

Interaction of Educational and Innovation Clusters in Order to Improve the Innovation Security of the Western Border Regions of Russia

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Abstract—The article examines the current trend of mutual clustering of education and innovative production sectors in Russia. The study focuses on the western border regions of Russia as the most problematic regions affected by the geo-economic turbulence in the Russia-West system after 2014, which caused the need for import substitution in the innovation sector, while the entire national education system is in the process of reforming, developing and the introduction of new technologies and digitalization. Statistical analysis is carried out for both educational and innovation spheres in order to identify the dynamics of the organizational space, work results and technologies used in the process. The study also provides a qualitative analysis of clustering, including general, the formation of educational clusters and the inclusion of educational organizations in the structure of non-educational clusters. The results of the study revealed both general trends for all considered regions, and exceptions. The independence between the shrinking organizational sector and the unstable dynamics of innovation reflect the weak linkages between the two sectors and the formal nature of cross-clustering in many cases. But the impulse of import substitution has caused a new wave of clustering, and the largest universities have become “condensation nuclei” of regional innovative business. The results of this trend are likely to become apparent after the lag period.

Keywords—*innovation cluster, educational cluster, Western border regions of Russia, self-organizing clustering, innovation security*

I. INTRODUCTION

Innovative development is one of the priorities for Russian regions due to the need to achieve competitiveness both at the national and global levels. This problem is especially relevant for the western border regions of Russia, adjacent to the European space and connected with it by close socio-economic ties [1, 2]. The problems of maintaining high rates of innovative growth and import substitution in the field of high technologies are caused both by the growing competition in the cross-border space and the loss of some opportunities for cooperation due to

the geo-economic turbulence in Russia. System of the West after 2014 (comes into force in 2020 in the context of a pandemic). Therefore, the strengthening of the innovation sector through its clustering in the border western regions is becoming an urgent issue.

Taking into account the sensitivity of innovation sector to both internal and external turbulent dynamics, as well as its need for additional resources to cover the essential risks of innovative activities, all the variety of means to maintain its stability and growth is the subject of academic and administrative discourse. After our previous research in the sphere of forming regional clusters being the cores of integration and competitiveness for regional economies, it becomes obvious the trend for cross-sector mutual clustering. Appearing within self-organizing mechanisms in regional economic space, such effect can become the reason for long-term competitive advantage of the profile regional industries. The example of mutual clustering within the sector of agricultural production, maritime transport and port logistics in Rostov region demonstrates the advantages of such scenario, as its exports continue growing even after the turbulence of 2014 [1]; also forming of touristic clusters helps to bring new technologies into a region and develop them [3]. That is why mutual clustering of innovation sector with the related ones seems to be way to maintain its stability and growth, to increase its own integrity and reach the most connectivity between the stages of innovation process, that is an urgent problem for many Russian regions, especially the North-West ones [2]. In accordance, the important task is to trace the current state and possibilities of mutual clustering between innovation sector and all its related spheres, including both the pre-stage of innovation process in educational bodies and the after-stage of practical implementation and commercializing, resulting in the innovative product.

The purpose of this study is to provide monitoring of emerging and existing innovation and educational clusters in the western border regions of Russia, to compare the potential

of regional innovation production and the regional education system and to identify cases of their interaction, combined with the cluster effect. The subject of the study is the complex of integration processes (both clustering and pre-clustering) taking place in the Western border regions of Russia after 2014 within the innovation import-substitution trend, on the one hand, and the evolution of educational system, on the other hand.

II. THEORETICAL BACKGROUND

The process of forming innovation clusters is of high relevance and during the last decade causes discussion in many aspects [4-6], including both its advantages and problems [7], that brings the need to assess its efficiency and find out the conditions, in which it is reasonable [8], including the issues of management specifics in innovation clusters [9]. In the recent years I.M. Ablaev contributed into the theoretical field of studying innovation clusters in Russia [10-13], including the regional level [13] and accenting the role of private-public partnership [10]. But the given classification of innovation clusters [11-12] mostly bases on the previously formed Russian system of monoprofile 'closed' cities and 'naukograds', which structure not always suits the realities of market territorial structure that causes the new cases of emerging innovation centers, as the need for them is high in the regions with the strategy of import substitution [14].

The interaction between the spheres of education and innovative production (including one in the form of clusters) is viewed mostly in two main directions. One of them considers innovation to be the means for improving education as it is, implementing new technologies into the studying process [15-17]. Another one focuses on raising the quality of human capital for industrial clusters and managerial systems via the innovating and clustering of educational system [18-21], including forming network structures around innovation clusters [4, 6, 22]. So that the reasoning of mutual clustering and networking of education and innovation production is bilateral: from the view point of education system it is within the trend of reforms (and probably will be urgent within after-pandemic trend of digitalizing), and from the positions of industrial and innovation sectors of economy it helps to enforce innovation structures, attract additional abilities of public-private cooperation and form the human capital with higher qualifications.

