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Fundamentals of Economic and Environmental Security of the Region

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Abstract

The article focuses on assessing the level of economic development of the region under investigation, the state of environmental [=ecological] security in the region, identifying its problems and providing recommendations for their elimination. The authors explore the theoretical aspects of economic and environmental security of the region, presenting the analysis of the economic development level of the region and the state of its environment. The research results revealed that the region under investigation has a pronounced imbalance between the level of socio-economic development and the environmental condition of the territory. These conclusions were obtained following the assessment of the ecological and economic security of the region on the basis of statistical indicators reflecting three directions of its development – the level of achieved economic development, social development and environmental condition. The low level of economic and production potential entails deterioration of social development indicators. A number of recommendations for improving the economic and environmental security of the region in the modern conditions have been proposed, based on the systemic-character imbalance between the subsystems "nature" and "economy". It is proposed to strengthen the economic potential by stimulating production, while allowing certain deterioration of the ecological component – not below the average Russian level. For this purpose, it is necessary to introduce the compensating mechanisms for the ecology, to be used in the development of new technologies, forestry stock and water resources.

Keywords: *economic development of the region, economic and environmental security, compensating mechanisms.*

Introduction

The stability of the Altai Republic economy, the quality and standards of people's living, the development of activity spheres depend on the state of the environment (ecology). Therefore, these two concepts – "economy" and "ecology" – are of key importance, engendering the need to ensure economic and environmental protection of the region.

The mechanism for ensuring economic and environmental security includes the following components:

- scientific research of this area;
- legal support of economic and environmental security;
- governmental bodies' activities aimed at ensuring economic and

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environmental security at the regional level;

– regular control of the economic system's status aimed at finding and eliminating any threats to economic and environmental security.

The goal of the present study is to examine the level of economic development of the Altai Republic, the state of environmental security in the region, to identify its problems and develop practical recommendations for their solution.

The following targets were outlined within the framework of the goal:

– to investigate the concept and mechanisms required for the realisation of economic and environmental security;

– to characterise the state of environmental security in the Russian Federation and in the Altai Republic;

– to describe the level of economic development of the Altai Republic taking into account the state of the environment;

– to identify the causes of environmental security problems and provide recommendations for their elimination.

The object of the study is the economic and environmental security in the Altai Republic; the subject of the study is the economy and ecology of the region as two interconnected concepts, as well as the mechanisms to provide economic and environmental security.

The information basis of the study is represented by the data provided by the Russian Federal State Statistics Service; information and analytical reports on the socio-economic development of the Altai Republic provided by the Ministry of Economic Development of the Altai Republic; strategic planning documents adopted for the Altai Republic and the Russian Federation; the Report on the state of ecology and environmental protection in the Altai Republic compiled by the Ministry of natural resources, ecology and tourism of the Altai Republic.

Materials and methods

Ecology, in translation from Greek, means "ekos – dwelling, place of residence", "logos – teaching". In common parlance and in this study, ecology will be understood as the state of environment.

Economics deals with economic laws of the society, e.g. how people buy and sell goods and services, why some countries are richer than others, etc. Ecology as a science investigates, as an object of the study, the relations of living organisms among themselves in interaction with the environment.

Economic security is the state of defending the national economy against internal and external threats.

Ecological security is the condition when the ecosystems and the population are secured from threats of natural and human-induced disasters and from anthropogenic impact. Environmental security intends to ensure due human life activity and contribute to sustainable state of the ecosystem (Environmental safety, 2023).

A.I. Muravykh (2015) suggests that economic and environmental security of a region should be understood as "the state of security (protection) of economic entities, natural environment, vital interests of the society from threats that arise during the relations involving the use of natural resources and preservation of natural environment".

The concept of "environmental security" is used at different levels of economy and in relation to different objects. It is possible to distinguish environmental security at the global level, national level, level of a region or municipality, or the same in relation to an enterprise or technology. The present study addresses the issues of environmental security at the regional level.

The modern concept of environmental security is explored at several levels: local, regional and global (Khoruzhy & Vyruchaeva, 2013).

V.Yu. Turanin and Tonkov E.E. (2015) believes that "the regional level of environmental security encompasses large economic or geographical zones, and in some cases – the territories of several states (the European Union, CIS). The management and control is exercised at the level of the country's government and interstate relations".

L.G. Klyukanova (2017) notes that "the comprehensive approach to the development of modern environmental policy of the Russian Federation (external and internal) involves a workout of a multifaceted and multi-aspect concept of ecological and legal regulation aimed at improving the quality of life of individuals and the society as well as the quality of the environment towards meeting the priorities of sustainable development and environmental security as an important segment of the national security of Russia".

According to A.M. Godin, "in order to achieve the goal of environmental security management both at the regional and global level, it is necessary to comply with the principle of transferring information about the state of environment from local to regional and global centres" (Godin, 2012).

Undoubtedly, sustainable development of the society requires environmental security. In the current conditions, when the natural environment is subject to strong anthropogenic load which depletes the natural resources, many regions of Russia are facing aggravated socio-ecological problems. At present, this is typical of large industrial centres in charge of a high level of pollution of the external natural environment (Khoruzhy et al., 2022, 2023).

Currently, the scholars are using the concepts of rational and irrational use of natural resources; however, no unambiguous definitions for these concepts have been worked out.

Rational nature management is one of the crucial concepts for ensuring economic and environmental security and for preserving the socio-environmental conditions for reliable development of a region; it represents a system of economic relations aimed at achieving and intensifying the efficient and integrated use of natural resources (Pogosyan, 2021a).

In case of inefficient environmental management, no security and protection of the economic and environmental potential is ensured. Irrational use of natural resources can lead to environmental crises (Dudukalov et al., 2022; Gabdulkhakov et al., 2021; Golovina et al., 2022). Irrational use of natural resources entails many negative processes of anthropogenic impact on the environment, such as extinction of some species of plants and animals, destruction of the natural landscape, pollution of the environment, disruption of links between the ecosystem objects, etc.

