SPECIFIC NATURE AND PROSPECTS OF USING INTEGRAL METHODS OF ECONOMIC SECURITY ASSESSMENT FOR THE ARCTIC REGIONS OF RF

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Abstract: The research relevance is conditioned by the increased attention to the issues of content and assessment of the economic security in Russia over the last years. A large number of scientific researches devoted to this theme prove it. At that, the majority of researches address the issues of economic security at a national level. Few researches in the field of economic security analysis at a regional level commonly propose multi-purpose assessment methods that do not take into account the specific nature of development and economic activity of specific regions and territories. The paper is aimed at revealing the specific nature and prospects of using the integral methods of economic security assessment for the arctic regions of RF. The proprietary methodology of assessing the economic security for the arctic regions of RF is proposed in the paper and is based on comprehensive analysis of indicators of various units of economic security, such as: capacity of the region for sustainable development, sustainability of the financial system of the region, economy dependence on the import of the essential types of products, poverty rate, scientific potential, quality of life, demography, ecology, transport accessibility. The lead approach to building a model for the economic security assessment is an indicative method with subsequent mathematical processing of actual results of the generated system of indicators on the basis of comparison thereof with the threshold limit values. Key elements of the model were selected on the basis of analysis of a large number of domestic and foreign practical developments of the principal researchers in the area of economic security assessment. The results presented in the paper can be used on the one hand for

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ranging the arctic regions of RF by the integral composite indicator of economic security, and on the other hand for qualitative assessment of the economic security level and the extent of potential risks for sustainable operation and development of a certain territory. The represented methodological fundamentals can also be applied for further investigations in the field of building integral models and revealing bottlenecks in the system of economic security management of different level entities.

Keywords: Arctic regions, economic security, security indicators, regional model

1. Introduction

Over the last years in view of the growing economic uncertainty, enhanced external adverse background, and increased probability of new economic risks there is a growing need for elaboration of the available methods of economic security assessment for the entities of regional level; for identification of those methods that better comply with the specific nature of arctic regions of RF; and for building new integral models of assessment meeting the modern reality. The economic security is a complex characteristic that on the one hand allows assessing sustainability of the economic development of the region, living conditions of the population, and possibilities for development of regional economy, and on the other hand, on the basis of analysis of this

category, the national concept for ensuring state security and fulfilling the economic interests of the country can be built.

The economic security can be considered with respect to different levels of the economic system: at a state level (macro-level), at a level of regions or individual territorial complexes (meso-level), at a level of individual enterprises or economic structures (micro-level). And if on the macro- and micro-level the issues of content, assessment and management of economic security are sufficiently studied and enacted by statute, the meso-level represents a differentiated in terms of quality characteristics research field that requires analysis of the territorial specific nature and additional study of possibilities of using the elaborated methodological models with respect to certain regional complexes. Arctic regions of RF should be referred to one of such specific territorial objects of research.

Presently as per the presidential decree "On land territories of the Arctic zone of the Russian Federation" [1] the Arctic zone in Russia includes the entire territory of the Murmansk oblast and three autonomous districts (the Nenets Autonomous District, the Chukotka Autonomous District, the Yamalo-Nenets Autonomous District) and partially the territories of three republics (the Republic of Karelia, the Komi Republic, the Republic of Sakha (Yakutia)), Krasnoyarsk Territory and Arkhangelsk oblast. The regions of the RF

Arctic zone for all their diversity are characterized by common features enabling to consider them as a certain complex of RF entities united by a certain specific economy pattern and similar problems and difficulties in management on their territories.

The Arctic zone has an exclusive strategic value for the Russian Federation thanks to a considerable natural-resources base involving the exceptional mineral wealth and essential coastal resources the production of which is a basis of economy on these territories; an access to northern seas and Northern Sea Route which potentially has essential capabilities for increasing the freight flow[5]and turning into an efficient through way connecting the Asian and European parts of the world; and unique natural ecosystems of crucial importance for conservation of biodiversity. Having a relatively low density and small share of population on these territories (around 1.5%), the Arctic region ranks high in the Russian economy structure, generating around 20% of the gross domestic product and ensuring over 10% of the national profit[1, p.15].

The climatic conditions in the arctic regions are considerably more severe as compared to the rest of the Russian territory. It is due to both low temperatures and long polar night in winter. The living conditions on the territory of the RF Arctic zone are less favorable than in southern and central regions which results in a relatively low density of population on these territories and preconditions for the out migration.

The mining industry commonly prevails in the structure of economy of the regions referring to the RF Arctic zone. A considerable volume of production of the gross regional product falls on the limited number of large enterprises.

It is worthwhile to dwell individually on a hard transport accessibility of the arctic regions making a problem of "delivery of goods to Northern territories" and resulting in high importance of unfailing functioning of transport hubs, expensive public utilities and products for population, and necessity for implementation of large-scale transport projects on these territories.