In application to Western border areas of Russia this phenomenon is not studied complexly. Several research views it in relation to the practice of St. Petersburg as the big technological, industrial and educational center [19], Rostov and Kaliningrad regions as the centers of early and full-scale clustering, including one in the sphere of education [23-24]. Also some researchers, using the concept of 'smart region', find out the possibility to form innovation center in Voronezh region [25]. But there is a need to construct the complex vision of the situation in all the regions of the Western borderlands of Russia as the zone that tries to intensify its innovation development in the recent years in order to reach self-sufficiency and competitive positions in national and cross-border space.

III. METHODS AND EMPIRIC EVIDENCE

The study is based on economic and statistical analysis of time series of data, which testifies, on the one hand, to the development of the regional educational system (the study

focuses on the higher education system, which is closest to the innovation space and unites initiatives for cooperation with regional business), and on the other, production and innovation. Both educational and innovative subsystems of regional reproduction are considered in three main directions:

- organizational space dynamics (indicated via the number of higher educational bodies for the educational space of every region, and also via the percentage of innovative enterprises in the general number of organizations – for the innovative space);
- the volume of productive performance (indicated via the number of students per 10.000 people of regional population for educational space, and also via the number of new technologies produced and the percentage of innovative production in the general volume of goods and services of a region);
- the use of technologies in the process of work (measured via the use of personal computers in higher educational bodies in the studying process, and also via the number of technologies used in regional production).

The data on the Western border regions of Russia (Krasnodar, Rostov, Voronezh, Belgorod, Kursk, Bryansk, Smolensk, Pskov, Kaliningrad, Leningrad, Murmansk regions, Republics of Crimea and Karelia, St. Petersburg and Sevastopol cities) are collected from the official sources of Russian statistics and calculated by the author. The data on the number of higher educational bodies and the number of technologies produced and used is presented not in percentage terms or in annual growth rates, but in absolute terms due to small values of indicators, in which the statistic 'law of large numbers' does not apply. The archive depth is 13 years (2006-2019), as this period allows assessing the trends before and after both important events for the global and Russian economy: the crises of 2008-2010 and the geo-economic turbulence of 2014.

The quantitative statistic analysis is combined with the study of qualitative cases on the educational and innovation clustering in the regions studied, the information collected by the author from the official sources of clusters, regional centers of innovation development, enterprises, educational bodies and regional administrative structures. Both clusters with official status and registration and clusters de facto (fixed via the fact of concentration, competition and cooperation within regional and cross-border space) are viewed. The number of innovation clusters and the number of educational bodies presented into the structure of clusters are calculated by author after the analysis of the wide range of official information sources on each region and cluster, as well as the Russian online cluster map.

IV. RESULTS

Organizational space of Russian higher education bodies, generally, develops in direction of reducing, due to the vector of federal state policy (Fig. 1). Private educational organizations, emerged and grew during the period of 1990s, are especially object of attention in order to control the quality of education and to reduce. Also the decline in the number is caused by the trend of enlargement of educational bodies in Russia after 2000 via merger in order to optimize the structure of educational space and join their resources.

The most full-scale decline took place during the period

2011-2017 in the regions with the primary big number of higher educational organizations (St. Petersburg, Krasnodar, Rostov, Voronezh and Kursk regions, where large educational centers are situated). As the Republic of Crimea and Sevastopol joined into the general Russian education system, they included into the same trend after 2014 (Fig. 1).

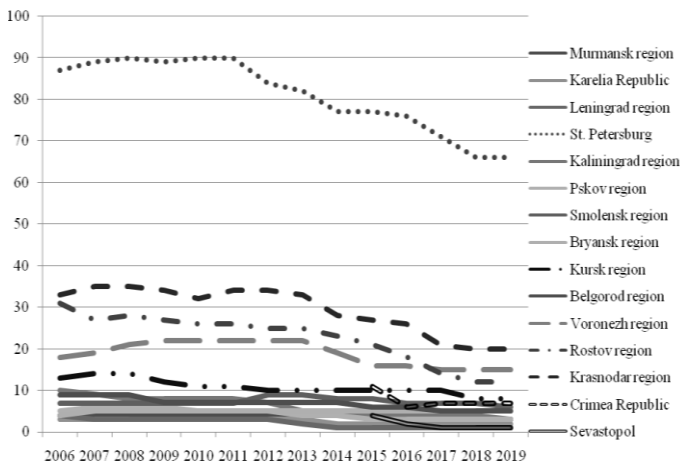


Fig. 1. Dynamics of the number of higher educational institutions¹

Finally, the most share of high educational bodies (HEBs) reduced is in both categories of gerions: where this number was initially low and hogh), they are: Sevastopol, Kaliningrad, Leningrad, Rostov and Pskov regions. Only Bryansk region remained its initially small number of HEBs without reducing (Fig. 2).

