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Digital Transformation of Marketing in the Industrial Market of Northern Regions: Challenges and Prospects

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Abstract. Digital transformation of marketing in the industrial market of northern regions is becoming increasingly important. It allows companies to effectively build a B2B interaction strategy and improve customer service quality using digital technologies, software and digital marketing tools. In addition, digital technologies contribute to improving the effectiveness of operational marketing solutions, expand opportunities for entering new markets and create personalized offers for customers. This research is aimed at analyzing the challenges and prospects of digital marketing transformation in the industrial market of northern regions. In order to achieve this goal, a systematic approach was used as a general scientific research method, and a comparative analysis of existing digital marketing transformation practices was carried out when processing and systematizing data. During the work, a conceptual model of digital transformation was created, which includes strategic and operational approaches to marketing management, emphasizing the importance of integrating data and analytics to optimize customer interaction. Special attention is paid to the adaptation of these approaches to the specifics of northern regions. The scientific contribution consists in systematizing existing knowledge about the digital transformation of marketing and offering new methods and tools that contribute to the effective integration of digital solutions into management processes. The research results can be successfully applied in the practical activities of industrial enterprises in northern regions, as well as in educational institutions for training specialists in the field of management, marketing management and digital marketing.

Keywords: *digital transformation, industrial market of northern regions, B2B interaction, digital marketing tools, strategic and operational marketing solutions, change management*

Introduction

In recent years, the global economy has experienced rapid growth in digital technologies, fundamentally changing the way businesses operate and interact with customers. This transformation is particularly noticeable in marketing, where traditional approaches are giving way to innovative methods based on data and high technology. Digital transformation of marketing in the industrial markets of northern regions is becoming not only relevant but also essential to ensure the competitiveness and survival of enterprises in a highly competitive market. Understanding the specific challenges and prospects of this transformation allows industrial companies in Russia to adapt

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to the dynamic conditions of the modern market, ensuring sustainable development and successful implementation of business strategies.

The relevance of this study lies in the fact that many industrial enterprises in northern regions face difficulties in integrating digital technologies into their marketing strategies for interacting with customers, as well as new challenges arising in the process of digital transformation of the marketing complex.

The theoretical basis of the study was provided by the works of both Russian and foreign researchers who have made a significant contribution to the understanding of modern marketing management and the application of its tools in the digital economy. Among the foreign researchers, the following can be highlighted: Beverland M. [1], Chaffey D. [2], Hanna R. [3], Kannan P. [4], Lipsman A. [5], Tiago M. [6], and others. Among the Russian researchers, the following can be noted: Hussein I.D. [7], Golubkov E.P. [8], Mann I.B. [9], Feofanova O.Yu. [10], and others.

Research shows that a lack of knowledge about digital tools and methods of their application in marketing can lead to missed opportunities, reduced competitiveness of companies, loss of customers and revenue. According to an online survey of 1,331 top managers (representing a wide range of regions, industries, and company sizes) conducted by McKinsey in 2022, 70% of companies are not realizing the potential of digital transformation due to the lack of a clear strategy and understanding of changing market practices [1]. This result highlights the need for in-depth study of the specifics of digital marketing transformation in the industrial sector of northern regions, as well as the development of effective methodological approaches that will help avoid common mistakes and ineffective management decisions in the field of marketing.

The object of the study is strategic and operational marketing decisions applied in industrial markets of northern regions in the context of digitalization. The subject of the study is the conceptual foundations of digital transformation in marketing, including specific challenges and prospects, as well as forms and methods of their application in this context. It is important to note that the approaches that worked in previous decades often cannot be effectively applied in the context of rapid introduction of new technologies and changing customer expectations.

The aim of this study is to develop the conceptual foundations of digital marketing transformation in the industrial market of northern regions, as well as to identify specific challenges and opportunities in this area. To achieve this goal, the following objectives need to be addressed:

- develop and substantiate a conceptual model of digital marketing transformation for the industrial sector of northern regions, taking into account the most effective practices and technologies applied both in Russia and abroad;

[1] LaBerge L., Smaje K. Three new mandates for capturing a digital transformation's full value. URL: https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/three-new-mandates-for-capturing-a-digital-transformations-full-value (accessed 01 October 2024).

- research modern trends and main directions of digital transformation of marketing in the industrial market of northern regions, including analysis of the current state and prospects for development;
- identify the characteristics and key aspects of digitalization of the marketing complex of industrial companies in northern regions, as well as areas for integrating modern digital technologies into marketing activities;
- study the mechanisms and strategies for managing digital marketing transformation in the context of the current challenges of the digital economy, with a focus on industrial companies in northern regions;
- identify the key challenges faced by industrial companies in northern regions in the process of digital marketing transformation and propose a model for their effective solution.

Thus, the study reveals issues of digital marketing transformation in the industrial market of northern regions, which can serve as a basis for practical recommendations to improve the efficiency and adaptability of enterprises.

Conceptual model of digital marketing transformation

Digital transformation has become an integral part of business strategies in various markets, including industrial markets in northern regions. The latest technologies, such as big data, artificial intelligence, the Internet of Things, and others are not only transforming business processes but also significantly influencing marketing decisions. The current, aggressive external environment of industrial markets in Russia's northern regions requires business to be flexible and able to quickly adapt to changing conditions.

In today's world, marketing is undergoing significant changes under the influence of digital technologies. Figure 1 presents a conceptual model of digital marketing transformation.

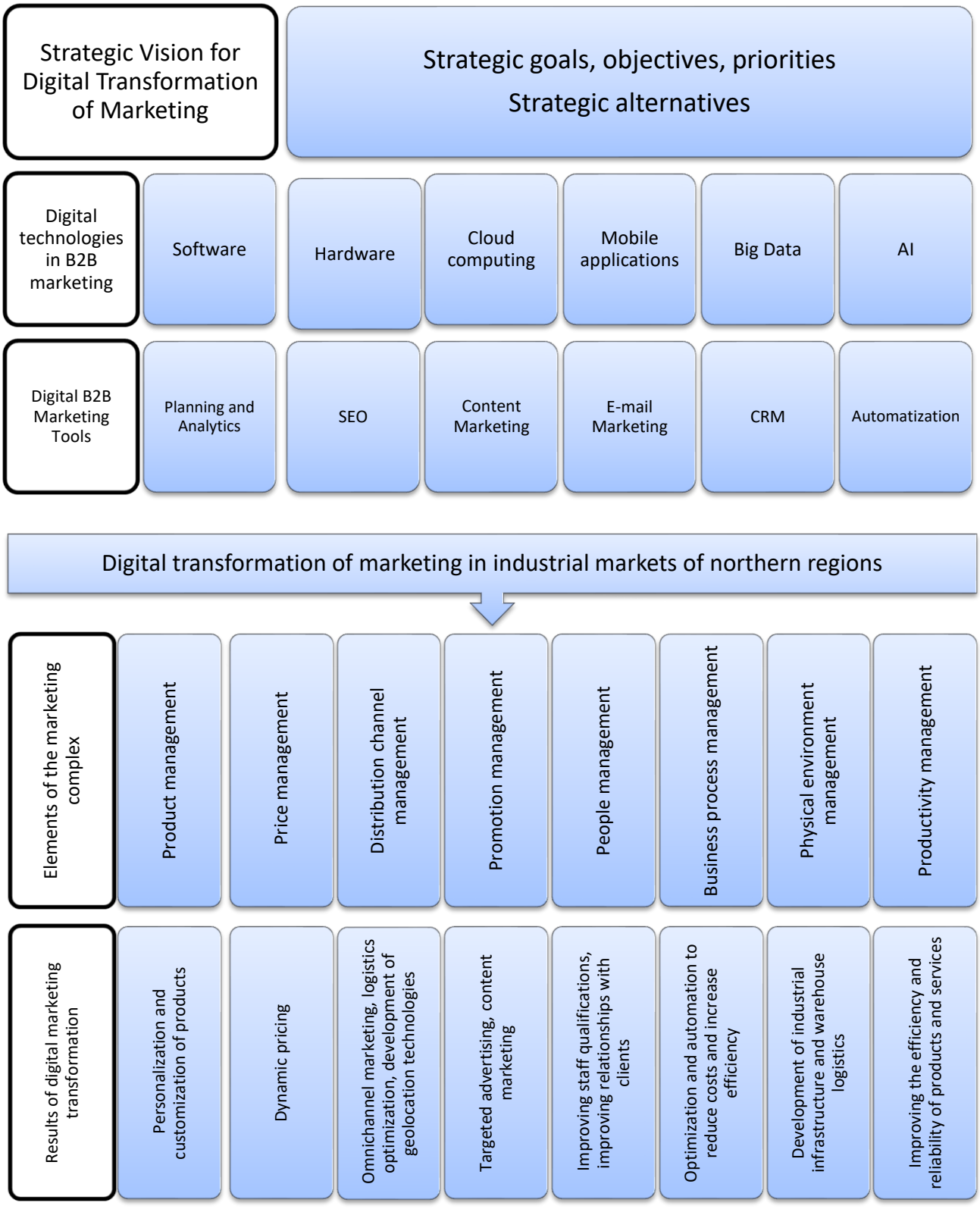

Fig. 1. Conceptual model of digital marketing transformation in the B2B market [2].

