Environmental management on the basis of Complex Regional Indicators Concept: case of the Murmansk region

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Abstract. The article presents an approach to sustainable environmental development of the Murmansk region of the Russian Federation based on the complex regional indicators as a transformation of a balance scorecard method. The peculiarities of Murmansk region connected with sustainable environmental development are described. The complex regional indicators approach allows to elaborate the general concept of complex regional development taking into consideration economic and non-economic factors with the focus on environmental aspects, accumulated environmental damage in particular. General strategic chart of sustainable environmental development of the Murmansk region worked out on the basis of complex regional indicators concept is composed. The key target indicators of sustainable ecological development of the Murmansk region are presented for the following strategic chart components: regional finance; society and market; industry and entrepreneurship; training, development and innovations. These charts are to be integrated with international environmental monitoring systems.

1. Introduction
According to the presidential decree of the Russian Federation, the Murmansk region is considered part of the Arctic zone [1]. Unlike some other Arctic territories such as the Sakha Republic (Yakutia) and the Yamal-Nenets autonomous region, which are relatively “clean” from the ecological viewpoint, large industrial areas including Murmansk and the Murmansk region are facing serious ecological problems. The imperfections of the market economy management system are reflected in the fact that some large industrial enterprises are not interested in solving problems of environmental pollution harmful to the environment. Experts believe that the Russian Arctic regions with the critical level of pollution represent at least 15% of the Russian Arctic zone. The Murmansk region belongs to the industrial region of old formation, where the economy has been based on the exploitation of natural resources for more than 80 years. “The areas with the highest pollution levels are located near the cities of Monchegorsk and Nickel. Environmentally, they are man-made wastelands, with no vegetation, with changed soil structure, and with heavily polluted waters” [2].

The JSC “Apatite” alone stores 30 million tons of waste annually. Over 750 million tons of tailings dumps of floatation enrichment have been accumulated for a 75-year period of the development and exploitation of the Khibiny deposit [3]. The mining enterprises of the Kola peninsula produce up to
200 million tons of solid waste annually. More than 6 billion tons of fractured rock mass have been accumulated in the tailings dumps [4]. The nature of the Arctic is simply unable to process such volumes of accumulated waste in hundreds of years to come. Thus the problem of accumulated environmental damage is evident. Being a key problem of the region, it hinders the steady economic development of the region.

The problem of accumulated environmental damage is addressed in the “Strategy of the Russian Arctic zone development and national security for the period up to 2020” [5]. There we read: “16. In order to protect the environment and to ensure environmental security in the Arctic zone of the Russian Federation, it is necessary to b) eliminate the environmental damage caused by the previous economic, military, and other activities in the Arctic zone of the Russian Federation including the evaluation of the environmental damage and cleaning-up of polluted Arctic seas and territories.” However, the document suggests neither specific mechanisms nor actions aimed at the solution of the problems of the Murmansk region.

Currently, the development of the Murmansk region is being carried out in accordance with the strategy for the socio-economic development of the region up to 2020, which was launched in 2012 [6]. Despite the fact that the strategic environmental goal of the program implies environmental protection and the improvement of its quality and safety, the strategy does not describe any ecologically-oriented urban development model. The measures taken in this sphere are fragmented and of no systematic character; the results do not demonstrate a complex approach to the elimination of the accumulated environmental damage.

Two other regulatory documents [7,8] clearly define the objects and the methods of evaluation of the accumulated environmental damage, but they do not describe complex approach methods of how to solve the problem of the accumulated environmental damage. There is one more official document considered fundamental for the Arctic zone of the RF development [9]. Regrettably, it does not cover environmental issues at all. Thus, the goal of this study is to develop proposals for the integrated management of sustainable development of the Murmansk region on the basis of Complex Regional Indicators (CRI) concept [10].

2. Existing literature

Existing Russian and foreign literature describes three key issues of importance for the enquiry: the application of balanced score cards concept, sustainable development, and environmental problems of the Arctic regions of the Russian Federation.

The authors of [11-13] propose a balanced scorecard approach for the evaluation of the ecological performance of the enterprises, not regions. The study [14] presents a very interesting but noncomplex approach since the focus is only placed on air environment. The authors of [15] define BSC as a tool for sustainable development but make no connection to the regional development. The ideas presented in [16] and [17] are relevant to the region of our enquiry, but no practical tools for sustainable development are proposed. Authors [18,19,20] provide a suite of indicators that can be applied at different scales as sustainability assessment tool, and as tool to measure the implementation of different policies and programs, but there is not based on complex strategy approach.

