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Monetary Policy and Clustering for Achieving Competitiveness in National Bussiness

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Abstract:

Territorial location has been a criterion for the development of an industry. In this regard, the formation of a single economic space between enterprises (organizations) of various forms of incorporation can be considered as an instrument for leveling the unevenness of economic development, which has been proved as a successful clustering practice. This efficient integration has transformed clustering into a national priority on a global scale.

The constant decline in the growth rate of world GDP is being discussed, and measures are suggested to solve this problem through the formation of efficient spatial relationships, the creation of which is a condition for expanding the number of "locomotives" of growth that carry out intensive exchange of production factors. Clustering has been the result of efforts to achieve competitiveness for quite a long time.

Further economic development is impossible without the development and the implementation of a new clustering model involving an increase in the level of cohesiveness of the monetary policy and the clustering strategy. A practical tool for transforming the economic space is the formation of clusters, the distribution of which allows achieving a synergic effect ensuring the growth of performance of economic entities in the region, which implies a change in the design of the monetary policy.

In this study, a hypothesis about the existence of a significant relationship between the costs of creating and implementing innovations and the volume of innovative products received has been put forward and confirmed, which is the rationale for monetary support for competitiveness.

Keywords: *Monetary policy, cluster, innovations, region, efficiency, competitiveness.*

JEL Classification: *E40, E42.*

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1. Introduction

The economy of any country is described by a high degree of discreteness in economic activity, uneven distribution of production capacities and business centers, as well as a high degree of contrast, particularly in comparison of the level of capital and the degree of periphery. Clustering is a local characteristic of a network. It describes the degree of interaction between the closest neighbors of a given node. The modern stage of modernization can be marked as scientific and technological, which involves changing economic relations and ties through innovation and clustering. The territorial size of a cluster allows applying the monetary policy measures and influencing the competitiveness of the companies participating in the cluster (Liapis *et al.,* 2013).

The idea that the success of the national economy ultimately depends on the development of the local concentration of specialized sectors had appeared more than a century ago by Marshall (1890) and was developed by Porter (1990). Marshall was the first economist to examine the synergic effect achieved by uniting enterprises. Cluster practice has been spreading in the world economy since the 90s of the XXth century, which was due to the globalization of the world economy. A new model of arranging the production with a specific feature of close technological and production ties is a "convenient" target for the impact of the targeted monetary policy. The cluster is an alternative to the sectoral grouping, since the emphasis is more often shifted to regional integration, while the cluster can also apply to service enterprises and to cultivate innovations. Porter, who popularized the term "cluster", insisted on its synonymity with the notion of competitiveness: *"...the only meaningful concept of competitiveness at the national level is productivity"* (Porter, 1990). According to him, not countries, but also firms compete ensuring the network development of the region on the basis of efficient targeted monetary patronage and replication of competitive advantages. The clustering process has been constantly accelerating in recent decades and covered an average of 50% of the economies of the world's leading countries, as shown in Table 1.

Table 1. *Expansion of clustering (General information on innovative territorial clusters).*

Country	Number of clusters	Country	Number of clusters
United Kingdom	168	Netherlands	25
Germany	32	US	380
Denmark	39	France	100
Italy	210	Finland	9
India	116	Russia	130

The cluster approach is advisable to apply in the design of a monetary policy, as it will allow personifying the credit expectations of potential investors using mezzanine, forward financing, innovation-product integrator, cluster financing based

on public-private partnership, endowment funds within innovation-driven growth programs with state participation in such areas as:

– reconstruction and modernization of fixed assets;
– R&D;
– increase in the share of innovative products in total output.

Innovative clusters can produce innovation activities using other (non-financial) growth factors, namely the intellectual potential (capital) formed in these territories, which leads to an increase in innovation activity of the territory of clusters in the regions.

2. Methods

Cluster technologies and strategies have already accumulated solid experience, but the key methods of performance management remained the same: optimizing the cluster structure; identification of funding sources and instruments of control; determination of efficiency criteria and methods of innovations' diffusion. It seems important to use the portfolio approach from the standpoint of the composition of participants in existing clusters. The management mechanism assumes the following stages: definition of needs; portfolio formation; implementation of R&D; creation of an experimental product; the first pilot series; consumer evaluation; organization of after-sales service, if possible. The stages of portfolio management are presented in Table 2.

