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The preconditions for the formation of mineral and raw materials centers in the support zones of the Arctic zone of the Russian Federation*

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Abstract. The new version of the state program "Social and economic development of the Arctic zone" and the draft law "On the Development of the Arctic Zone of the Russian Federation" have designated support zones as the main instrument for the development of the Arctic. Their main task, according to the specified documents, is the development of mineral and raw materials centers (MRCs) in the Arctic zone of Russia, attraction of investments, development of the Northern Sea Route and development of energy infrastructure. Therefore, the selection of promising mineral and raw materials centers in the support zones in the Russian Arctic is an urgent task. By actualization of information on the resource potential of the Arctic zone of Russia, it is possible to form a list of prospective MRCs, the development and support of which should be in the priority focus of public policy in this region. Equally important is the analysis of key risks such as financial, construction and geological risks that arise when creating and developing mineral resource centers and have a significant impact on the profitability of such projects. The paper suggests some indicators that assess the macroeconomic, social, geopolitical and innovative effects that arise in the development of MRCs and which should be used for evaluating the social and economic impacts of MRC projects in support areas. Also, it is necessary to take into account the social and economic importance of MRC projects and the impact of their results on the life of the population. As the primary approach in the selection and creation of mineral resource centers, the authors propose the use of the cluster approach. Such clusters will act as pivots in the spatial organization of the regional economy and will achieve the maximum multiplicative effect. In conclusion, based on the analysis, the authors formulated the main principles for the implementation of MRC projects, which include: the formation of a single geological exploration program, the joint development of nearby deposits, and the formation of complex socio-economic effects for the exploration areas.
Keywords: *mineral resource center, the Arctic zone of the Russian Federation, support zone, cluster, evaluation of social and economic impacts of MRCs, multiplicative effect.*

Introduction

At present, the Arctic region is becoming an important direction for the development of the Russian fuel and energy complex. Among the main strategic priorities are the integrated use of the mineral potential and the development of transport infrastructure in the Arctic. The development of the Arctic resources is accompanied by harsh climatic conditions, seasonality of work, a

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low degree of geological study, the need for continuous monitoring of weather conditions and the state of oil platforms exposed to wave loads, icing, collisions with icebergs and the effects of pack ice , the complex process of towing and installation of the platform (for offshore oil and gas fields), a limited number of personnel at the fields. It should also be noted that for the development of Arctic deposits it is required to make substantial capital investments, use unique technologies that are often not tested in world practice, consider the risks that the government should share with investors. In this regard, it can be assumed that the development of the Arctic is a task that requires a point approach in the state strategy of the development of the Arctic territories in conditions of significant investment and high geological, economic, environmental risks. That is why it is relevant to highlight the most promising mineral resource centers (MRC), which can act as drivers of growth in the Arctic economy and which will primarily important for the state.

Mineral resources centers — the ground for support zones for development in the Arctic

In accordance with the changes made to the state program "Socio-economic development of the Arctic zone of the Russian Federation for the period up to 2020 and beyond" [1] approved in 2014, the development of the Arctic is planned through a system of "support zones" – integrated projects for the development of the Arctic territories are going to be completed with the mechanisms of public-private partnership[2].

Currently, it is planned to form 8 support zones or territorial multi-projects. Mineral resource centers are seen as an effective tool for program-targeted planning proposed in the "Strategy for the development of the geological industry until 2030"[3], approved in 2010. According to this document, the MRC should be based on deposits that are at different stages of development. They could be interconnected by a common infrastructure system, incl a common shipping point for the extracted raw materials.

The introduction of such an approach implies full use of project management since the MRC is a multi-project that forms the commodity-oriented flow of goods. From a regional perspective, spatial planning and the formation of the MSC will allow solving a range of tasks related not only to the development of the resource base and the achievement of high-efficiency indicators of its development but also tasks aimed at the integrated socio-economic development of the regions. Up-

[1] Postanovlenie Pravitelstva Rossiyskoy Federatsii "O vnesenii izmeneniy v postanovlenie Pravitelstva Rossiyskoy Federatsii ot 21 aprelya 2014 g. № 366" ot 31 avgusta 2017 g. № 1064 [Resolution of the Government of the Russian Federation "On amendments to the resolution of the Government of the Russian Federation dated April 21, 2014 № 366" dated August 31, 2017 № 1064] URL: http://static.government.ru/media/files/GGu3GTtv8bvV8gZxSEAS1R7XmzloK6ar.pdf (Accessed: 13 March 2018). [In Russian]

[2] Grigoriev M.N. Mineral'no-syr'evye tsentry kak draivery ekonomicheskogo razvitiya Arkticheskoy zony [Mineral resource centers as drivers of economic development of the Arctic zone]. URL: http://pro-arctic.ru/29/03/2017/resources/25915 (Accessed: 13 March 2018). [In Russian]