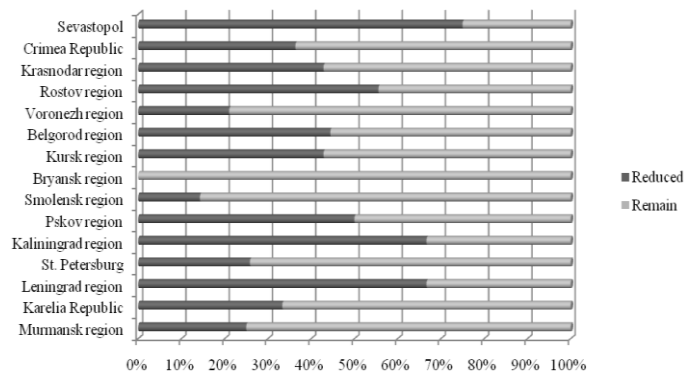


Fig. 2. The share of high education bodies reduced (%); 2019 to 2015 for Sevastopol and Crimea Republic; 2019 to 2007 for other regions¹

This trend, being perceived within the educational system as harmful and problematic, led not only to economy of resources after optimizing, but also to the decline in the finally performance, as the number of students per 10000 population reduced synchronically (Fig. 3).

Along with the general decline, the policy for closing little organizations and strengthening of big educational centers (also gaining the status of ‘federal universities’ and ‘reference universities’) redistributed the number of students in territorial extent, the most reducing in Murmansk and Leningrad regions, student flows directed to St. Petersburg and other big centers (Fig. 4).

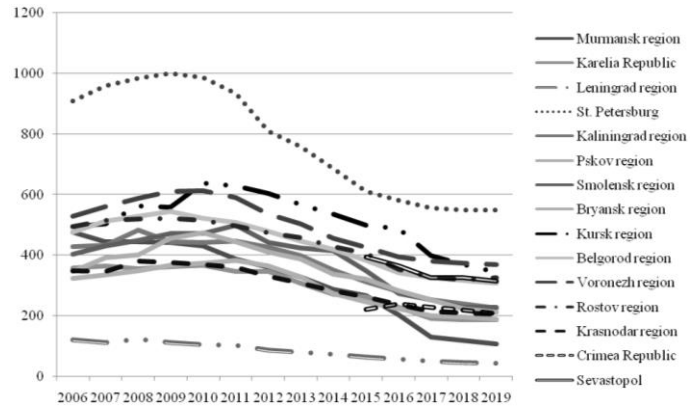


Fig. 3. Dynamics of the number of student of bachelor, specialist and master courses per 10.000 population of the region¹

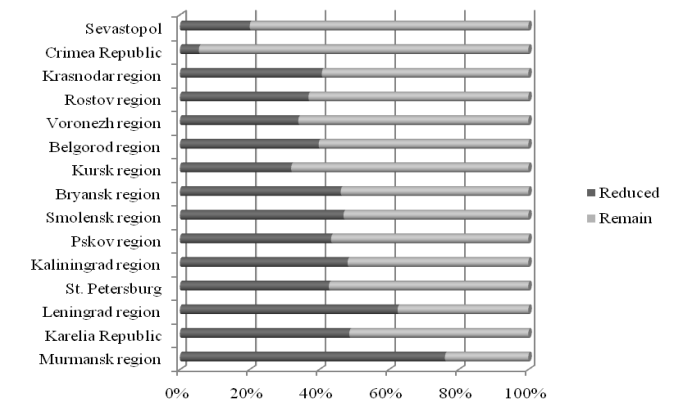


Fig. 4. The number of students of bachelor, specialist and master courses per 10.000 population of the region (%); 2019 to 2015 for Sevastopol and Crimea Republic; 2019 to 2007 for other regions¹

The vector of improving the quality of education environment in Russia formed the new instrument and program basis for the higher education organizations. As the general regional statistics of this sphere in Russia has not yet reflected the internal structure of this process, one can trace it via the dynamics of the number of personal computers used in education that directly reflects the digitalizing of HEBs. The highest values of this indicator per 1000 students are Belgorod, Leningrad, Kaliningrad and Murmansk regions that is due to the lower number of students in these regions; but the general growth trend is obvious. The intensive digitalizing takes place in southern regions with the larger number of students and HEBs (Krasnodar, Rostov, Voronezh regions). The small reduce is fixed in St. Petersburg, Smolensk and Kursk regions (Fig. 5).