The environmental aspects of the Arctic and the Murmansk region development attract attention of both Russian and foreign researchers[21]. Y.I. Sokolov [3] justifies the relevance of the integrated approach development for tackling the problem of environmental safety in the Russian Arctic zone. The author has compiled the data about the cumulative environmental damage. He argues that “…storage, disposal and removal of waste out of the newly development regions of the Russian Arctic zone, as well as their recycling and reduction of the sources of waste should be one of the major factors taken into consideration while planning and executing any kind of activity in the Russian Arctic zone”.

Well-known researchers F.D. Larichkin and A.E. Cherepovitsyn with co-authors [22,23] examine issues related to the environmental risks and propose a number of measures to eliminate them. However, the authors only focus on the offshore oil fields in the Arctic.
We cannot but agree with [24-27] that the maintenance of ecological safety is largely dependent on the approach taken; it implies either the measures appropriate for the old tradition (unsteady development) or the strategy and the concept of steady development. We support the position of those who believe that ecological security should be ensured within the framework of sustainable development.

The authors of [28] consider sustainability performance management an emerging term which addresses social, environmental, and economic aspects of corporate management in general and of corporate sustainability management in particular. They propose a term “integrative management” as a complex approach to govern any economic system. However their concept is not applied to the specifics of the Arctic regions.

To sum up, the above mentioned studies have made a significant contribution to the research of the ecological and economic problems both at the regional and the enterprise level. However, the tools have not been sufficiently elaborated for the regional level so that to ensure a complex-oriented approach to the problems associated with environmental management and environmental protection when designing and applying the strategy for the sustainable socio-economic development of the Murmansk region and other Arctic regions of the Russian Federation.

3. Methodology
The methodological basis of this research is the method of integrated regional indicators which are grouped according to a certain classification. The method of analogies as a qualitative research method has been used to justify the transition of the balanced score card system into the complex regional indicators method in the description of the environmental component of the Murmansk region. Methods of analysis and synthesis are also considered as qualitative research methods, in particular, the content analysis and the expert analysis. The methods of synthesis are primarily used in summarizing the results of the content analysis. The proposals and findings of the research are carried out in accordance with the program-oriented management methodology. An important methodological basis of the enquiry is a concept of sustainable development.

4. Findings and proposals
Solving the problem of sustainable ecological development and cumulative environmental damage in the Murmansk region is only possible with the program-targeted approach which involves the development of the Complex of Regional Indicators (CRI). The system of balanced indicators proposed by R. Kaplan and D. Norton has been adopted as the basic methodology for the development of the CRI [29,30].

The CRI model was created with account taken of a region’s characteristic properties. As the CRI system is based on the purposive approach, the MBO approach to the Arctic Zone of Russia can be developed drawing on strategic plans specially mapped out for each territory. At the regional level, the CRI exercise is intended to formalize the development strategy of the Russian Arctic, to inform every head of a municipal entity (territory, enterprise) about this strategy and to implement it, to provide monitoring (which is an MBO stage) and feedback at every level (specifically, region, territory, municipal entity, enterprise).

The CRI approach facilitates tying the strategy for the Russian Arctic with a basket of interrelating factors tailor-made for different interconnected levels (those of a territory, municipal entity, enterprise). This system shall balance out the economic, social, financial and other performance results of a region (territories, municipal entities, enterprises) as well as aid in coordinating and pursuing strategies at every level. The CRI of the Russian Arctic is a mechanism that allows for converting the AZRF development strategy into a sequence of activities aimed at attaining the objectives set at every management level. It improves the system of management by bringing the objectives that face the head of a municipal entity (territory, enterprise) into line with those of the region.

According to the overall strategic development map of the Russian Arctic zone presented in [10,31], the problem solving proposals related both to sustainable ecological development and to the
Improvement of environmental safety involve all the components of the CRI as shown on the diagrams (figures 1-5). The key target indicators for monitoring the sustainable ecological development of the Murmansk region are included into schemes (figures 1-5).

5. Conclusions
As a strategic perspective, the sustainable development of the region is based on the achievement of social, economic, and environmental objectives. Thus, the environmental component is viewed as an integral part of the sustainable development strategy. The strategic maps of sustainable development proposed in this study enable the creation of the Complex of Regional Indicators. Its regular monitoring forms the information field for the assessment of the current status and dynamics of the ecological situation in the region. This ensures the monitoring system to control the current state of the pollution level and the use of modern means of land, air, and space-based surveillance. The system is also to be integrated into the existing and emerging international environmental monitoring systems in order to ensure the detection and forecasting of dangerous and extreme natural phenomena in the Murmansk region, including the adverse climate changes, as well as the timely detection and forecasting of natural and man-made disasters.

Figure 1. Arctic zone of Russia general strategic map
Figure 2. Perspective «Regional finance»

Figure 3. Perspective «Market and society»
Figure 4. Perspective «Industry and Entrepreneurship»

Figure 5. Perspective «Training, development and innovation»
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