years. According the Russian Ministry of Economic Development (2008), with domestic clusters being included in global value-added chains it is possible to significantly raise the national technology base level, increase the pace and quality of economic progress due to the international competitiveness boost of the clusters` members. However, the theory and practice of regional clusters` internationalization still remain underexplored. In particular, there is lack of data, concerning the level of regional clusters` internationalization in Russia as well as methodical background for such studies.

In the present study internationalization of clusters is regarded as the establishment of sustainable links among clusters worldwide in trade, finance and industry as well as R&D, educational and institutional cooperation performed on a complementary basis and leading to the increase of competitiveness, economic, innovative and social potential of clusters` members and their locations. The paper aims at discovering theoretical and analytical ground of clustering concept and internationalization, the reviewing of best internationalization practices from the clusters worldwide as well as exploring empirical issues of regional clusters` internationalization in Russia and their comparison with the EU outputs. A special emphasis is put on the articulation of practical guide for cluster management organizations responsible for the development of global linkages.

Theoretical framework

As Charlie Karlsson notes, “the increased theoretical and empirical interest among economists in where economic activities take place and why they concentrate in space has to do with its importance for core areas such as location theory and international trade theory” [Karlsson, 2008, P. 2]. Several researchers point out common theoretical ground of clustering concept and internationalization [Sandberg, 2009; Gomes-Casseres, 1996; Gorynia, Jankowska, 2010; Mariotti, Piscitello, 2001]. They focus on two main aspects of the issue.

The first aspect has to do with the role of clusters in assisting their members to access global markets and get involved into international knowledge transfer. Cluster approach may facilitate and speed up the internationalization of innovation in small high-technology companies by reducing obvious internationalization liabilities such as restricted resources, lack of critical mass, international expertise, etc. [Falize, Coeurderoy, 2012]. Another aspect is joint marketing policy of clusters, which is regarded as the source of competitive advantage in global markets. It means that skyrocketing of a company's market share would be ensured by the marketing activity synergy of the cluster it belongs to [Vladimirov, Sheresheva, 2012]. There is also the “coopetition phenomenon” [Gorynia, Jankowska, 2010, P. 1160] which is typical for clusters and can turn out an important advantage for internationalization of cluster members due to strong links within the local environment. Combination of cooperation and competition enables firms to produce higher quality for a lower price and thus conquer customers worldwide. This positive feedback between participation in a cluster and successful internationalization was widely raised by M. Porter (1998). Local company environment that involves production system, economic agents, social institutions, specific culture and collective learning may complete its unique competitive potential and support its foreign expansion [Mariotti, Piscitello, 2001].

The other aspect is focused on the development of joint innovative, industrial, marketing and R&D activities of clusters worldwide. Internationalization of clusters open broad opportunities to reorganize innovation processes across regions, based on new forms of division of labor among firms at international level. Increased global collaboration among clusters provides a chance of sustaining firms' competitive advantages. This is due to the fact that firms can have access to new competencies, knowledge and expertise, in addition to what is available at the local level [Di Maria, Costalonga, 2004]. In fact, there is commercial internationalization, presuming that local firms set up global marketing networks and thus strengthen their positions, and industrial internationalization under which local players transfer their production facilities abroad.

Moreover, internationalization of clusters is considered a strategy towards the development of world-class clusters in the EU. European clusters, faced with the fierce competition from emerging countries and persistent market fragmentation, need to come together, to forge alliances, setting up permanent consortia of three or four clusters complementing one another in the value chain and equipped with a joint management team and a common strategy [TACTICS, 2010].

The review of works on clustering concept and internationalization discovered their common theoretical ground. To begin with, basic principles of local industrial specialization were for the first time articulated within foreign economic concepts: theories of absolute and comparative advantages by A. Smith and D. Ricardo [Smith, 1776; Formaini, 2004]. Those theories were based on speculations about international division of labor and foreign trade as well as spatial aspects of the economy and competitive advantages acquisition. The key idea, combining clustering and internationalization, was that specialization, i.e. concentration of manufacturing in independent sectors with special technology process and human recourses, was the basis for international trade.

In 1937 the works of the American economist R. Coase formed the ground for the Transaction costs theory [Coase, 1937]. A transaction is the exchange of goods, services and information between economic actors, taking place inside or between organizations. An increasing share of knowledge and technology embedded with other firms in value added chains cannot be obtained through simple market or industrial transactions. This has led to analyses and interpretations involving the clustering concepts. Transaction costs include network transactions, related to the development of specific relations long-term connections by the parties within clusters that might speed up internationalization. Foreign economic activity is more successful within a cluster, where actors cooperate with less network transactions [Christensen, Lindmark, 1993].

In the 1950-s professor of Reading University J. Dunning combined the resource, location and transaction costs theories in the Eclectic paradigm to explain foreign value-added activities (mostly, FDI) of firms as determined by the configuration of three sets of forces:

- ownership advantage, arising from the firm's privileged ownership of income-generating assets outside their national boundaries (O);
- location advantage, arising from specific economic, social, political environment of a chosen country in a way that benefits it relative to domestic location (L);
- internalization advantage, which relates to the way the firms organized the generation and use of the resources and capabilities within their jurisdiction and those they could access in different locations (I).

The connection between “OLI-paradigm” of internationalization and clustering theory is derived from the development of inter-firm relations under conditions of “coopetition” and alliance capitalism (which is close to the clustering process) opposite to the concept of an individual firm as the sole or independent source of intellectual capital. “A company is better viewed as an organizer of a collection of created assets, some of which it generates internally and others which it accesses from other firms, yet the deployment of which it exercises some kind of influence or control” [Dunning, 2001, P. 184].

In the 70-s J. Johanson and J-E. Vahlne from Uppsala University in Sweden suggested the Stage internationalization model (also known as U-model). The model describes foreign market entry as a stage process, consistent of acquiring experiential knowledge that leads the firm to taking small, incremental steps to opening up new markets [Johanson, Vahlne, 1977]. The model puts special emphasis on the first (pre-internationalization) stage, which involves gaining domestic clustering experience. It was of crucial importance for companies, mainly SMEs, at the beginning of their international expansion. Managerial, financial, HR, information, technological and other liabilities are easier to overcome as a cluster member.

A decade later, in the 80-s J. Johansson and L-G. Mattsson modified the Stage internationalization model into Network model [Johansson, Mattsson, 1988]. Its key distinction applied to the fact that a firm’s internationalization strategy emerges as a pattern of behavior influenced by a variety of network relationships and not only from its own phases of preparedness. “A basic assumption in the network model is that the individual firm is dependent on resources controlled by other firms. The only way the firm can get access to these external resources is by establishing a position within the network” [Ofosu, Holstius, 2012, P. 4]. Foreign economic activity is a part of group work guided by economic and social rules. Whether companies internationalize successfully or not is the result of their networking and position within a cluster.

In the 90-s there was a remarkable contribution to the progress of both clustering and internationalization (international trade) theories by the Nobel Prize winner P. Krugman and his Economy of scale, originally derived from A. Marshall’s industrial districts. A firm can benefit from the economy of scale (i.e. expansion of production along with price reduction due to specialization) when there is capacious global market. At the same time, economy of scale is due to geographic concentration followed by clustering effects: knowledge transfer, easier access to resources and strong networking. As Krugman states, “the phenomenon of concentration in economic geography takes place at many scales. <...> For international affairs the forces that lead to localization of particular industries are of even more interest” [Krugman, 1991, P. 34].

The new approach to internationalization and clustering, which untangled the paradox of location in a global economy, was suggested by M. Porter and his Competitive advantage theory. Famous “Ten nations study” resulted in the idea that competitive advantage of a country should be regarded through international competitiveness of its clusters. Geographic concentration strengthens domestic competition and, combined with globalization, forces companies to enter foreign markets, so their internationalization increases [Porter, 1998].

Finally, the combination of clustering effects and internationalization is discussed within Born global concept by B.M. Oviatt and P.P. McDougall. The born globals (BGs) are small innovative enterprises that enter foreign markets fast due to their deep specialization. BGs manage their activities through international networks providing them with information and resource benefits (knowledge about foreign partners and new competitive market) and control benefits (trust, embeddedness among network partners) [Falize, Coeurderoy, 2012]. Network ties are an important tool speeding up their internationalization, as when acting within a cluster such companies develop their competences and increase international competitiveness.