While the dynamics of educational space is quite general for all the Western border regions because of the federal policy regulation in this sphere, the development of innovative sector of economy demonstrates variety of regional trends (Fig. 6). There are some common dominating trends of reducing after the crisis of 2008-2010 and the new decline in the situation of geo-economic turbulence of 2014, each one causing further growth and resistance of regional economic systems. But for each region these trends are more or less in resonance with the internal rhythmic of self-oscillation. The most growth now takes plays in the regions – previous leaders in the share of innovative

¹Source: graphed by author on the basis of Federal State Statistic Service, 2020. (In Russ.). Retrived from <https://rosstat.gov.ru/>

enterprises: St. Petersburg, Belgorod and Voronezh regions. But also the new impetus of superior innovation growth takes place in Krasnodar region, due to its active competitive position within the national cross-regional competition. After the attempts to keep the positions and enforce innovative import substitution after 2014 the new decline in innovative corporate sector followed in the last two years in Rostov, Kursk, Smolensk, Pskov, Kaliningrad, Murmansk regions and the Karelia Republic (Fig. 6).

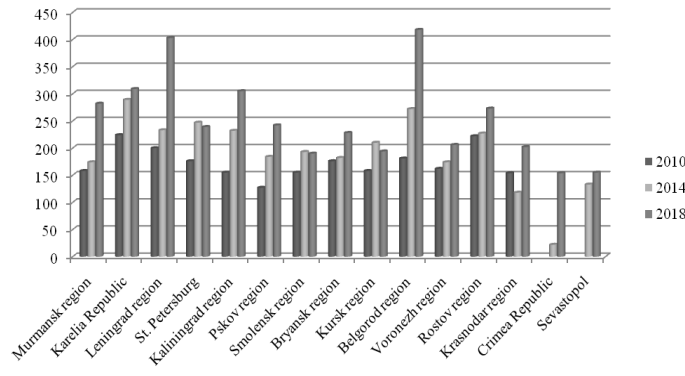


Fig. 5. The number of personal computers used in higher education institutions per 1.000 students²

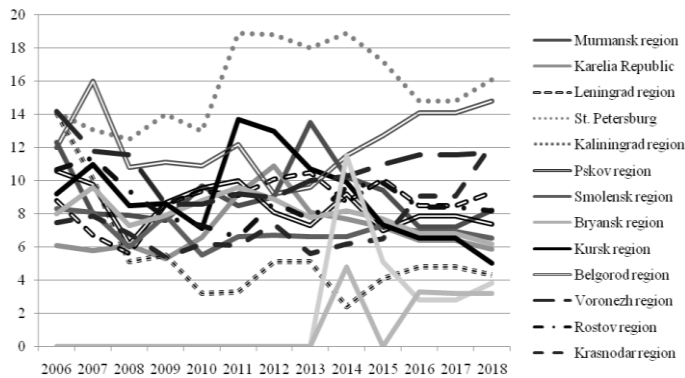


Fig. 6. Dynamics of the share of innovative organizations in the total number of organizations in the region²

It should be noted that these tendencies reflect not only the liquidation and forming of organizations (as well as gaining and losing the status of ‘innovators’, but also the territorial migration of enterprises caused by the changes in the business-environment in the regions (e.g. re-dislocation and formal re-registration of Rostov firms to Krasnodar because of better conditions, as well as ones of Crimea to other regions of Russia).

Just the same picture of superior growing Belgorod and Krasnodar regions is reflected in the dynamics of the new technologies invented. But St. Petersburg performs the deepening decline and Voronezh region – stabilization of situation, while Rostov and Smolensk regions try to overcome the situation of reducing organizational space. The small, but important growth in the last years perform Sevastopol, Republic of Crimea and Kaliningrad region (Fig. 7, 8, the data on St. Petersburg is shown separately due to the much larger scale of the values).

As it takes place in the educational systems, the use of technologies in regional economies permanently grows, the crisis of 2008-2010 only caused small decline in some regions, that is not noticeable in the general picture of Western areas of Russia. And the leading regions are St. Petersburg, Krasnodar and Rostov regions, followed by Voronezh, Belgorod and Leningrad regions (Fig. 9).