Table 2. *Cluster portfolio management mechanism.*

Stage	Groups of the portfolio management processes		
	Portfolio building	Portfolio balancing and adjustment	Formalized decision making and control
Strategic portfolio management	Building the portfolio concept and investment policy; Building the roadmap	Developing and adjusting strategies	
Corporate portfolio management	Determination of the portfolio management methods	Portfolio optimization	Portfolio administration
Portfolio yield management	Adjusting the portfolio structure in terms of profitability. Covariance and correlation analysis.	Ranking of investment projects and enterprises	Using saddle strategies
Portfolio risk management	Determination of portfolio risk, calculation of standard deviation and variance	Determination of risk types and diversification	
Revision of the	Calculation of	Ranking of	Audit

portfolio and adjustment	performance indicators	performance indicators	

Following the portfolio analysis, it has been determined that there are educational institutions in most clusters (95%). The representativeness of other organizations in the clusters is distributed as follows:

– scientific organizations – 71%;
– objects of infrastructure for supporting entrepreneurship – 58%;
– objects of technological infrastructure – 50%;
– non-profit/public organizations – 45%;
– financial organizations – 34%.

The definition of rational sources of funding implies the need to take the starting conditions for the cluster creation into account. Therefore, the performance criteria can vary: volume of gross revenue; costs for R&D and other indicators in financial reporting. The most popular indicators are shown in Table 3.

Table 3. *Essence and content of indicators reflecting the performance of the innovative cluster.*

Indicators that describe:	Content
Production structure of the cluster	- gross output of cluster participants in value terms or by consolidated taxpayer groups; - share of gross output of the cluster participants in the gross regional product; - share of the final type of product retailed in the total volume of production in the cluster territory; - share of the production cost in gross sales revenue.
Resource potential	- natural and resource potential of the territory (region); - non-current assets of nature protection purposes, rub.; - current assets and business cycle; - market value of intangible assets of nature protection and environmental purposes, rub.; - share of intellectual investment in the total volume of investment and the innovation fund, rub.; - financial investment in capital investments, rub.
Economic indicators	- amount of operating and net profit of cluster members from the sale of certain types of products, rub.; - share of each participant in the aggregate net profit of the cluster, %; - profitability of production by operating profit, net profit of each type of product in the cluster, %; - average specific value of the indicator of the cluster formation return, %.
Innovation potential	- return on personnel (production and management) of the firms

	participating in the cluster formation; - efficiency of funds allocated for remuneration to firms participating in cluster formation; - synergic effect of joint use of key competencies of companies included in the cluster; - synergic effect of joint use of intangible assets within the cluster, such as consumer assets, information technology, infrastructure assets, etc.; - specific weight of intangible assets in the structure of the company's assets; - growth rate of the share of intangible assets in the structure of the company's assets; - share of the production cost of the produced and sold products in gross sales revenue; - company's economic added value; - return on the company's intangible assets.

Dynamics of corporate investment indicators and liquidity can serve as selection criteria for credit institutions. Monetary preferences can be formalized in the optimization economic and mathematical VAR model in equation 1:

$$K_t = A((k_1 k_2 k_3)_{t-1}) + B(y_1; y_2; y_3; y_4; y_5) + C(z_1; z_2; z_3; z_4; z_5; z_6; z_7) + \varepsilon_t \rightarrow max \quad (1)$$

where: K_t is the company's competitiveness in the period t;
$A(K_{t-1})$ is the company's competitiveness polynomial in the period (t-1), i.e. the previous period;
T is the lag of calculations or forecasting;
k_1 is the regression characteristic of the market;
k_2 is the regression characteristic of the technology;
k_3 is the regression characteristic of the situation;
y_1 is the business activity;
y_2 is the NPV;
y_3 is the profit (EBIT), ICF;
y_4 is the return on investment, IR;
y_5 is other factors;
B is the polynomial of the production and investment efficiency indicators;
z_1 is the influence of money supply;
z_2 is the influence of interest rate;
z_3 is the influence of inflation;
z_4 is the influence of the exchange rate;
z_5 is the swap index;
z_6 is the investment rates;
z_7 is the eurobond rates;
$C(z_1; z_2; z_3; z_4; z_5; z_6; z_7)$ is the polynomial of the transmission mechanism;

ε_t is the error.

This model may have some limitations:

$$\begin{cases} f(y_1; y_2; y_3; y_4) > 0 \\ f(z_1; z_2; z_3; z_4) > 0 \end{cases}$$

In the context of monetary preferences, it must be noted that institutional and credit organizations are primarily guided by the return on investment, which is shown by the proposed model above. The structure of funding sources for innovative clusters is not uniform: there are clusters funded entirely from public funds, but most of them involve co-funding or partnership. Another relevant architectural problem is the interaction between enterprises or manifestation of a synergic effect, which can be estimated using the clustering ratio in equation 2:

$$S_i = R_i/[f_i(f_i-1)/2] \quad (2)$$

where R_i is the real number of links;
f_i is the node degree.