To sum up internationalization and clustering concepts have common theoretical background due to the following features:

- specialization as the basis for international trade and industrial localization;
- location characteristics and networking as an important tool for transaction costs decrease;
- the role of competition and innovations.

Internationalization of clusters: worldwide practices

There is no one-size-fits-all approach to cluster internationalization process and its coordination. Meanwhile different countries have gained vast experience in this field that is worth benchmarking. This section contains the review of the best cluster internationalization practices from all over the world.

Internationalization of clusters in the EU: pan-European level

The European approach towards clusters` internationalization is one of the most imperative and policy-driven, incited by strong fragmentation, lack of critical mass and weak linkages among clusters and their members within the EU on the one hand, and global emerging competitors from Brazil, India and China on the other hand [TACICS, 2010]. The problem-solving here has been focused on the development of so-called world-class clusters or WCC. These clusters can be described by a set of specific criteria and requirements they should fulfil.

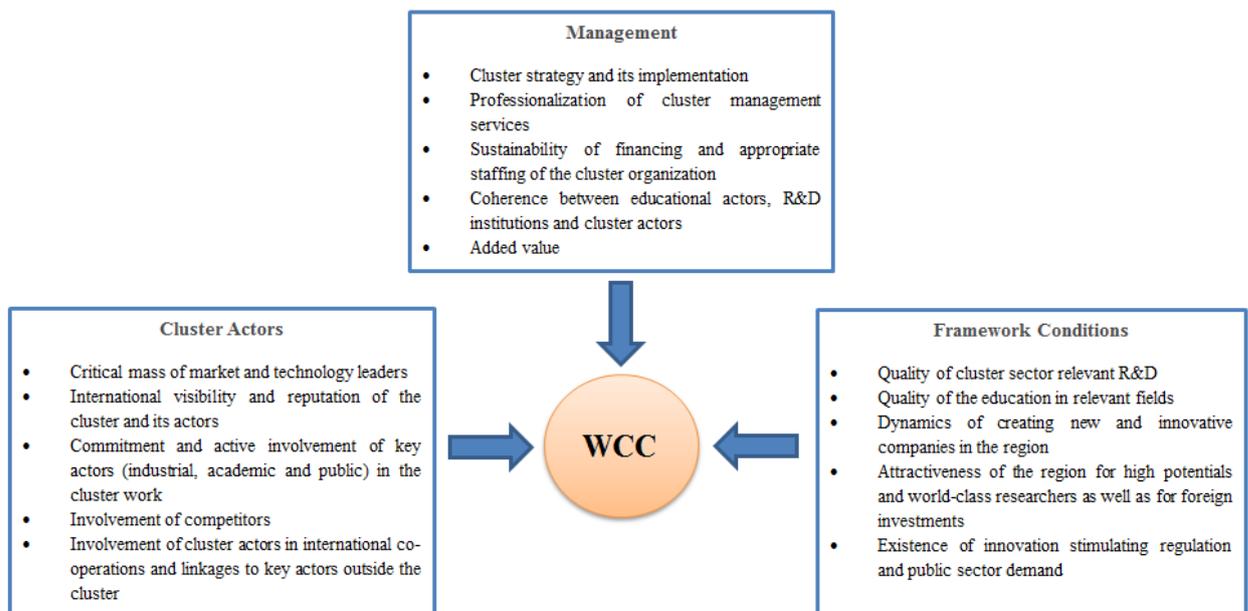


Figure 1. World-class cluster`s main characteristics

Source: TACTICS, 2010

Fostering of the WCC creation is provided by a pool of programmes and initiatives to support cluster policy makers and encourage trans-national cooperation: European cluster alliance, European cluster collaboration platform, European cluster observatory, European secretariat for cluster analysis, Enterprise-Europe-Network, Foundation Clusters and Competitiveness, European cluster policy group. Table 1 contains brief description of these programmes.

Table 1. The EU programmes and initiatives to foster cluster internationalization

Programme	Description
European Cluster Observatory	A single access point for statistical data, analysis and mapping of clusters, cluster policy and regional competitiveness conditions in Europe. It also provides a cluster library, a classroom for cluster education, offers cluster benchmarking, program evaluation and coaching of cluster organization management
European Cluster Alliance	An open platform established to maintain a permanent policy dialogue at the EU level among national and regional public authorities responsible for developing cluster policies and managing or funding cluster programmes in their countries or regions
European Cluster Policy Group	An initiative established by the European Commission to deliver recommendations on how to better support the development of more world-class clusters in the EU and design cluster policies in the Member States
Enterprise-Europe-Network	A one-stop shop for helping small companies make the most of the business opportunities in the European Union, find international business partners, source new technologies, receive the EU funding or finance, advise on intellectual property, going international, or the EU law and standards.
European	A network of cluster experts, mandated by the European Cluster

Secretariat for Cluster Analysis	Excellence Initiative, which promotes cluster management excellence through benchmarking and quality labelling of clusters and cluster management organizations.
European Cluster Collaboration Platform	An online portal launched within European Cluster Excellence Initiative which provides online quality information and networking support for clusters aiming to improve their performance and increase their competitiveness through the stimulation of trans-national and international cooperation both between cluster organizations and cluster members
European Foundation for Cluster Excellence	The ECEI-follow initiative, offering courses for trainers of cluster management excellence, monitoring of their performance and organization of an accreditation system for certifying instructors. The EFCE was set up to evaluate, raise and sustain the competitiveness of regional economic clusters worldwide. Its aim is to promote the use of clusters as an effective tool for the economic development of regions.

Source: *Islankina E., Nazarov M., Fiyaksel E. (2013)*

Internationalization of clusters: selected global benchmarks

The examples of cluster internationalization support practices in different countries can be broadly classified under one of four headings which enclose the following:

Targeted projects (e.g. the NICER project, West Midlands, the UK). The overall objective of the NICER (Networks for the Internationalization of Cluster Excellence in Regions) project was to identify and implement a number of strategies to support the internationalization of clusters in the EU regions. The strategic focus was put on the design of effective public policy for maximizing the impact of foreign direct investment on regional economic development and cluster upgrading – innovation. The University of Birmingham representing West Midlands was one of the project participants. Among regional good practices worked out within the NICER project from 2011 to 2013 there were links of FDI policy to support cluster development; selected targeting of inward FDI related to comparative existing strengths (e.g. encouraging Shanghai Automotive R&D centre to Birmingham (MG Cars)); building on financial services by attracting Deutsche Bank processing centre in Birmingham, etc. As the result the West Midlands turned out to be the only one among English regions outside of London that bucked the trend of significant declines in foreign investment projects in 2012 [Banchelli, Caloffi, Bailey, 2012].

CMO services (e.g. the MVA Ambassador Program, Skane region, Sweden and the Island of Zealand, Denmark). The MVA Ambassador Program is a unique service created solely to assist private and public organizations in Medicon Valley cluster of Danish and Swedish regions with the internationalization process and to increase awareness about Medicon Valley in the leading life science hubs around the world. MVA has three Ambassadors permanently based in San Diego, Boston and Tokyo. MVA has formal partnerships with the leading cluster

organizations in all these areas giving the MVA Ambassadors unrivalled access to local networks with a strong insight into local businesses, research, academia and healthcare. Their services include business development, technology search, in- and out-licensing support, market analysis, sales support and delegation visits [Medicon Valley Alliance, 2012].

Regional support institutions (e.g. Clusterland, Upper Austria, the Republic of Austria and Enterprise Rhône-Alpes International, the Rhône-Alpes Region, France). Clusterland Upper Austria is an independent entity to manage six clusters (automotive, plastics, furniture & timber construction, health technology, mechatronics and environmental technology) and three networks (human resources, design media and network energy). One of the key focuses of its mission is to enhance internationalization of regional clusters. Clusterland Upper Austria supports international activities of the member companies through direct actions such as organizing business trips, international fairs or events and also through cooperation projects with international participation. Participation in European projects had increased lately as it implied benefits not only for the companies, but also for the organization, improving its image and visibility and providing funds. Other indirect actions were also conducted to promote company internationalization, such as holding round tables on topics related to international activities, or receiving foreign delegations to promote networking and increase the potential for participation in international projects [Blazquez, Berrone, Duch, 2012].