All these factors shall be taken into account when making the models of economic security assessment of the Arctic zone of RF.

2.   Materials and Methods

Within the frameworks of the paper an objective was set to study the available methods of the economic security assessment, analyze the possibility of using thereof for the arctic regions and develop the proprietary approach to the integral assessment of economic security of the Arctic regions of RF on the basis of the available scientific works.

The research included the following stages:

1. Studying the methodology of available theoretical and practical approaches to integral assessment of the economic security.

2. Assessing the applicability and adaptability of the studied approaches to the integral assessment of the economic security of RF arctic regions.

3. Developing general requirements to the methodology of assessing the economic security level for the Arctic regions of RF and the procedure of using the model in practice.

4. Generating the proprietary model of assessing the economic security level for the Arctic regions of RF with due account for specific features of the territories and need for calculation of the final integral indicator of the economic security of the region.

5. Determining the ranges of values for differentiation of arctic regions by the level of the final integral indicator of economic security.

In order to resolve the set objective the following methods of scientific cognition were applied in the research: the method of rising from the abstract to the concrete, within the frameworks of which the possibilities of practical application of the available theoretical approaches to the integral assessment of economic security have been evaluated; the normative method that allowed appraising the possibilities of using the methodology established in the strategic

documents for the development of Russia for practical purposes; analysis and synthesis on the basis of which the width and depth of indicators used to assess the economic security in different approaches have been evaluated and the relevance of calculating the general integral assessment indicators has been determined; comparison which enabled to make an objective comparison of the models of economic security assessment. To generate the primary conclusions the methods of generalization, deduction and induction were used.

In order to process the actual values of indicators of the developed model and bring them to a commensurable form the mathematical and statistical methods are used, in particular, the method of norm setting on the basis of using the power function which implies the comparison of the actual value of each indicator with the proposed threshold value. When calculating the aggregative composite indicators of security levels by separate units and the total integral indicator of the regional economic security the calculation of the weighted average value is used on the basis of weight ratios obtained by expertise.

Within the framework of differentiation of the arctic regions by the level of the final integral indicator of economic security there were used the expert methods of identifying the deviation levels for each type of regions and graphic representation of the

assessment scale of the economic security level.

3.   Literature Review

The key stage of research was studying the methodology of available theoretical and practical approaches to integral assessment of economic security.

It should be noted that in modern practice one should distinguish the methodology of the economic security assessment represented in the regulatory enactments and in the research field. At that the approaches represented in them are often not congruent.

Presently among the regulatory sources in force the issues of content, goal-setting and methodology of the economic security assessment are stated to the fullest extent possible in the Strategy of Economic Security of the Russian Federation till 2030 [4] (hereinafter referred to as the Strategy). Despite the fact that the document was adopted at a national level and regulates the primary aspects of the economic security at a macrolevel, many provisions can be considered when building the models for regional systems as well.

The methodology of the economic security assessment is elaborated in section IV of the Strategy. The assessment itself comes down to the list of forty indicators of the economic security condition which cover different aspects of the economic development of the state: economy condition, living standard, the extent of integration into the global economy, innovative potential. At that the indicators are not grouped and are not systematized in any way in the strategy itself. Within the frameworks of the economic security assessment the legislator does not propose a calculation of a single summarizing composite indicator or a methodology for fulfilling of the integral assessment on the basis of enlisted indicators, but only assigns functions of monitoring the values to executive authorities. At the same time there are no threshold values of the enlisted indicators in the document and reference as to what rates and tendencies of their changing could be considered sufficient to state certain conclusions. Moreover, in accordance with the Strategy the specified list of indicators is not considered to be comprehensive and unchanged by the legislator.

Therefore, when elaborating the methodology of the economic security assessment for individual regions one positively should focus on the Strategy of the economic security of the Russian Federation till 2030, and to use the specified list of assessment indicators as a basis. However at the same time there remain rather broad opportunities for revising a set of indicators with due account for regional specific nature of

the models being elaborated and improving their practical applicability.

In the scientific literature the range of represented models of economic security assessment is rather broad and diverse.

In the foreign literature the economic security is considered in the context of the issues of sustainability, globalization and ensuring national interests over the last years. The content of the economic security as a criterion of sustainable development of the economic system in the western scientific thought is considered with respect to the federal level or microlevel (the level of an enterprise or economy). The level of regional systems (as part of the territory of one state) is practically not considered as an object of research.

Among the primary issues addressed when considering the economic security the following can be distinguished: interrelation of the national security with the foreign investments attracted [5], external trade [6], and modern processes of globalization and development of transnational corporations [7]; dependence of the economic security on the power-generating sector of economy [8]; impact of financial crisis and external economic shocks on the national security condition [9]; correlation of the economic security and national competitive capacity [10].

