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АНАЛИЗ ЭКОЛОГИЧЕСКОЙ И ЭКОНОМИЧЕСКОЙ БЕЗОПАСНОСТИ ПРИБРЕЖНЫХ РЕГИОНОВ АРКТИКИ

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Аннотация: особую актуальность приобретают вопросы и проблемы обеспечения экологической и экономической безопасности регионов в условиях ухудшения экологической обстановки, а также продолжающегося санкционного давления и распространения коронавирусной инфекции. В то же время регионы Арктической зоны Российской Федерации, где сосредоточены основные запасы нефти, природного газа, алюминия, золота, платины и других полезных ископаемых, подвергаются воздействию неблагоприятных факторов в большей степени, чем регионы, расположенные в центральной и южной частях страны. Это связано с промышленной направленностью экономической деятельности большинства арктических городов, а также с суровыми условиями жизни, характерными для регионов этой группы. В статье определено, что, несмотря на значительное количество научных статей, монографий и других работ, посвященных проблемам обеспечения эколого-экономической безопасности, существует определенный пробел в вопросах, связанных со сравнительным анализом эколого-экономической безопасности территориальных систем. Также делается вывод о том, что ключевым элементом при проведении сравнительного анализа является выбор показателей, которые должны отражать состояние окружающей среды, а также экономики региона. показатели должны быть не только репрезентативными, то есть объективными, но и простыми для интерпретации. Анализ, проведенный в рамках исследования, показал, что из всех регионов Арктической зоны Российской Федерации Ямало-Ненецкий автономный округ обладает самым высоким уровнем экологической и экономической безопасности. Аутсайдерами оказались Республика Карелия и Красноярский край. В ходе сравнительного анализа Республика Коми, не имеющая границ с морем/океаном, была исключена из арктических прибрежных регионов.

Ключевые слова: экологическая безопасность, экономическая безопасность, Арктика, прибрежные регионы.

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Analysis of environmental and economic security of the Arctic coastal regions

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Abstract: the issues and problems of ensuring the environmental and economic security of the regions in the context of a deteriorating environmental situation, as well as the ongoing sanctions pressure and the spread of coronavirus infection, are of particular relevance. At the same time, regions of the Arctic zone of the Russian Federation, where the main reserves of oil, natural gas, aluminum, gold, platinum and other minerals are concentrated, are exposed to adverse factors more than regions located in the central and southern parts of the country. This is due to the industrial orientation of the economic activity of most Arctic cities, as well as the harsh living conditions typical of the regions of this group. the article determines that, despite the significant number of scientific articles, monographs and other works devoted to the problems of ensuring environmental and economic security, there is a certain gap in issues related to the comparative analysis of environmental and economic security of territorial systems. It is also concluded that the key element in conducting a comparative analysis is the choice of indicators, which should reflect the state of the environment, as well as the economy of the region. the indicators should not only be representative, i.e., objective, but also easy to interpret. The analysis carried out as part of the study showed that of all the regions of the Arctic zone of the Russian Federation, the Yamalo-Nenets Autonomous District has the highest level of environmental and economic security. The Republic of Karelia and the Krasnoyarsk Territory turned out to be outsiders. During the comparative analysis, the Komi Republic, which has no borders with the sea/ocean, was excluded from the Arctic coastal regions.

Key words: environmental safety, economic security, Arctic, coastal regions.

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The Arctic territories have always been of particular importance for the development of the Russian Federation. It is here that the main reserves of copper, aluminum, tin, platinum, gold and other rare earth metals are concentrated, as well as the overwhelming majority of the explored reserves of natural gas and oil [1]. Despite the difficult climatic conditions of life — low temperatures, long winter period, alternation of polar day and night, industrial development of these territories is a matter of national security. Even though federal budget revenues from the sale of oil and natural gas have somewhat decreased (from 51% in 2010 to 29% by the end of 2020), they are still a key source of budget replenishment, and will remain so in the near future [2]. At the same time, the industrial development of the Arctic territories has an extremely negative impact on the fragile ecosystem of the Arctic, and the problems of ensuring environmental security come to the fore [3, 4, 5, 6]. In order to reduce the pressure on the environment, the mandatory introduction of resource-saving technologies and