Enterprise Rhône-Alpes International (ERAI) is a supporting institution, assisting the region to expand itself on an international scale via businesses and universities, public and private sectors networking. The Rhône-Alpes “Internationalization cluster programme” implemented by ERAI is a supporting tool for cluster members to foster a collective dynamics around key projects in order to increase the number of companies participating in international activities, i.e. market study, collective trade mission abroad, participation in fairs/events, promotion material. The “Clusters Mobility programme” also managed by ERAI was launched to promote regional clusters and develop cooperation with partners regions in Europe and at global level. It resulted in setting-up and managing the “Rhône-Alpes Clusters Ambassadors” network composed of more than 60 experts [Clusterix, 2015].

Specific cluster type (e.g. export clusters, regions of Hangji and Suzhou, China and super-clusters, California, the USA). Internationalization of Chinese regional clusters is determined by strong export-orientation of their companies. As S. Sandberg notes, an export cluster is a domestic cluster (geographical base) and a take-off node from where a firm could enter a foreign market network [Sandberg, 2009, P.105]. Such clusters (e.g. the Hangji toothbrush cluster or the textiles cluster in Suzhou), primarily established as industrial ones, soon have the potential to spur the member firms’ international take-off.

The super-cluster concept often used to describe the internationalization process of regional clusters in the United States deals with the transition of three types of relationships: weak ties, strong bonds and covalent bonds [Engel, del-Palacio, 2009]. Weak ties characterize the most common type of interactions between clusters, including information exchange and short-term interpersonal communication in the forms of international trade fairs and exhibitions, conferences, professional and industry forums. This kind of cooperation is the least expensive, but provides access to the necessary information. As cooperation grows more intense the exchange of contacts between clusters covers new areas (technology, services, HR), so strong links appear. Covalent bonds emerge if the relationships are permanent and the role of each cluster is embedded in the business processes or the value chain of the other. Covalent bonds are characterized by reversing the flow of information, capital, goods, with single actors performing vital functions in multiple locations - and even multiple businesses – simultaneously [Engel, del-Palacio, 2009]. A pattern of covalent bonds in foreign cluster collaboration is the U.S Silicon Valley and Israel which started with American hi-tech companies' interest in Israel's engineering and scientific skills. It resulted in emerging of born global entrepreneurial companies within Israel. The cluster in which they operate is neither U.S. nor Israel, but a super-cluster of both countries, linked by covalent bonds.

Internationalization of regional clusters in Russia: first empirical study

Methodology and sample layout

Establishing a set of metrics that are capable of tracking the performance of a cluster is important for identifying its strengths and weaknesses as well as further appropriate interventions. However, “the science of measuring clusters remains in its infancy” [DTI, 2004, P. 17]. The estimation of a cluster's internationalization level in particular appears to be rather complicated due to the following aspects:

- *imperfections of the cluster data base, especially concerning international activity.* In general, there are three potential sources of information which might be used to assess the development of clusters: official statistical data sets; commissioned survey work; qualitative understanding based on discussions with cluster members [DTI, 2004, P. 18]. At the moment clusters are not subject to analysis in terms of official statistics. Statistical bureaus do not collect data on clusters' performance indicators, thus there is scarcely unified public information for large-scale assessments. Information about clusters and their international activity is most likely to be collected within target researches (interviews, questionnaires) or from specific reports

[Gohberg, Shadrin et al., 2012; Meier zu Coeker et al., 2007; 2010]. As E. Kutsenko notes, statistics on Russian clusters started to expand from the launch of a pilot innovation clusters competition in 2012, as part of which applicants prepared fairly comprehensive applications (a total of 94). The publication of new information opens up opportunities for proper cross-country comparison of cluster development trends and drafting of expert recommendations. Although many aspects analyzed in foreign studies lack equivalents in Russia, where cluster initiatives are still in their early stages, awareness of the problems emerged makes it possible to outline areas of improvement in cluster policy [Kutsenko, 2015];

- *necessity to make assessment on a multiple basis.* Clusters are not mere business entities; their international activity is performed by various groups of players, often described in terms of a triple (quadruple, pentagonal) helix, including private companies, universities and research centres, supporting organizations, administrative institutions, etc., and covers a variety of dimensions from R&D and networking to trade and production.

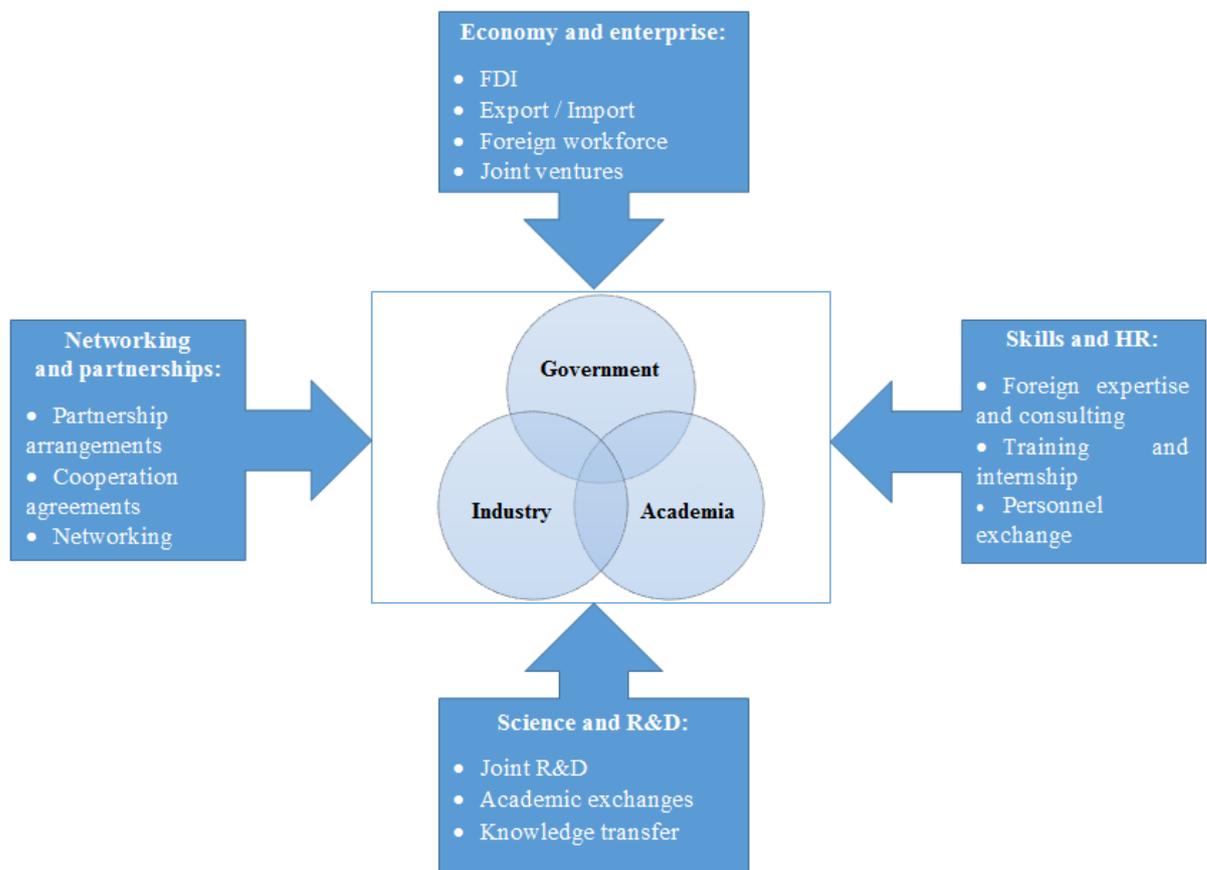


Figure 2. Cluster internationalization dimension
Source: compiled by the author

International cooperation of cluster actors, representing Academia, is focused on expanding access to new knowledge, technologies and R&D. Consequently, internationalization comes in the forms of joint research projects, academic exchanges, joint educational programs,

training and scientific activities. In addition, an important task is know-how commercialization. International target setting of private companies is basically economy-driven; their main activities include export-import operations, integration into the global value-added chains, creation of joint ventures, foreign direct investment. The key activities of public authorities and institutions regarding internationalization of clusters are aimed at creating conditions, including various support programs and relevant policy, for achieving the objectives of the first two groups of players as this enables to attract the best international expertise and resources to ensure the growth of the regional economy and improve the quality of life along with strengthening the international competitiveness of the region. Assessment of internationalization activity will be incomplete unless multiple indicators are used;

- *lack of a single set of internationalization indicators.* There are only few general indicators suitable for internationalization performance assessment of a cluster among all indicators that are typically suggested (e.g. export/import amount, number of foreign cluster members, etc.), however their set seems to be rather fluctuating in different cluster programmes, reports or guides. E.g. among cluster benchmarking indicators suggested by European Secretariat for Cluster Analysis [Hantsch, S., Kergel, H., Lämmer-Gamp, T. et al., 2013] there are: international participants of the cluster; thematic and geographical priorities of the cluster strategy; internationalization of cluster participants; geographical origin of external cooperation requests; characteristics of cooperation with other international clusters; degree of internationalization of cluster participants; impact of the work of the cluster organization on international activities of the cluster participants. Some of them are suitable for quantitative evaluation and some are for qualitative. National Research University Higher School of Economics and Russian Ministry for Economic Development suggest export amount, number of international participants, costs on joint international R&D, number of papers published in WoS and Scopus editions by cluster members` employees [Gohberg, Shadrin, et al., 2012];

- *variety of assessment tools.* They are either quantitative or qualitative, based on the analysis of statistics data, KPI or interviews, peer reviews, surveys, etc. The first group of tools benefits from credibility and comparability, being at the same time rather neutralized. The other group enables to conduct a more in-depth research, but on a less scale and less comparative opportunities.

