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The Research of Cluster Initiatives of a Higher Education Institution in a Priority Development Area

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***Abstract*— The formation of industrial clusters aimed at the accelerated development of regions is a strategic priority for the Russian Federation. Today in the Russian Far East6 priority social and economic development areas have been established; the Innovative Territorial Cluster of Aircraft Engineering and Shipbuilding (TCAES) operates in Khabarovsk Krai. The research of cooperation chains of the innovation cluster's anchor resident in the territory of advanced development made it possible to conclude that regional organizations play a small part in the value chain of hi-tech products. Their contribution, for the most part, is about the provision of labour resources, general infrastructure and the provision of services, primarily in construction, installation, and maintenance. At the same time, small innovative businesses under a state university situated in the territory of advanced development participate in the territorial innovative cluster. The research of the university's engagement with cluster participants made it possible to formulate a hypothesis on the higher education institution's cluster initiatives in the region. It has been proved that the establishment of small innovative businesses under a university helps to launch cluster initiatives in the production industry of a region. New demand emerges when there is engagement in the value chain; in order to meet that demand the participants of that engagement (the institution, first of all) conduct R&D and come up with innovative ideas that are later introduced into the production industry. The described processes help to understand the new role of higher education institutions in the management of regional development. The university is considered the centre of regional development that introduces education, research, and development activities into the curriculum. The creation of innovative infrastructure in territories of advanced development and business promotion can encourage the commercialization of scientific and technological ideas within a university. The goal of this research is to test the hypothesis on a higher education institution's cluster initiatives in an advanced development area. The authors examined the models of an institution's engagement with the cluster's production companies in the advanced development area using the example of Komsomolsk-on-Amur. The authors concluded that the hypothesis had been confirmed.**

Keywords*— advanced development area, innovative territorial cluster, higher education institution, communicative engagement, cluster initiative.*

I. INTRODUCTION

The formation of industrial clusters is one of the indisputable space priorities for Russia's innovative development; this mechanism must help to address the challenge of ensuring Russia's global technological leadership by 2035 [16]. Cluster approach is provided for in mid-term and long-term strategic development programmes that are being elaborated in Russia. For instance, the concept of long-term socio-economic development of the Russian Federation until 2020 stipulates the creation of advanced economic development centres under territorial production clusters concentrated in urbanised regions and oriented towards hi-tech manufacturing in priority sectors of Russian economy [6]. In the "Mid-term social and economic development programme for Russia until 2025" "The Growth Strategy" (developed under Russian President's request of July 14, 2016) states that the development of hi-tech territorial clusters is part of the action plan on encouraging growth sources within the economy [12].

According to the Association of clusters and technological parks, there are 137 clusters operating and forming in 52 Russian regions, with 25 of them being industrial clusters. As the Association review notes, "industrial clusters have been the driver of growth in real sector of the Russian economy for many years. For example, average labour productivity in industrial clusters is 30% higher than the average rate in the processing industry in Russia and constitutes 4.2 mln rubles per capita." [5; 20]

In Michael Porter's definition, clusters are geographic concentrations of interconnected companies, suppliers and firms in relevant areas as well as organisations that are connected to their activities in specific fields and are competitors but at the same time they cooperate [9]. In the context of cluster research, their contribution to competitiveness improvement of the region as a whole was identified and is described with the help of the so-called "national rhombus." [7; 16]

Higher education institutions are necessary participants of a cluster. Their role in a cluster is integral to their contribution to the management of regional development. Today Russia reassesses their role: the university is considered the centre of regional development that introduces education, research and development activities into the curriculum. By 2018, no less

than 55 university centres of innovative, technological, and social regional development will have been established in the Russian Federation entities; by 2025, their number will grow to no less than 100. These university centres must ensure "... the formation of an attractive social environment, access to latest technologies, creation, and development of knowledge-based and experience economies..." [8] The need for "master programmes on technical business, technological projects management in cooperation with the real economy sector and development institutions..." results in higher education institutions creating and developing regional clusters.

Moreover, high-level universities can play a central role in the development of clusters themselves. Depending on the type of a cluster (industrial or educational) and the scale of an institution, there are a number of strategies for its participation in clusters' activities [10; 13; 15]. Universities can initiate the creation of clusters or participate in one or a number of clusters (mono- and multi-cluster strategies). In the case of educational clusters, institutions can cooperate either with other institutions or with schools and secondary vocational institutions [4]. Under pilot innovative (industrial) clusters, there are three engagement models for higher education institutions and businesses: implementation of education programmes in priority areas designated by the cluster's participants, retraining and advanced training programmes, in engineering in particular; applied research in cooperation with businesses; and joint use of innovative infrastructure of higher education institutions [11; 16; 18].