It should be noted that when building the economic-statistical models characterizing the sustainability of the economic system to negative external and internal actions, in foreign scientific literature they more often use a number of terms different from the direct notion of "national economic security," such as "national power" or "national capacity." When considering the content of models for economic scope these categories prove to be close to the term of "national economic security" used by the Russian scientific community.

In foreign practice unlike Russian researches where the economic security of a system of certain level is very often considered as the compliance of a complex of elaborated indicators with the established threshold values, "national power" or "national capacity" is assessed on the basis of a complex integral indicator or a composite index. As an example can be the Composite Index of National Capability, CINC, developed by J. David Singer [11], which represents the mean value of coefficients and indicators characterizing the population size, share of the urban population in the total number, metal production based on ferroalloys, power consumption, size of an army and military expenses of the state. Despite the fact that the index negligibly evaluates the economic potential of the state, it is often used for

practical comparison of countries by the level of security.

Another composite indicator used in the foreign practice – is the National Power Index, NPI [12]. The index is calculated as an integral indicator taking into account the following components: economic, military, diplomatic, technological and image-building. Each component has its weight in the index (the greatest weight falls on the economic and military components – 35% each, the remaining share is equally distributed between the rest of components). The composite index for each component is calculated on the basis of macroeconomic indicators. Thus for example the economic component is evaluated on the basis of indicators of the gross domestic product, external imbalance and budgetary indicators. It is mostly used to compare the countries in terms of the degree of protection from external and internal threats.

Among the domestic developments in the area of economic security assessment the most accomplished and close to the practice models are presented in the researches of Glaz'ev S.Yu., a group of authors of the Economy Institute of RAS under the leadership of Senchagov V.K., Tatarkin A.I., and Kuklin A.A., Mityakov S.N., a group of authors under the leadership of Karpov V.V. and Korableva A.A.

One of the founders of the researches in the field of economic security in the domestic scientific environment in modern history is Glazyev S.Yu. In his papers the foundations for the economic security assessment were laid, 22 modules were identified enabling to perform a comprehensive assessment of different elements of economic security on macrolevel [13]. Glaz'ev S.Yu. not only developed the methodological foundations for the assessment, but also performed practical calculations of the national security level of Russia as compared to some foreign countries and made conclusions with respect to the most important risks and directions for elimination thereof. At that the principles established by Glaz'ev S.Yu. in the system of the economic security analysis can be transferred to the regional level only in constrained degree.

It should be noted that the issues of methodology of the economic security analysis on national level were raised in the papers of lead Russian economists rather regularly. Various aspects of the system of economic security assessment in Russia were covered in the papers of Abalkin L.I. [14], Bogdanov I.Ya. [15], and Il'in V.A. [16]. Mesolevel as an object of methodology of the economic security assessment was identified by the scholars more seldom. At that there is a certain scientific reserve in this area in the Russian scientific environment.

One of the most required domestic models of the economic security assessment on the regional level is presented in the researches

of Tatarkin A.I. and Kuklin A.A. [17]. These leading scholars made a significant contribution to studying the issues of content, assessment and management of the economic security on different levels. The methodology of the model for the economic security assessment of regional economic systems by these scholars is based on identifying thirteen spheres of indicators that are grouped by three groups specified as "the capacity of the territorial economy for sustainable growth," "ensuring an acceptable level of existing on the territory," "environmental security. Capacity of the territory for retention of balance between human and nature." The methodology of analyzing the economic security of the region implies the comparison of actual values of indicators of each sphere with the threshold (critical) values. The primary advantage of the model is a broad list of indicators of the economic security assessment, availability of borderline values for each indicator, possibility of using the methodology to range territories by the level of economic security. The disadvantage of the methodology is inaccessibility of data in open statistics for some identified indicators.

One more accomplished model of studying the regional economic security is presented in the researches of a group of authors of the Economy Institute of RAS under the leadership of Senchagov V.K. [18]. For the regional level the authors propose to use a limited set of indicators of economic security as compared to the federal level, that can be grouped in two sections: economic indicators and social indicators. For each indicator within the frameworks of the model there was proposed a threshold value (the selection of which is justified in detail) and norm setting system, which allows using many methodological elements of the model in further researches in the area of practical application for a complex of territories united by a certain specific nature. Also one of the positive features of the system of assessment of the regional economic security proposed by the researchers from the Economy Institute of RAS is using the methodological forecasting tool set which enables to analyze not only the indicators of the current condition of regional systems, but also the perspective condition.

The model of economic security assessment of the region proposed by Mityakov S.N. is established and rather justified [19]. The model is based on the complex of indicators distributed by 10 projections that reflect different directions of development of regional systems including social, environmental, innovative and economic development, as well as different sides of security (industrial, food-based, power, budgetary and financial, personnel). For each indicator Mityakov S.N. proposed threshold values. Norm setting of indicators is implemented on the basis of the power

functions based on the correlation of the indicator value with the threshold value. The model also implies the calculation of aggregated indicators for each of the identified projections with due account for the weight fraction of individual indicators and the calculation of a general aggregative indicator of the economic security of the region. Mityakov S.N. performed approbation of the proposed model on the example of Russian regions, in particular, the level of the economic security of Nizhny Novgorod oblast was calculated during runtime.