With respect to the above mentioned issues a two-step method for a cluster`s internationalization assessment is suggested. It combines quantitative and qualitative analysis and involves an express self-assessment of cluster managers which aims at identifying the internationalization potential of a cluster; assessment of basic internationalization factors implemented by the means of a questionnaire. Further expertise and statistical data analysis

enables to design the system of appropriate indicators for internationalization index calculation based on a multivariate comparative analysis. Overall, the mix of various sources and methods will provide the fullest understanding of the clusters` international performance.

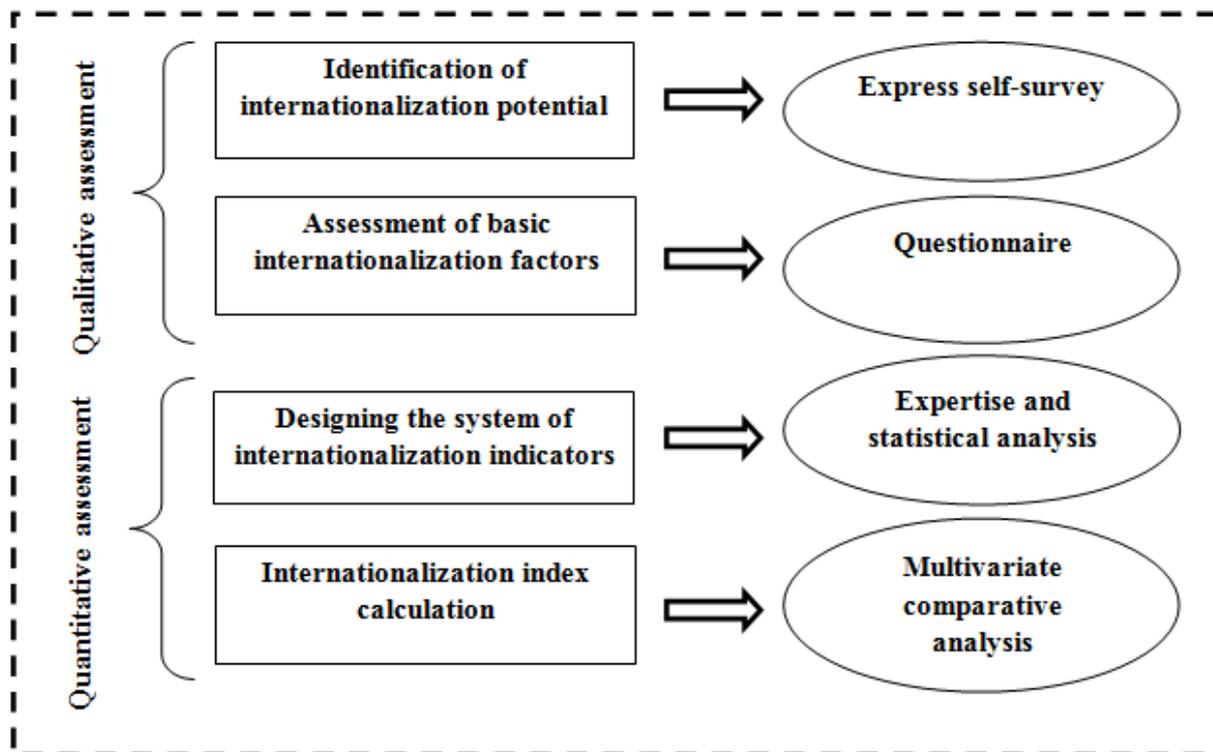


Figure 3. Two-step cluster internationalization assessment method

Source: compiled by the author

Qualitative assessment

The first step of the clusters internationalization “soft” analysis is targeted to discover whether a cluster is internationally active at any extent and whether global performance is a shared goal for its members and CMO. For clusters with scarce internationalization ambitions or activity further quantitative assessment might be untimely. So prior to shifting to the questionnaires cluster managers are asked to go through a short self-assessment and indicate the clusters` level of internationalization according to a seven-grade scale with respective descriptions.

Table 2 – A scale for self-survey on clusters` level of internationalization

7	6	5	4	3	2	1
Obviously internationally acting network	Intense cross linking / partnership with one or more foreign	Active, regular and intense participation of the cluster and its	Selective co-operations with international partners exist, but	First participation in and / or organization of international	No international activities by the cluster`s management are	No international activities by the cluster`s management

	networks	members in foreign projects and other events	are unspecific and rather sporadic.	all events by the cluster's management are visible.	visible, but are intended.	entire are visible or intended.
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Source: Meier zu Koeker et al. (2007)

Those having chosen the first grade are not suggested to be subject to further analysis.

The next step is intended to assess basic factors of clusters' internationalization. Data collecting is to be carried out by the means of online questionnaire forms distributed among cluster managers from the selected clusters. The questionnaire form is based on the survey of European clusters' internationalization [Meier zu Köcker et al., 2007; 2010], Overview of cluster benchmarking indicators [Hantsch, Kergel, Lämmer-Gamp et al., 2013] and TACTICS Internationalization Handbook [Greenhalgh, 2012]. The questionnaire form comprises of two sections:

- 1) general questions on a cluster (age, number of members, management model and cluster manager's functions);
- 2) specific questions on internationalization (international activity of cluster members and CMO; internationalization strategy; geographical scope, key partners and areas of cooperation: R&D, trade, production, HR etc.; decision making and management within the internationalization process framework; barriers for international cooperation, goals and ambitions to go global).

Quantitative assessment: multivariate comparative analysis

After the quantitative assessment is completed, the cluster's internationalization level is suggested to be assessed with the following set of indicators [Gohberg, Shadrin, 2012]:

- costs on joint R&D;
- number of publications in Scopus / WoS editions by cluster members' employees;
- export amount of cluster members;
- number of international cluster members.

As the statistical data collecting might be complicated due to the aspects listed above only four indicators are used, however covering various dimensions of international activity. The assessment method is multivariate comparative analysis.

The first step of the analysis involves composition of a matrix of the clusters being analyzed, and their internationalization indicators:

Table 3. Matrix of cluster internationalization indicators

	Indicator 1	Indicator 2	...	Indicator j
Cluster 1	X ₁₁	X ₁₂	...	X _{1j}
Cluster 2	X ₂₁	X ₂₂	...	X _{2j}
...
Cluster i	X _{i1}	X _{i2}	...	X _{ij}

Source: compiled by the author

As the contribution of each indicator is not equal, it is suggested to multiply the value of each indicator by a respective weighting factor α (calculated according to the experts' estimations). Then the reference (maximum) value for each indicator - $x_{ij \max}$ is identified, and each value x_{ij} is correlated with the reference value $x_{ij \max}$. After that these correlations are squared, summed and the square root is extracted:

$$I_i^{CI} = \sqrt{\sum_{j=1}^m \left(\frac{\alpha_j \cdot x_{ij}}{\max_j(\alpha_j \cdot x_{ij})} \right)^2} \quad (1)$$

I_i^{CI} - cluster internationalization index

α - weighting factor

x_{ij} - value of i -cluster's j -indicator

$\max_j(\alpha_j \cdot x_{ij})$ - reference (maximum) value for each indicator

This method enables to analyze the level of a certain cluster's internationalization level compared to other clusters, which is an important benchmarking tool. The limitation of the method concerns the availability of uniform data in different clusters. Besides, it is essential to use multivariate comparative analysis for assessing internationalization level of clusters broken down by industrial affiliation to avoid distortion of results (e.g. by comparing internationalization level of a food cluster to an aerospace cluster).