Let us take a closer look at the presented model of marketing transformation in the industrial markets of northern regions. The model focuses on the process of digital marketing transformation, taking

[2] Source: compiled by the authors.

into account the specific characteristics of northern regions. The uniqueness of these territories is determined by a number of factors. Firstly, climatic conditions: extremely low temperatures in winter and a short growing season require a special approach to analyzing customer needs and forecasting demand. Secondly, limited human resources and the inaccessibility of certain territories necessitate the effective distribution of labor and the accelerated introduction of digital tools to compensate for staff shortages. Thirdly, the specific natural, climatic and economic conditions of the region imply a high degree of uncertainty in the external environment: seasonal fluctuations in supplies, difficulties in organizing logistics and regular changes in factors affecting customer behavior. This requires flexibility in adapting marketing strategies.

Trends in the digital transformation of industrial marketing in northern regions

The strategic level of digital marketing transformation opens new business horizons for industrial companies, forming the basis for the creation of a new digital culture. This level requires adaptation to rapidly changing environmental conditions and business model transformation. The strategic vision is the direction and goal for subsequent digital marketing transformation actions. In the northern regions, the emphasis is on sustainable development: the use of renewable energy sources and the efficient distribution of resources. Sustainability is not limited to economic efficiency; it is also a matter of corporate social responsibility.

Modern digital technologies offer industrial companies new opportunities to develop and optimize marketing processes, which is particularly relevant for companies in northern Russia and other regions of the world with similar conditions. Let us take a closer look at each component of digital technologies for industrial marketing, as shown in Figure 1.

1. Software and hardware. Using specialized software allows companies to optimize production processes and marketing strategies. An example of best practice in the implementation of the Internet of Things (IoT) is Vestas (headquartered in Aarhus, Denmark), the world's largest wind turbine manufacturer. Vestas actively uses IoT to manage its wind farms. Using data collected from thousands of sensors installed on turbines worldwide, the company optimizes energy generation and predicts maintenance needs [3]. As a result, Vestas successfully maintains a high level of customer service, as well as the reliability and performance of its turbines.

2. Cloud computing. Moving data and applications to the cloud provides flexibility and cost-effectiveness in resource management. For example, manufacturing companies in the northern region, such as Severstal, are actively implementing cloud solutions; it allows them to scale capacity and reduce IT infrastructure costs [4].

[3] Digital services. URL: https://www.vestas.com/en/energy-solutions/service/digital-services/vestasonline (accessed 10 October 2024).
[4] Severstal has implemented intelligent business process analysis technology. URL: https://severstal.com/rus/media/archive/2020-11-03-severstal-vnedrila-tekhnologiyu-intellektualnogo-analiza-biznes-protsessov/ (accessed 10 October 2024).

3. Mobile applications. Industrial companies are increasingly using mobile applications to improve communication and interaction with partners and customers. For example, an application for remote equipment monitoring can significantly reduce downtime and increase service efficiency.

4. Big Data. Analyzing large volumes of data plays a key role in strategic decision-making. Companies use analytics platforms to study customer behavior, predict trends, and optimize complex production processes. Gazprom Neft is an example of successful using big data, where data analysis helps to implement energy efficiency strategies [5].

5. Artificial Intelligence (AI). The implementation of AI allows for the automation of routine processes and the provision of more personalized solutions for customers. Companies can use chatbots to interact with partners or customers, as well as machine learning algorithms to optimize production processes.

The set of digital B2B marketing tools includes six elements.

1. Planning and analytics. The use of planning and analytics platforms helps marketing professionals develop more accurate and relevant strategic plans. An example is the use of Power BI analytics, which provides powerful tools for data visualization and analytics [11]. One of the best practices for using analytical platforms in conjunction with AI is ALROSA (headquartered in Mirny, Russia). The company actively uses analytical platforms to improve the efficiency of data mining and processing, which has significantly reduced production costs and strengthened its competitive position in the global market [6].

2. SEO (search engine optimization). Although SEO has not been used very actively by industrial enterprises, it has recently gained popularity. Increasing the visibility of professional websites through SEO helps to attract potential customers and strengthen a company's online reputation.

3. Content marketing. Creating useful and educational content is useful for strengthening the brand and the company's position as an expert in its field. For example, blogs and videos on YouTube or Rutube can explain complex technical aspects and promote the company's innovations.

4. Email marketing. This is one of the most effective tools for retaining customers and increasing loyalty. Case studies of successful industrial companies show that well-designed newsletters can significantly enhance the effectiveness of other marketing campaigns.

5. CRM systems. Customer relationship management remains a critical aspect, especially in the B2B segment. Using systems such as Bitrix helps to integrate customer information and optimize interaction at all stages of the customer cycle.

[5] From "wildcat" to Big Data: the evolution of oil production technologies. URL: https://www.gazprom-neft.ru/press-center/special-projects/ot-dikoy-koshki-k-big-data (accessed 10 October 2024).

[6] The head of Alrosa spoke about the world's first artificial intelligence-powered rockbreaker. URL: https://alrosa.ru/press-center/news/2024/glava-alrosa-rasskazal-o-pervom-v-mire-butoboe-s-iskusstvennym-intellektom/ (accessed 10 October 2024).

6. Marketing automation. Automation tools help to optimize routine tasks and to direct resources to more important strategic areas. An example is the implementation of HubSpot, which automates email campaigns, social media management, and analytical processes [7].

Digital transformation of the marketing complex in the industrial market of northern regions

The 8Ps concept is an expansion of the traditional 4Ps marketing concept (Product, Price, Place, Promotion), described by Professor E. Jerome McCarthy in 1960 in his textbook "Basic Marketing. A Managerial Approach". This expansion includes four additional elements: People, Processes, Physical Evidence, and Performance. The 8Ps concept is often associated with the work of Philip Kotler, although the term 8Ps is not as widely used in modern research as the 4Ps. The main drawback of the 8Ps concept is often cited as its complexity, associated with the large number of elements, which makes the management process labor-intensive for small companies. Nevertheless, according to the authors of the article, the 8Ps concept reflects the modern nature of marketing in the industrial market better than others.

1. *Product* in the industrial market includes an assortment portfolio, product or service characteristics, and brand. Today, a product is no longer viewed solely as a physical object, but includes services and digital goods. Digitalization makes it possible to create unique offers based on data about consumer preferences and behavior. Personalization is becoming a key factor in interacting with customers in the industrial market, as each company in this segment has its own specific requirements and expectations. Machine learning algorithms allow not only analyzing customer behavior, but also predicting future actions. For example, in northern regions, it is necessary to adapt offers to extreme operating conditions and the needs of the target audience. This may include the development of special protective mechanisms or the improvement of operating conditions for equipment used in harsh climatic and physical conditions. Vestas can be mentioned among the best practices, as it develops climate-resistant wind turbines for various geographic regions, which allows the company to adapt its offerings to the needs of different markets [8].

2. *Price* in the industrial market includes pricing policy, pricing strategies, discounts, and payment terms. In the digital economy, dynamic pricing is becoming a common practice. Using big data processing technologies, industrial companies can set prices that adapt to demand in real time, making pricing more flexible and effective. Pricing strategy should take into account not only cost, but also customer perception of value. For example, Norilsk Nickel uses highly accurate price modeling based on market trends and demand analysis to remain competitive in the international market [9].