The catastrophic changes occurring in the human environment result in the problem of ensuring environmental security. Any region has its own individual concept of environmental security developed on the basis of exploring the environmental situation, its prognostication and identifying more dangerous sources of threat to environmental security as well as the regional social and natural features. In connection with the above, every region forms its own system of principles guiding environmental security (Movchan et al., 2022).

The concepts of economic growth and environmental security are interrelated. The proportional combination of these two processes can ensure a balance between human activity and nature. With the development of the scientific and technological progress and significant anthropogenic impact on natural environment in the 20th century, the issue of

general prospects of human survival was raised in connection with the global ecological crisis. Since the second half of the 20th century, the scholars developed an industrial ecology philosophy designed to reduce the existing load on natural resources (Karakeyan and Ryabyshenkov, 2003).

In the 1960s-1970s, nature management economics began to take shape as a science. The need to address such complex socio-economic issues as meeting the needs of the future and current generations in clean and life-bearing natural environment served as a basis for the emergence of environmental economics.

The whole process of ensuring the security of the two spheres simultaneously – "economy" and "ecology" – should be based on a long-term relationship between the socio-economic and industrial-technological spheres of a region. Their balanced evolvement creates a due condition for long-term sustainable development. The term 'relations' is treated as material and non-material relations between the regional flora and fauna, water and forest resources, soil and climatic conditions, enterprises, the administrative and managerial sphere and the population (Yakovleva et al., 2022).

The criterion of economic and environmental security serves to be an indicator of the state of economy and ecology, including social welfare of the population (Pogosyan, 2021b,c). The criteria reflect the essence of economic and environmental security. A flexible approach to adjusting and realising the criteria in accordance with changing environmental conditions and management structures is always important.

The security parameters (indicators) determine the extent of protection from external and internal threats and are characterised in quantitative terms. The system based on criteria and parameters (indicators) is the ground for the development and realisation of the strategy for economic and environmental security.

The economic and ecological security criteria of a region can be divided into three main types: economic, social, environmental.

Let us consider each of them. Economic criteria determine the level of economic development of a region, while social criteria determine the level of welfare of the population. Ecological criteria are used to assess the natural environment of a region.

The economic criteria include the following indicators:

- gross regional product (GRP),
- volume of investments in fixed capital,
- production of agricultural output,
- production of industrial output.

The social criteria include the following indicators:

- average per capita income,
- unemployment rate,
- average salary,
- volume of paid services to the population,

The environmental criteria include the following indicators:

- emissions of pollutants into the atmospheric air,
- maximum allowable concentration,

– amount of greenhouse gas emissions,

– necessary amount of drinking water.

By examining the indicators according to these criteria, it is possible to conclude whether the region is better secured in environmental or economic aspect.

The criteria for some ecological systems may be represented by safety, integrity and specifics their interrelations. Certain individuals may deem preservation of living standards and health conditions to be the criteria of safety (Akimova, 2019).

The most important indicator of economic security is the GRP (gross regional product). It also belongs to the category of macroeconomic indicators and includes newly created products and services within a year, those produced within a region with the use of all production factors managed by the region owners (Ilyukhina & Fedotova, 2020).

The solution of economic and environmental security problems is the responsibility of public authorities, mainly the administration of a municipality, i.e. they are supposed to ensure economic and ecological safety. The mechanism may imply transition of the economy from one status to another, when the needs of the population are efficiently met.

The region and its organisations need innovations, i.e. launch of innovative development management process. The actual procedure in this case begins with analysing or diagnosing the state of innovative development of the Altai Republic territory. The predominant role in management is given to economic and environmental security.

The step-by-step methods to ensure economic and environmental security are divided into 4 blocks:

– goal-setting and statement of problems to be solved;

– mathematical substantiation of financial and material support for the assigned activities;

– the ways to handle the objectives set by the research;

– evaluation of the project progress and efficiency in terms of indicators.

The activities of technical, biological, chemical and nuclear production facilities are the main source of environmental threat. Potential environmental damage is also caused by hydraulic structures and transport vehicles.

Results

The core of the Altai Republic economy is represented by tourism, some branches of agriculture (mainly animal husbandry), timber harvesting and wood processing, partially pharmaceuticals (production of medicinal herbs and plants) and beekeeping. It has also enterprises producing construction materials; non-ferrous and extractive metallurgy; alternative energy facilities.

The factors of economic development of the Altai Republic include natural resources, human capital, production capital and infrastructure.

Due to the climatic features and unique nature (with regard for the clean environment), tourism is the best developed sphere. In recent years, the Altai Republic has been visited by up to 2.5 million tourists annually. The main type of recreation is summer ecological tourism, cultural and educational travel with visits to natural, cultural and historical sites; water activities and mountaineering, rafting, etc. Ski tourism is also developed in winter.

The economy of the Altai Republic will be assessed herein by economic and social criteria, such as the gross regional product (GRP), investments in fixed capital, agricultural and industrial production, unemployment rate, average per capita income of the population, average monthly nominal wages and volume of paid services to the population.

To begin the analysis, a review of the main socio-economic indicators of the Altai Republic achieved in 2022 (January-August) should be presented (table 1).

Table 1. Key economic and social indicators Altai republic (January – August 2022 vs. January – August 2021)

<table>
<tr><td colspan="2">Economic situation</td><td>Social sphere</td></tr>
<tr><td>Industrial production
index
94.9%</td><td>Agricultural production
101.4%</td><td>Employee’s average monthly salary
nominal 113.8 %
real 96.9%

July 2022
vs. July 2021</td></tr>
<tr><td>Scope of work and services performed by parameter “Construction”
147.2%</td><td>Commissioning of residential buildings
133.2%</td><td>Overdue wage arrears (as of the beginning of the month)
September 2022
vs. August 2022

absent</td></tr>
<tr><td>Passenger transportation by public motor vehicles
91.4%</td><td>Turnover retail trade
100.2%</td><td>Average number of employees (without external part-timers)
July 2022
vs. July 2021
99.8%</td></tr>
<tr><td>Scope of paid services to the population
105.7%</td><td>Public catering turnover
110.2%</td><td>Number of officially registered unemployed (by the end of period)

August 2022
vs. August 2021
69.0%</td></tr>
<tr><td colspan="2">Consumer price index
August 2022
vs. December 2021

112.6%</td><td>
August 2022
vs. July 2021

100.1%</td></tr>
</table>

Source: Main indicators of socio-economic development of the Altai Republic for the period January – August 2022 (Altai Statistics Committee data)

The volume of paid services to the population, turnover of retail trade and public catering, commissioning of residential buildings, scope of construction and agricultural output increased over the period compared to the same period of 2021. The nominal average monthly wages increased, while the real wages, on the contrary, fell. The industrial production index, passenger transportation volume and average number of employees decreased.