For example, according to 2016 data published by the Association of Clusters and Technology Parks of Russia (Non-Profit Partnership "Association of Technology Parks in the Field of High Technologies"), there were 125 industrial clusters created or in the process of creation in the country. 44 clusters are functioning, and only 25 of them have the status of innovative territorial clusters. The largest clustering factor for innovative structures, according to the calculations of the authors, was established due to the following relationships:

– "Nuclear and radiation technologies";
– "Production of aircraft and spacecraft, shipbuilding";
– "Pharmaceutical, biotechnology and medical industry";
– "New materials";
– "Chemistry and petrochemistry";
– "Information technology and electronics".

Synergic effect and the use of a positive clustering factor allows to accumulate the competitive potential of the territory. Innovative clusters can form the basis of the regional innovation system that unites research, production and marketing organizations into a single network driven by competitive mechanisms. For example, such clusters in the Russian Federation are in Moscow, Nizhny Novgorod and Ulyanovsk regions (Official website of Atomprom JSC). In China, an industrial cluster of integrated circuits "Zhanjiang" is in Shanghai and an industrial cluster of computer software products is in Chengdu, Sichuan. In France, there are clusters of

biotechnology and bioresources. Table 4 shows the conjugate types of clustering that have been established in the world.

Table 4. *List of emerging related industries of innovative clusters (compiled by the authors) based on the references: General information on innovative territorial clusters; Overview of industrial clusters in Russia, 2015; Official website of Atomprom JSC; Official website of "Enterprises of Russia: Ulyanovsk region: instrument engineering"; Official website "Biotechnological Innovative Cluster of Pushchino; Official website "Russian Cluster Observatory".*

Industry type	Related industries and supporting industries	List of involved supporting clusters depending on the industry specifics
Atomic industry	Nuclear power plants, medical industry, construction, instrumentation, electronics, power engineering, chemical industry	Cluster (instrument engineering), cluster (pharmaceutics, biotechnology, medical industry), cluster (chemistry and petrochemistry)
Instrument engineering	Machine building, instrument engineering, information technology and electronics	Cluster of information technology and electronics
Pharmaceuticals, biotechnology, medical industry	Food, medical, instrument engineering	Cluster of instrument engineering
Nanomaterials	R&D, medical industry, instrument engineering, oil and gas industry, telecommunications	Cluster of pharmaceutics and biotechnology, cluster of instrument engineering, petrochemical cluster
Petrochemistry	Defense industry, motor industry, synthetic detergent production, latex industry	Nanotechnology cluster, pharmaceutical and biotechnology cluster, cluster of instrument engineering

Information presented in Table 4 once again confirms the network principle of clusters' building.

3. Results

During the study, the authors suggested and tested a hypothesis of the networking nature of the relationships between the costs of creating and implementing innovations and the obtained volumes of innovative products. A regression equation model was built during the study to demonstrate the relationship between the costs of innovational activity and the volumes of innovative products sold. Two types of costs were considered: costs of technological innovation and the internal R&D costs in the context of eastern and western clustering as presented in equations 3 and 4:

$y=2,8147x +4108; R^2= 0,6903$ (3)

$y=1,8491x+46556; R^2=0,7043$ (4)

where R^2 shows what part of the variability of the sold innovative product volumes can be explained by the model built demonstrating a sufficiently high value in both cases (69.03% and 70.43% accordingly). As such, the overall variability in the volume of innovative product sales is determined by the costs of innovation to a statistically significant extent, although they are not determinative, judging by the magnitude of the free term of the regression equation. Regressive dependencies always reveal the efficiency of investment in the development and creation of technological innovations. The study was conducted based on the model in equation 2, using the materials of Kolmakov (2015) and Polyakova (2014).

It seems justifiable to note that the absolute amount of R&D and the technological innovation costs influences the volume of shipped innovative products, but this effect, as shown in a research by Tsertseil (2015) is delayed in time: the most significant economic effect of innovation activity costs is revealed 4 years after their implementation (Polyakova, 2014). It is obvious that it would be inappropriate to explore the comparative efficiency of such costs between different clusters in a synchronous presentation. However, there is a measure that allows to make a conclusion about the intensity level and thus evaluate the potential return on investment in R&D or technological innovation in the future. Such a measure is the ratio of re-investment of gross revenues from the sale of innovative products, estimated as the ratio of R&D (technological innovation) costs in the reporting period and the volume of shipped innovative products during the same period.