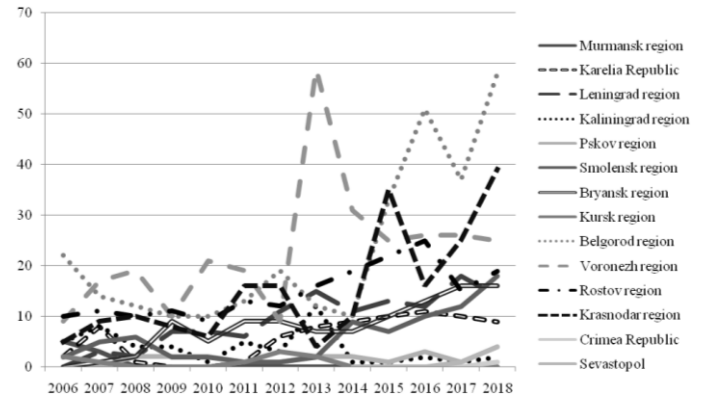


Fig. 7. Dynamics of the number of new technologies invented²

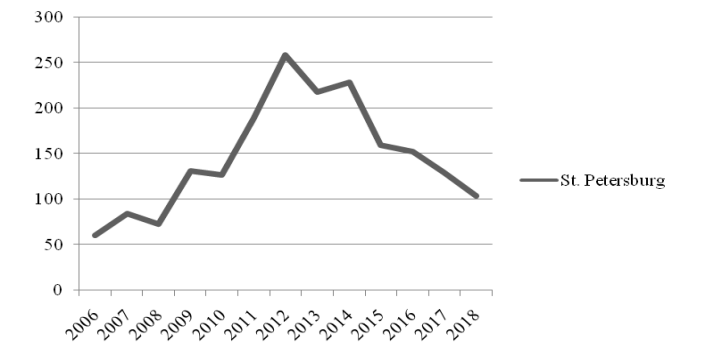


Fig. 8. Dynamics of the number of new technologies invented in St. Petersburg²

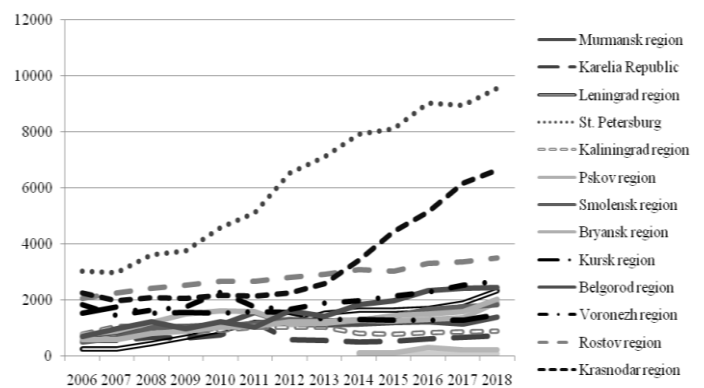


Fig. 9. Dynamics of the number of new technologies used²

So that the growth in the use of technologies in production process, marketing and management suits one in the sphere of educations: just the same regions list of leaders (except St. Petersburg, where the digitalizing of educational environment took place earlier). After tracing these trends, it is important to identify, whether the reducing and enlargement of HEBs made them more likely for clustering (including both forming

²Source: graphed by author on the basis of Federal State Statistic Service, 2020. (In Russ.). Retrived from <https://rosstat.gov.ru/>

specifically educational clusters and also productive and innovational ones with the HEBs among the participants). The

general picture of clustering in the regions studied is presented in the Table I.

TABLE I. THE NUMBER OF CLUSTERS EMERGED (CE), INCLUDING EDUCATIONAL CLUSTERS (EC), INCLUDING CROSS-BORDER ONES (CB), AND THE NUMBER OF EDUCATIONAL BODIES (EBs) WITHIN THE STRUCTURE OF NON-EDUCATIONAL CLUSTERS, BY YEARS OF FORMING^a

Region	Formed before 2014			Formed in 2014-2017			Formed in 2018-2020, forming, projecting and potential		
	CE	Incl. EC	EBs within non-educational clusters	CE	Incl. EC	EBs within non-educational clusters	CE	Incl. EC	EBs within non-educational clusters
Murmansk region	-	-	-	1	-	6 EBs in 1 cluster	2	-	1 EB in 1 cluster
Karelia Republic	-	-	-	-	-	-	4	-	-
Leningrad region	-	-	-	-	-	-	5 + 1CB	2	-
St. Petersburg	4	-	18 EBs in 3 clusters	9	1	6 EBs in 4 clusters	4	-	5 EBs in 3 clusters
Kaliningrad region	7	-	3 EBs in 2 clusters	-	-	-	2	-	6 EBs in 2 clusters
Pskov region	-	-	-	2	-	1 EB in 1 cluster	-	-	-
Smolensk region	-	-	-	4	-	6 EBs in 4 clusters	1	1	-
Bryansk region	-	-	-	6	5	-	4	-	2 EBs in 1 cluster
Kursk region	-	-	-	1	-	-	4	-	-
Belgorod region	-	-	-	2	-	1 EB in 1 cluster	4	-	-
Voronezh region	-	-	-	9	-	4 EBs in 7 clusters	5	2 CB	-
Rostov region	7	-	-	11	2	14 EBs in 9 clusters	5	-	4 EB in 2 clusters
Krasnodar region	-	-	-	4	-	3 EBs in 4 clusters	4	1	2 EBs in 1 cluster
Crimea Republic	-	-	-	6	-	-	5	-	1 EB in 1 cluster
Sevastopol	1	-	1 EB in 1 cluster	-	-	-	1	-	3 EBs in 1 cluster

