Integrated analysis of risks in terms of Russian Arctic zone sustainable development

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Abstract. The sustainable development of the Russian Arctic zone is characterized by unique hydrocarbon and mineral resource potential and the key spheres of regional development are negatively affected by various risks. The present article addresses the issue concerning a long-term development strategy for the Arctic region growth, which is beyond the existing traditional approach. It examines a complex range of environmental, social, political, and industrial problems caused by the increasing industrial activities. The negative impact of the revealed risks has been specified. The model of the Russian Arctic zone sustainable development has been proposed.

1. Introduction

The social and economic development of a region is comprised of the agreed strategic goals and objectives which are developed and implemented by the management body with regard to total area of the region, its economic performance indexes and characteristics features, as well as its sustainable development.

The current level of Russian Arctic development shapes peculiar geographical and geopolitical factors. The geographical factors involve natural-resource, transport, economic and demographic potential. The geopolitical factors are comprised of regional geopolitical position, geopolitical interests of other countries, and geopolitical differences [1]. In general, the development of the Arctic natural resources is characterized by hard conditions, i.e. a number of unfavorable environmental, industry-related, and infrastructural factors [2, 3]. The Arctic climatic and environmental features pose the basic limitations to geophysical survey on the Arctic shelf and prompt to implement and enforce stringent requirements to machinery and equipment, infrastructure development, and environmental safety. Therefore, the expected dynamics of long-term socioeconomic development of Russian Arctic zone involves resolving a number of strategic tasks which enforce the government to develop and implement a well-planned procedures and structured set of policies to address all possible challenges including the Arctic shelf project implementation and the development of the whole region.

2. Materials and methods

Trendsetting in sustainable regional development inevitably involves assessing its weak and strong points. The present research is based on the approach that includes the following aspects: analysis of

region's hydrocarbon potential, identification of key regional priorities and corresponding negative risks using a newly developed method.

The research literature includes scientific articles, normative documents and regulations, government statistics data, and the reports of various international nongovernmental organizations.

2.1. Hydrocarbon potential of Russian Arctic zone

The Russian Federation (RF) occupies especially significant position on the world market of hydrocarbons [4, 5, 6]. It takes the leading place in natural gas reserves, i.e. 23 % of world reserves, and provides 25 % of world trade; the RF ranks first in crude oil production and makes 12 % of world oil trade. Besides, the RF has tangible advantages over other Arctic countries in terms of hydrocarbon reserves, production, and consumption (tables 1, 2).

Table 1. Natural gas production and consumption in the Arctic countries [6].

Country	Country status in world gas trade	Gas production world rank	Gas consumption world rank	Gas export world rank	Gas import world rank	Gas reserves world rank
USA	Importer	1	1	10	4	4
Russian Federation	Exporter	2	3	1	28	1
Canada	Exporter	6	8	5	13	19
Norway	Exporter	8	57	3	75	18
Denmark	Exporter	51	66	38	55	65
Finland	Importer	96	69	95	38	136
Iceland	Importer	146	156	115	207	151
Sweden	Importer	195	87	184	59	196

Table 2. Oil production and consumption in the Arctic countries [6].

Country	Country status in world oil trade	Oil production world rank	Oil export world rank	Oil import world rank	Oil reserves world rank
USA	Importer	2	43	1	11
Russian Federation	Exporter	3	2	70	8
Canada	Exporter	5	7	15	3
Norway	Exporter	16	14	65	22
Denmark	Exporter	39	35	51	43
Finland	Importer	172	110	32	131
Iceland	Importer	184	130	201	147
Sweden	Importer	84	68	20	192

Russian Arctic zone holds most of hydrocarbon and mineral resources and has a huge economic potential to serve the needs of Russian economy on a long-term basis in terms of hydrocarbon and mineral resources, and to protect geopolitical interests of the country. The development of the High North and Arctic shelf hydrocarbon and mineral resources and exploitation of the Northern Sea Route are the priority projects for Russian Arctic region development. To implement these projects, it is essential to resolve a number of tasks, precisely, contribute to economic, social, scientific, and transport-related infrastructure development, as well as to guarantee environmental safety and facilitate international cooperation.