cyclically closed production is proposed. [6]. As for the economic component, the ongoing sanctions pressure, as well as the fight against the spread of the COVID-19 coronavirus infection, have a negative impact on the economy of the Russian Federation as a whole, and the regions of the Arctic zone of the Russian Federation (hereinafter — the Russian Arctic). It should be reminded that part of the sanctions — the ban on the purchase of equipment and technologies that allow deep-sea drilling, the refusal of Russian oil and gas companies in long-term lending and cooperation with major foreign partners, are aimed precisely at complicating the work of domestic companies on the development of oil and natural gas fields, primarily on the shelf of the Arctic seas. Thus, the relevance of the article is beyond doubt, and the main goal is to compare the Arctic coastal (sea/ocean-facing) regions of Russia in terms of environmental and economic security and to identify trends in the economic development of the designated territories.

1. Overview of the main sources of research and publications

Many scientific articles and monographs [7, 8, 9, 10] are devoted to the issues and problems of assessing the environmental and economic security of states and regions. Of particular interest are the first works of Russian scientists, in which the national level of economic security was highlighted, and attempts were made to develop a system of indicators and threshold values [11, 12, 13, 14, 15, 16]. The success of such developments is confirmed by their recognition and application by the state authorities to assess the state of the economy of the Russian Federation in the mid-1990s.

However, the use of existing systems of indicators at the regional level was not so effective. This is due to the presence of peculiarities in the development of certain groups of regions that were not taken into account in the system of indicators developed for the national level. Therefore, there was a need not just to highlight the regional level of economic security as a separate object of study, but also to determine the features in their development, grouping, development of new indicators and their threshold values. It should be noted that in recent years, many scientific papers have been devoted to the problems of economic security of territorial systems. Among the most interesting and significant is the work of V. K. Senchagov *Economic security of the regions of Russia*, which examines in detail the existing levels of economic security, as well as factors that have a decisive impact on the economic development of the regions. One of the main conclusions is "ensuring the national interests of the country begins at the regional level" [17]. As for ensuring the environmental and economic security of the Arctic regions, these issues are discussed in detail in the works of V. S. Selin [9]. In particular, the features characteristic of the development of these regions are highlighted, the indicators that take these features into account are defined, and the main threats to environmental and economic security are identified.

The analysis showed that, despite a significant number of scientific articles and monographs devoted to topical issues of ensuring ecological and economic security of regions, there is a certain gap in the issues of comparative analysis of security between regions.

2. Comparative analysis of economic security of Arctic coastal territorial systems

According to Decree of the President of the Russian Federation No. 296 of

02.05.2014 (as amended by Decree No. 287 of June 27, 2017, No. 220 of May 13, 2019), the territories of the following regions are fully or partially assigned to the Arctic zone of the Russian Federation: Arkhangelsk Region, Krasnoyarsk territory, Murmansk region, Nenets autonomous district, Republic of Karelia, Komi Republic, Republic of Sakha (Yakutia), Chukotka autonomous district and Yamalo-Nenets autonomous district [18, 19, 20].

As part of an earlier study, it was found that both coastal and Arctic regions are considered to have a coastal coastline and belong to the Russian Arctic, that is, all of the regions listed above, except for the Komi Republic [10].

The earlier study showed that in practice there are several methods for assessing the economic security of regions: rating assessment; the use of a system of indicators and threshold values; methods of applied mathematics. However, the approach based on a comparative analysis of the economic situation of territorial systems seems to be the most preferable for comparing regions with each other according to criteria and indicators of economic security. The essence of this method consists in performing the following steps:

– Setting the oscillation range. Based on the above, we can say that:

$$B_{max} - B_{min}, \quad (1)$$

where B_{max} is the maximum value of a specific indicator, and B_{min} is the minimum.