Results of empirical implementation

Russia launched the nationwide cluster program in 2012. The Concept of Long-term Social and Economic Development of the Russian Federation (2008) stipulates the creation of spatial clusters, that would advance business activity, encourage new investment and hiring, spark innovation, and promote continued economic growth and prosperity in respective Russian regions. In 2012 the Russian Ministry of Economic Development selected 25 pilot innovative regional clusters (out of 94 initial applications) from 19 regions in such fields as medicine, pharmaceuticals, IT, shipbuilding, electronics, nuclear power technologies, instrument engineering, automobile construction, aircraft building, chemistry, oil processing, power

engineering to receive state budget and non-budget support to implement respective programs of their development (Figure 4). The selection of the pilot innovative clusters was the first phase of this program which is being continued in 2013, once the Russian government has defined the main tools for the future support of pilot innovative clusters [Kutsenko, Meissner, 2013].

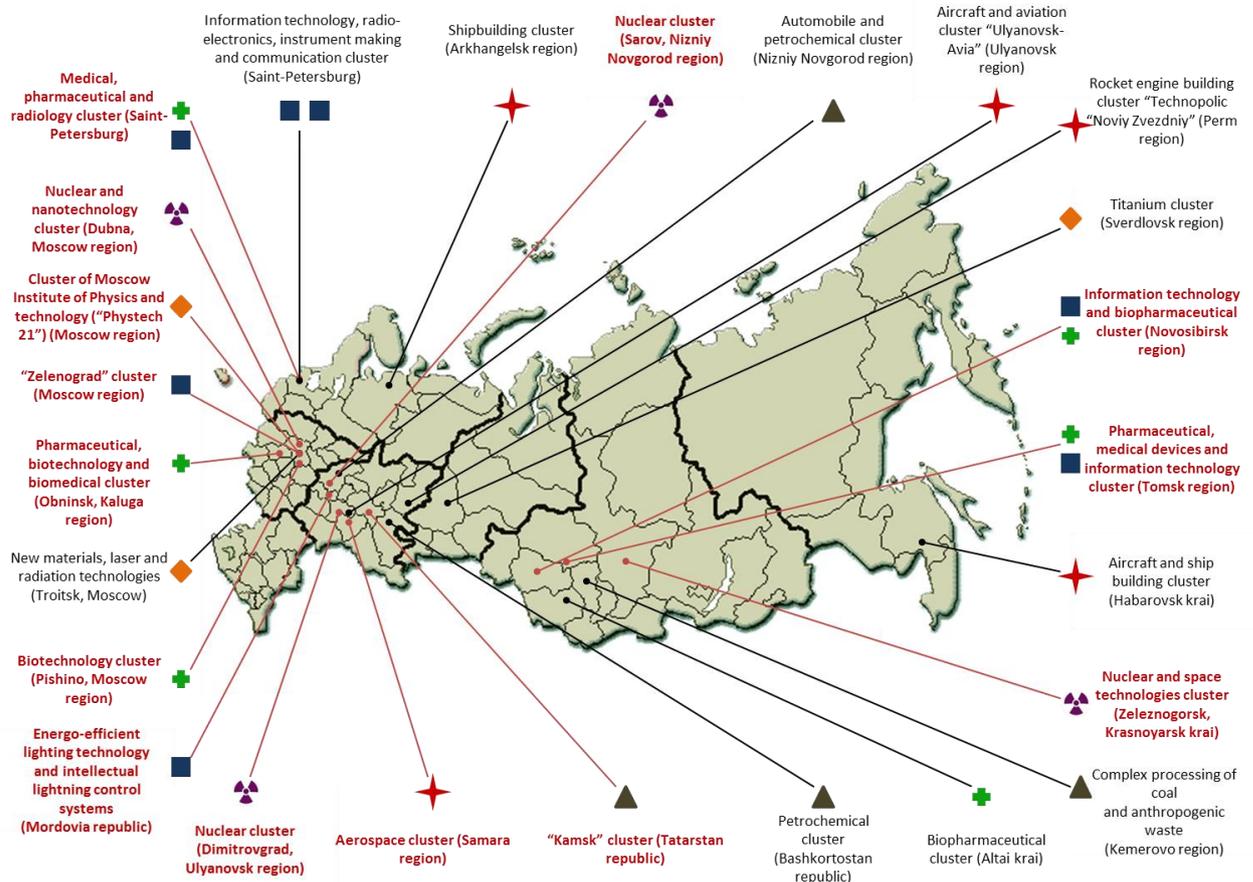


Figure 4. The pilot innovative regional clusters
 Source: Abashkin V. Boyarov A. Kutsenko. E. (2012)

Those clusters were chosen as the object of the present research. Altogether 16 cluster managers from 19 Russian regions were interviewed. The interviews were conducted by providing online questionnaires. A first contact was established preliminary to the survey usually in form of a personal telephone call, in order to receive appropriate background information to avoid possible misunderstandings [Islankina, Nazarov, Fyaksel, 2014].

Results of qualitative assessment

Qualitative assessment is preceded by the self-assessment of CMO regarding the internationalization level of their clusters. According to the results, only one cluster reported of obvious international acting. 75% of the clusters interviewed assess their foreign cooperation

level from intense cross linking and partnerships to selective, unspecific and rather sporadic cooperation with international partners. No cluster selected absence of international activities.

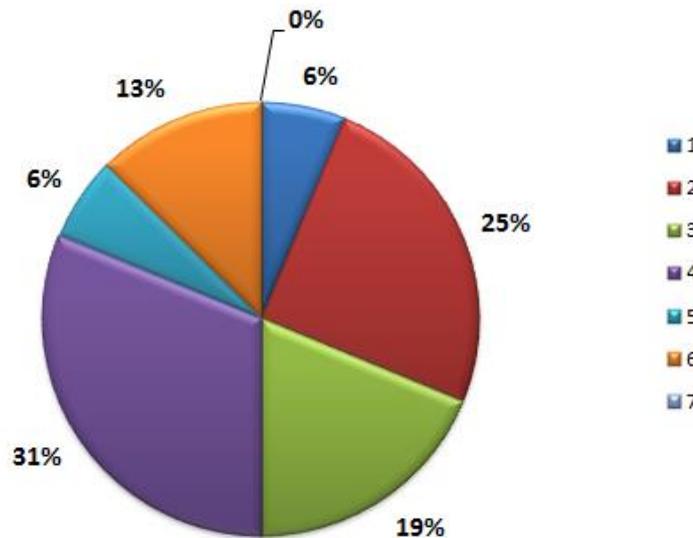


Figure 5. Results of the self-assessment of the CMOs
Source: compiled by the author

To assess the clusters` members internationalization activity a scale from 0 to 4 was suggested (0 – least active, 4 – most active). Cluster members that demonstrated maximum internationalization activity were universities and big enterprises. SMEs and supporting organizations (banks, HR-agencies etc.) on the contrary were the least internationally active. It proves that a general constraint many SMEs face is relatively restricted resource as compared to what is available to larger firms.

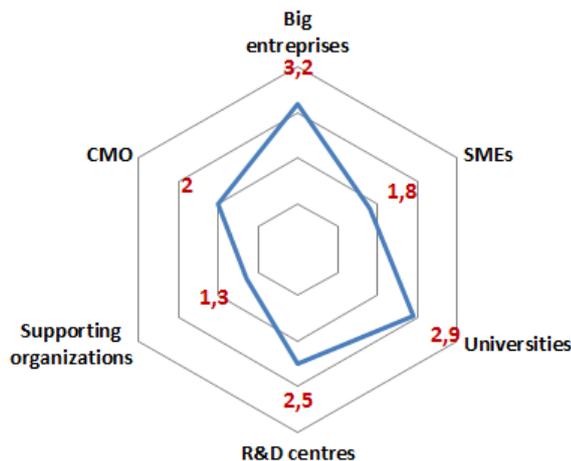


Figure 6. International involvement of key cluster members
Source: compiled by the author

The internationalization process requires a level of investments and resources that smaller companies typically do not possess. Besides, cluster management organizations (CMOs) also demonstrated little internationalization activity (average rate was 1,0), which meant that they

were neither drivers, nor coordinators of internationalization process within clusters. According to the EU findings, cluster managers play an important role in initiating as well as sustaining cluster`s international visibility [European Cluster Alliance, 2010]. Cluster organizations should focus their support to cluster members through various activities/services and even the international cooperation with peers (other cluster organizations) is subordinated to this ultimate goal.