Russian Arctic zone accounts for about 12-15% of Russian gross domestic product. According to expert estimates, Arctic deposits total more than 70% (oil) and 80 % (gas) of all Russian offshore petroleum resources, with approximately 70 % being located in the Barents Sea and the Kara Sea – in the west of the Arctic [1]. The estimates of the Russian Academy of Sciences show that ultimate

potential oil resources are greater in the Arctic onshore zone than in offshore area, the difference between onshore and offshore gas deposits being insignificant. However, the experts say that the Arctic territory including both onshore and offshore areas is understudied in terms of geological data. Therefore, it cannot be excluded that hydrocarbon reserves in East-Siberian region, the Laptev Sea and the Chukchee Sea, have been underestimated.

The assessment of Russian Arctic zone petroleum potential has revealed the urgency to estimate the correspondence of prospective Arctic oil and gas reserves development with the ambition for sustainable development framework.

2.2. Model of Russian Arctic zone sustainable development

The concept of sustainable development is referred to achieving overall balance between social, economic, and environmental aspects. The social aspect implies social stability in all existing cultural systems, equitable distribution of natural resources among all members of society, preservation and development of human and cultural potential. The economic aspect involves natural resource management, application of resource-saving technologies, recycling and disposal of hazardous wastes. The environmental aspect is referred to conserving biological diversity and ecosystems. The effective implementation of sustainable development plans directly depends on the possibility to adapt the above-mentioned aspects to the particular region. Compared with other Russian regions, the Arctic has a number of characteristic features that prompt to search for nonstandard solutions in implementing sustainable development plans and the Arctic shelf projects. They are as follows:

1) geographical location, climate change, icecap current conditions;
2) uncertainty in the Arctic shelf boundaries delimitation;
3) hard climatic conditions;
4) hard engineering and geological setting;
5) raw-materials export development model;
6) under population;
7) remoteness from main industrial centers, etc.

Having regarded the enumerated characteristic features in relevance to the Arctic sustainable development plans, it is also proposed to consider political and transport-related aspects (figure 1).

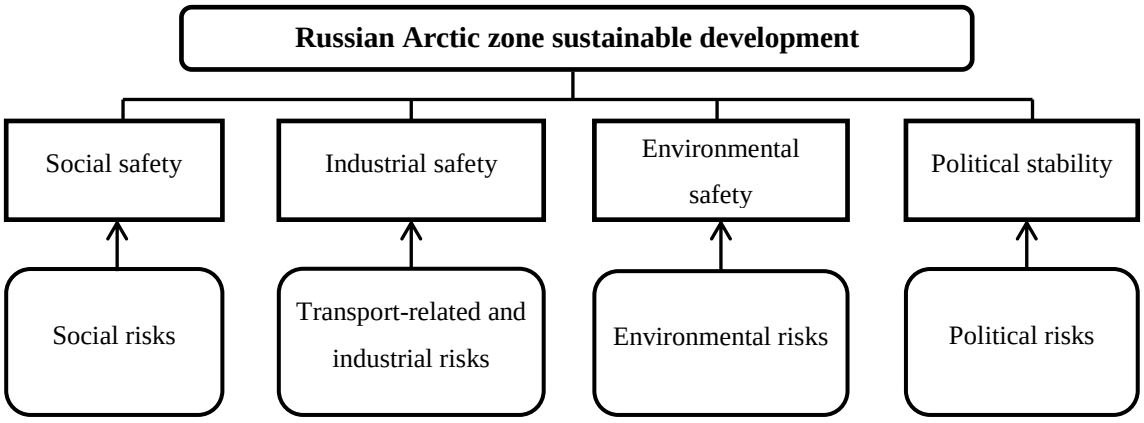

Figure 1. The Proposed model of Russian Arctic zone sustainable development.

