

# Innovative Clustering of Mining Regions as a Tool for Sustainable Development of Resource-Extracting Country

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**Abstract.** Increasing the degree of mineral processing directly determines the environmental burden on the nature of countries that concentrate on the extraction of mineral raw materials. In the modern world, with the transition to the priorities of advanced technological structures, the creation of a dynamically developing innovative system is becoming increasingly important for mineral extracting countries in the context of the transition to sustainable development. Due to the large territorial fragmentation of the Russian mining regions, it is difficult to identify development of mechanisms and tools for each of them, which provide for the formation of a new technological structures based on the use of the latest advances in science and technology and will help putting the economy on a sustainable development path. The author examines the aspects of the organization of innovation activity at the regional level and substantiates the need for innovative modernization of resource-producing regions, in particular through the creation of innovative regional clusters. The article discusses the prospects of innovative modernization of the coal mining cluster in Kemerovo region.

## 1 Introduction

The strongest interregional mismatch in the distribution of productive forces, the lack of state-and-corporate linking of the mineral resources extraction placement issues leads to the fact that the problems of spatial development of Russian territories become very relevant. Moreover, it is important to search for mechanisms and tools for innovative modernization of individual mining territories, thereby achieving a balance in regional development, increasing the overall level of innovation in the country and ensuring sustainability, which is so necessary in modern environmental realities.

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## 2 Materials and Methods

In the environment-geographical and socio-economic sciences the identifying the horizontal ordering of mineral resources extraction is widely used as the concept of territorial and environmental management processes organization [1]. Considerable attention is paid to theoretical and applied issues of the territorial organization of various types of mining activity. This is evidenced by the theory of complexation, the theory of the territorial organization of the productive forces, individual sectors of the economy, the theory of economic zoning and regional formation, the theory of relative (comparable) regional advantages, the theory of optimal placement of an individual enterprise or their spatial organization, the theory of growth poles, the theory of regional self-development, etc. [2-5] Conceptual approaches to the study of the spatial organization of mining activities cover the theoretical basis of the above mentioned theories and ideas, but also take into account the institutional framework for creating favorable conditions for the realization of the competitive advantages of certain types and forms of mining business in a specific location, prospects and opportunities for integration, cooperation and clustering for the effective use of natural resources by various enterprises.

Each stage of socio-economic and environmental development transforms the conditions of spatial organization of mining, including self-organization, in accordance with new challenges and tasks of sustainable development. The spatial organization of innovation activity is primarily associated with geographically defined mineral resource flows and their management. It is aimed at ensuring interaction between the subjects of mining activity and the system of innovation relations, which determines the attraction of productive forces to sustainable development, increases the competitiveness of business entities and the optimal spatial organization of their functioning, creates the basis for optimizing the system of economic relations and regional changes, which are formed as a result of the territorial division of mineral resource extracting [6].

The effectiveness of the spatial organization of innovation activity is ensured by the construction of an appropriate organizational and economic mechanism for the transformation of the innovation space of mining industries, which requires taking into account the existing international experience in its implementation. The functioning and development of the innovation space of mining regions is a continuous process, accompanied by a cycle of conditions, resources, factors and products.

Sustainable balanced development of the Russian Federation mining regions is one of the necessary conditions for successful progressive socio-economic development of the Russian state as a whole and implies the reduction of excessive differences in the level of economic and ecological development of regions. The scenario of balanced development, which was introduced by the Ministry of Economic Development of Russia and presented in the Spatial Development Strategy of the Russian Federation until 2025, suggests that many mining regions have the potential for endogenous growth, that is a certain internal reserve for sustainable development [7-8]. The required effects can be given by the specialization of the mining territories that the nature has given them. A reach mineral deposits and soils allow developing mining and agriculture, the proximity of international transport corridors – the logistics, forest resources – the woodworking. A number of such specializations can well provide economic growth even to remote regions.

Thus, the innovative modernization of the Russian economy at the regional level, above all, should manifest itself in the formation of clusters (mineral resource mining and processing, logistic, etc.), which will be linked to the regional innovation process. Clusters assume the localized (geographically concentrated) deployment of intensively cooperating firms and other participants in cluster cooperation, which allows them to quickly learn best practices from each other, regularly interact with the carriers of unique new knowledge and

competencies and, ultimately, constantly generate and implement innovations. Creation of conditions for co-location of cooperating economic entities should be considered as an effective instrument of state policy in the field of location of productive forces, ensuring the accounting of positive externalities of knowledge flows and implemented in the form of technology parks, business incubators, special economic zones in which the clustering processes are linked together.