The methodological foundation of the model for economic security assessment presented in the research of a group of authors under the leadership of Karpov V.V. and Korableva A.A. [20] is a system of 29 indicators united into three groups: economic sphere, social sphere and financial sphere. The author suggests calculating the integral indicator for each of these three spheres on the basis of identified indicators, as well as a total integral indicator. Before calculating the integral parameters, the indicators of the model are transformed to a dimensionless form by means of norm setting and are taken into account with different weight coefficients reflecting the level of significance of each of them in a certain sphere. The model approbation is performed on the example of regions of the Siberian Federal District. The absolute advantages of the elaborated model is

the practical focus thereof, account of a sufficiently large number of indicators, and use of tools for norm setting of certain indicators when calculating integral indicators. Another positive moment is the attempt of authors to determine threshold values for each indicator within the model. As a disadvantage of the model one can specify the imbalanced distribution of indicators over the identified spheres of economic security. The choice of spheres also raises certain questions (for instance, "the economic sphere" can hardly be identified as a separate unit of economic security of the region).

The domestic scientific thought has rather successful attempts of adapting the most popular models to application for a complex of regions characterized by certain conditions. Thus in particular the attempt to adapt the methodological tool set of the economic security assessment for cross-border regions of Russia proposed by Voloshenko E.V. and Voloshenko K.Yu. deserves attention [21]. Within the frameworks of the studies the authors have elaborated an algorithm for assessing the level of their economic security with due account for specific features of cross-border regions of RF, and threats and risks typical of this group of regions, and adapted a system of particular and general indicators for assessment of individual units of the economic security with due account for the territorial position of these entities on the map of Russia.

Certainly the practice of such adaptation makes the models of the economic security assessment more informative and capable of revealing specific kinds of risks for individual groups of regions.

4. Results and Discussion

The conducted analysis of the practical experience of developing the economic security assessment models allows evaluating the prospects and possibilities of using thereof to study the level of economic security of the Arctic regions of the Russian Federation (Table 1).

Table 1

Possibilities of using the primary models of economic security assessment for the Arctic regions of RF

Ser. No.	Model	Possibilities of application for the Arctic regions of RF
1	The assessment system represented in the Strategy for Economic Security of the Russian Federation till 2030	Cannot be applied due to the lack of such necessary elements of the model as the calculation of the integral complex indicators and threshold values of the economic security indicators. At that the list of indicators presented in the Strategy should serve as a basis for building any model for assessment of the regional system
2	Foreign models	Cannot be applied for assessment of the economic security level of the arctic regions of RF due to the focus on the national level, presence of a large number of indicators for which there is no data in the regional Russian statistics, and lack of indicators for many important units of economic security in Russia
3	The model of Glazyev S.Yu.	Can be applied to some extent for assessment of the economic security level of the Arctic regions of RF due to the focus on the federal level (including for comparison with the foreign countries) and application of macroeconomic indicators
4	The model of Tatarkin A.I. and Kuklin A.A.	Can be used as a basic model on condition of adapting thereof by means of introducing additional indicators characterizing specific conditions of the economic activity and transport accessibility of the Arctic regions of RF

5	The model of a group of authors of the Economy Institute of RAS under the leadership of Senchagov V.K.	Can be used for the Arctic regions of RF to a limited extent due to a relatively small number of indicators used in the model.
6	The model of Mityakov N.S.	Can be used as a basic model on condition of adapting thereof by means of introducing additional indicators characterizing specific conditions of the economic activity and transport accessibility of the Arctic regions of RF. Certain elements of the model can be used, in particular, threshold values for the key indicators and applied method of norm setting of indicators
7	The model of a group of authors under the leadership of Karpov V.V. and Korableva A.A.	Can be used as a basic model on condition of adapting thereof by means of introducing additional indicators characterizing specific conditions of the economic activity and transport accessibility of the Arctic regions of RF
8	The model of Voloshenko E.V. and Voloshenko K.Yu.	Cannot be applied for assessment of the economic security level of the Arctic regions of RF due to the presence of indicators adapted for the analysis of the economic security of cross-border regions of RF

The conducted analysis of methodological approaches to the regional economic security assessment allows stating the following general requirements to the methodology applied for the Arctic regions of RF:

• The basis for building the methodology for the economic security assessment should be a set of indicators that will enable to a sufficient extent to evaluate the possibilities of a sustainable development of the territory and overcome the main threats and risks including those associated with unfavorable external factors of influence.