The analysis of the current situation makes it possible to basically assess the consequences of the 2022 crisis that commenced in 2020 for the regional economy.

In order to evaluate the ecological and economic condition of the region, it is necessary to consider the indicators registered within several years, since ecological and economic security is formed mainly in the long-term and medium-term periods. Let us consider the GRP of the Altai Republic for the period 2016-2020 (Table 2, Fig. 1).

Table 2 – GRP dynamics in the Altai Republic in current prices within the period 2016-2020.

Indicators:	2016	2017	2018	2019	2020
GRP, million rubles	44 264.7	44 897.9	54 069.4	57 064.0	62 520.3
Growth rate against the previous year, %	0.2	1.4	20.4	5.5	9.6

The data are presented for the end of the year. They show the growth of the nominal GRP with an average annual increment rate of 7%. This increment is due to both the inflationary processes and the increased physical volume of manufactured products and provided services.

The second important indicator is the GRP structure since it shows the regional specialisation; using it, one can estimate the production potential rate.

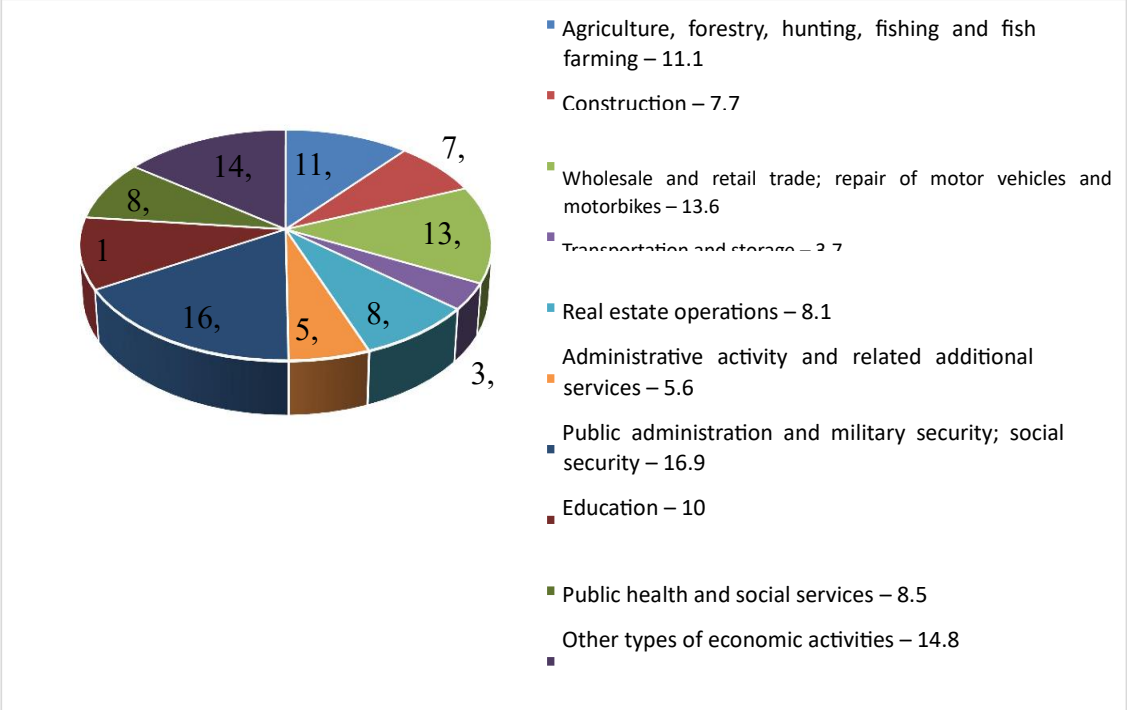

Figure 1 – Structure of GRP in current basic prices of the Altai Republic as of 01.01.2022 (according to Altai Statistics Committee)

The GRP structure shows that the economy has a low production potential, since the production sectors (agriculture, construction) account for only 18.8%; industry accounts for less than 3% of the GRP and is included in other activities.

Let us compare the GRP of the Altai Republic with the same figures in two subjects of the Siberian Federal District – Novosibirsk region and Kemerovo region. These regions were chosen for comparison because they are territorially close to the Altai Republic, but at the same time they have a significant industrial potential (Table 3).

Table 3 – Comparison of the Altai Republic GRP with the GRP of Novosibirsk and Kemerovo regions

Region	Gross regional product, million rubles						Growth rate in 2020 vs. 2005, %
	2005	2010	2015	2018	2019	2020	
Altai Republic	8,805.8	22,393.7	42,165.7	54,069.4	57,064.0	6,2520.3	589.3
Kemerovo region	295,378.4	625,914.9	843,345.4	1,266,424.5	1,110,194.8	1,038,086.7	251.4
Novosibirsk region	235,381.8	484,141.3	1,021,642.9	1,301,631.1	1,332,895.8	1,356,861.5	476.5

The Altai Republic showed the highest GRP growth rate among the three neighbouring regions, with no decline in GRP since 2005. The other regions, on the contrary, show a decline in the GRP since 2019. In this aspect, the economic situation in the Altai Republic has advantages. The low GRP in the Altai Republic compared to other regions is explained by the low population base and insignificant number of enterprises.

The second criterion for assessing economic security is investments in fixed capital (Table 4).

Table 4 – Investments in fixed capital in the Altai Republic

Year	2017	2018.	2019.	2020	2021
Investments, million rubles	12,450	14,783	21,027	13,989	15,233
Growth rate against the previous year, %	-0.9	18.7	42.2	-33.5	8.9

Data provided by the Russian Federal State Statistics Service https://rosstat.gov.ru/storage/mediabank/Region_Pokaz_2022.pdf

A total of 35.2 % in the volume of investments in fixed assets was represented by own funds, and 64.8 % – by borrowed funds. The total volume of financial investments amounted to 260,297 million rubles (Table 5).