The most frequent international activities of clusters were in such fields as R&D and knowledge transfer and HR-development. Industrial, financial and trade cooperation turned out to be least internationalized (scale from 0 to 4, 0 – no active, 4 – most active).

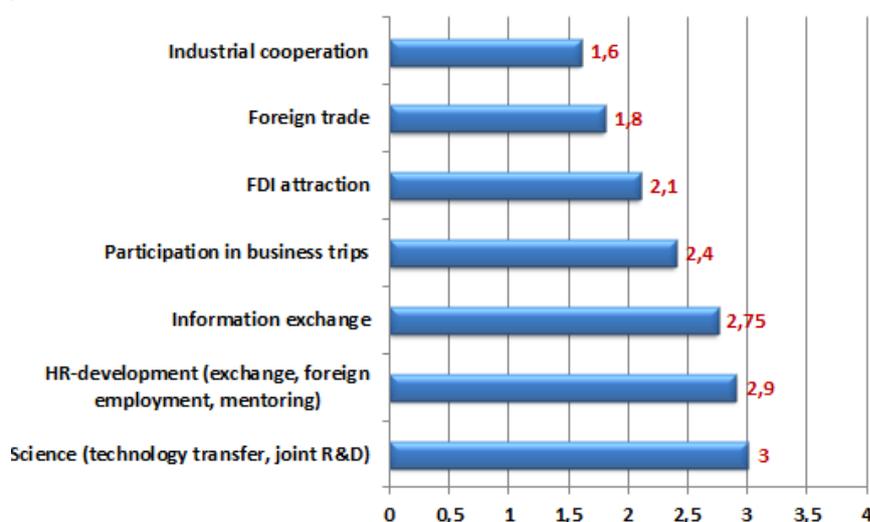


Figure 7. Internationalization activities within Russian regional clusters

Source: compiled by the author

As for geographic scope of the Russian regional clusters` internationalization, that majority of partners came from the EU (50%), the USA and South-Eastern Asia (25%). It is interesting to note that only 12,5% of partners came from the CIS and the former Customs Union of the Republic of Belarus, the Republic of Kazakhstan and the Russian Federation³ respectively. It reflects foreign economic cooperation trends in Russia in the same period (2013). The key trade partners of Russia were the EU (49,4%), the USA and South-Eastern Asia (24,7%), the CIS (13,6%) [Federal State Statistics Service of the Russian Federation, 2013-a]. 58% of FDI were also from the EU (Cyprus, Luxembourg, the Netherlands, Germany, France, the Republic of Ireland, the UK) and 9,5% from the USA, China and Japan [Federal State Statistics Service of the Russian Federation, 2013-b].

³ The research was conducted in 2013

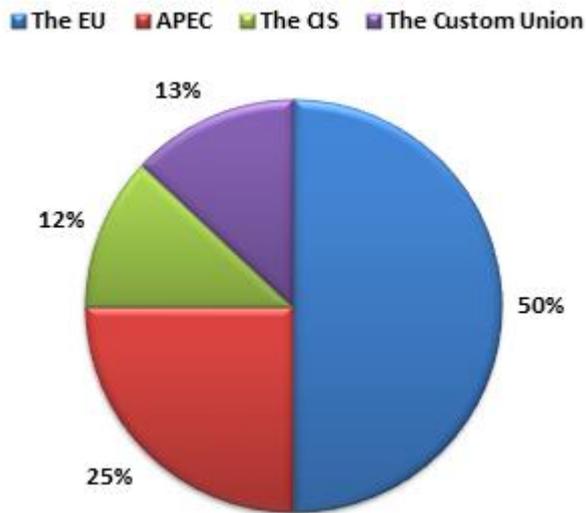


Figure 8. Geographical scope of internationalization within Russian regional clusters
Source: compiled by the author

As for the cluster internationalization in the EU, G. Meier zu Koeker makes a differentiation between cooperation already established within and outside of Europe, as well as within the same technology and application field or between different ones.

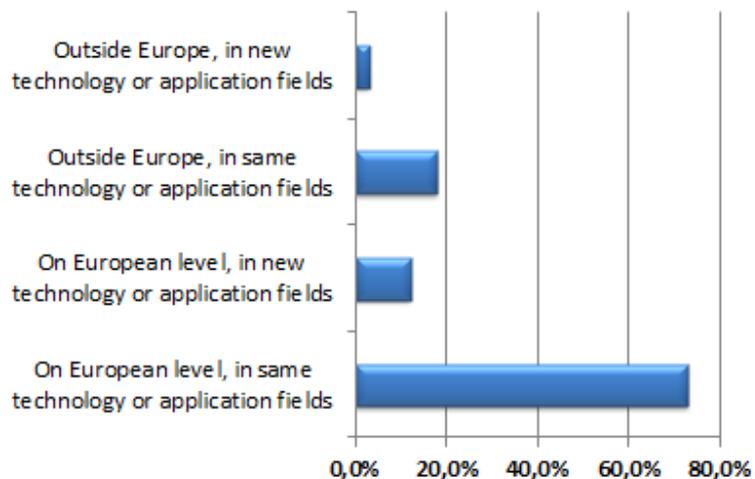


Figure 9. Breakdown of new, successful cooperation achieved (by regions and application fields)
Source: Meier zu Koeker G., et al. (2010, P. 16)

The key reasons for internationalization of Russian regional clusters were access to know-how and technologies as well as regional development, while the least important was strengthening of the world-wide positions (answers were provided as multiple choices). In European research [Meier zu Koeker, et al., 2010] the priorities were totally different: contribution to assure worldwide leading position and strengthening of worldwide market position ranked top among reasons for the internationalization of clusters in the EU.

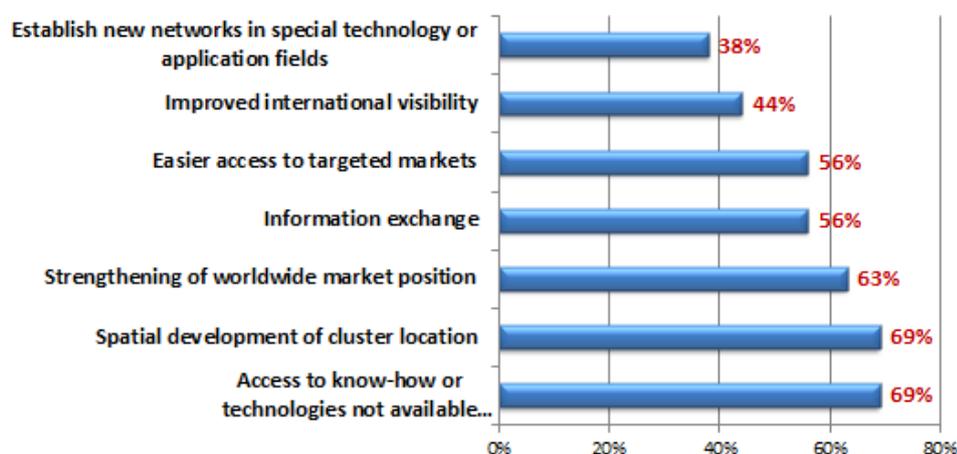


Figure 10. Internationalization goals of Russian regional clusters

Source: compiled by the author

The biggest barriers for clusters' internationalization in Russia were lack of financial resources and well-trained HR. Cultural differences and geographical distance were the least important (scale from 0 to 4, 0 – no importance, 4 – crucial importance).

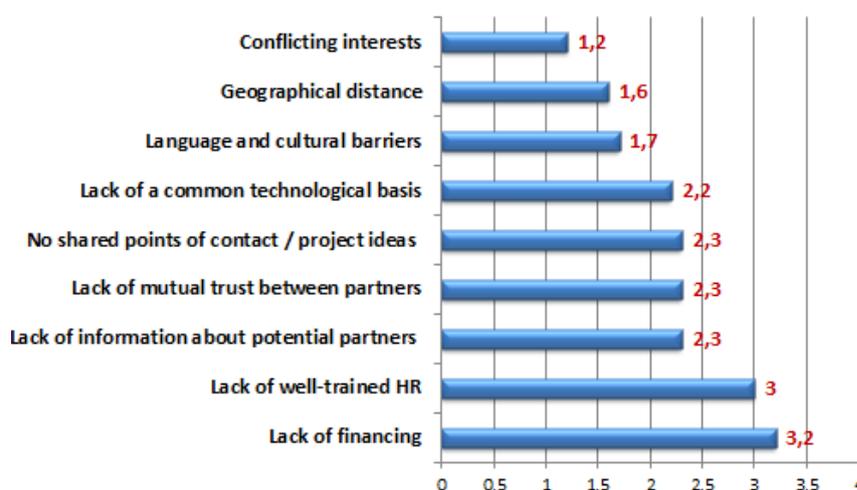


Figure 11. Liabilities to internationalization within Russian regional clusters

Source: compiled by the author

It was no surprise that European clusters were confronted with the same liabilities. Critical factors in internationalization were the possession of appropriate knowledge of the foreign market, techniques of foreign operations, ways of doing business in dissimilar countries and the firm's financial, personnel and marketing resources [Meier zu Koeker, et al., 2010].