– Setting the interval value — D:

$$D = \frac{(B_{max} - B_{min})}{k}, \quad (2)$$

where k is the number of intervals,

$$k = p - 1, \quad (3)$$

where p is the number of objects that participate in the comparative analysis.

– We can find the value of each indicator (F) for each territorial system — F_n:

$$F_n = \frac{(B_{max} - B_{min})}{k} + 1, \quad (4)$$

The resulting score of economic security indicators is found by adding each of the ten components:

$$РБ = F1 + F2 + F3 + F4 + F5 + F6 + F7 + F8 + F9 + F10, \quad (5),$$

$$КБ = F1 + F2 + F3 + F4 + F5 + F6 + F7 + F8 + F9 + F10,$$

where $F1$ is the value of GRP per capita (thousands of rubles); $F2$ is investments in fixed assets per capita (thousands of rubles); $F3$ is the monetary income of the population per capita (thousands of rubles); $F4$ is the population with incomes below the subsistence minimum (%); $F5$ is the unemployment rate (%); $F6$ is retail trade turnover (thousands of rubles); $F7$ is household spending on housing and communal services (% of total consumer spending); $F8$ is the commissioning of residential buildings (per 1000 people, m2); $F9$ is volume of pollutants released into the atmospheric air (thousands of tons); $F10$ — population per doctor (person).

The choice of indicators is a key point in assessing the level of economic security. On the one hand, each of the selected indicators should reflect the state in a particular area of economic activity, and on the other hand, be representative, that is, objective, and at the same time easy to interpret. The basic one is the so-called gross regional product, which not only reflects the real level of development of a particular region, but also gives a total cost estimate of the goods produced and services rendered. The unit of measurement is thousands of rubles per capita. Another indicator — "Investments in fixed assets", reflects the

total amount of costs that are aimed at incrementing the cost of fixed assets. This may be the purchase of new machinery and equipment, including as part of the modernization and/or expansion of production, software, as well as other elements of intellectual property.

Monetary income of the population per capita is a generalized value reflecting the average income of 1 person, in this case for a month. It is calculated as the sum of all incomes of the population of the region divided by the total number of residents of the region. Despite the unequal number of pensioners, workers, children and other categories of the population from region to region, this indicator allows us to compare the average per capita income of the population between regions of the same group — the Arctic coastal zone of the Russian Federation.

The next indicator — "population with incomes below the subsistence minimum" — provides information in percentage terms about what part of the population has incomes below the required level, which is defined by the state as the minimum. This indicator allows us to determine which part of the population of a particular region is below the so-called poverty line.

Unemployment rate: this indicator reflects what part of the working-age population is currently unemployed for one reason or another, but is actively looking for work. We can say that this indicator indirectly characterizes the efforts of regional authorities to create new jobs.

The indicator — "retail trade turnover" — is the amount of money received from sale of goods to the population, both for personal needs and for use in the household. At the same time, the proceeds received from the sale of goods to individual entrepreneurs and legal entities are not taken into account in the retail turnover, as well as the turnover of public catering is not accounted.

The next indicator — "household expenditures on housing and communal services"– is the amount of money spent by an individual family each month to pay for housing and communal services — electricity, cold and hot water, heating, garbage collection, maintenance and repair. In this case, it is % of the total family spending on consumer needs. At the same time, consumer spending refers to all family's expenses for the purchase of goods and services, with the exception of those funds that were used to purchase certain categories of goods, such as jewelry, works of art, etc. This indicator allows us to estimate how large is the share of compulsory payments in the total consumer spending of the region's population.

The indicator "commissioning of residential buildings (m2 per 1,000 people)" represents the volume of residential space commissioned per 1,000 people. The higher the value of this indicator, the more attractive the region is for the population. It indirectly characterizes the capabilities of the construction industry and reflects the current socio-economic situation in a particular region.

The indicator "volume of pollutants released into the atmospheric air" characterizes the volume of emissions of pollutants that have a negative impact on human health and the environment released into the atmospheric air, the unit of measurement is thousands of tons.