• When building a model of the economic security assessment for the entities of the Arctic zone of the Russian Federation one should include into the system of parameters the indicators characterizing such specific living conditions in these regions as transport remoteness from the metropolitan

area and a resource-producing pattern of economy.

• The additional requirements when selecting the indicators should be the possibilities of tracking thereof with the help of official information services, such as the website of the Russian Federal State Statistics Service, annual statistics digests, the website of the Unified Interdepartmental Informational-Statistical System (UIISS), the available data for not less than five previous years, and equilibrium, that is the reflection of various aspects of the economic security.

• When calculating the integral indicator on the basis of the generated list of indicators it is reasonable to smooth the actual values of indicators on the basis of their comparison with threshold values.

• When determining threshold values of the indicators allowing to state the conclusions regarding the level of the economic security of specific region, one should use a comprehensive approach based on the expert assessment, determination of mean values of indicators for a group of regions or RF as a whole, account for a dynamics if indicators as compared to the dynamics of similar indicators of other RF entities.

It is reasonable to apply the elaborated model in the following stages represented in Figure 1.
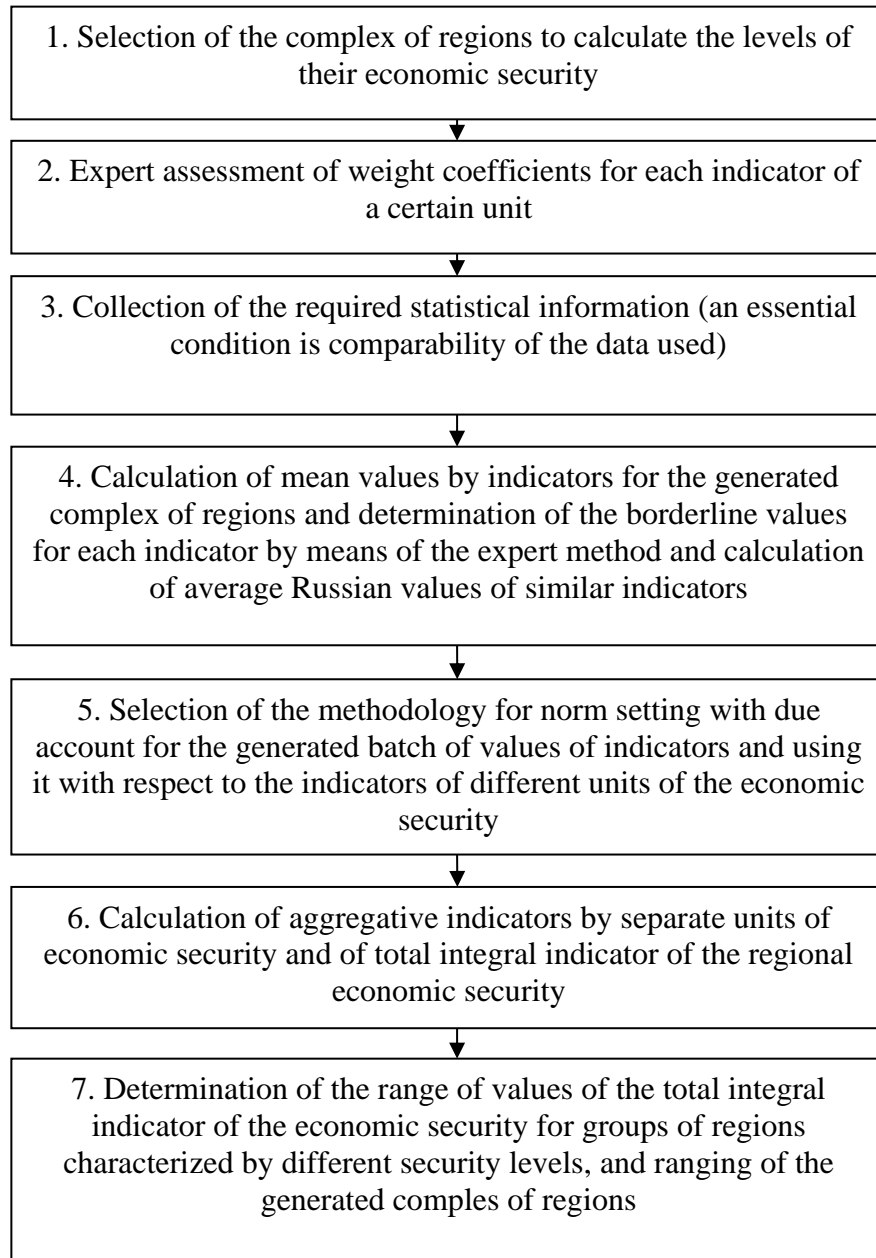
Fig. 1. Main stages of using the models of economic security assessment for the Arctic regions of RF

The basic stage of developing a model for assessment of the economic security level of the Arctic regions of RF is determining a list of indicators of the economic security.