[7] Why choose HubSpot. URL: https://www.hubspot.com/why-choose-hubspot (accessed 10 October 2024).
[8] Vestas unveiled the world's largest onshore wind turbine, with a capacity of 7.2 MW. URL: https://power-green.pro/novosti/144-vestas-predstavil-samyj-bolshoj-v-mire-nazemnyj-vetrogenerator-moshchnostyu-7-2-mvt (accessed 10 October 2024).
[9] Problems and challenges of digital transformation at Norilsk Nickel. URL: https://iaassaaspaas.ru/interview/problemy-i-vyzovy-tsifrovoy-transformatsii-v-kompanii-nornikel (accessed 10 October 2024).

3. *Place* in the industrial market includes distribution channels, points of sale, logistics, and geographic coverage. Access to products has become significantly easier due to online platforms. An important aspect is the use of geolocation technologies to direct consumers to the nearest sales points. For example, Atomflot (a vessel base in Murmansk, Russia) is actively involved in the creation and support of ports and logistics centers in the Arctic [10].

4. *Promotion* in the industrial market includes product promotion (sales, promotional events), advertising, direct marketing, and PR. Advertising and product promotion have become digital, with the focus shifting to a personalized approach to the client, which is possible due to user data analysis technologies. The need for unified customer expertise has led to the integration of communication channels. In today's digital world, customers can interact with companies through a variety of platforms (omnichannel marketing), including social networks, email, and mobile applications. Creating a unified platform where customers can obtain information and services is becoming the basis for improving customer service. An example of this is the company Arcticgas (Russia) and its founders Novatek and Gazpromneft, which organize international conferences and seminars to engage potential clients and partners, as well as promote environmentally friendly products based on natural gas, such as liquefied natural gas (LNG) [11].

5. *People* are of key importance in industrial market marketing. This includes not only company employees who interact with customers and provide high-quality customer service, but also the buyers themselves. Understanding their needs and preferences helps to create more effective marketing strategies and improve service quality. An example of best practice is Stora Enso (headquartered in Helsinki, Finland), one of the leaders in the forestry industry, which actively involves its employees in sustainable development processes. Employee engagement takes place through training programs on sustainable development and environmental protection in northern regions, environmental committees and groups, competitions for ideas and innovations to reduce environmental impact and optimize resources, etc. [12]

6. *Process*es also play an important role in the marketing complex of industrial companies. These include all business processes in the supply chain, from new product development to delivery to the customer. Process optimization helps to reduce costs, to improve customer service, and to increase customer satisfaction, which ultimately contributes to reducing customer outflow, increasing loyalty and the likelihood of repeat purchases. An example of best practice in this area is Equinor (headquartered in Stavanger, Norway), which is implementing digital transformation technologies to improve the efficiency of its oil and gas production processes. Equinor actively uses robotic solutions and automation to reduce human intervention in routine and hazardous operations

[10] Digitalization of logistics will be implemented on the Northern Sea Route. URL: https://novelco.ru/press-tsentr/tsifrovizatsiya-logistiki-budet-realizovana-na-severnom-morskom-puti/ (accessed 10 October 2024).
[11] LNG Congress 2025. URL: https://www.lngrussiacongress.com/ (accessed 10 October 2024).
[12] Steering our sustainable journey. URL: https://www.storaenso.com/en/sustainability (accessed 10 October 2024).

[13]. This not only reduces the risk of errors, but also improves safety at the field. Control systems allow operations to be carried out remotely, reducing the need for on-site personnel, which is especially important for hard-to-reach and hazardous fields in northern regions.

7. *Physical Evidence* refers to all the material elements that surround the product and customer interaction. In the industrial market, this can mean the quality of packaging, the condition of warehouses and production infrastructure. For example, Gazprom Neft continuously monitors and renovates its points of sale and gas stations to improve customer service [14].

8. *Performance* is measured in terms of efficiency and reliability of products and services. Continuous monitoring and improvement of performance ensures long-term competitiveness and financial stability. The main key performance indicators (KPIs) in supply chain management in the industrial market are logistics service quality indicators. These indicators include the following: order fulfillment by the specified deadline; completeness of order fulfillment; accuracy of order parameters in terms of assortment; reliability and timeliness of communication with customers; presence of customer complaints; availability of stocks; presence of unplanned situations: product returns, out-of-stock (OoS), increases in transport tariffs [12, pp. 57–58]. Another group of indicators for industrial enterprises in northern regions includes environmental risks, emissions into the environment, and work on sustainable development of the enterprise.

Thus, in the context of digital transformation, the marketing complex of industrial enterprises requires rethinking and integration with the new IT tools mentioned in the previous section. The digital transformation of marketing in the industrial markets of northern regions involves a wide range of changes, in which each element interacts with the others to create the most effective business model.

Change management in digital marketing transformation

The topic of changes in the process of digital marketing transformation is widely covered in research by foreign and Russian scientists. Among the most authoritative foreign studies, the following are worth mentioning: O'Reilly C. and Tushman M. [15], Schwab K. [13], and Ritson M. [16] These studies examine how companies can adapt to market changes, including digital transformation, by creating organizational structures that facilitate both innovation and exploitation of existing resources. They also discuss how modern technologies are changing not only business practices but also fundamental aspects of marketing. Among the key challenges is the need to rethink traditional approaches to branding and customer interaction.

[13] Drones and robots in Equinor. URL: https://www.equinor.com/energy/drones-and-robots (accessed 10 October 2024).
[14] Gazpromneft network opens new format gas stations. URL: https://regnum.ru/news/3897074 (accessed 10 October 2024).
[15] O'Reilly III C.A., Tushman M.L. The Ambidextrous Organization. URL: https://hbr.org/2004/04/the-ambidextrous-organization (accessed 09 October 2024).
[16] Ritson M. Marketing in the Age of Digital Disruption. URL: https://www.marketingweek.com/mark-ritson-ai-digital-disruption/ (accessed 09 October 2024).

Among the most relevant Russian studies, the following are worth noting: Bespyataya M.N. [14], Guzeev L.O. [11], Kuznetsova E.I. [15], Morozov K.D. [16], and Petrova S.A. [17]. The article by Bespyataya M.N. examines how digital transformation affects marketing, focusing on digital technologies and understanding the value chain for consumers [14]. Guzeev L.O. analyzes the key aspects of the digital transformation process in marketing, including technological innovations, changes in consumer behavior, new strategies and tools, as well as development prospects [11]. Kuznetsova E.I. and Rusavskaya A.V. use the example of media business to identify the main problem of digitalization that influences all qualitative changes in the market: data management. The article emphasizes that modern organizations have become more active in interacting with their audience and receiving feedback through the implementation of technology [15]. Morozov K.D. and Sharonov D.I. consider the problems of communication innovations, the cultural dynamics of prosumerism, and the communication strategies used by manufacturers. The key aspect is the mass digitalization of society and its penetration into different areas of human life. Modern communications have influenced society, revealing a completely new type of consumer with new forms of attitude and ideas about values and things that affect the representation of goods and services on the market [16]. The article by S.A. Petrova and V.M. Mikhailova discusses the impact of the digital economy on the marketing activities of enterprises in terms of the components of the marketing complex. The authors note that digital transformation has significantly influenced marketing, transferring it almost entirely to the digital environment [17].

All of the above studies emphasize the importance of adapting marketing strategies in the context of digital change and offer various approaches to solving the emerging problems.

The authors applied the Nadler-Tushman model to characterize the changes that occur in an industrial company during digital transformation. The Nadler-Tushman congruent change management model examines organizational change through the prism of four interrelated elements: tasks, organizational structure and systems, culture, and personnel. Each of these elements is subject to changes at three key stages of transformation: optimization, regulation, and automatization (Table 1).

Table 1

Digital marketing transformation management [17]

Elements	Optimization	Regulation	Automatization
Tasks	Improving the efficiency of marketing processes through data analysis and improving current strategies	Introducing clear regulations and standards for the use of digital tools and channels	Automatization of processes such as email marketing and advertising campaign management using technologies
Organizational structure and systems	Creating cross-functional teams to quickly respond to market changes	Formalization of roles and responsibilities within new digital processes	Implementation of specialized positions and teams to manage automated processes

[17] Source: compiled by the authors.