II. RESEARCH METHODS AND RESULTS

In the Russian Far East in the Komsomolsk industry agglomeration, with its centre in Komsomolsk-on-Amur, there is a hi-tech economy sector complex in which Russia already has or plans to have in the midterm serious competitive advantages, namely in aircraft and shipbuilding, iron and steel industry, and crude oil refining [2]. A number of strategies, long-term (federal) state programmes, and policies with necessary financial and management resources are aimed at the development of these sectors. A priority social and economic development area (PSEDA) "Komsomolsk" has been launched in the region. Thus, a broad range of opportunities is now open for clusters in the region.

The Innovative Territorial Cluster of Aircraft Engineering and Shipbuilding (TCAES) in Khabarovsk Krai launched in 2012 focuses on defence industry, transport machine building (aircraft- and shipbuilding), machine and equipment production, complex automation, strengthened metals technology, IT technologies, composites and polymeric materials, prototyping and robotics. The cluster is on the list of pilot innovative territorial clusters in Russia.

The branch office of PAO "Kompania "Sukhoi' 'Komsomolsk-on-Amur Gagarin aircraft plant" is the regional centre of the innovative cluster. It is the biggest company both in Khabarovsly Krai and the Far East by output volume, products importance, and its role in socio-economic development of the city and the region. The plant is the leading production platform for key military and civil products of the Joint Aircraft Engineering Corporation, namely Su-35, T-50, and Sukhoi Superjet-100.

The plant has always had the closest cooperation ties with the primary provider of innovative ideas and technologies OKB "Sukhoi" (Moscow). Major global equipment manufacturers from France, Germany, Switzerland, and the USA are leaders in technological infrastructure provision. The traditional cooperation of the aircraft engineering plant with many Russian companies in central Russia has also been maintained. The conducted research showed that Khabarovsk Krai organisations' role in the hi-tech products value chain for the major part occupies a very restricted sector of labour resources, general infrastructure, and services provision, mostly in construction, installation and renovation.

Small businesses in Komsomolsk-on-Amur and Khabarovsk Krai do not form an integral part of production chains of a major city-forming company. In PSEDA "Komsomolsk" facilities for new local aircraft building plant suppliers must have been constructed, but the work has not been carried out. There are some objective explanations, for instance, the dependence on one consumer and defence enterprise status [1].

That being said, it is important to note that "Komsomolsk-on-Amur State Univeristy" (ФГБОУ ВО КнАГУ) is one of the TCAES cluster's participants; small innovative businesses of the university form part of the cluster. Communicative engagement between the university and cluster companies is carried out using one of the three models: education research, scientific research, and joint use of university's innovative infrastructure [14].

The two first models are based on two traditional long-developed areas. The third model of engagement between the Komsomolsk-on-Amur State University and business concerns the joint use of the innovative university infrastructure and is relatively new. Under "Innovative territorial aircraft and shipbuilding cluster development in the Khabarovsk Krai" and "Innovative development and modernisation of Khabarovsk Krai's economy" programmes in 2015 a research and development laboratory "Composites and knowledge-based technologies" founded with support of OAO "Amur Shipbuilding Plant" on the basis of the Komsomolsk-on-Amur State University. The future and present goals of the laboratory is the development and introduction into modern sea and river vessels manufacturing based on import phase-out technologies of composites products manufacturing.

Joint use of the university's innovative infrastructure brings the cooperation between the cluster's participants to a new level: small innovative companies established with the support of the university provide both engineering services and conduct scientific research as well as engage in joint production activities [2]. For instance, in 2013 the Komsomolsk-on-Amur Gagarin aircraft plant (KnAAZ) signed a long-term agreement on modelling and development of aircraft component moulding by the elastic and granular medium. This agreement is unique because the modelling is done by the university while a small innovative business launched with the support of the university manufactures the test equipment. The small business OOO Kompozit DV

supported by the university will also manufacture products for PAO Amur Shipbuilding Plant (ASZ). Technical Park manufactures several product items under an agreement with PAO ASZ and PAO KnAAZ CNC machines [3].

The introduction of relevant research into the area of laser technology controlled size is a perfect example of the university's participation in the development of the TCAES cluster: various programme and machine complexes are operational (laser trackers, laser radars, laser manipulators, laser scanners) PAO ASZ. An agreement is signed with PAO Sukhoi Civil Training on expert training for the metrology department. The laboratory of laser technologies is going to establish a verification and adjustment centre for laser optical equipment. In order to do that, OOO Neva-Technology (St. Petersburg) signed a cooperation contract on adjustment services with the Komsomolsk-on-Amur State University.