### 3 Results and Discussion

The current agenda of Russian cluster policy is the creation and development of innovative mining territorial clusters (IMTCs), which have a high level of investment attractiveness, infrastructure and human potential, integrated into global value chains and ensuring rapid growth of the national economy. Innovation clusters can become those points of growth that will contribute to the development of the national innovation system, attract foreign investment and enhance foreign economic integration.

The leader cluster program in Russia started simultaneously with the Canadian national program Innovation Superclusters (Innovative Super Clusters), whose task is to concentrate government efforts on regional growth points that employ a large number of companies in certain activities with a high potential for entering the international markets. Five Canadian superclusters were selected to receive support in launching joint research projects, technology commercialization and strengthening the position of national companies in emerging global mineral resource markets.

Let us consider an example of creating an innovation mining cluster “Integrated processing of coal and industrial waste” in the Kemerovo Region. This pilot IMTC is part of the operating Kuznetsky Basin Coal Industrial Cluster. Interacting with the leading industrial cluster, the innovative subcluster expands the range of competencies, markets, products and services. The basis for the development program and the creation of a cluster were the legal documents of the federal and regional levels. The cluster is located in the Kuzbass agglomeration zone, which is characterized by a high degree of urbanization (85% of all its inhabitants are urban). On the territory of the agglomeration, up to 85% of the region's GRP is formed annually. The industrial core of the cluster is formed by two industrial giants JSC “AZOT”, OJSC “KOKS”. The core of the innovation and development infrastructure is Kuzbass Technopark OJSC, created under the Federal program for the creation of high-tech technology parks in Russia. Within the framework of the Kuzbass Technopark, active cooperation is being developed with the Siberian Branch of the Russian Academy of Sciences, with the Kemerovo Scientific Center, higher educational institutions and research centers of the region [9].

The need to create an IMTC in the coal industry of the Kemerovo Region is due to the fact that the extensive development of the coal mining has practically exhausted itself. In terms of reserves and volumes of coal production, the Kuzbass is one of the largest basins in Russia and the main supplier of technological raw materials for Russian industry. The Russian Federation now has all the necessary foundations and resources to secure the status of an advanced coal power in the modern world. But for this to happen, the focus should put in the application of high technologies development in the extraction and processing of coal.

According to the results of the analysis carried out by the Department of Investments and Strategic Development of the Kemerovo Region [10], one should mention a number of key parameters characterizing the features of the innovation development of the region:

1) Competitive intellectual property. Kemerovo Region ranks 5th in terms of the number of applications submitted among the subjects of the Siberian Federal District, according to the information reflected in the report on the activities of Rospatent for 2016, which indicates a rather high level of inventive activity in the region.

- 2) A sufficiently developed, but poorly coordinated innovation infrastructure in the region. The innovation system of the region lacks a number of significant elements for its functioning.
- 3) Instability of the regional innovation sector in the face of crises.
- 4) The lack of a sufficient number of innovation infrastructure facilities, such as business incubators, venture funds, technology transfer centers, etc., which hinders the release of innovative products.
- 5) Low involvement of small and medium-sized innovative enterprises in the international division of labor. According to statistics, the main share in the export of Kuzbass-manufactured goods (80.5%) is occupied by fuel and energy products. The share of industrial products produced by small and medium enterprises in the total volume of export deliveries is insignificant (from 0.02% to 0.4%) [11].
- 6) Access to financial resources. The main source of funds for innovative enterprises are their own funds.

Thus, the development of the innovation sector of the Kemerovo Region faces a number of additional problems, both common to the regions of Russia and to the inherent Kuzbass economy, as an export-oriented mining region:

- the lack of a well-functioning effective system of interdepartmental cooperation in the implementation of a unified strategy for the innovative development of the region;
- the need to reformat the existing elements of the innovation infrastructure and add new elements in it;
- the problem of ensuring the diversification of the economy (the development of high-tech industries, coal chemistry, waste management, etc.).

The creation of an innovative territorial cluster in the region allowed to partially solve the above problems, to create conditions for cooperation of all cluster members. So small innovative enterprises of a cluster, higher educational institutions and scientific institutes conduct active cooperation both with each other and with the largest production associations. However, an important condition for the further successful development of IMTC remains a sound economic policy on the part of regional authorities and its support at the federal level.