Table 5 – Investments in fixed capital in the Altai Republic as compared with Novosibirsk and Kemerovo regions

Region	Investments in fixed capital, million rubles						Growth rate in 2020 vs. 2005, %
	2005	2010	2015	2019	2020	2021	
Altai Republic	2,914	9,522	12,185	21,027	13,989	15,233	422.8
Kemerovo region	80,315	156,519	170,470	288,407	275,045	321,598	300.4
Novosibirsk region	36,829	115,015	164,440	247,429	265,706	297,874	708.8

Data provided by the Russian Federal State Statistics Service https://rosstat.gov.ru/storage/mediabank/Region_Pokaz_2022.pdf

In 2020, the volume of investments in fixed assets decreased by 39% compared to 2019. Novosibirsk region did not show any decrease in the volume of investments. In general, the Altai Republic showed a mid-level increase in fixed capital investment since 2005 compared to the other regions.

The third significant evaluation criterion is the agricultural production volume. This indicator was chosen due to the specialisation of the region. The production potential is formed largely due to the development of agriculture (Tables 6, 7).

Table 6 – Agricultural production volume in the Altai Republic

Year	2017	2018	2019	2020	2021
Agricultural production, million rubles	13,183	11,700	10,646	11,930	13,129
Growth rate against the previous year, %	4.8	-11.3	-9	12.1	10.1

Data provided by the Russian Federal State Statistics Service https://rosstat.gov.ru/storage/mediabank/Region_Pokaz_2022.pdf

Table 7 – Comparison of agricultural output by region

Region	Volume of agricultural production, million rubles						Growth rate in 2020 vs. 2005, %
	2005	2010	2015	2019	2020	2021	
Altai Republic	3,057	6,080	9,522	10,646	11,930	13,129	329.4%
Kemerovo region	16,148	31,881	48,464	47,807	60,589	80,285	397.1%
Novosibirsk region	27,027	47,695	75,229	92,988	106,302	148,713	450.2%

Data provided by the Russian Federal State Statistics Service https://rosstat.gov.ru/storage/mediabank/Region_Pokaz_2022.pdf

The highest agricultural output growth rate was shown by the other regions. On the downside, one can note that the Altai Republic demonstrated a decline in the volume of agricultural production from 2018 to 2019. In 2021, the Altai Republic ranked 70th in the overall agricultural production rating of the Russian Federation; Kemerovo region's ranking was 32, Novosibirsk region – 18.

Although the industry in the Altai Republic is in fact poorly developed it is still impossible to fully assess the level of environmental security without evaluating the industrial production output. The indicator assessing industrial production is the volume of domestically produced shipped goods, performed work and rendered services with the use of own resources in the industrial production sphere of the Altai Republic (Table 8).

Table 8 – Volume of domestically produced shipped goods, performed work and rendered services with the use of own resources in the industrial production sphere of the Altai Republic

Year	2017	2018	2019	2020	2021
Million roubles	11,766.4	9,699.8	8,057.0	8,711.7	9,070.4
Growth rate against the previous year, %	13.2	-17.6	-16.9	8.1	4.1

Data provided by the Russian Federal State Statistics Service https://rosstat.gov.ru/storage/mediabank/Region_Pokaz_2022.pdf

Most of the produced items are foodstuffs since their supply is related to processing of home-grown agricultural products. But the share of metallurgy is quite high (gold mining at "Vesely" mine in Choysky district); in addition, repair industries are an obligatory element of industrial production in all regions, being active even in the regions with a low industrial production level (Figure 3).

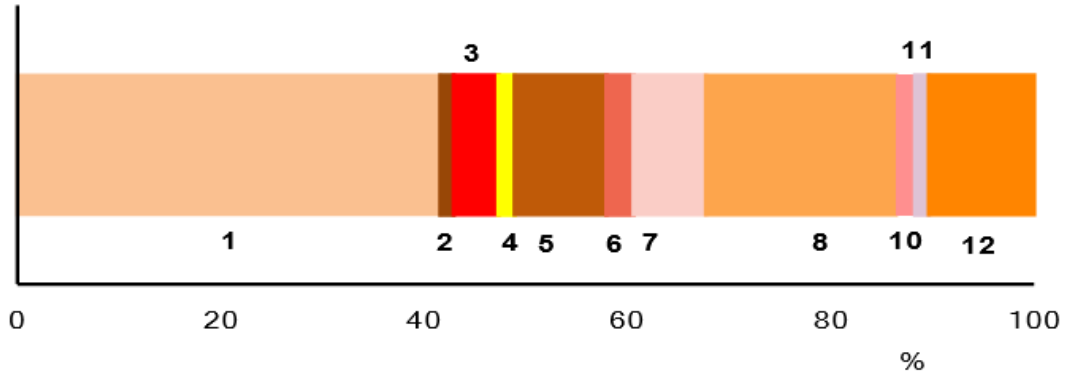

Figure 3 – Volume of domestically produced shipped goods, performed work and rendered services with the use of manufacturing industries' own resources by type of economic activity in the Altai Republic in 2020

1 – Production of foodstuffs; production of beverages; production of tobacco items (45.6%)

2 – Production of textiles; production of clothing; production of leather and leather goods (0.3%)

3 – Wood processing and production of wood and cork items, except furniture, production of straw-work items and weaving materials (4.4%)

4 – Production of paper and paper goods; printing and recorded media reproduction (0.6%)

5 – Production of coke and petroleum products; production of rubber and plastic items (9.0%)

6 – Production of chemicals and chemical materials; production of medications and materials used for medical purposes (2.7%)

7– Production of other non-metallic mineral products (7.1%)

8 – Metallurgical production; production of finished metallurgical items, except machinery and equipment (18.7%)

9 – Production of computers, electronic and optical articles; production of electrical equipment (0.0%)

10 – Production of machinery and equipment not included in other groups; production of motor vehicles, trailers and semi-trailers; production of other vehicles and equipment (0.9%)

11 – Production of furniture; production of other finished goods (0.3%)

12 – Repair and assembly of machinery and equipment (10.4%)

The Table 9 data show that the industrial output growth rate h decreased in the Altai Republic since 2017. Meanwhile, the other regions show a significant growth of this indicator. Thus the economy of the region under consideration is lagging behind in this sphere.