[3] Strategiya razvitiya geologicheskoy otrasli do 2030 goda. Utverzhdena rasporyazheniem Pravitelstva RF ot 21.06.2010 №1069-r [Strategy of development of geological branch till 2030. Approved by the decree of the RF Government from 21.06.2010 №1069-R]. URL: http://www.mnr.gov.ru/regulatory/list.php?part=1323 (Accessed: 13 March 2018). [In Russian]

dating information on the development of the mineral resource base allows us to confirm that Russia has a significant hydrocarbon resource potential in the Arctic, which can serve as the most significant driver of growth and development of the country's fuel and energy complex [1, Telegin E.A., p. 40; 2, Dodin D.A., Kaminsky V.D. et al., p. 3]. At the same time, marine hydrocarbon projects are usually profitable due to high capital intensity and unfavorable economic and geographical location of many fields and promising areas [3, Dudin M., p. 2297].

In general, for the subsequent evaluation of the most promising MRC development projects, the following risks of such projects should be highlighted: critical, significant and moderate.

Critical risks include:

- financial risk (the cost of the project and its re-engineering);
- construction risk (permafrost conditions, delayed deliveries);
- geological risk (non-compliance with the stated reserves, confirmability of the reserves).

Significant risks include:

- managerial risk (project uniqueness, lack of highly qualified specialists to work effectively under challenging conditions of development;
- environmental risk (difficulties in neutralizing problems associated with, for example, oil spill response);
- marketing risk (price changes in global energy markets, a drop-in demand due to increased extraction of unconventional minerals, such as shale oil and gas);
- political risk (refusal of state support in the implementation of the project, international technological and economic sanctions).

Moderate risks include:

- natural risk (climatic force majeure);
- legal risk (change of legislation, cancellation of tax benefits).

Limited financial resources of mining companies make it difficult to determine the directions of investment of funds. Modern methodologies for evaluating investment projects recommend selecting the Arctic MRC projects considering commercial, budgetary and public efficiency. It is necessary to note a vital principle of the Arctic MRC projects — the impossibility of their implementation and evaluation with a focus on real commercial efficiency only [4, Carayannis, E.G., Cherepovitsyn A.E., Ilinova A.A.]. As part of the MSC development projects, it is necessary to synchronize all development works with solving socio-economic problems of the territories, affected by development, to ensure the long-term sustainable operation of the territory’s economy [5, Smirnova, O.O., Lipina S.A., et al., p. 148]. Thus, in addition to the leading indicators for evaluating large-scale integrated investment MRC projects that reflect the final results through the modeling and calculation of cash flows, it is necessary to consider additional indicators that evaluate socio-economic efficiency and are often targeted indicators for development under the target planning (table 1).

Table 1

Types of effect and indicators of their evaluation that may occur during the MRC development projects

No	Effects	Indicator
1	Macroeconomic effect	Cash inflows to the federal and local budgets because of new projects for the development of the Arctic natural resources, the creation of regional infrastructure, labor productivity growth, the growth of macroeconomic indicators of the development of Arctic territories: share in GNP, etc.
2	Social effect	Improving the quality of life of the local population, preserving the lifestyle of indigenous people, reducing the migration flow from the Arctic settlements, increasing the number of jobs in the areas with mineral deposits development.
3	Geopolitics effect	Increase the share of the Arctic minerals of the Russian Federation in world markets, maintaining the status of a reliable supplier of raw materials, strengthening positions in world markets, incl via the export of unique technological solutions for the development of raw materials in the Arctic.
4	Innovation effect	Increase the technical and technological levels of MRC companies, and home products of oil and gas and mining machinery, meeting the harsh conditions of the Arctic, creating fundamentally new technologies and technical means, incl. intellectual technologies, enhancing the research and development activities of Russian MRC companies, increasing the scientific and educational level of specialists.

Also, it is advisable to use indicators of social efficiency of investment projects and the following groups of indicators:

1. The degree of socio-economic orientation of the project.

- The regional significance of the project — compliance of the project results with the socio-economic development strategy of the region;
- Provision of the area with services — the current degree of regulation of the area with the services provided by the project;
- Sectoral affiliation of the project — an industry that is influenced by the results of the project;
- Coverage of the project results.

2. The degree of influence of the results of the investment project on the life of the population.

- Prices for services — the difference in prices for services provided by the project, in comparison with local prices;
- Employment rate — growth in the number of jobs because of the project to the number of employees in the area;
- Increase in the volume of services — the nature of the services provided in the region, according to the results of the project;
- Changes in the quality of services following the project implementation.