Culture	Creating an innovative culture that encourages experimentation and adaptation	Establishing norms and values that support digital transformation and working with new tools	Adoption of data and analytics as the basis for decision making, it requires a change in employee mindset
Personnel	Training employees in new technologies and approaches in marketing, the importance of continuous learning	Providing clear qualifications and skills required to perform new tasks in the digital environment	Recruiting specialists with high digital skills and an aptitude for working with data

The first stage is optimizing the business process of marketing management in the industrial markets of northern regions. At this stage, manufacturing companies analyze existing processes and identify bottlenecks hindering development. Optimization methods include data analysis, process re-engineering, and implementation of tools adapted to the specifics of northern regions. At this stage, marketing tasks focus on improving existing marketing process and working methods. The organizational structure becomes more flexible, which facilitates a more rapid response to changes. The organizational culture emphasizes innovation and readiness for changes, which contributes to employee engagement. Staff training becomes a priority to develop the necessary competencies, taking into account the specific challenges of digitalization and sustainable development.

The second stage is regulating the marketing business process, which includes the documentation and standardization of actions and procedures. This stage involves the introduction of clear standards and procedures to streamline work processes in the digital environment. Formalized structures are created within organizations to clearly define roles and responsibilities. The culture is focused on compliance with norms and rules aimed at supporting digital transformation. At the same time, it becomes important to define the qualification requirements for personnel to ensure the fulfilment of new tasks in the conditions of northern regions.

The third stage is automatization of the marketing business process. At this stage, companies implement the modern technologies described above to automate routine tasks and free up resources for strategic initiatives adapted to the needs of the northern regions. Marketing processes are undergoing profound digitalization, which requires not only technical implementation but also changes in the operational model itself. The organizational structure begins to include specialized teams and roles responsible for automated processes. The organizational culture is shifting its focus to data and analytics as fundamental elements for strategic and operational marketing decisions. When recruiting personnel, attention is focused on skills in working with modern digital tools and analytics necessary for effective work in the industrial market of the northern regions.

Addressing the problems of digital marketing transformation

Over the past five years (2020–2024), Russian and international researchers have identified the following five groups of issues and challenges in digital marketing transformation:

- integration of new technologies [18], [19];
- problems with data and its analysis [20], [21];

- staff training [22], [23], [24];
- changes in consumer preferences [25], [26], [27];
- cybersecurity and data protection [28], [29].

Integrating new technologies into marketing strategy is a critical task for companies in the context of rapid digital development. Every year, the market offers innovations, from artificial intelligence to process automation, which can significantly improve marketing. However, implementing these technologies requires time and resources, as well as changes in corporate culture and structure. Many organizations face difficulties in choosing the right tools and platforms, as well as in configuring and integrating them into existing systems. This can lead to ineffective investments and difficulties in achieving planned results. In addition, the lack of a unified platform for managing all tools complicates the situation. Studies [18] and [19] emphasize the importance of a comprehensive approach to technology integration in order to achieve sustainable results.

The collection, storage, and analysis of large amounts of data have become key challenges for digital marketing. Companies face problems with the proper organization of data and the use of powerful analytical tools. The need to process large amounts of information requires qualified specialists and technologies capable of ensuring effective analysis. Mistakes at this stage can lead to incorrect conclusions and wrong strategic decisions. Moreover, issues of confidentiality and data protection are becoming increasingly relevant, especially given new laws such as the General Data Protection Regulation (GDPR). Studies [20], [21] highlight important aspects of data management and analysis methods for achieving competitive advantages.

In the context of digital transformation, *employee training and development* are a key task. New technologies require specific skills, and lack of training can become an obstacle to the successful implementation of digital tools. Companies that do not pay sufficient attention to this aspect risk losing their competitiveness. This is emphasized by studies [22], [23], [24], which focus on the need to develop systematic and individual training programs for employees.

The dynamic change in consumer preferences is another problem faced by marketers. In a highly competitive environment and under the influence of digital technologies, consumer preferences can change rapidly. The need to quickly respond to changing consumer preferences complicates long-term planning and requires marketers to be flexible and have an intuitive understanding of current trends. Studies [25], [26], [27] deepen the understanding of this issue and highlights the importance of exploring consumer behavior.

With the increase in digital marketing and its dependence on data, cybersecurity is becoming an increasingly pressing issue. Vulnerabilities in systems can lead to data leaks, which can undermine consumer trust and lead to financial losses. It is important for companies not only to protect their own data, but also to maintain a high level of security for customer information. This requires the implementation of multi-level protection systems and regular training of employees in cybersecurity rules. Studies [28], [29] focus on the necessary measures and strategies to ensure security within digital marketing.

Based on data from five groups of digitalization problems and challenges, the authors propose a model for managing digital marketing transformation in the industrial market (Fig. 2).

Figure 2 is a schematic interpretation of the processes and challenges of digital marketing transformation, using the management model proposed by the authors.

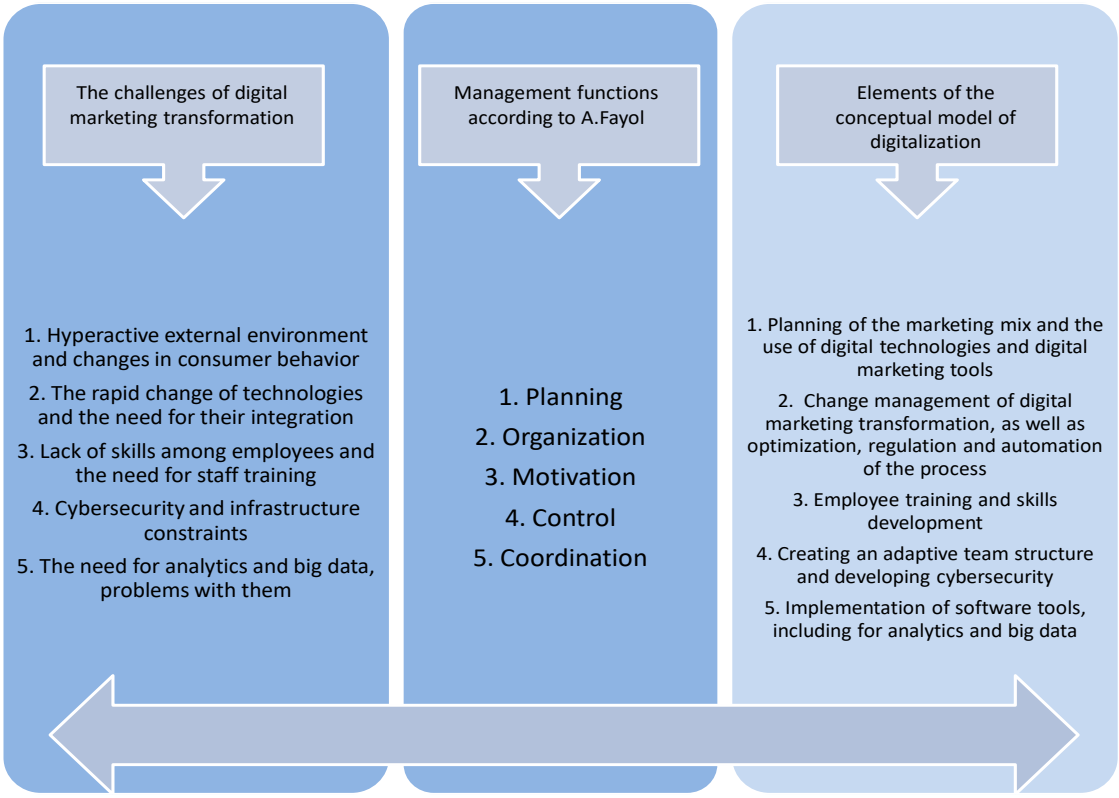

Fig. 2. Conceptual model of digital marketing transformation management [18].

The first block in the figure is devoted to the external challenges and problems faced by organizations during the digital transformation of marketing in the industrial market of northern regions. As mentioned above, northern regions face specific challenges, such as remoteness of customer locations, impact of climatic conditions, and limited infrastructure, which complicate digital transformation.

The second block in the figure presents the five management functions according to A. Fayol: planning, organization, motivation, control, and coordination [30]. These five functions represent standard management activities necessary for effective marketing in the context of digitalization. Planning requires adapting strategies not only to the influence of the digital environment, but also to the regional characteristics of northern markets. Organization focuses on adjusting internal processes, taking into account geographical characteristics, for the effective implementation of marketing initiatives. Motivation becomes a difficult task due to staff distraction and requires additional initiatives to maintain the engagement and effectiveness of the marketing team. Control and coordination ensure that the plan is consistent with actual actions in complex logistical schemes, which contributes to the achievement of marketing goals.