Nevertheless, the successful participation of SIE University in TCAES cluster activities is more of an isolated case and is based on individual orders and exceptional engagement. The present relations of the majority of the cluster SIE are more of a "cluster initiative." In other words, it is a start of activities (a joint project or an action plan) on the creation or development of a cluster.

The most evident results of the development of cluster initiatives can be seen in the city's education cluster: the network engagement "School – Higher Education Institution – Business" has been operational for a number of years. The project "Education for Life, Education for the Future" is implemented on the basis of the cluster-oriented education concept. It established cooperation between city schools and the university, production businesses, organizations and vocational training institutions, including those that participate in the territorial innovative cluster. The new form of relations between the university and schools needs to be focused on: the Technological Park has developed and implemented educational school workshops on basic electrical engineering and electronics, basic analogue and digital electronics, and basic robotics.

The analysis of communicative engagement of the Komsomolsk-on-Amur State University (its innovative infrastructure facilities), companies and organizations leads to a conclusion that the university encourages the development of clusters in the region. The following cluster initiatives of the university in the shipbuilding cluster are most prominent: thanks to serious research conducted by the University in composites development technologies, Sredne-Nevsky Shipbuilding Pant and Amur Shipbuilding Plant in Khabarovsk Krai can cooperate in the area of composite materials for military and civil vessels. In the future Amur shipbuilding plant plans to produce composite panels for military and civil vessels with the help of Sredne-Nevsky plant. Thus, the Komsomolsk-on-Amur State University will be able to become part of St. Petersburg composite cluster.

The management of cooperation within the value chain in the shipbuilding cluster results in additional demand that needs to be met. For instance, to cut composite materials used in large ship secondary structure construction in PAO ASZ, the laboratory of composite materials has been established in Komsomolsk-on-Amur University. In this lab, the relevant research in high capacity laser technologies that can process and cut different materials was carried out.

As a result, Komsomolsk-on-Amur State University and Far East Shipbuilding and Repairing Centre will develop their cooperation in design, implementation, and assessment of education programmes, internship programmes organization and student employment support, research and development and creation of joint integrated projects like basic departments, laboratories, scientific and educational centres etc.

Within the TCAES cluster, the University also fulfills the educational function in innovative activities area by inviting experts from leading national and international companies who offer workshops, training courses, thus broadening professional competencies of the University's staff and companies' employees in the city and the region.

Many examples of the cooperation between the University and companies and organizations in research and development go beyond the TCAES cluster. Detailed research is needed in order to understand whether cluster initiatives play any role in such cooperation. Without any doubt, the development of university-based infrastructure encourages new links and collaboration.

The upcoming launch in 2018 of a first regional technological business accelerator in Komsomolsk-on-Amur in close proximity to the university will encourage the implementation of cluster initiatives. Along with the implementation of city projects aimed at the creation of industrial parks and new innovative infrastructure facilities (under PSEDA "Komsomolsk" projects and The Comprehensive social and economic development plan for Komsomolsk-on-Amur) cluster initiatives elaboration can achieve a new level.

III. THE ACHIEVED RESULTS

1. Key functions of a higher education institution in an innovative territorial cluster were identified: they are connected to the implementation of educational programmes in priority areas designated by the cluster participants in training, retraining, advanced training programmes as well as in relevant scientific research in collaboration with businesses.

2. It has been proved that the development of innovative infrastructure in a university encourages new connections and cooperation; new forms of cooperation between the university and cluster participants emerge. Joint use of the innovative infrastructure of a university is an example of the latter. New services are also popular with manufacturing companies that are founded under the Priority Social and Economic Development Areas project (PSEDA).

3. It has been proved that small innovative businesses under the auspices of a university encourage cluster initiatives in production: SIEs of a university found production facilities to meet the needs of industrial companies.

4. It has been established that engagement organization in value chain results in additional demand. In order to meet

this demand, cooperation participants (first of all, a higher education institution) engage in RD activities and come up with innovative ideas that are later introduced into a manufacturing process.

5. It has been proved that innovative and business activities promote the improvement of professional qualities of university staff, employees of companies in the city and the region.

6. It has been established that SIE staff, the innovative infrastructure facilities employees actively search for partners to implement joint scientific and innovative projects.

7. The hypothesis on university cluster initiatives in an accelerated development area has been confirmed.

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