We believe that the decision on the MRC project should be made considering the comparison of various projects (project variants). At the same time, the efficiency indicators can vary greatly, and the investment decision based on absolute values becomes biased. In such a situation, it is necessary to define a single comprehensive efficiency indicator of alternative projects, expressing the advantage of a project with a specific value. An example of such an indicator could be

the integral indicator Topt[4]. This indicator simultaneously considers key technical (coefficients due to oil, gas, condensate) and economic (net present value, discounted state income) project performance indicators. Using the SWOT-analysis based on open-press data [6, Kontorovich A.E., p. 46; 7, Zuykovsky N.I., p. 50; 8, Panichkin I.V.; 9, Lipina S.A., Zaikov K.S., Lipina A.V.], the authors assessed the potential of existing and prospective MRC development projects in the Arctic zone of Russia. The analysis showed that these projects are economically unprofitable without state support.

One of the strategic objectives of the state and companies-subsoil users within the framework of MRC development projects is the acquisition of new competencies and experience in the development of unique projects that require extraordinary technical solutions and further contribute to the transfer of knowledge and technology when implementing other projects in the Arctic, incl. international cooperation. In this regard, the target indicators of comprehensive MRC development projects should be indicators of innovation activity and innovative potential of both the companies and the projects themselves. For promising Arctic MRC development projects, the state and investor companies should:

- ensure the complexity of the project: the maximum possible development of raw materials facilities using a single infrastructure;
- analyze the effectiveness of investment projects, considering and excluding state support in the form of tax incentives and subsidies;
- ensure the interrelation of the project with related industries;
- maintain the sustainability of economic growth in the region;
- ensure safety: use innovative technologies that prevent accidents, human-made disasters;
- minimize the negative impact on the environment;
- ensure maximum project coverage of the local population.

It is possible to implement these provisions based on the cluster model.

Formation of competitiveness clusters around MRC projects of the support development zones in the Arctic

The cluster approach focuses on the microeconomic and social components of the development of the territory. The approach aim is to create incentives for the development of regional business and to enhance the competitiveness of the industry, raising living standards, increasing revenues to budgets of various levels and other positive effects. Analyzing foreign experience of cluster formation [10, Gakashev M.M., p. 86; 11, Battalova A.A., Battalov A.M., p. 1; 12, Aleinikova I.S., Vorobev P.V. et al., p. 119], it can be assumed that in the present conditions the Japanese model is the most preferable for Russia, considering the presence of a leading company. As a rule, it is a giant company, which allows reducing costs at the expense of scale.

[4] Rasporyazhenie Minprirody Rossii ot 18.05.2016 № 12-r “Ob utverzhdenii Vremennyh metodicheskih reko-mendacij po podgotovke tekhnicheskih proektov razrabotki mestorozhdenij uglevodorodnogo syrya”. [Order of the Ministry of Natural Resources of Russia, 05.18.2016 No. 12-p “On approval of the Interim methodological recommendations on the preparation of technical projects for the development of hydrocarbon deposits”. URL: http://www.consultant.ru/cons/cgi/online.cgi?req=doc&base=EXP&n=662717#0 (дата обращения: 11 October 2018). [In Russian]

At the same time, such a company should be innovatively active, i.e. have sufficient resources to develop and implement new technologies. In addition, the transformation of the territorial-industrial complexes created in the Soviet time into territorial industrial or innovation clusters seems promising. The main characteristics of innovative technological clusters for creating them at the MSC base include the following:

- Innovation clusters are focused on combining the scientific and production potentials of businesses and organizations to create a single product chain, including a high level of redistribution. Therefore, the creation of processing industries near mining enterprises is the most urgent task. Although in the Arctic, this approach will not always be economically justified.
- Industrial clusters are characterized by a profile orientation with a simple organizational structure based on a standard resource base, while in the innovation cluster the fundamental principle is the creation of a favorable innovation climate with a multi-vector interaction between its members.
- The innovation cluster should be the main driving force of a wide range of industries in the region of presence.
- Horizontal links within the innovation cluster contribute to the rapid spread of technological, organizational and other innovations, which ultimately determines a higher level of development compared to the traditional industrial cluster.

An analysis of the creation and development of innovation-technological clusters allows us to conclude that the formation of such clusters should be carried out at potential mining centers, which are a set of promising subsoil use objects located close to each other, sufficiently studied and worthwhile to attract investment. Such clusters will be the reference points in the spatial organization of the regional economy, defining the main directions of the socio-economic development of the region and serving as a driver for related industries. It can be assumed that the cluster model of the development of the mineral resource base of the Arctic region is the most optimal and allows achieving the maximum multiplicative effect. Analysis of each support zone from its potential for the formation of innovation clusters based on mineral resources allows us to conclude that there are significant prospects for the development of the mineral resource base in each support zone subject to the implementation of planned infrastructure projects (Table 2).