^a Sources: collected and systematized by author on the basis of Center for Cluster Development of the Belgorod region, 2020. (In Russ.). Retrieved from <https://brric31.ru/centr-klaster-nogo-razvitiya/>; Center for Cluster Development of the Bryansk region, 2020. (In Russ.). Retrieved from <https://мойбизнес32.рф/centry/ksentn-klaster-nogo-razvitiya/>; Center for Cluster Development of the Kaliningrad region, 2020. (In Russ.). Retrieved from <https://mbkaliningrad.ru/cluster/>; Center for Cluster Development of the Murmansk region, 2020. (In Russ.). Retrieved from <http://murmanccluster.ru/>; Center for Cluster Development of the Republic of Crimea, 2020. (In Russ.). Retrieved from <https://ckr.frbk.ru/>; Center for Cluster Development of the Smolensk region, 2020. (In Russ.). Retrieved from <https://ckr67.ru/>; Center for Cluster Development of St. Petersburg, 2020. (In Russ.). Retrieved from <https://spbcluster.ru/cluster/>; Center for Cluster Development of the Voronezh Region, 2020. (In Russ.). Retrieved from <http://cluster36.govrn.ru/>; Development of a long-term strategy for socio-economic development of the Krasnodar Region. Stage 3. "Priority directions and tasks of social and economic policy of the Krasnodar territory". Krasnodar, St. Petersburg, 2017. (In Russ.). Retrieved from https://economy.krasnodar.ru/razr-strat/files/K30.Socio-economic%20policy_170705.pdf; Educational Cluster of the Southern Federal District, 2020. (In Russ.). Retrieved from [http://klaster.icdau.ru/](https://www.sfedu.ru/www/stat_pages22.show?p=KAN/main/M; Multidisciplinary Scientific and Educational Cluster should be on the Don Land, 2020. (In Russ.). Retrieved from https://donstu.ru/news/obshchee/mnogoprofilnomu-nauchno-obrazovatelnomu-klasteru-na-donu-byt; Research and Production Electrotechnical Cluster Of The Kursk Region, 2020. (In Russ.). Retrieved from https://kurskcluster.ru/; Russian cluster Observatory, 2020. (In Russ.). Retrieved from https://map.cluster.hse.ru/; Virtual Cluster of Pedagogical Innovations of Schools and Universities of the Krasnodar Region, 2020. (In Russ.). Retrieved from <a href=)

6 educational institutions demonstrated interest to the Touristic Cluster and joined in on Murmansk region after 2014, and at the moment the Food Production Cluster includes one of the regional colleges. In Karelia Republic the process of including educational bodies into clusters has not began yet.

As St. Petersburg is a large education center, many EBs of higher and middle levels participate in cluster structure, accordingly to the profile specialization. On the other hand, not all clusters contain educational organizations. Educational cluster organized in 2015 in the sphere of medicine, involving 8 educational bodies, surrounded by scientific and commercial organizations. 2 educational clusters can appear in Leningrad region. One of them is projected as the part of educational and recreational infrastructure for the Ust-Luga big port center, and one more is creating in Kudrovo by the Agreement between Admiral Makarov State University of Maritime and Inland Shipping and St. Petersburg State University of Economics.

The Western branch of the Russian Presidential Academy of National Economy and Public Administration, Immanuel Kant Baltic Federal University and the Kaliningrad State Technical University are included in the Amber Cluster of the Kaliningrad Region. Also Kaliningrad State Technical

University joins the Shipbuilding Cluster. In the perspective of forming Cluster of Energy-efficient Technologies it will also innovate into educational environment of the region, providing 'green technologies' for schools and HEBs. Also creating of Educational-Cultural cluster in projecting with the participating several newly created educational organizations.

Pskov State University becomes the basis for the forming infrastructure of "Mogilno" Industrial Electrotechnical Cluster. Probably some educational bodies will participate in touristic cluster in the region.

Smolensk Academy of Professional Education is included in Composite Material Cluster, and Smolensk State Agricultural Academy is within Flax Cluster of Smolensk region. IT-cluster includes: Smolensk Academy of Professional Education, Smolensk State University and the Branch of National Research University "Moscow Power Engineering Institute". Smolensk Humanitarian University and Educational Sports and Recreation Complex are included into touristic cluster. Educational and Production Cluster of Construction and Urban Economy is projecting and forming since 2018 in the region, joining mainly middle level colleges, administrative structures and also firms.