[18] Source: compiled by the authors.

The third block of the conceptual model consists of five elements, some of which have been described in previous sections of this article. The first element is the process of planning a marketing complex using digital technologies adapted to the conditions of northern regions and tools for achieving strategic and operational goals. The second element is related to managing changes in the field of digital transformation, taking into account specific regional requirements, as well as optimizing, regulating and automating processes to increase the effectiveness of marketing activities.

Employee training and skills development are critical to successful digital transformation in the context of northern regions. Companies in the industrial market are faced with the need to implement new technologies, which requires employees to undergo continuous training and adaptation. For example, data analysis skills and understanding of digital tools adapted to regional conditions are becoming essential. Research shows that companies that invest in training programs focused on regional specifics demonstrate higher competitiveness and adaptability in the markets. According to research by publications such as Harvard Business Review [19], [20], [21] McKinsey [22], and others, companies that actively train their employees report increased efficiency and productivity. Organizations can use methods such as online courses, seminars, and workshops to improve their employees' professional skills, focusing on such aspects as data analytics, social media management, and digital communication.

Creating an adaptive team structure also plays a crucial role in the digitalization of processes, especially in northern regions. Flexible teams with cross-functional skills ensure rapid response to market changes. A Deloitte study [23] emphasizes the importance of forming such teams for achieving sustainable success in the era of digital transformation. Adaptive team structures based on Agile and Scrum technologies have become standards in many industries, as they enable rapid response to changes. These working methods promote closer collaboration between marketing, IT, and sales departments, ensuring consistency in the implementation of digital transformation strategies.

Cybersecurity development has become an urgent necessity in the digital age. Implementing a robust data security system helps industrial companies avoid leaks and protect confidential information. An article in the MIT Sloan Management Review [24] argues that companies should

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implement comprehensive security strategies, including employee education on cyber threats and the use of modern data encryption technologies. Effective cybersecurity can be achieved by creating specialized security departments and implementing advanced technologies, such as artificial intelligence and machine learning, to identify threats at early stages.

Thus, the management model described represents a comprehensive approach to managing the modern challenges associated with the digital transformation of industrial marketing in the rapidly changing environment of northern regions.

Conclusion

This study conducted a comprehensive assessment of digital marketing transformation in the northern industrial market, focusing on the challenges and opportunities companies face in the context of modern changes. The results demonstrate that digital transformation is becoming critical for the successful operation of enterprises in a rapidly changing environment, particularly in the context of northern regions, where unique climate conditions and remoteness from major markets create additional challenges. The implementation of new digital technologies, such as artificial intelligence, the Internet of Things, big data, and others, not only transforms business processes but also significantly impacts marketing decisions.

The authors developed and substantiated a conceptual model of digital marketing transformation for industrial markets in northern regions. Northern industrial markets require a more accurate and in-depth analysis of specific customer needs, consideration of labor resource constraints, and adaptation to rapidly changing, aggressive external conditions. This leads to the transformation of marketing strategies, goals, and priorities. In addition, northern regions have specific requirements for logistics and IT infrastructure, which play a key role in shaping approaches to digital transformation.

Modern digital technologies provide industrial enterprises with new opportunities for developing and optimizing marketing processes, which is particularly relevant for enterprises in the northern region of Russia and other regions of the world with similar conditions. In northern regions, particular attention is paid to sustainable solutions, such as the use of renewable energy sources and effective resource management.

The study identified key aspects of digitalization of the marketing complex, including the integration of the latest digital technologies into the 8Ps (Product, Price, Place, Promotion, People, Process, Physical Evidence, Performance). In the context of digital transformation, the marketing complex of industrial enterprises requires rethinking and integration with new IT tools. The ultimate goal of digital marketing transformation in northern industrial markets is to create a process in which each element interacts with the others, creating an effective business model.

In the modern digital economy, effective mechanisms and strategies have been developed for managing changes. The authors used the Nadler-Tushman congruence model to describe the changes a company undergoes during digital marketing transformation. The model includes four

elements: tasks, organizational structures and systems, culture, and personnel. Each of these elements changes at three key stages: optimization, regulation, and automation.

Based on the analysis, a model for managing digital marketing transformation was proposed, adapted to the conditions of northern regions. This management model addresses the main challenges hindering digital transformation processes, which are caused by:

- market turbulence, including frequent changes in the composition of suppliers, consumers and their needs;
- rapid development of digital technologies and, consequently, the need to quickly adapt to changing conditions;
- level of readiness (or unreadiness) of personnel for change and their ability to continuously learn and develop cross-functional knowledge, skills and competencies in the field of digital transformation;
- weak cross-functional coordination between internal departments, which prevents all organizational structures, programs, and processes from focusing their efforts on advancing through the stages of digital transformation;
- infrastructural limitations related to technologies and technical means, organizational structures, and legal mechanisms supporting transformation processes;
- cyber threats and the need for enterprises to create a reliable data protection system.

The findings of the study can serve as a basis for the development of future digital transformation strategies aimed at improving the efficiency and adaptability of industrial enterprises in the digital economy, which is particularly relevant for the complex external environment of northern regions. The implementation of the proposed models can help strengthen companies' positions in the markets and increase their resilience to external challenges.

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Assessment of the Potential for Solar Panel Implementation as Alternative Energy Sources in the City of Arkhangelsk

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Abstract. The green economy is currently receiving considerable attention around the world. Alternative energy sources are replacing traditional ones and are increasingly supported by the government and investors. Large projects in the renewable energy sector are being implemented in the country and worldwide. In the northwestern part of Russia, the most well-known example of such a project is the Kola wind farm, which is the largest facility located above the Arctic Circle. Compared to other regions, the potential of this industry in the Arkhangelsk Oblast is relatively small, which has prompted local scientists and representatives of the region's energy sector to identify ways to make the most effective use of alternative energy sources. Research and assessments of the effectiveness of implementing such energy generation methods as solar or wind power plants are constantly being carried out. This paper presents the results of a study of solar energy intensity in the central part of the city of Arkhangelsk using a solar power plant, analyses the dependence of electricity generation on external factors such as temperature and humidity, and provides data on average daily electricity generation. The economic efficiency of this experiment is calculated, and a conclusion is made about the effectiveness of using solar photovoltaic panels in the city of Arkhangelsk.

Keywords: *Arkhangelsk, green economy, solar photovoltaic panels, renewable energy, Arctic*

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Introduction

Throughout history, humanity has used and continues to use fossil fuels to provide various forms of energy. These types of fuel are the easiest to extract and use, but their continuous consumption over many years has gradually led to deterioration in the overall global environmental situation, as well as to a significant depletion of fossil fuel reserves. The most obvious way to influence both of the above threats is to introduce more alternative energy sources into the global energy supply system [1, Al-Okbi A., Vankov Y., Hussain H.M., p. 1; 2, Upadhyay S., Sharma M.P., pp. 48–50; 3, pp. 26–32]. One of such energy sources is solar energy.

Solar energy also has a number of quite significant disadvantages: low efficiency, dependence on weather conditions, and the complexity of conversion into other types of energy. This form of energy is becoming increasingly widespread due to one factor alone: the absence of any obvious impact on the environment and any emissions during the production of one of the simplest types of energy — electricity [4, Xinghui Z., Jiaojiao Y., Yi F. at al., p. 214; 5, Filippo P., Nelson S., Francesca L. at al., p. 4].

Solar photovoltaic panels are used to convert solar energy into electrical energy. Such panels have a significant advantage over other alternative energy sources — they can be used in various geographical locations and landscapes without reducing efficiency: in mountains, plains and forests, the efficiency of this energy source will be equivalent under equal conditions of solar activity [6, Oleynikov A.M., Kanov L.N., pp. 62–63]. The scale of their application is also wide: solar panels are used both in large power plants supplying entire regions, and in individual mode — they are installed in summer cottages, cottage settlements, industrial workshops and enterprises [7, Gloeckler M., Sankin I., Zhao Z., pp. 1390–1391; 8, Ali N., Hussain A., Ahmed R. at al., p. 727].

Taking into account the climatic features of the Arkhangelsk Oblast, the use of energy sources such as wind or solar can be considered on a small scale to provide electricity to individual households or enterprises [9, Yu L., Yixiang S., Ningsheng, pp. 43–44; 10, Pandey A., Tyagi V., Jeyraj A. at al., p. 862].