The next group of questions concerned organizational aspects of internationalization in clusters, and namely planning of internationalization activities, coordination, responsibility and functions of CMOs regarding internationalization. The chart below shows distribution of foreign activity coordination options.

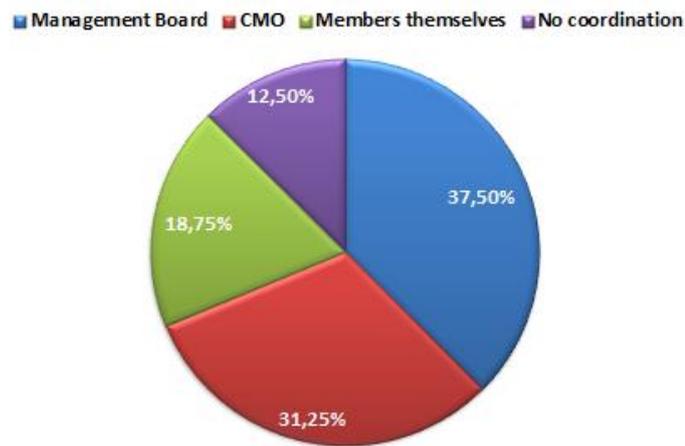


Figure 12. Coordination of internationalization activities within Russian regional clusters
Source: compiled by the author

As we see, one third of the clusters had cluster managers or management boards responsible for internationalization activities coordination. However, the previous questions revealed that CMOs were among least internationally active cluster members. Their responsibility was mostly centered around cluster`s image making, participation in conferences, fairs, exhibitions etc. Least popular were distribution of information about the cluster abroad and matchmaking. In the EU the responsibility for the internationalization of clusters generally lied with the cluster management or with the companies within a network.

One of the basic managerial functions refers to planning, so it was important to know, if internationalization was a subject to such planning, i.e. the existence of internationalization strategy. The number of European clusters implementing a strategy for internationalization has markedly increased in recent years, which lead to considerably better results than in cases where an internationalization consists of uncoordinated individual measures” [Meier zu Koeker, et al., 2010, P. 23]. The chart below represents the respective outputs of the Russian clusters:

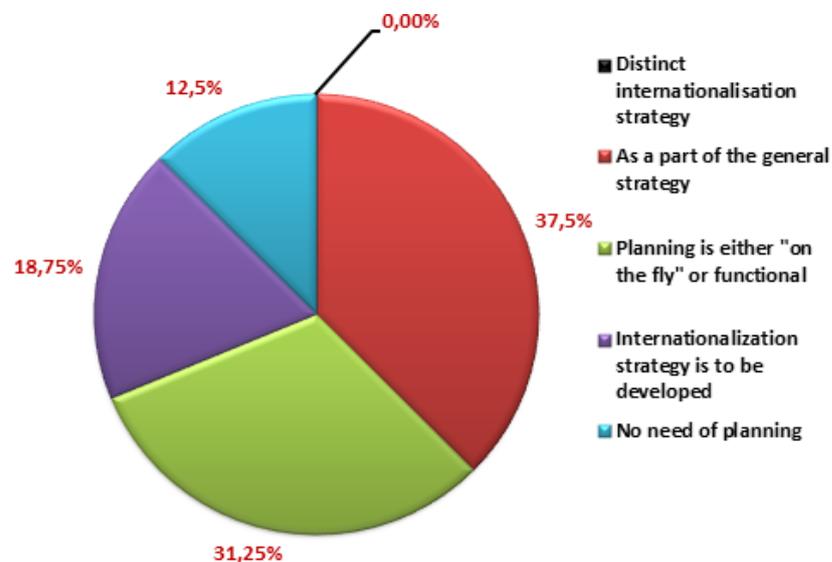


Figure 13. Internationalization strategy within Russian regional clusters
Source: compiled by the author

It is good to state that in total almost 69% of clusters have their internationalization planned. However, no cluster reported of having a special strategy, two clusters neglected the need of internationalization activity planning.

Results of quantitative assessment

The values of the Russian pilot innovative clusters` internationalization index (I_i^{Cl}) were calculated by the means of multivariate comparative analysis. Table 4 contains initial data derived from the programmes of their development.

Table 4. Pilot innovative spatial clusters` internationalization indicators

No.	Cluster`s name	Number of international cluster members	Export amount of cluster members, bln rub.	Number of publications in Scopus / WoS editions by cluster members` employees	Costs on joint R&D, bln rub.
Nuclear industries					
1	Nuclear and nanotechnology cluster (Dubna, Moscow region)	0	1,2	1177	1,9
2	Nuclear cluster (Sarov, Nizhniy Novgorod region)	0	25	1769	1,7
3	Nuclear cluster (Dimitrovgrad, Ulyanovsk region)	n/a	1,8	259	1,7
4	Nuclear and space technologies cluster (Zheleznogorsk, Krasnoyarsk krai)	n/a	18,7	3155	0,2
Aerospace and shipbuilding					
5	Shipbuilding cluster (Arkhangelsk region)	n/a	12,2	84	0,07
6	Rocket engine building cluster "Technopolis "Noviy Zvezdnyy" (Perm region)	n/a	2,5	3239	2,2
7	Aerospace cluster (Samara region)	n/a	1,06	1301	35
8	Aircraft and aviation cluster "Ulyanovsk-Avia" (Ulyanovsk region)	2	25	1244	1,44
9	Aircraft and shipbuilding cluster (Habarovsk krai)	3	4,38	492	0,08
Pharmaceutical, biotechnology and medical industries					
10	Pharmaceutical, biotechnology and biomedical cluster (Obninsk, Kaluga region)	4	0,1	1149	0,01

11	Biotechnology cluster (Pushino, Moscow region)	n/a	n/a	694	0,39
12	Medical, pharmaceutical and radiology cluster (Saint-Petersburg)	0	0,25	596	n/a
13	Biopharmaceutical cluster (Altai krai)	0	1,2	41	0,35
14	Pharmaceutical, medical devices and information technology cluster (Tomsk region)	0	0,55	1150	8,4
New Materials					
15	New materials, laser and radiation technologies (Troitsk, Moscow)	0	0,01	4458	3,3
16	Cluster of Moscow Institute of Physics and technology (“Phystech 21”) (Moscow region)	n/a	15,6	3028	3,8
17	Titanium cluster (Sverdlovsk region)	n/a	22	200	2,6
Chemistry and Petrochemistry					
18	Automobile and petrochemical cluster (Nizhniy Novgorod region)	7	9,6	3285	0,32
19	Petrochemical cluster (Bashkortostan republic)	n/a	0,35	42	0,4
20	“Kamsk” cluster (Tatarstan republic)	0	72,4	691	8,2
21	Complex processing of coal and anthropogenic waste (Kemerovo region)	n/a	16,7	146	0,15
IT and Electronics					
22	“Zelenograd” cluster (Moscow region)	3	6,9	317	0,5
23	IT, radio-electronics, instrument making and communication cluster (Saint-Petersburg)	n/a	1,67	172	1,2
24	Energy-efficient lighting technology and intellectual lightning control systems (Mordovia republic)	n/a	0,4	877	0,22
25	IT and biopharmaceutical cluster (Novosibirsk region)	n/a	6,2	2532	1,55

Source: Ministry of Economic Development of the Russian Federation (2012), compiled by the author

Furthermore the values of clusters` internationalization index were correlated with the foreign economic activity index of respective Russian regions (also calculated by the means of

multivariate comparative analysis; indicators used were: FDI per capita; foreign trade turnover per capita; foreign trade surplus per capita; number of foreign-owned companies per 10.000 people [Federal State Statistics Service of the Russian Federation, 2012]. Thus we have a matrix of four internationalization scenarios based on Johansson and Mattson model of the firm`s internationalization (1988):

- Potential internationalization: neither a cluster, nor the region of its location are internationally active or visible yet.