It should be noted that in Luzin Institute for Economic Studies KSC RAS there were held investigations before to adapt the system of indicators of economic parameters and their threshold values with respect to a certain

region - Murmansk oblast which falls under the Arctic zone of RF. In the papers [22, 23, 24] there were identified specific risks for northern region; requirements for a system of indicators characterizing the economic security in the Arctic region; primary structural units that enable to assess the level of economic security of Murmansk oblast in a flexible manner (the authors identify the following among such units: capacity of the region for sustainable development, sustainability of the financial system of the region, economy dependence on the import of the essential types of products, poverty rate, scientific potential, quality of life, demography, ecology). Let us assume the list of indicators and their threshold values elaborated by the authors to be an indicative foundation of the generated model for assessment of the level of economic security of the Arctic regions of RF (Table 2).

Table 2

Areas of economic security and indicators of assessment of their level for the Arctic regions of RF

Ser. No.	Indicator	Threshold value of the indicator	Weight in the structure of the relevant unit of the economic security, %
1	*Capacity of the region for sustainable development*		
1.1	Volume of GRP per head of the population, in percentage to the relevant period of the previous year	104	10
1.2	GRP growth rates to the relevant period of the previous year, %	104	5
1.3	Investments to fixed assets, in percentage to GRP	20	15
1.4	Index of industrial production, in percentage to the previous year	104	10
1.5	Index of agricultural production, in percentage to the previous year	103	10

1.6	Index of physical quantity of the retail turnover, in percentage to the previous year	103	10
1.7	Inflation rate per year, %	10	10
1.8	Share in industrial production:		
	– processing industry, %	50	10
	– mechanical engineering, %	10	5
	– metallurgy, %	40	5
1.9	Share of new types of products in total production volume, %	5	10
2	*Sustainability of the financial system of the region*		
2.1	Deficit of consolidated budget, in percentage to GRP	2.5	50
2.2	Index of consumer prices, December to December of the previous year, %	105	10
2.3	Amount of internal debt, in percentage to GRP	5	20
2.4	Amount of external debt, in percentage to GRP	10	20
3	*Economy dependence on the import of essential kinds of products*		
3.1	Ratio of import to export, %	20	40
3.2	Import ratio in internal consumption by the population, %	40	40
	– including food staff	30	20
4	*Poverty and Unemployment Rate*		
4.1	Number of population with revenue below the minimum living wage, in percentage to the total number of the population	9	35
4.2	Ratio of revenues of 10% of the most and 10% of the least well-to-do population	8	25
4.3.	Cost of the fixed market basket (by the end of a year), in percentage to average Russian cost	130	20

4.4	Unemployment rate by the methodology of International Labor Organization (ILO), %	7	20
5	***Scientific potential***		
5.1	R&D expenses, in percentage from GRP	2.5	30
5.2	Number of population with higher education per 1000 people	200	20
5.3	Number of students per 1000 people	40	20
5.4	Number of those working in science and education, in percentage to those working in the economy	2	20
5.5	Number of signed and accomplished economic contracts between scientific organizations and enterprises by the end of a year, ea.	Average level for the last five years for a region increased by 10%	10
6	***Quality of Life***		
6.1	Expenses for health care and sports, in percentage to GRP	7	20
6.2	Length of Life	71	20
6.3	Ratio of average salary and minimum living wage	300	20
6.4	Crime rate, number of crimes per 100 thous. people	2000	10
6.5	Expenses for culture, in percentage to GRP	3	10
6.6	Commissioning of dwelling houses, thous.m2 per 1000 people of population	Not less than 50% of the average Russian level	5
6.7	Ratio of dilapidated and condemned buildings in the total area of the whole housing stock, %	6	5
6.8	Ratio of monthly expenses of the population for heating over the region to the average value of monthly expenses of the population for heating throughout RF, %	130	5

6.9	Ratio of monthly expenses of the population for electric power over the region to the average value of monthly expenses of the population for electric power throughout RF, %	130	5
7	**Demography**		
7.1	Depopulation rate (number of the born to the number of the deceased)	1.5	30
7.2	Birth rate, persons per 1000 people of population	12	10
7.3	Death rate, persons per 1000 people of population	8	10
7.4	Infant mortality in the age before 1 year (per 1,000 of the born)	3	10
7.5	Balance of migration, thous. people	0	30
7.6	Death rate of the population due to deceases caused by professional activity, number of persons per 1000 people of population	5	10
8	**Ecology**		
8.1	Pollutants discharges into the atmosphere, thous. tons per 1000 people of population	100% of the average Russian level for a reporting year	50
8.2	Dirty discharges (without purification and insufficiently purified), mln. m^3 per 1000 people of population	100% of the average Russian level for a reporting year	50
9	**Transport accessibility**		
9.1	Distance from Moscow to the most remote settlement of the region by road	Mean value for the selected complex of regions	40
9.2	Availability of railways (Engel's coefficient)	7	30

9.3	Share of settlements without regular transport connection (hard top roads), % of the total number of settlements	100% of the average Russian level for a reporting year	30

Values of weight coefficients by presented indicators of economic security for the Arctic regions of RF were calculated by the expert method.