In order to correctly assess the potential of a specific area for solar energy production, many factors should be taken into account: solar activity and its variation by month and season, the landscape of the area, humidity in the region of use, and temperature conditions, which also affect the efficiency of solar panels. All of the above characteristics can be obtained using official meteorological sources, but the data from these sources is often exaggerated compared to the actual indicators in the study area.

The purpose of this study is to obtain and process data from a photovoltaic solar power plant (hereinafter referred to as SPP) installed on the university campus. Based on the data obtained, a conclusion is made about the efficiency of this solar panel when used as a source of electrical energy for one of the educational and laboratory buildings of the Northern (Arctic) Federal University named after M.V. Lomonosov (hereinafter referred to as NArFU).

Materials and methods

In order to determine the total solar radiation values for the coordinates 64°53′02″ north latitude and 40°55′17″ east longitude (location of the NArFU SPP), a DAVIS Instruments Vantage Pro 2 ground-based weather station (hereinafter referred to as the NArFU weather station) and a PCE-SPM 1 solar radiation detector (hereinafter referred to as the solar radiation detector) were used. Data on the level of electrical energy generation by the SB array depending on the amount of solar radiation were recorded in the NArFU SPP system.

The total solar radiation reaching the horizontal surface of the Earth was measured using a solar radiation sensor installed at a right angle to the Earth's surface, as shown in Figure 1, which is part of the weather station shown in Figure 2. This weather station kit also includes: a weather station control unit, a temperature sensor, a relative humidity sensor, an atmospheric pressure sensor, a precipitation sensor, and an anemometer. The weather station measures atmospheric pressure, outdoor and indoor air temperature, outdoor and indoor relative humidity, wind speed and direction, dew point temperature, precipitation amount and intensity, date and time, weather forecast, moon phase, sunrise and sunset times.

Fig. 1. Total solar radiation sensor.

Fig. 2. DAVIS Instruments Vantage Pro 2 weather station with control unit.

The PCE-SPM 1 detector, shown in Fig. 3, was used to measure reflected solar radiation [11, Kafetzis A., Ziogou C., Panopoulos K.D. et al., p. 14; 12, Elmohlawy A.E., Ochkov V.F., Kazandzhan B.I., p. 3]. The detector recorded total solar radiation, including direct, diffuse, and reflected radiation. To assess the contribution of reflected radiation, additional measurements were taken at various sensor tilt angles (-90°, -45°, 0°, 45°, and 90°), which allowed for recording reflected radiation from various surface types, including snow cover and soil.

The data obtained showed that snow cover significantly increases the proportion of reflected radiation in the total radiation, which is especially relevant for high latitudes in spring. However, this research did not distinguish between the individual components (direct, diffuse, and reflected radiation), which is planned for future studies using appropriate models and analysis methods. Taking these factors into account will improve the accuracy of assessing the impact of reflected radiation on the performance of solar photovoltaic cells.

Fig. 3. PCE-SPM 1 solar radiation detector.

The SB array under study is part of the NArFU SPP. The SPP is integrated into the general power supply system of the laboratory building of the Department of Thermal Power Engineering and Heat Engineering. The power supply circuit is designed in such a way that the SPP can be completely disconnected from the laboratory's power supply system for conducting research without loss of power to the load [13, Alramlawi M., Li P., p. 2025].

The developed circuit ensures the operation of the load devices in three configurations:

- the load is powered only by alternative energy sources;
- the load is powered only by the building's switchgear;
- the load is powered by alternative energy sources with the possibility of supplementing the missing power from the grid.

The parameters studied by the SB were monitored and recorded using the Malina-2 software and hardware complex based on a microcomputer for remote monitoring of power grids and control of inverters, MPPT controllers and batteries. This software was used to record the main operating parameters of the solar power plant, in particular the power and current generated by the solar panels, the state of charge and voltage of the batteries, and the power consumption [14, Romanov K., p. 247].

The SPP configuration is presented in Table 1 [14, p. 246]. The main characteristics of the SPP are presented in Table 2 [14, p. 246]. The technical characteristics of the components are presented in Tables 3–6 [14, pp. 246–247]. Figure 4 shows the location of the weather station and the SPP components.

The solar photovoltaic cells were installed at an angle of 30° to the horizontal surface and oriented to the south (azimuth 0°). This choice was based on recommendations for maximum panel efficiency in northern latitudes.

Table 1

Configuration of the SPP

Name of component	Number of pcs
SB	6
Inverter	1
MPPT controller	1
Battery	8

Table 2

Main parameters of the SPP

Parameter	Value
Rated power	1200 W
Output voltage	220 V
Frequency	50 Hz

Table 3

Technical characteristics of the solar panel

Parameter	Value
Rated voltage	24 V
Rated power	200 W
Peak power	30 V
Open circuit voltage	36,5 V
Short-circuit current	7.13 A
Current on peak power	6.67 A
Maximum voltage in the system	1000 V
Connector	MC4
Size (LxWxD)	1326 x 990 x 35 mm
Weight	16 kg
Operating temperature	-40 to +85°C
Rate of germination	IP 65
Light transmittance of the glass	97%
Glass	Tempered, with anti-glare coating
Wind load	to 60 m/s (200 kg per square meter)
Photovoltaic conversion efficiency (COP)	to 17.3%
Photocell type	polycrystalline

Table 4

Technical characteristics of the battery

Parameter	Value
Battery model	GST 12-100 SOLAR 12V 100 Ampere-hour
Service life	To 12 years
Capacity	100 Ampere-hour
Electrolyte	Sulphuric acid, condensed in gel

Table 5

Technical characteristics of the inverter

Parameter	Value
Rated power	6000 W
COP	93 %
Battery voltage	24 V
Output voltage	220 V
Frequency	50 Hz
Peak power	9000 W
Maximum power	6000 W
Own consumption on idle	9.6–14.4 W

Table 6

Technical characteristics of the MPPT controller

Parameter	Value
Battery voltage	12, 24, 36, 48, 96 V
Maximum of charge current	100 A
Maximum power of solar panel	12V – 1350 W, 24V – 2750 W, 48V – 5500 W, 96V – 1100 W
Maximum voltage of solar panel	185 V
Standby power consumption	to 1,9 W
Maximum COP	12 V - 95 %, 24 V - 96,5 %
Type of battery	Gelitic, lead-acid, alkaline
Operating temperature	-40 °C to 60 °C
Humidity (non-condensing)	95%

Fig. 4. Location of the SPP and weather station.

Total solar radiation has been measured since 2019 using a meteorological station installed perpendicular to the Earth's surface. Measurements of radiation reflected from snow cover and total solar radiation using a solar radiation detector were carried out in specific cases to determine the instantaneous radiation value in the spring months.

Results and discussion

As a result of the study, data on solar activity, humidity, ambient temperature, and electricity generation were obtained and processed using a photovoltaic station installed on the university campus.

Information on the data obtained is shown in Figures 5–7. This study presents results acquired throughout 2023, excluding months where weather conditions affected measurement accuracy. The ice crust that formed during January, February, November, and December did not allow for maximum accuracy in data sensing. The experiment is currently ongoing.