Table 9 – Industrial output in the regions

Region	Volume of domestically produced shipped goods, performed work and rendered services with the use of own resources in the industrial production sphere, million rubles					
	2017	2018	2019	2020	2021	Growth rate in 2021 vs. 2017, %
Altai Republic	11,766.4	9,699.8	8,057.0	8,711.7	9,070.4	-22.9
Kemerovo region	1,558,761	1,866,403	1,728,654	1,553,246	2,559,241	64.2
Novosibirsk region	587,220	703,302	719,745	750,004	911,090	55.2

Data provided by the Russian Federal State Statistics Service https://rosstat.gov.ru/storage/mediabank/Region_Pokaz_2022.pdf

The increase in industrial production is closely connected with the intensified exploitation of other minerals (breakstone, sand, gravel) by 67.4% compared to 2020, as well as the activated production of dairy products by 1.5%, bakery and flour confectionery by 24.4%, ready-mix concrete by 34.4% and electricity by 5.6%.

The second block of criteria assessing environmental and economic security is represented by social indicators as they reflect the results of the socio-economic development of the region. The social criteria, as treated by the authors, include such criteria as unemployment rate, average per capita income, volume of paid services to the population.

First, let us consider the unemployment rate in the Altai Republic, its dynamics, and compare it with other regions (Table 10).

Table 10 – Unemployment rate in the Altai Republic

Year	2017	2018	2019	2020	2021
Unemployment rate, %	11.9	11.2	11.0	14.0	12.0
Growth rate against the previous year, %	-1.65	-5.9	-1.8	27.7	-14.3

Data provided by the Russian Federal State Statistics Service https://rosstat.gov.ru/storage/mediabank/Region_Pokaz_2022.pdf

Every year, except 2020, the unemployment rate was falling, evidencing the positive trends in the social development of the region. The exception is the surge in unemployment in 2020 due to the COVID-19 pandemic. At that period the unemployment benefit increased as part of the anti-crisis measures, but in 2021 the benefit returned to the previous level, and the unemployment fell almost to the level of 2017. However, it should be noted that the overall unemployment rate of 12 % is quite high for the region (Table 11).

Table 11 – Unemployment rate in the Altai Republic compared to Novosibirsk and Kemerovo regions

Region	Unemployment rate in % / year					
	2017	2018	2019	2020	2021	Growth rate in 2021 vs. 2017, %
Altai Republic	11.9	11.2	11.0	14.0	12.0	1
Kemerovo region	7.1	6.1	5.5	6.7	5.4	-24
Novosibirsk region	6.0	6.7	6.4	7.0	6.6	10

Data provided by the Russian Federal State Statistics Service https://rosstat.gov.ru/storage/mediabank/Region_Pokaz_2022.pdf

The unemployment rate in the Altai Republic as of 2017 – 2021 is considered to be high (2-4% – low, 4-5% – normal, above 7% – high). As one can see, Novosibirsk and Kemerovo regions show mid-level unemployment rates. In general, the high unemployment rate above 7% points to economic recession. According to the Table 12 data, one can see a yearly growth of Altai Republic residents' average per capita income.

Table 12 – Average per capita income in the Altai Republic

Year	2017	2018	2019	2020	2021
Average per capita income per month, rubles	18,411	19,503	20,256	21,683	23,798
Growth rate against the previous year, %	3.2	5.9	3.9	7	9.8

Data provided by the Russian Federal State Statistics Service https://rosstat.gov.ru/storage/mediabank/Region_Pokaz_2022.pdf

But the area lags behind the other regions by this indicator, occupying the 83rd place in the list of 85 Russian Federation entities (Table 13).

Table 13 – Comparison of average per capita income of population in the Altai Republic with that of the other two regions

Region	Average per capita income per month, rubles					
	2017	2018	2019	2020	2021	Growth rate in 2021 vs. 2017, %
Altai Republic	18,411	19,503	20,256	21,683	23,798	29.3
Kemerovo region	21,910	23,175	24,890	25,441	28,048	28
Novosibirsk region	27,698	28,871	30,566	31,606	35,261	27.3

Data provided by the Russian Federal State Statistics Service https://rosstat.gov.ru/storage/mediabank/Region_Pokaz_2022.pdf

Despite the fact that the level of average per capita income in the other regions is higher, the Altai Republic showed the highest growth rate in average per capita income. This can be connected with social transfers for low-income regions in the form of unemployment benefits, social support of multi-child families and the targeted Altai Republic development programme for the period 2020 – 2024 (Table 14).

Table 14 – Average monthly nominal wages in the Altai Republic

Year	2017	2018	2019	2020	2021
Average monthly nominal wages, rubles	26,316	30,953	33,387	36,269	39,806
Growth rate against the previous year, %	4.9	17.62	7.9	8.6	9.8

Data provided by the Russian Federal State Statistics Service https://rosstat.gov.ru/storage/mediabank/Region_Pokaz_2022.pdf

Let us consider the monetary income structure of the Altai Republic population. The monetary income structure makes it possible to determine the share of factor and non-factor incomes; respectively, this will provide information about the use of production factors and the level of participation of the population in generating income. The share of social payments is 1/3 of the total income of the population (Figure 4).