Despite similar conditions of doing business in the regions of the Arctic zone of RF, these entities considerably differ by the degree of transport accessibility which generates additional risks and threats for the territories remote from the center of Russia. In this regard on this stage of research there was taken a decision to supplement the earlier elaborated list of indicators by three parameters characterizing the transport accessibility (the distance from Moscow to the most remote settlement of the region by road, Engel's coefficient, share of settlements without regular transport connection).

Using the average value as a threshold value of the indicator "distance from Moscow to the most remote settlement of the region by road" for the selected complex of regions allows taking into account the impact of remote location of the eastern regions of the Arctic zone of RF when assessing the level of their economic security.

Engel's coefficient as an indicator characterizing the availability of railways in the region shows the density of railways and is calculated by the formula [25]:

$$d_E = \frac{L_k}{\sqrt{S * H}},$$

where d_E – Engel's coefficient,

L_k – kilometers of railways,

S – square of the territory,

H – number of residents.

Engel's coefficient was introduced into the list of indicators not only for assessment of accessibility of settlements, but for the possibility of accounting the development of new productions in the region.

Another indicator characterizing the transport accessibility of the region is the share of settlements without regular transport connection. The higher the parameter, the more essential the risks in terms of timely provision of the population with essential commodities.

An important stage in the system of economic security assessment of the region is norm setting of values of the generated indicators. Among the parameters selected as indicators for the model of economic security

assessment of the Arctic regions of RF there are both in direct proportion with the security level of the region, and in reverse proportion. In such conditions it seems rational to apply an algorithm of norm setting on the basis of using the exponential function proposed for the indicators of economic security by Mityakov S.N. [26]. For indicators with the increase of which the economic security level of the region will grow the following function should be applied:

$$y = \begin{cases} 2^{(1-\frac{a}{x})/\ln\frac{10}{3}}, if\ \frac{x}{a} > 1 \\ 2^{-\log_{10/3}(\frac{a}{x})}, if\ \frac{x}{a} \le 1 \end{cases}$$

where

x – is an actual value of a certain indicator in the reporting period for the region under study,

a – threshold value of the relevant indicator.

For indicators with the increase of which the economic security level of the region will drop the following function should be applied:

$$y = \begin{cases} 2^{(1-\frac{x}{a})/\ln\frac{10}{3}}, if\ \frac{x}{a} < 1 \\ 2^{-\log_{10/3}(\frac{x}{a})}, if\ \frac{x}{a} \ge 1 \end{cases}$$

Such system of norm setting allows transforming the values of different indicators to a comparable form. At that the range of obtained values for different types of actual values of indicators (with due account for their correlation with threshold values) is presented in Table 3.

Table 3

Range of values for different types of actual values of indicators of the model for economic security of the region (with due account for their correlation with threshold values)

Type of indicator	Correlation with the threshold parameter	
	x ≥ a	x ≤ a
For indicators in direct proportion with the level of economic security	from 1 to 1.78	from 0 to 1
For indicators in reverse proportion with the level of economic security	from 0 to 1	from 1 to 1.78

After norm setting of the actual values of indicators of economic security one should proceed to the calculation of the aggregated composite indicators of security levels by individual units. The calculation should be performed by the formula:

$$X_i^{agr} = \sum_{j=1}^{n}(x_i^j * p_i^j),$$

where

X^{agr}_i – aggregated composite indicators of security levels by individual units (i unit),

x^j_i – actual value of a certain indicator in the reporting period for the region under study (i unit),

p^j_i – indicator weight in the structure of a relevant unit of economic security, % (i unit).

On this stage it is reasonable to supplement the calculations with a graphic representation of the data obtained, in particular, illustrative is the representation of the aggregated complex indicators of security levels by individual units for the region under study in form of radar charts.

For the final comparison of the economic security levels of separate regions of the Arctic zone of RF and ranging thereof, the total integral indicator of the economic security of the region should be calculated on the basis of addition of aggregated composite indicators with due account for their expected weight coefficients. The calculation on the basis of an expert method (the experts were the researchers from Luzin Institute for Economic Studies KSC RAS) allowed determining the values of weight coefficients for separate aggregated indicators (Table 4).