Clustering of education in Bryansk region was provided only for the EBs of the middle level (colleges were joint into 5 clusters accordingly to their specialization), but at the moment the formed structures are not actively presented in the regional initiatives for communication with business. Bryansk State University Academician I.G. Petrovsky and Bryansk State Technical University are within the structure of Bryansk Cluster of Digital Economy formed in 2018, while earlier formed touristic cluster and forming railway engineering and agricultural clusters develop without and EBs.

In Kursk region educational bodies do not directly participate in clusters, but Southwestern State University became the partner of the Research and Production Electrotechnical Cluster of the Kursk Region.

In Belgorod region there are only 2 clusters formed after 2014, and there is particular the Faculty of veterinary medicine of Belgorod State Agricultural University named after V.Ya. Gorin to participate in the Cluster of Bio-pharmaceutics. The IT cluster develops separately from the educational bodies.

The wave of clustering in Voronezh region after 2014 involved 4 HEBs (Voronezh State University, Voronezh State Technical University, Voronezh State University of Architecture and Civil Engineering, and Voronezh State University of Forestry and Technologies named after G.F. Morozov) into 7 clusters. The 2 cross-border profile educational innovation clusters are discussing to be formed in the region: the Medical Education Cluster of federal meaning and the Cross-regional Innovative Scientific and Educational Cluster in the field of ensuring the uniformity of measurements, technical regulation and quality management.

The extensive development of mutual clustering takes place in Rostov region. 2 educational clusters appeared in Rostov region with the highly developed educational and innovative environment. Their concepts and main development vectors are quite different, as the understanding of the concept of educational cluster as it is. The Educational Cluster of Southern Federal University (SFU) formed in 2015 to join schools and the educational bodies of the middle level and develop cooperation between the links of educational chain in the region, as well as to create the platform for selecting the best students and pupils for the further innovation-oriented studying. The educational cluster of Don State Technical University (the dynamically developing main competitor of SFU) was formed in 2016. It supports cooperation not within the educational system, but between the University and innovative production organizations, aiming at all the students' and graduates' best projects being directly implemented into the business practice. These two big universities participate in the most of the industrial innovation clusters of the region, along with the smaller hither and middle professional EBs (including the subsidiaries of Moscow institutes), accordingly with the specialization of each cluster. Moreover, the sector of education becomes the integrative platform for the new generations of innovation clusters.

Some initiatives to create educational cluster in Krasnodar region sounded before 2014 from the academic community of the region, aiming at renewing the educational resources and assets with the state support, but it was not realized. At the moment Kuban State University is projecting Regional Cluster of Pedagogical Innovations with the goal to introduce of innovative computer didactics technologies in schools of the

Krasnodar territory. Kuban State University and Kuban State Agrarian University are included into the initiative of the Cluster of deep processing of agricultural product, biotechnology; Educational Center "Sirius" participates in the touristic clusters, the new forming clusters are also to include the main universities of the region.

In the Republic of Crimea 6 touristic clusters formed after 2014 joining without declared official participation of educational bodies. The new generation of clusters, formed with the support and coordination of the Center of Cluster Development of the Republic of Crimea, is to include scientific-educational organizations. Crimean Engineering and Pedagogical University joined the Local Electric Vehicles Production Cluster, and also Research Institute of Agriculture of Crimea participates in the Agro-Industrial Biotechnological Cluster. But the special educational cluster does not form at the Crimean peninsula, as the EBs are in the process of adaptation after integrating onto the Russian educational system.

In Sevastopol shipbuilding cluster has formed to 2014, including educational and innovative links in its productive chain, but after the joining to the major Russian shipbuilding system and the change in the structure and the number of companies the cluster space was 'collapsed', as well as due to the changes in the system of orders. Cultural and touristic cluster is to be built in Sevastopol with the participation of projected educational bodies in the sphere of art (art school, music school, choreographic college), accordingly to the project of federal level. So that projecting of clusters is able not only to involve existing EBs into the cluster structure, but also to create new ones (including the building of assets and campuses), when the project is supported at the state level.

V. DISCUSSION

The results of the research find out the difference between understanding of the term 'regional cluster' in Russian and European practice. While in Europe only economically motivated subjects form cluster and the educational and scientific environment, influencing it indirectly, is usually defined as 'regional innovation system', Russian academic, administrative and business practice perceive educational bodies to be more likely participants of clusters than outer partners. On the other hand, such view does really suite the Russian practice, when universities, institutes and colleges are not only the environment giving new human resources and ideas, but the sector of equally economically interested organizations, as they can attract the resources of state support and cooperate with private enterprises.