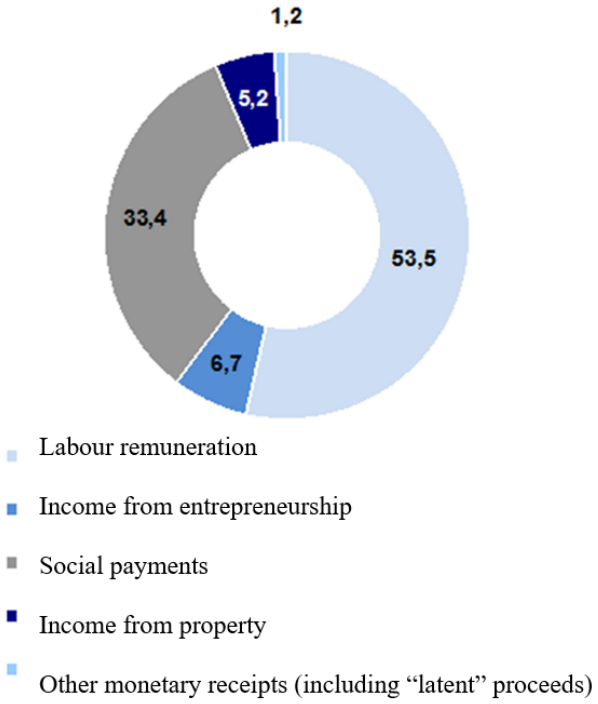

Figure 4 – Structure of monetary income of the Altai Republic population (in % of the total monetary income of the population)

The comparison of the average monthly nominal wages with salaries in Novosibirsk and Kemerovo regions shows that the analysed region is lagging behind the other industrially developed regions (Table 15).

Table 15 – Comparison of average monthly nominal average wages of the Altai Republic population with salaries in Novosibirsk and Kemerovo regions

Region	Average monthly nominal wages, rubles					
	2017	2018	2019	2020	2021	Growth rate in 2021 vs. 2017, %
Altai Republic	26,316	30,953	33,387	36,269	39,806	51.3
Kemerovo region	32,645	37,478	41,770	43,429	48,313	48
Novosibirsk region	32,287	34,570	39,076	41,534	46,167	43

Data provided by the Russian Federal State Statistics Service https://rosstat.gov.ru/storage/mediabank/Region_Pokaz_2022.pdf

As one can see, the average monthly nominal wages in the Altai Republic grew faster from 2017 to 2021 than in the other two regions. The average wages in the Altai Republic in 2021 were 30.5% lower than the average for the whole of Russia (57,244 rubles according to 2021data).

Another indicator is the volume of paid services; it indicates at the service consumption level; the high share of such services in consumption is evident of the post-industrial development of the region (Table 16).

Table 16 – Volume of paid services to the population of the Altai Republic as compared with Novosibirsk and Kemerovo regions

Region	Volume of paid services to the population, million rubles					
	2017	2018	2019	2020	2021	Growth rate in 202 vs. 2017, %
Altai Republic	5,322	5,964	6,497	6,569	8,660	62.7
Kemerovo region	109,795	117,270	126,122	122,059	139,298	26.9
Novosibirsk region	151,580	162,381	173,183	157,591	182,034	20.1

Data provided by the Russian Federal State Statistics Service https://rosstat.gov.ru/storage/mediabank/Region_Pokaz_2022.pdf

The volume of paid services to the population in the Altai Republic from 2017 to 2021 grew by 62.7% faster than in the other regions, which is indicative of the region's economic growth and the increase in the number of enterprises in the service sector.

The macroeconomic situation in the Altai Republic in 2021 was characterised by the increase in industrial production since 2019, more active investments in fixed capital from 2020, growth of paid services to the population and wage hike starting from 2017. At the same time, certain decrease in the agricultural output and the scope of construction work was noted.

Analysing the economic situation in terms of the highlighted criteria group, one can conclude that the Altai Republic has not ensured due sustainable increment of the basic socio-economic indicators which might have allowed it to reach high-level economic security. The industrial production decreased since 2017. On the plus side, one can note high growth rates, as concerns the GRP, people's wages, the volume of paid services to the population, as compared to the neighbouring regions. The comparison of the Altai Republic's economic indicators with those for the whole of Russia show that the economic performance of the Republic is much lower. The level of economic development of the Altai Republic leaves much to be desired.

The ecological security can be characterised by the acceptable level of negative impact of economic and natural factors on the environment and human beings.

The quality of the environment is becoming an urgent issue in the context of economic growth. The objectives connected with boosting the economy and the demographic situation lead to negative impact on the environment.

The Altai Republic is a region with insignificantly developed economic activity, for the most part. The urbanised areas include: the city of Gorno-Altaysk and suburban villages (Maima, Kyzyl-Ozek, Alfyorovo, Karlushka). Talking of "urbanised territories", we mean not only these areas' having some attributes of a city, but also being significantly involved in certain economic activities. The anthropogenic load on these territories affects the ecological state of the Maima River and its tributaries.

As one can see from Tables 17-19, the situation with air pollution in the other regions is worse; respectively, much more pollutants are captured and neutralised in these regions. In the Altai Republic the share of captured substances does not exceed the amount of pollutants even by half; this is due to a very low amount of emissions, and this situation is not so dangerous for the environment and public health since the actual amount of emissions does not exceed the permissible norm. The maximum registered number of pollutants was captured in the Altai Republic in 2019 – 32% of the total amount of

pollutants; this is very little compared to the other regions, so the measures in this direction do not need to be extensive.

Table 17 – Comparison of pollutant emissions into the atmospheric air from stationary sources by region

Region	Thousand tonnes per year					
	2005	2010	2015	2019	2020	2021
Altai Republic	13	6	8	6	7	7
Kemerovo region	1,282	1,411	1,344	1,760	1,612	1,603
Novosibirsk region	213	228	185	136	164	188

Table 18 – Capture of air pollutants from stationary sources

Region	Thousand tonnes per year					
	2005	2010	2015	2019	2020	2021
Altai Republic	2	2	2	3	1	1
Kemerovo region	4,829	4,823	4,683	3,380	3,049	3,309
Novosibirsk region	963	1,009	1034	659	831	1,008

Table 19 – Share of captured and neutralised air pollutants in the total amount of waste pollutants from stationary sources.

Region	%					
	2005	2010	2015	2019	2020	2021
Altai Republic	12.6	26.9	18.1	32.4	16.6	7.5
Kemerovo region	79.0	77.4	77.7	65.8	65.4	65.8
Novosibirsk region	81.9	81.5	84.8	82.9	83.5	82.6

A total of 1,421 thousand tonnes of CO_2 equivalents from all sources were emitted into the atmosphere in the Altai Republic (the emission being 0.08 tonnes/ha); this indicator is quite low for the country.