Speaking about the results of the IMTC, we can say that in 2014 Kuzbassky Technopark OJSC monitored the Cluster Development Program, within which the intermediate performance results for the period 2012–2013 were evaluated. Thus, during the preparatory stage (2007–2014), more than 50 projects were implemented at regional enterprises; more than 7.2 billion rubles invested by innovative companies in project implementation, 1,447 new high-performance jobs were created; 350-370 million rubles were paid as taxes annually by innovative companies to budgets of different levels. In 2013, a specialized laboratory and production building “Ecology and Nature Management” was commissioned with a total area of 2.3 thousand square meters.

As part of the activities of the pilot IMTC, a number of investment and innovative projects are being implemented, the key indicators of which are presented in Tab. 1.

**Table 1.** The main investment and innovation projects of Kuzbass cluster “Integrated processing of coal and industrial waste”.

Project name	Investor	Key development indicators
<b>Coal chemistry</b>		
Creating the power producing cluster based on the Karakansky-Zapadny surface mine	CJSC Mine Belovskaya	Total investment – 7.5 billion rubles Number of jobs created – 4500 Implementation – 2020
Creation of energy technology complex "Serafimovskiy" with deep processing of coal	“MPO Kuzbass”	Total investment – 70 billion rubles Number of jobs created – 3139 Implementation – 2020

Creation of an energy technology complex for deep processing of coal on the basis of the Menchopetskoe deposit	JSC "Inter RAO UES"	Total investment – 70 billion rubles The number of jobs created – 8230 Implementation – 2020
Technological complex for deep processing of brown coal based on the Itatskoye deposit	Coal-S LLC	Total investment – 5 billion rubles Number of jobs created – 1000 Implementation – 2020
<b>Carbon materials</b>		
Creation of industrial production of sorbents for gas separation	LLC "Sorbents of Kuzbass", LLC FC "Intellect-Capital", Skolkovo Foundation	Total investment - 2 billion rubles Number of jobs created - 150 Implementation – 2014
Creation of industrial production of carbon fiber and nanotubes	LLC "Sorbents of Kuzbass", LLC FC "Intellect-Capital", Skolkovo Foundation	Total investment – 4 billion rubles Number of jobs created – 300 Implementation – 2014
<b>Coal burning power producing and recycling</b>		
Underground gasification of coal in the mine "Dalnie Gory"	CJSC IC Yukas-Holding).	Total investment – 1 billion rubles Number of jobs created – 120 Implementation – 2014
Reconstruction of high-efficiency small boilers with installation of technological equipment for burning low-grade coals and waste coal dressing in a fluidized bed with at least 85% efficiency and a steam turbine generator with back pressure instead of reduction devices (introduction of cogeneration plants)	LLC "UKEK"	-
Power producing complex for obtaining heat and electrical energy based on jet-emulsion processes.	-	-
Introduction of standard modular power plants (boiler and thermal cogeneration power plants (TPP)) with a capacity from 0.5 MW to 5 MW based on coal gasification for small distributed power generation	CJSC Karbonika-F	-
Energy technology complex for obtaining heat energy and building materials	BelovoEnergetic LLC	-
Mobile modules of complexes for the production of building mixtures at generation facilities.	-	-

The composition of innovative projects reviewed and successfully approved by the Expert Council of Kuzbassky Technopark OJSC corresponds to the sectoral focus, the majority of which are innovative projects related to the development of new materials and recycling of secondary resources. As we can see, part of the projects was implemented in 2012-2014, the implementation of the rest is envisaged as part of the cluster development program

"Integrated processing of coal and industrial waste" for the period 2015–2020, which was amended after the first years of cluster launch.

Thus, the Integrated Processing of Coal and Technogenic Waste created in the Kemerovo Region resolves the innovative modernization of the key branch of the regional economy – the coal mining.

## 4 Conclusion

Creation of conditions for co-location of cooperating economic entities should be considered as an effective instrument of state policy in the field of location of productive forces, ensuring the registration of positive externalities of knowledge flows and their implementation in the form of technoparks, business incubators, special economic zones, in which the clustering processes are linked together. Speaking of Russian practice, it should be noted that the launch of pilot projects for the construction of cluster infrastructure using new forms of production organization, in particular, through the creation of innovative mining clusters and attracting financial support from the state, is an important task in the framework of sustainable development.

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