As the result of reducing higher educational organizations sector, shown in this study, the competition between them growth and motivates them to use additional resources to maintain stability and demonstrate their deeply rooting and meaningful positions within a region, including their participation in clusters and becoming the cores of educational clusters, if the internal resources allow this. On the one hand, such trend stimulate educational environment for integration. But on the other hand, in many cases the inclusion of EBs into cluster structures is rather formal than really active and productive. Clusters are interested to demonstrate the presence of scientific-educational infrastructure and the additional number of participants in order to grant the regional or even federal support. But in some cases both sides are really

motivated for productive collaboration, especially in those cases, when universities' science is at a high level and innovative projects do have the perspectives for commercializing, or in the cases when business does need the qualified personnel (e.g. in Rostov region private enterprises create and provide with resources the special teaching farms for the students of agricultural institutes and colleges in order to have the new generation of qualified workers). So that the quality of links between educational sector and innovative and industrial production depends not only of the institutional conditions of gaining support due to cluster status, but rather on the quality of business environment and science within educational bodies, as well as it correlates with the presence or absence of long-term traditions of interrelation between education, science and practice, which is higher in the old 'naukograds' and centers of hi-tech production, bearing the 'genetic inertia' of the former Soviet territorial system.

The efficiency of the reducing HEBs policy as it is can also be the subject of discussion. On the one hand, it strengthened the pressing on the higher educational sector and mobilized the HEBs to develop more actively and fight for remaining the working places. But on the other hand, the long-term period (continuing even at the present time) and the big scale of the HEBs reduces, as well as the bid on closing commercial bodies limits private enterprise and the interest in the educational sector, and after the exit of the most mass of organizations, the competition becomes limited, as the educational market situation becomes closer to monopolistic competition, and each institute becomes the regional monopolist in its profile sphere.

As the study has shown, this reduce does not directly influence the dynamics of innovation production, but such situation is due to the weak correlation between the links of innovation production chain in Russia as it is [2]. Also it should be noted that the problems of educational sector, including the reduce of its variety in each region, may not be reflected in the statistics of innovation because of the essential lag effect, so that this may manifest itself in the future. But also it should be noted that enlargement of universities has also positive consequences as they became the large platforms with the resources enough for accumulating organizational regional space and supporting innovative clusters.

VI. CONCLUSION

The study identified some common trends for the process of mutual clustering of educational sector and innovative production:

Both innovative and educational clusters are creating in Russia with the various understanding of 'cluster' concept as it is. That is why there formed 2 main understandings of an educational cluster: one as the cooperation of only the educational bodies (mainly, colleges and school – horizontally, or with the organizing role of a university – vertically), and also one as the group of educational bodies (or even single big university) as the 'condensation nuclei' for regional business-environment related to the profile specialization.

The basis of interest for both sides is presenter by 2 groups of reasons: gaining state support or ensuring the status positions for the administrative structures – and the symbiotic profits of collaborations. The noted reduce caused the 'collapse' in the organizational space of higher education in the regions, where

the primary the number of HEBs was not large, creating an artificial competition between them and then limiting the competition in the sector after the lost of the 'weak players' of the market. But in the region (and specialization spheres) with the stronger and more developed educational space the same trend caused not the situation of monopoly, but of oligopoly, that tends to cause market clustering.

The long-term changes of educational system are not reflected directly in the innovation production dynamics, but the starting mutual clustering has already given the results for those regions, where it takes place longer and more intensively: Krasnodar, Rostov, Voronezh regions and St. Petersburg. The only exception is Belgorod region, where innovation growth takes place without extensive clustering, but is caused by the initially higher rates and potential in the sphere of innovative production.

Clustering of education and the inclusion of EBs into innovation industrial clusters causes the additional trend of cross-border cooperation, and also cross-border clustering. Both subsidiaries of educational organizations and firms from other regions participate in common projects and the exchange of knowledge takes place. But at the moment such processes are slow and not of large scale, they are presented only in several cases, but such practice may be developed and spread wider.

The main trend of educational clustering in Russia is to enforce the existing institutions, but in some regions and spheres (especially in art and music education and in regions with growing touristic sector) some new EBs are creating and projecting specially to fulfill the gaps in the new clusters' structure. This reflects the important fact: the already formed in Russia understanding of the educational bodies needed for the harmonious and long-term development of clusters, despite clusters without such links in their structure continue existing and forming in Russia successfully.

St. Petersburg and Rostov region are the leaders in the number of mutual initiatives between educational and innovational clustering. St. Petersburg started such trend before 2014 as the leading center of advanced development in the Western area of Russia, and the Rostov region was stimulated after 2014 by the need for import substitution and the new market niches for the regional business. Generally, the waves of clustering develop in time from these 2 centers of early innovation clustering to the periphery while the trend of mutual clustering with educational bodies develop, mainly, from the North to the South.

In the most of regions involved in the innovative production there in an urgent need for the local business and R&D sector firms to be organized not only via the creating system of cooperation contracts, but also by the time rhythm of co-working and gaining common orders and projects, and the role of such organizational platforms can be given to the educational system leading institutions, accumulating resources and state support, that covers additional risks of innovation process.

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