The indicator "population per doctor" is calculated as the ratio of the total number of doctors to the average annual population of the region. This indicator characterizes the availability of doctors to the population of a particular region.

Further, with the help of expert evaluation, the significance of each of the indicators — fn — is determined. Thus,

Table 1

Ranking of regions by criteria of economic security [2]

Region	F1 Th. R. M/B	F2 Th. R. M/B	F3 Th. R. M/B	F4 % M/B	F5 % M/B	F6 Th. R. M/B	F7 % M/B	F8 m² M/B	F9 Th. tons M/B	F10 People M/B	Scores	Posi-tion
Murmansk Region	828.4 6/7.68	230.1 5/7.49	44.2 5/6.23	10.6 4/3.87	5.4 4/3.87	240.4 3/3.51	13 8/8.00	60 7/7.58	231 5 / 1.62	193 6/7.20	58.26	6
Arkhangelsk Region	509.9 8/8.00	85.8 7/7.97	33.9 6/7.6	12.7 5/5.08	6.2 5/6.02	240.2 4/3.53	8.8 2/1.88	294 5/4.68	137 4/1.35	179.7 4/5.58	51.68	5
Republic Of Karelia	527.8 7/7.98	78.2 8/8.00	30.9 8/8.00	15.7 6/6.80	7.4 7/7.42	209.6 7/7.08	10.1 4/3.77	450 3/2.75	122 3/1.30	193.3 5/7.19	60.29	7
Republic Of Sakha (Yakutia)	1258.7 4/7.25	393.1 4/6.95	45.5 4/6.05	17.8 8/8.00	6.9 6/6.83	254.7 2/1.85	9.7 3/3.19	580 2/1.14	288 6/1.78	162.4 2/3.54	46.58	4
Nenets Autonomous District	7530.5 1/1.00	2176.3 1/1.00	81 3/1.32	9.4 3/3.18	7.9 8/8.00	223.6 5/5.46	10.1 4/3.77	430 4/2.99	67 2/1.14	194.3 7/7.30	35.17	2
Yamalo-Nenets Autonomous District	5710.5 2/2.81	1592.3 2/2.95	83.1 2/1.04	5.6 1/1.00	1.9 1/1.00	262 1/1.00	8.2 1/1.00	268 6/5.00	763 7/3.16	176.3 3/5.18	24.14	1
Krasnoyarsk Territory	938.0 5/7.57	148.6 6/7.77	31.7 7/7.89	17.3 7/7.72	4.5 3/4.03	201.7 8/8.00	11.9 7/6.40	591 1/1.00	2432 8/8.00	200.2 8/8.00	66.38	8
Chukotka Autonomous District	1898.6 3/6.61	518.4 3/6.53	83.4 1/1.00	8.5 2/2.67	3.8 2/3.22	209.9 6/7.05	11.4 6/5.67	26 8/8.00	18 1/1.00	140.9 1/1.00	42.74	3

Table 2

Ranking of regions by economic security indicators

	Z(F1-F3) = 3			Z(F4-F6) = 2			Z(F7-F10) = 1					
	F1 f1 = = 1.0	F2 f2 = = 0.69	F3 f3 = = 0.8	F4 f4 = = 0.56	F5 f5 = = 0.51	F6 f6 = = 0.46	F7 f7 = = 0.24	F8 f8 = = 0.2	F9 f9 = = 0.16	F10 f10 = = 0.38	Gint	Posi-tion
Murmansk Region	7.68	5.17	4.98	2.17	2.59	1.61	1.92	1.52	0.26	2.74	15.57	VI
Arkhangelsk Region	8	5.50	6.08	2.85	3.07	1.62	0.45	0.94	0.22	2.12	14.03	V
Republic Of Karelia	7.98	5.52	6.4	3.81	3.78	3.26	0.91	0.55	0.21	2.73	16.46	VII
Republic Of Sakha (Yakutia)	7.25	4.80	4.84	4.48	3.49	0.85	0.77	0.23	0.29	1.34	12.67	IV
Nenets Autonomous District	1	0.69	1.06	1.78	4.08	2.51	0.91	0.60	0.18	2.78	9.58	II
Yamalo-Nenets Autonomous District	2.81	2.03	0.83	0.56	0.51	0.46	0.24	1.00	0.51	1.97	6.38	I
Krasnoyarsk Territory	7.57	5.36	6.32	4.33	2.06	3.68	1.54	0.2	1.28	3.04	17.52	VIII
Chukotka Autonomous District	6.62	4.51	0.8	1.49	1.64	3.24	1.36	1.6	0.16	0.38	10.67	III