Table 2

Reasons for the MRC in the support zones of the Arctic

Name of the support zone	Main extraction centers (existing or perspective)	Main deposits	Raw materials shipment centers
The Kola support zone	Offshore hydrocarbon fields of the Barents Sea	Shtokman, Murmansk, Ludlovsk, Ledovoye, North Kildinsky	Port Teriberka (project draft)
	Khibiny group of apatite-nepheline deposits	Kukisvumchorr, Yuksporskoye, Apatite circus, Plateau Rasvumchorr, Koashva, Nyorpahk, Kuelpor, Partomchorr, Oleny Ruchey	Ports Murmansk, Kandalaksha, railway transport
	Group of sulfide copper-nickel deposits	Zhdanovskoe, Zapolyarnoye, Kotselvaara, Semiletka, By-	

		strinskoe, Tundrovoye, Sputnik, Verhnee	
	Olenegorsky ore district	Olenegorsky, Kirovogorsky, Bauman, 15 years of October, Komsomolsk	
	Kola Province	Deposits of iron ore, chromium, rare-earth metals, phosphorus, etc.	
Arkhangelsk support zone	Mining center in the Novaya Zemlya archipelago	Pavlovskoye deposit of lead-zinc ores, Prinovozemelskaya group, HCF project	Construction of a shipping terminal on the NL
Nenets support zone	m/R HCF in the Timan-Pechora province	Prirazlomnaya, Kumzhinskoe, Korovinskoe, Kharyaginskoe,Yagerskoe, Vala Gamburtseva fields, etc.	Varanday terminal, Indiga terminal (project), Amderma terminal, Usinsk – Ukhta – Yaroslavl – Moscow oil pipeline, “Severnoe Siyanie” gas pipeline, Pechora LNG
	Bolshezemelsky shale basin		Railways
Vorkuta support zone	The Pechora coal basin	Vorkuta, Inta, Usinsk, and Yunyaginskoe, Vorgashorskoye	Port of Naryan-Mar
Yamalo-Nenets support zone	Shelf and continental deposits HCF	Kharasaveiskoe, Bovanenkovo, Uhzno-Tambeyskoye, Kruzenshternskoye, Novoportovskoye, messoyakha, Semenovskoe, Geophisicheskoe, etc.	The Sabetta port, terminal “Vorota Arktiki”, “Zapolyarye-Purpe” oil pipeline, Arctic LNG-2
Taimyro-Turukhansk support zone	Vankorskaya group of hydrocarbon fields	Vankorskoe, Lodochnoe, Tagul'skoe, Suzunskoe	Vankor — Purpe oil pipeline
	Ust'-Yenisei oil production center	Pajyahskoe, Bajkalovskoe,	Ports of Dudinka and Dixon
	Khatanga center of oil production	Vostochno-Tajmyrskij LU	Port of Khatanga
	Dickson centre of coal mining		Port of Dixon
	Taimyr coal basin,	Chernoyarskoe, Pyasinskoe, Krest'yanskoe, Syrdasajskoe	Port of Dixon
	Deposits of copper-nickel ores	Oktyabrskoe, Talnahskoe, Norilsk-1	
North Yakut support zone	Cluster “Ust-Yana”	Tomtor (REM), tin ore Deposit Deputataskoe, mineral deposit of tin Stream Tirekhtyakh, Churpunnya, Odinokoe, etc.	
	Anabar diamond-mining center	Ehbelyah, Morgor, etc	
	centers of gold mining	Kyuchus, Haptagaj-Haya (+antimony), Tamara-Tass	
	Tamalinsky cluster	Taimyrskoe coal deposit	Port of Tiksi
Chukot support zone	Beringovsky coal basin	Amaamskoe, Verhne-Alkatvaamskoe, Bay Ugolnaya	Port of Anadir
	Centers for a wide range of non-ferrous and precious metals production	Deposits of copper, nickel, bismuth, mercury, tin, lead, uranium, gold, platinum, silver	Port of Pevek

Conclusion

Thus, the implementation of large-scale investment MRC development projects should be based on the following principles:

1. A unified program of exploration, development and industrial exploitation of mineral deposits should be a part of a single project with common infrastructure development.
2. Development of closely located mineral resources facilities or satellite fields based on an agreed flowchart and technical solutions to ensure the efficient operation of all deposits, as well as cost savings due to the effect of production scale.
3. Simultaneous solution of technical and economic issues of the development of the field and the socio-economic problems of the functioning of the territory's economy, and ensuring the sustainable development of the social environment, the economy of the region, and the environment.

The Arctic zone of Russia is a promising region, the resource base of which can bring a great economic effect for subsoil users and the state. A significant amount of reserves and forecast resources of raw materials in the reference areas, along with the lack of infrastructure and high capital intensity of its construction in promising mining sites, opens up broad prospects for the formation of mineral resource centers based on the principles of clustering and allowing for its positive effects.

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