4. Discussion

The evolution of the cluster understanding in its modern interpretation has passed a long way, which has resulted in the formation of three complementary formulations, each of which is quite relevant for describing the optimization of the cluster structure; identification of funding and control sources; identification of efficiency criteria and methods of innovation diffusion. The descriptions of the cluster funding concept are described by a widespread version of the "initiative from above", backed by several benefits and preferences for potential participants. The role of monetary policy in this case is to determine the strategy for the monetary funds and financial infrastructure creation. For example, as Tsertseil (2015) describes some countries use direct state funding of the costs of organizations engaged in the development of innovative products (USA, France), provision of interest-free loans or grants for R&D in full (Sweden) or partially (Germany), compensation of costs of the inventions patenting, tax benefits and tax holidays (Austria, Germany).

According to the interpretation of Shakhlo (2013), the cluster structure is a vertically integrated structure with a pronounced product specialization, where participants are

united by economic ties as suppliers and consumers of related and intermediate products or services. The cluster core in this case is the copyright holder of technology, trademark or another copyrighted intangible asset. In some way, this cluster interpretation makes it like a corporation that unites scientific research, production, supplying and marketing enterprises in its structure, with the only difference that they do not lose their economic independence in the cluster. Such an activity organization, according to Krugman (1991), allows to save time and resources required to implement the full cycle of commercialization of innovation-driven growth, while the territorial clustering principle also acquires significance with time, since the controls of all elements of such a cluster structure tend to localize in one place.

At the junction of the first and second interpretation, (Bergman and Feser 1999; Enright, 2000) we identify a definition of an innovative territorial cluster, which is understood as the aggregate of enterprises and organizations located in a limited territory (cluster participants) described by the presence of the research and production chain in one or more sectors, which unites the participants, as well as a mechanism for coordinating the activities and the cooperation of the cluster's participants. For example, the link between the cluster and the national system is stressed in several researches (Latypova, 2015; Polyakova and Simarova, 2014; Liapis *et al.,* 2013; Albekov *et al.,* 2017; Bashmakov *et al.,* 2015; Anikina *et al.,* 2016), where the innovative cluster is regarded as a structural link in the regional economy. At the same time, the driving forces behind the innovative cluster development, in the opinion of Kulikova (2013) are geographic concentration and cooperation in the field of knowledge and skills. Kalinina (2010) goes further and gives a broader definition of an innovative cluster, describing it as an independent economic system that ensures a positive synergic effect.

The third interpretation defines a cluster as an association of enterprises varying in scale of activities and size, which is based on the exploitation of some technology (Dudin, 2016). The key principle of such an association is the transfer by the large enterprise of certain elements of the technological process to the area of responsibility of small enterprises based on outsourcing or franchising. Such a method can also be described as "artificial", but from the standpoint of this result, such a cluster ensures more technological mobility, allows accelerating the introduction of new product types, diversifying risks, efficiently exploiting economies of scale through saving on variable costs. The resulting network structure redistributes the individual components of the multistage production process, thereby ensuring vertical and horizontal integration of the participants in the association. As such, the cluster under this interpretation will be an infrastructure complex existing in the interests of a major producer but not limited to these interests in its activities.

5. Conclusion

The article presents theoretical and practical aspects of the essence and content of the "innovative cluster" concept, key advantages of developing a regional economy in the context of the network approach, and prospects for interaction between the state and commercial sectors. The analytical part of the study covers the key problems of clustering, such as the cluster structure, conjugate activities, dynamics of the clustering factor, regression of costs for technological innovations. As such, the innovative territorial cluster has the following key features:

– consolidation of all stages of the production (technological) process, including R&D, at the enterprises participating in the cluster;
– availability of a positive synergy effect due to the high level of cooperative and competitive relationships among enterprises participating in the cluster;
– high degree of dependence of preferences for credit institutions on investment performance criteria;
– increase in the share of intangible assets in the structure of assets of enterprises participating in the cluster;
– increase in the share of gross profit in the proceeds from the sale of enterprises participating in the cluster, resulting from the introduction of the R&D results in the production process.

Conclusions about the positive impact of the economy clustering on the state development are based on several features emerging for economic entities participating in the innovative cluster:

– uniqueness of the internal environment, cluster association infrastructure;
– strengthening the interrelations between the monetary policy design and clustering processes;
– increasing the level of competence of employees, changing the style and psychology of management, improving social security, building new communication networks;
– access to new technologies, R&D results;
– efficiency of funding;
– cost reduction;
– stable position in the market;
– positive impact on other economic entities in the region.

An innovative regional cluster is a system of geographically adjacmentnt interconnected industrial enterprises and organizations that complement each other due to the formation of a unified strategy for corporate governance and cooperation, which results in the formation of the innovation potential of cluster participants and an improvement in their competitive advantages.

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