Table 19 – Volumes of off-nominal ambient air samples in 2019 – 2021

Settlement	2019		2020		2021	
	total	above the maximum allowable concentration, %	total	above the maximum allowable concentration, %	total	above the maximum allowable concentration, %
Gorno-Altaysk	837	0	1,070	0	444	0
Maima	320	0	201	0	162	0

The volume of off-nominal samples on the territories of Gorno-Altaysk and Maima does not exceed the maximum permissible concentration level (Table 19). Thus, it can be concluded that the condition of the atmospheric air is satisfactory. One should not forget about air pollution by exhaust gases from motor transport along the central highways of Gorno-Altaysk, moreover that these highways are transit ones. The data on atmospheric air pollution by motor vehicles are not available.

Figure 5 shows that the consumption of such resources as fossil coal and firewood is gradually decreasing, in parallel with increased consumption of natural gas, gasoline and diesel fuel oil. Thus, the consumption of fuel resources is less harmful for the environment.

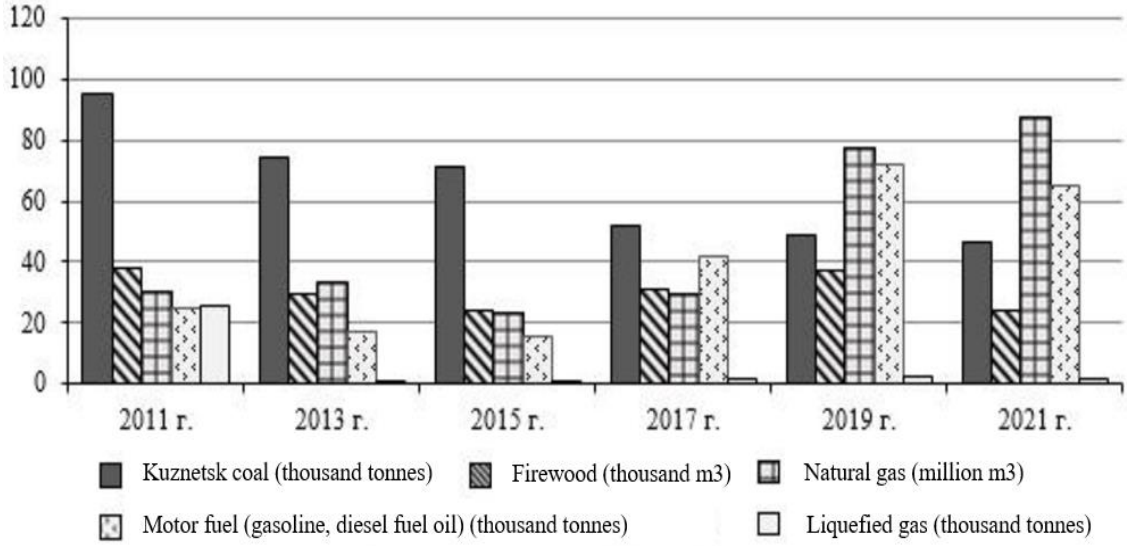

Figure 5 – Consumption of fuel resources in the Altai Republic

One of the most acute identified ecological problems in the Altai Republic is the problem of accumulation and disposal of consumer waste (including overstuffed rubbish bins). The reason for this problem is that waste disposal operators fail to meet their duties as proper and do not remove waste in a timely manner. This is because the authorities do not allocate insufficient money for waste removal and disposal, and the number of employees in this sphere is scanty.

Another problem is the low coverage of the area by centralised sewerage systems. Only a part of Gorno-Altaysk has centralised sewerage, mainly along the central roads, while the remaining part of the city and all other districts of the Republic make use of the sump-type sewer system (in the form of pit latrines). The absence of centralised sewerage in the bulk of the region, along with the cesspool sewerage, leads to surface- and groundwater pollution. The construction of centralised sewerage system is very expensive.

The problems of ecological security in the sphere of tourism are truly urgent in the Altai Republic and require special research.

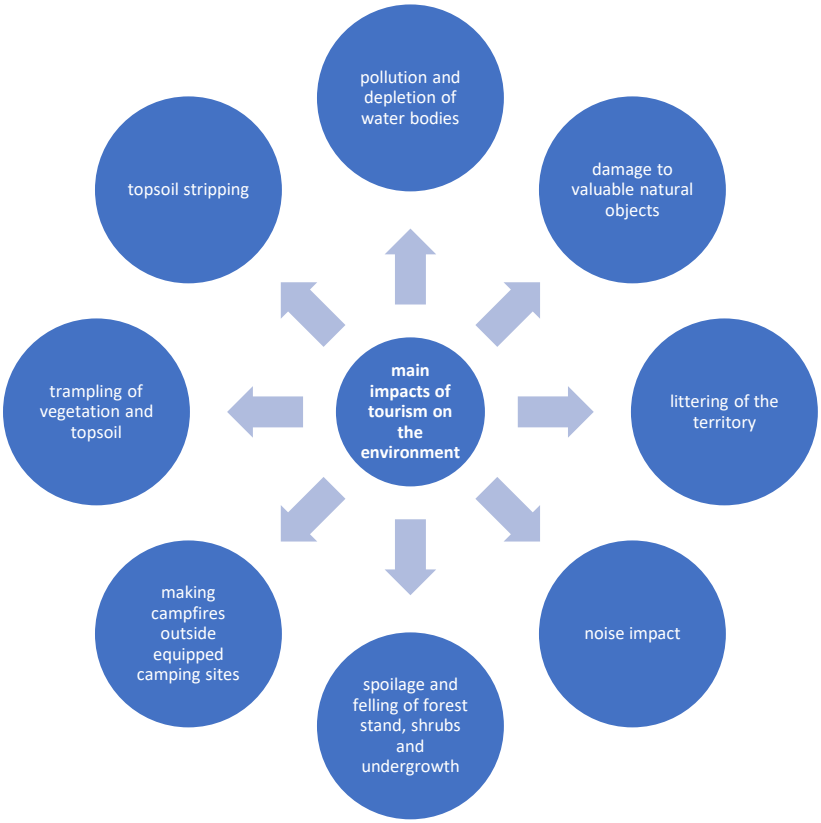

Figure 6 – Main types of impact caused by tourism on the environment

The direct impact of tourism on the environment is expressed, in the first place, in making campfires outside the equipped campsites; this damage is caused by unorganised tourists whose share in the tourist flow in the region is still high. And it is easy to predict that the decline in real incomes of the population will ramp up the share of unorganised tourists. The unregulated tourism can also lead to undue cutting of trees and bushes and causing damage to natural monuments such as rare petroglyphs and neolithic rupestrian drawings scattered throughout the Altai Republic that are predominantly not duly protected or guarded. Both organised and unorganised tourism lead to trampling of soil and grass, pollution and depletion of water bodies, increased accumulation of solid municipal waste, increased area of landfills, etc.