- Lonely internationalization: a cluster is characterized by a high level of internationalization while the region of its location is not so active in foreign cooperation. The advantage of this scenario is a pioneering position of a cluster; disadvantage – lack of support from regional institutions, underdeveloped environment within the region;

- Supported internationalization: both a cluster and the region of its location are internationally active. Thus the cluster and the region can benefit from each other`s foreign economic activities.

- Late internationalization: a cluster with low international activity is located in a region with highly-developed foreign economic relations and international visibility. The advantage – internationalization can be speeded up due to active benchmarking; disadvantage – omitted opportunities.

The results are shown in picture 14 below. Only three clusters have supported internationalization (top right-hand square): the one (marked green) is from the Kaluga region and two others are from Moscow. 14 clusters are more internationalized than their regions; 8 clusters have low internationalization level as well as the regions of their location. There was no correlation between the internationalization level of clusters and the industries they represented.

These scenarios are suggested as a guide to modify regional clusters policies either in a way to support clusters with their internationalization ambitions or to exploit their potential to foster regional outward cooperation.

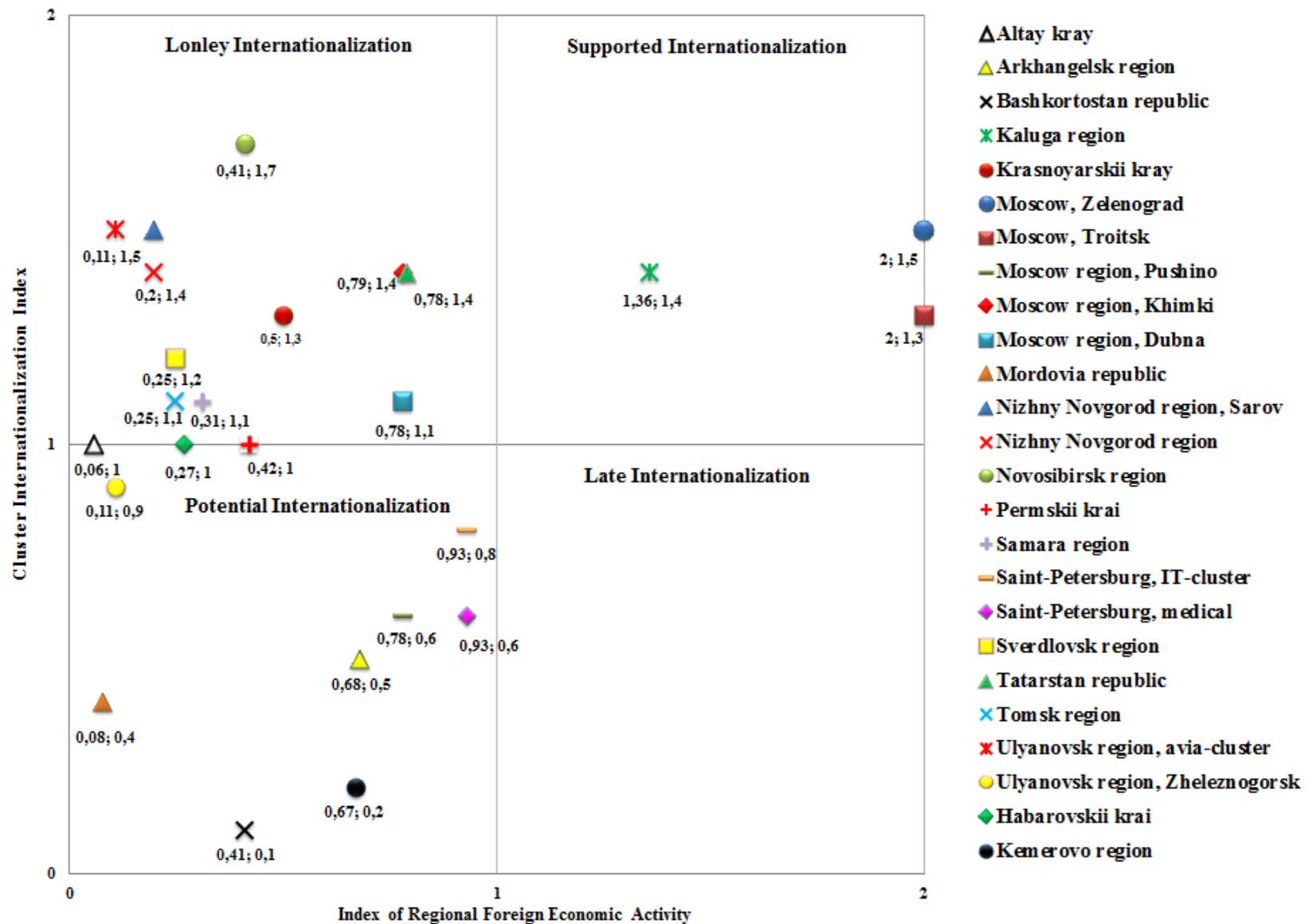


Figure 14. Internationalization scenarios of Russian pilot innovative spatial clusters

Source: compiled by the author

Conclusion

The present study revealed some relevant aspects of the cluster internationalization.

First, the issue turned out to be important for all the cluster representatives interviewed, in spite of the fact that only half of them could boast of active and to some extent successful outward cooperation. It proves our assumption that there is a need for more detailed studies of cluster internationalization as well as for designing respective methodical guides and recommendations for cluster practitioners, adjusted to national features.

Second, regional internationalization and clustering activities should be more harmonized. This thesis derived from the assumption of common theoretical background of clustering and internationalization, discussed at the beginning of the paper, and also from the results of comparing the cluster internationalization index with the index of regional foreign economic activity. Being drivers of regional development clusters may contribute to the internationalization level increase of their locations.

Third, the assessment tools for clusters' internationalization stay in progress. The most relevant liability of the issue is lack of public unified data of foreign activity within clusters. E.g. the only systematic cluster data base in Russia has been created within Russian cluster observatory. The joint report of the HSE and the Russian Ministry for Economic Development [Gohberg, Shadrin, et al., 2012] was the unique source of cluster internationalization indicators. This set, in our view, could be broadened (indicators to be included are amount of import and amount of FDI attracted within a cluster).

Fourth, successful internationalization should be subject to management and planning. This thesis has been concluded from the surveys, guides and practical outputs of foreign researchers. Special emphasis here is put on the active role of the cluster's management company, which is a supporting player but with a crucial role. The cluster management is supposed to build a good international network and be aware of the landscape beyond its national borders. Key services of the CMO regarding internationalization of clusters include:

- monitoring relevant cluster activities world-wide ("cluster days", road-shows, exhibitions, conferences, etc.) combined with targeted matchmaking and benchmarking;
- information exchange with foreign partners and organization of business trips, meetings with representatives of embassies, offices of international organizations in a respective country, national trade missions abroad, chambers of commerce, regional development institutions of foreign countries;
- creation and distribution of printed information materials about the cluster and its members in foreign languages; hosting the English version of the cluster's web-site;

- increasing the cluster`s international visibility via special databases and platforms;
- detailed planning of international activity, enhancing joint projects in various activities (R&D, education, industry, marketing, etc.).

Over the last few years in Russia there emerged hundreds of cluster initiatives, having no less weight in the economy and the prospects for development than the pilot innovative clusters analyzed within the present study. However, relevant information about Russian clusters almost always concerns the 25 pilot ones. In response to this challenge in 2015 the HSE Russian Cluster Observatory⁴ is launching “Cluster Map of Russia” web project. Any cluster corresponding to minimum requirements may be registered in the system. The information provided is grouped in five blocks: general data, cluster priorities, management, members, partners and projects, and is aimed at encouraging inter-cluster communication via informing potential participants, investors, entrepreneurs, authorities in Russia and abroad about the existing cluster initiatives, therefore speeding-up their internationalization. We are persuaded that the combination of clustering advantages (specialization, networking, acceleration of the innovation process, transaction costs reducing, competitive cooperation, etc.) and internationalization (access to new markets and factor endowments, exchange of expertise and knowledge transfer, integration into global value-added chains, etc.) can strengthen the competitiveness of clusters, their participants and locations.

⁴ www.cluster.hse.ru

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