The model of Russian Arctic zone development involves the most unstable spheres that are subjected to a great number of risks.

As a basis of further study, it is required to analyze the basic risks which adversely affect sustainable development of the Russian Arctic zone and implementation of the Arctic shelf projects.

3. Results and Discussion

Given the particularity of the Arctic and diversity of negative factors that accompany any activity within the Arctic region, it is reasonable to address the hydrocarbon production challenges on the basis of natural resource management. In addition, to maintain Arctic sustainability, elaboration of the methods to mitigate institutional risks in Arctic resource development is considered a priority task facing the state regulatory bodies.

1. Social risks.

Strategic and geopolitical importance of the Russian Arctic zone is intrinsically linked to creating favorable conditions for human potential development as a central criterion of social stability and sustainable region development [7]. Today, the RF's interests in the Arctic contradict current development trends in the Arctic region, which is manifested by negative impact of the following risks: impairment of the rights of minorities and indigenous peoples, increase in population morbidity rate [8], adaptation problems of indigenous peoples and migrated groups, lack of skilled human resources.

2. Transport-related and industrial risks.

Implementation of potentially important Arctic transport project is accompanied by a number of serious problems due to environmental and climatic characteristic features, especially ice cap conditions [9, 10]. The basic challenges in Arctic shelf projects implementation are as follows: hindrance for trans-Arctic shipping, construction and operation of offshore ice-resistant fixed platforms,insufficient provision or absence of ice-resistant sea vehicles including helicopter support facilities, supply ships, and auxiliary fleet; poor condition of coastal infrastructure, absence of service bases; stringent health and safety requirements.

3. Environmental risks.

The Arctic environment is an important indicator of changes in global climate. Assuring environmental safety as one of the key factors in sustainable development faces a number of natural and human-related challenges [3], which prevent from sustaining the balance between economic benefit of the Arctic shelf project implementation and minimized effects on the environment. As a side effect of industrial development, environmental negligence has resulted in a complex range of ecological problems [11, 12] leading to severe environmental risks.

4. Political risks.

Most of Arctic hydrocarbon and mineral deposits are within agreed boundaries of the Arctic countries. Despite this fact, the Arctic territorial disputes are still in full swing and involve not only boundary claims concerning special economic zones of the "Arctic five", but also the issues related to safety precautions, territorial and international water boundaries. The number of countries that do not directly border the Arctic Circle but are eager to participate in the Arctic problem solving is constantly increasing [13, 14]. The most serious problems are as follows: official and nonofficial claims for the North Pole, continental shelf and offshore areas; uncertainty in the maritime boundaries delimitation; conflicts in determining marine routes; disputes around the status of the Spitsbergen.

4. Conclusion

Holding most of Arctic hydrocarbon reserves and mineral deposits, Russia faces a number of problems caused by the unconformity of hydrocarbon and mineral deposit development plans and the Arctic sustainability. The characteristic features of the Arctic urge to apply new approaches toward consolidated decision making. Today, there is a huge disbalance between the above-discussed aspects of the Arctic region development, which results in high-severity risks. Taking into consideration the cost to mitigate adverse impacts, it is reasonable to solve Arctic-related problems within the framework of international cooperation. In addition, the RF should pursue initiatives to reinforce its presence in the Arctic in order to counter the increasing economic and geopolitical interests of non-Arctic countries. Besides, it is essential to actively seek to resolve inter-state conflicts, establish partnership with all participants of business activities and natural resource management, and sustain the balance between sustainable use of natural resources and economic value of Arctic hydrocarbon

deposit development. The expected Arctic resource potential prompts to develop an integrated environmental safety system which would consider the negative impact of risks not only at the stage of strategy development, but also during project implementation. Overall, such a system should be integrated into all spheres of economic development of the region.

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