The negative impact of tourists on the natural environment includes travel off the roads and trails, garbage disposal, making campfires in inappropriate places, writing on the rocks, visiting unequipped areas.

Earlier, the development of touristic infrastructure in the region was mainly of spontaneous character, and the flow of tourists was mostly unorganised due to their relative small numbers; the tourists used to spontaneously explore the river valleys most accessible and convenient for camping – Katun, Biya and some of their tributaries, the northern part of Lake Teletskoye.

As a result, the uncontrolled recreational activities of the local population and visitors have led to local degradation of natural landscapes, deterioration of their landscape and aesthetic properties and, accordingly, to people's reduced psycho-emotional comfort. Stated differently, the most valuable and accessible recreational resources are being destroyed.

However, no environmental problems that would equal to all-Russian ones in terms of hazard have been identified, and in general the situation, as concerns environmental development, is favourable. Owing to the unique nature and clean environment, the interest in the Altai Republic has been growing over the years, with the tourism sector being most actively developed. If the supreme authorities shift to intensive development of production

and industry, building a lot of facilities towards solution of the local economic problems, all this will definitely lead to deterioration of the ecological situation; the region will be excluded from the list of subsidised territories; people's welfare will of course grow, but all this can result in significant losses. For instance, this will lead to loss of tourist attractiveness of the region, environmental sustainability, clean water and air. This is the main problem of economic and environmental security of the region.

Having this alternative, the options are either to develop the region in favour of economic growth or to continue the development at the current level in favour of ecology. There is no unambiguous solution to this problem because the situation is much complicated. A simple example: cutting down a single tree means a loss of several components, albeit in a small fraction. This is because trees produce oxygen, protect people from mudslides, landslides, wind, nourish the soil and improve human health. If industrial production is intensively developed this will lead to water pollution. Laying centralised sewerage and its cleaning is very expensive and may not be profitable for the region in the long run (even if all the aspects are envisaged in advance and prove to be valid).

The authors believe, considering that the Altai Republic lags behind the other areas in terms of the average Russian economic indicators, that the economic security issues are not met in the region since economic security needs sustainable and high economic growth, as stated in its theory.

When forming recommendations towards elimination of identified problems in all spheres, it is always necessary to provide for minimisation of losses. In order to create due conditions for economic and environmental protection of the region, strict governmental control is necessary, in the first place.

In today's world, the preferred role is given to industrial ecology; assessing all kinds of harm, it develops and improves the means for protection of natural environment. It is necessary to globally develop waste-free, low-waste and closed-loop production. Lately, environmental education and training of engineers and technical specialists in the sphere of environmental protection has become relevant. The ongoing tasks are solved through developing due engineering and technical measures for nature protection; full-fledged waste-free and low-waste technologies are inculcated in industrial production. Due equipment for purification of waste water from impurities, for air cleaning and treatment of gas emissions, etc. is used. However, these methods are not fully realised in connection with the economic situation. In some countries and regions these methods are not even used at all, with preserved negative impact on nature and human health. For instance, returning to one of the identified problems, it is possible to state that Gorno-Altaysk does not keep record of emissions from road transport. In order to resolve the problem, it is easier just to reduce the emissions. Due layout of motor roads will also help in this case, for instance, construction of bypass roads and street planting. As one can see, this situation does not even require treatment facilities.

It should be noted that the region has a positive carbon balance; the yearly discharge is about 6.75 Mt. There is a possibility of its further reduction through gasification of the private sector and complete shift of public steamshops to gas as well as creation of renewable energy sources (solar power plants, etc.). This is one of the direct methods for carbon reduction. A number of indirect methods exist as well. This involves, in particular, total building renovation, thermal insulation of heating networks, since the volume of burnt fuel will be reduced.

The following measures are proposed as the ways to address the outlined problems:

1. Preservation and enhancement of the natural wealth of the region;

2. Improvement of the legislative environmental framework based on its practical application;

3. Strict verification in case of transfer of natural resources into private ownership;

4. Realisation of measures aimed at overcoming the economic crisis towards due realisation of environmental projects in the future.

The solution of problems specific of the tourism sector of the Altai Republic should be aimed at proper organisation of territories for recreation purposes, along with realisation of competent measures for due development and use of recreational resources:

– development of ecological types of tourism;

– restricting travel to recreational facilities located at the margin of sustainability, stopping access to areas with irreversible change in landscape; necessary reforestation and phytomelioration measures in such areas;

– using all possible information channels to interact with tourists, providing them with information about the location of ecological trails and other organised recreational areas;

– strengthening control over cases of violation of environmental law, in particular, imposition of administrative fines;

– improving the environmental management culture.

The principal measure is monitoring the ecology of recreational landscapes and control of efficiency of implemented organisational measures and rehabilitation activities.

Conclusion

The given paper addresses the criteria of economic/environmental security and the mechanisms to ensure it. The paper offers an analysis based on the criteria of economic/environmental security (economic, social and environmental criteria); explores the level thereof in the Altai Republic, identifies the relevant problems and develops due recommendations for their elimination.

The novelty of the paper lies in its conclusion that, although there is a need for transition to economic development, improvement of economic performance with maximum possible preservation of the environment, all of this in fact entails deterioration of the ecological situation. Still, the growth of economy can be treated as a more important aim than resolving the environmental problems, since the duration and quality of people's life depend more on the economic level of the area they live in.

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