the most significant indicator was *F*1 — the value of GRP per capita — 1.0, and the least significant — *F*9 — the volume of pollutants released into the atmosphere (thousand tons) — 0.16. Further, *F*2 — investments in fixed assets per capita — 0.69; *F*3 — monetary income per capita — 0.8; *F*4 — population with incomes below the subsistence minimum — 0.56; *F*5 — unemployment rate — 0.51; *F*6 — retail trade turnover — 0.46; *F*7 — household spending on housing and communal services — 0.24; *F*8 — commissioning of residential buildings — 0.2; *F*10 — population per doctor — 0.38.

The G ranking for each region is determined within the significance of each of the levels of indicators:

$$Gi = \sum_{p-1}^{k} Fn\, f / z, \qquad (6)$$

where z is the significance of the points.

At the same time, the integral ranking is determined by the formula:

$$G\text{int} = \sum_{i=1}^{a} Gi. \qquad (7)$$

The sum of all indicator rankings gives the final indicator of the economic situation of territorial systems, relative to each other, based on ten components (values of 10 economic indicators).

Tables 1 and 2 provide calculations and data on the economic situation of the Arctic coastal regions. The Yamalo-Nenets Autonomous District has the highest level of economic security, followed by the Nenets and Chukotka Autonomous Districts.

The data presented in the tables show that the Yamalo-Nenets Autonomous District, like the Chukotka Autonomous District, are among the top three in all groups of indicators, while the Nenets Autonomous District is the undisputed leader only in the first group of indicators. This group includes such indicators as — "GRP", "investments in fixed assets" and "monetary incomes of the population", all indicators are given per capita. At the same time, this region is characterized by the highest unemployment and extremely low provision of the population with doctors.

The obvious outsiders are the Krasnoyarsk territory — the eighth place, and the Republic of Karelia — the seventh place. At the same time, the Krasnoyarsk Territory took the last place among all the coastal Arctic regions, when assessing such indicators as "retail trade turnover", "emissions of pollutants into the atmosphere" and "provision of the population with doctors". Also extremely low values were noted for such economic indicators as "the number of people with incomes below the subsistence minimum" (seventh place) and "per capita monetary incomes of the population" (seventh place). The positions of the Republic of Karelia were also extremely weak –seventh place when assessing such an indicator as "GRP per capita", eighth place — "investments in fixed assets", "monetary incomes of the population per capita" — also eighth place, "unemployment rate" — seventh place, "retail trade turnover" — seventh place.

3. Conclusions

Based on the above, a number of conclusions can be drawn:

1. Despite the significant number of scientific articles and monographs devoted to topical issues of regional environmental and economic security , there is a certain gap in the issues of comparative analysis of security between regions.

2. The choice of indicators is a key point in assessing the level of environmental and economic security. On the one hand, each of the selected indicators should reflect the state in a particular area of

economic activity, on the other hand, be representative, that is, objective, and at the same time easy to interpret. At the same time, the simultaneous use of indicators characterizing the environmental and economic components of regional security is an effective method of obtaining consolidated information about the development of the regions.

3. The comparative analysis carried out within the framework of the study showed that among all the territorial systems referred to the coastal Arctic regions, — Nenets, Chukotka and Yamalo-Nenets Autonomous Districts have the highest level of environmental and economic security. Krasnoyarsk Territory and the Republic of Karelia are the outsiders.

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