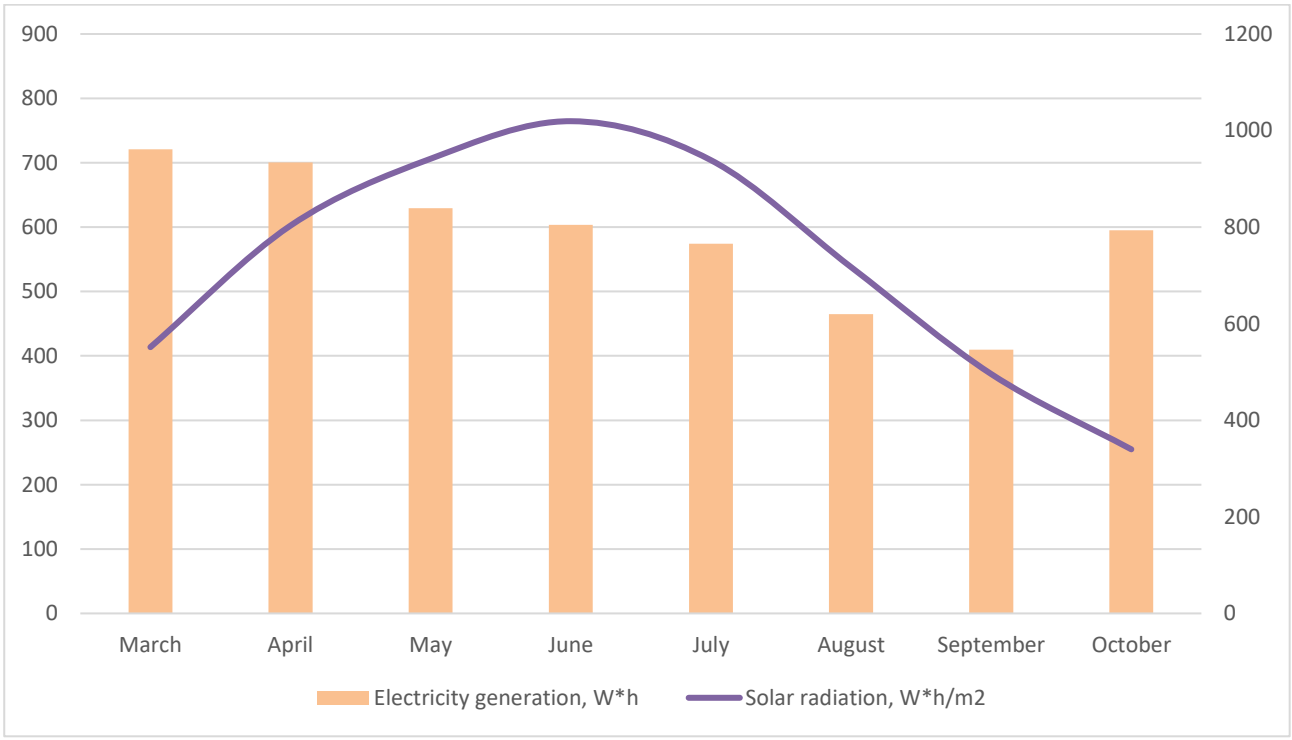

Fig. 5. Dependence of electricity generation on solar radiation during 2023.

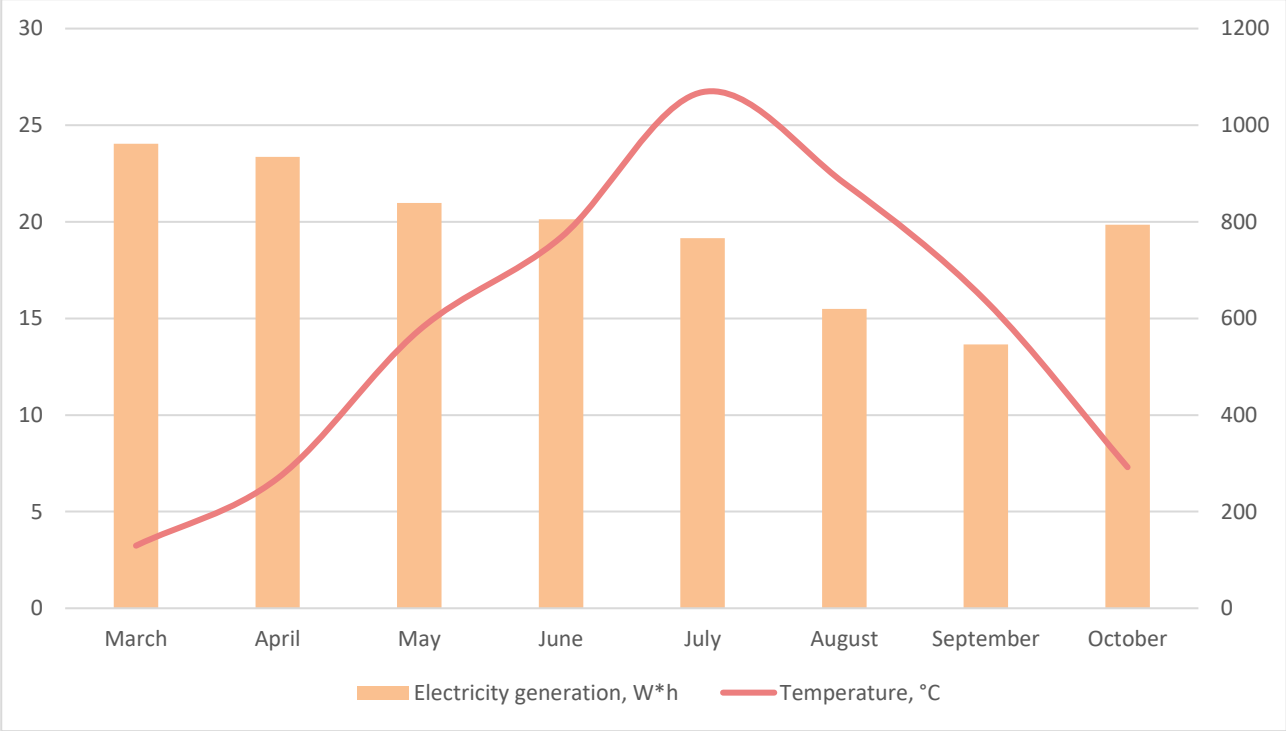

Fig. 6. Dependence of electricity generation on ambient temperature during 2023.

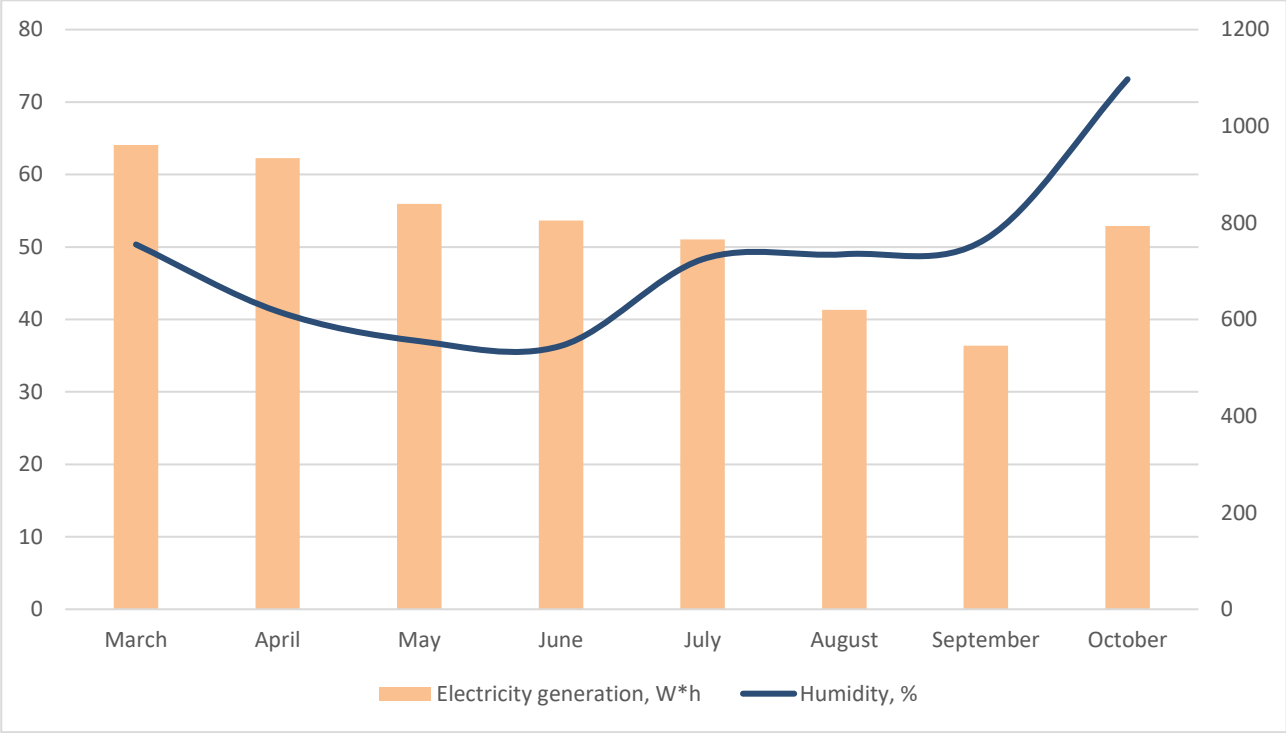

Fig. 7. Dependence of electricity generation on humidity during 2023.