Table 4

Values of weight coefficients for separate aggregated indicators by the units of economic security of regions

Ser. No.	Economic security unit	Aggregated indicator(X^{agr}_i)	Weight coefficient (p_i), %
1	Capacity of the region for sustainable development	$X^{agr}_{sust. dev.}$	15
2	Sustainability of the financial system of the region	$X^{agr}_{fin.}$	15
3	Economy dependence on the import of essential kinds of products	$X^{agr}_{imp.}$	12.5
4	Poverty and unemployment rate	$X^{agr}_{pov and unemp.}$	10

5	Scientific potential	$X^{agr}_{sci.}$	7.5
6	Quality of life	$X^{agr}_{qual.\ life}$	10
7	Demography	$X^{agr}_{demogr.}$	12.5
8	Ecology	$X^{agr}_{ecol.}$	7.5
9	Transport accessibility	X^{agr}_{trans}	10

Total integral indicator of economic security of the region is calculated by the formula:

$$X^{int} = \sum_{i=1}^{n} (X_i^{agr} * p_i),$$

where

The final stage of using the model for assessment of the economic security level for the Arctic regions of RF is building the ranking scale to range the obtained total integral indicators.

As it was established before, the range of changes of the total integral indicators ranges from 0 to 1.78. At that if the value of the indicator is higher than one the actual values differ from the threshold ones to a favorable side taking into account the weight coefficients of individual indicators and

X^{int} – total integral indicator of the regional economic security,

pi – weight coefficient for the aggregated composite indicator of the security level by separate units (i unit), %.

structural units of the economic security. In a reverse situation the value of the total integral indicator will be less than 1. Therefore let us select the value $X^{int} = 1$ as a limit value to refer the region either to a favorable or unfavorable area by the level of economic security.

For a more precise ranging of values let us calculate the values of normed indicators for special cases when actual vales of the indicators differ from the threshold values by 25% and 50%. The calculation results are presented in Table 5.

Table 5

Values of normed indicators for special cases when actual vales of the indicators differ from the threshold values by 25% and 50%

Type of indicator	Actual value differs from the threshold value by 25%	Actual value differs from the threshold value by 50%

	$x \geq a$	$x \leq a$	$x \geq a$	$x \leq a$
For indicators in direct proportion with the level of economic security	1.122	0.847	1.212	0.671
For indicators in reverse proportion with the level of economic security	0.879	1.155	0.792	1.334

Limit values for the intervals of the range of the total integral indicator can be calculated basing on the ratio of indicators in direct proportion with the economic security level (25 out of 47), and indicators in reverse proportion with the economic security level (22 out of 47).

Using the values of normed indicators for special cases calculated in Table 5 when the actual values of indicators differ from the threshold values by 25% and 50% we will obtain results presented in Table 6.

Table 6

Limits of internal intervals for the range of values of the total integral indicator of the regional economic security

	Actual value differs from the threshold value by 50% unfavorably	Actual value differs from the threshold value by 25% unfavorably	Actual value coincides with the threshold value	Actual value differs from the threshold value by 25% favorably	Actual value differs from the threshold value by 50% favorably
Calculation	$= 0{,}671 * (25/47) + 0{,}792 * (22/47)$	$= 0{,}847 * (25/47) + 0{,}879 * (22/47)$	-	$= 1{,}122 * (25/47) + 1{,}155 * (22/47)$	$= 1{,}212 * (25/47) + 1{,}334 * (22/47)$
Limit value	0.728	0.862	1	1.137	1.269

The graphic representation of the obtained scale for assessment of the level of

economic security for a certain region of the Arctic zone of RF is shown in Figure 2.

Unfavorable area			Favorable area		
0.728	0.862	1	1.137	1.269	
Disastrous risks	High risks	Low risks	Slight risks	Negligible risks	No risks

Fig. 2. The graphic representation of the scale for assessment of the economic security level for Arctic regions of RF (total integral indicator of the economic security of a region)

Calculated values of the total integral indicator allow allocating the region on the presented scale with proper account for the values of economic security levels characteristic thereof.

5. Conclusion

The presented model for the assessment of the economic security level for arctic regions of RF enables not only to range the regions by the value of the total integral indicator, but also make qualitative assessment of the economic security level and the extent of potential risks for sustainable operation and development of a certain territory.

It should be noted that the application of the developed model in practice for the Arctic regions of RF can become an efficient tool for monitoring of the socioeconomic condition of this group of RF entities. At that the primary condition for the efficient use of the model is a dynamic principle that implies performing regular calculations and making conclusions not only on the basis of the resulting value of the total integral indicator of the economic security, but on the basis of its dynamics for a rather long period. The dynamic nature of using the model is important from the point of view of timely detection of crisis phenomena some of which can be

determined on early stages upon assessment of actual values by individual indicators of economic security.

The model can be used as a tool for making managerial decisions on correction of accepted and being implemented strategies and programs for development of territories. In case of low values of the total indicator one should consider the obtained values of the aggregated composite indicators of security levels by separate units, reveal the most problematic points in the development of the region, typical risks and correct the direction of state support by means of timely interference of authorities.

We should additionally note that the developed model is not something unchanged and constant. In accordance with changing external and internal conditions it is possible to revise not only threshold values by separate indicators, but the list of the indicators and identified units of economic security used in the model.

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