One of the important factors affecting the generation of electrical energy by solar photovoltaic cells is the temperature of the environment and of the modules themselves. To analyze the influence of temperature in the city of Arkhangelsk, an assessment was made of the dependence of energy production on the module temperature recorded during the experiment. According to the data obtained, an increase in module temperature led to a decrease in energy production, which corresponds to the known temperature coefficients of reduction in the efficiency of photovoltaic

cells specified in the technical documentation. For example, in the temperature range from -7°C to +25°C, the decrease in energy production was up to 8% for every 10°C increase in temperature. This confirms the need to take temperature fluctuations into account when designing solar energy systems in regions with diverse climatic conditions. At the same time, humidity and solar activity affect electrical energy generation in direct ratio.

Analyzing the experimental results presented in Figures 5–7, it was noted that in the spring months, the amount of energy generated by the SPP exceeds similar values in the summer months, despite lower solar insolation. The two factors that influence efficient generation in the spring months are the ambient temperature and the zenith angle of the Sun. As part of the study, solar panels were installed at a fixed angle of 30° to the horizontal surface and pointed strictly south (azimuth 0°). This orientation was chosen to maximize energy generation efficiency in northern latitudes.

During the experiments, the influence of reflected solar radiation was identified, which was not taken into account in the regression models, but affects the operation of the photovoltaic cells.

Let us consider the operation of the SPP on selected spring and summer days. Tables 7–8 present the main data on the operation on April 7 and July 15, 2023.

Table 7

Experimental data on the operation of the SPP on April 7, 2023

Time	SPP generation, W·h	Insolation, W·h /m^2	Temperature, °C	Humidity, %	Zenith angle, °
0:00	0	0	-4	46	90
1:00	0	0	-5	43	90
2:00	0	0	-5	44	90
3:00	0	0	-6	45	90
4:00	0	0	-7	47	90
5:00	1	8	-7	49	89
6:00	17	65	-7	49	83
7:00	47	178	-6	46	76
8:00	104	274	-4	43	70
9:00	347	432	-2	39	65
10:00	547	512	2	28	61
11:00	643	555	4	23	58
12:00	762	573	4	24	58
13:00	906	549	5	20	59
14:00	829	492	6	19	62
15:00	498	393	6	18	66
16:00	448	291	8	16	72
17:00	249	208	8	17	78
18:00	18	91	8	25	84
19:00	0	23	7	31	90
20:00	0	0	5	36	90
21:00	0	0	3	37	90
22:00	0	0	1	39	90
23:00	0	0	0	41	90

Table 8

Experimental data on the operation of the SPP on July 15, 2023

Time	SPP generation, W·h	Insolation, W·h /m^2	Temperature, °C	Humidity, %	Zenith angle, °
0:00	0	0	18	64	90
1:00	0	0	18	66	90
2:00	0	2	18	68	90
3:00	2	17	17	68	87
4:00	12	32	17	70	82
5:00	22	127	18	69	76
6:00	22	293	19	66	70
7:00	99	415	21	64	64
8:00	157	415	22	60	57
9:00	223	553	23	55	52
10:00	498	618	24	50	47
11:00	490	666	25	46	44
12:00	620	626	25	38	43
13:00	614	587	26	37	45
14:00	423	473	26	39	48
15:00	160	257	26	39	53
16:00	61	129	25	44	59
17:00	38	88	25	49	65
18:00	7	30	24	51	71
19:00	0	13	18	78	78
20:00	0	9	18	82	83
21:00	0	6	18	78	88
22:00	0	0	18	78	90
23:00	0	0	18	79	90

It should be noted that the results of the comparison of SPP operating modes presented in Tables 7 and 8 can be refined for different tilt angles and azimuths, as these parameters significantly affect the volume of incoming solar radiation.

Based on the data obtained on April 7, it can be established that the level of energy generation by the solar power plant was significantly higher than could be expected based on direct insolation alone. This effect is explained by the additional contribution of reflected solar radiation from the snow cover, which increases the total amount of energy reaching the surface of the solar panels. It has been established that in spring conditions, reflected radiation can account for a significant proportion of total solar radiation, which is confirmed by measurements at various panel tilt angles.

Figure 8 shows the SPP operating conditions on April 7. Snow cover located under the SB array is capable of reflecting solar radiation onto the surface of the photovoltaic cells. It is evident that on July 15, the main reflective surfaces were paving stones and grass, which have much lower reflection coefficients than snow cover. Reflected solar radiation was measured using a radiation sensor according to the diagram: figure 9 shows the tilt angles at which measurements were taken by the solar radiation detector. Reflected solar radiation was recorded at detector positions of -90° and -45°.

Fig. 8. Conditions for conducting the experiment on April 7, 2023.

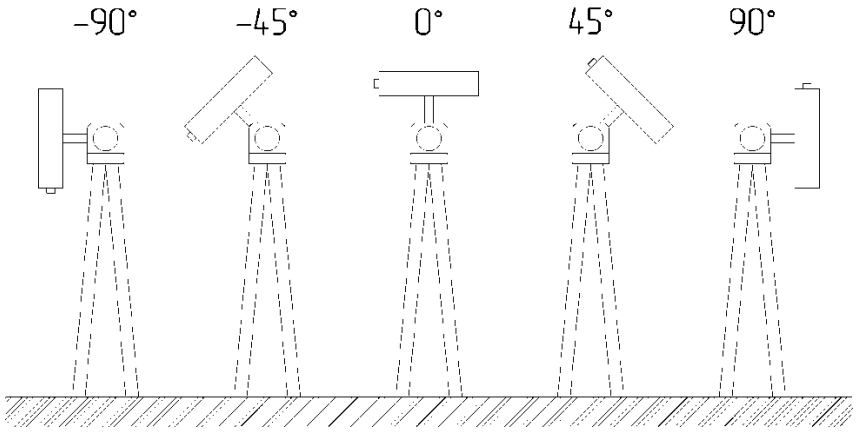

Fig. 9. Solar radiation measurement scheme.

The results of solar radiation measurements on April 7 and July 15 are presented in Tables 9 and 10.

Table 9

Results of solar radiation measurements on April 7, 2023

Time	Solar radiation at different detector tilt angles, W/m^2				
	-90°	-45°	0°	-45°	90°
11:50	294	455	1047	998	599
13:30	317	500	1098	951	604
15:56	227	385	802	770	324

Table 10

Results of solar radiation measurements on July 15, 2023

Time	Solar radiation at different detector tilt angles, W/m^2				
	-90°	-45°	0°	45°	90°
12:50	95	96	341	1046	654

The measurement results showed that during the snowy period, reflected solar radiation accounts for a significant portion of the total radiation recorded on the panel surfaces. For example,

at tilt angles of -90° and -45°, the radiation level from the snow cover exceeds that values from the ground. This is explained by the high reflectivity of the snow surface.

However, the data were obtained on the basis of total radiation measurements, without distinguishing its individual components (direct, diffuse, and reflected). In order to accurately assess the contribution of reflected radiation and its exact impact on energy production, additional measurements are planned, taking into account the spatial orientation of the panels, weather conditions, and the spectral composition of the reflected radiation.

To increase the efficiency of photovoltaic stations operating in high latitudes by reflecting solar radiation, it is recommended to cascade SBs on structures closer to the ground surface, up to the permissible wind load values for the solar panel array area, at an angle to the Earth's surface equal to the zenith angle of the Sun.

A technical and economic calculation was performed to assess the economic efficiency of the SPP. The cost of the equipment is shown in Table 11.

Table 11

Cost of the SPP equipment

Name of component	Number of pcs	Cost, rubles
Polycrystalline SB, 200W, 24V	6	73 200
Battery, 12V, 100Ah	8	104 000
Solar MPPT controller	1	40 900
Inverter 6 kW, 24V	1	89 900
Total		308 000

The cost of hiring specialists to install the equipment is estimated at 20% of the cost of the equipment being installed, which in this case amounts to 61,600 rubles.

To assess the economic efficiency of using a solar power plant in Arkhangelsk, data on average seasonal electricity generation was analyzed. The level of insolation in high latitudes varies depending on the season, so calculations of the average annual energy production were based on seasonal insolation data obtained during the experiment.

The average seasonal production was:

- Winter (December–February): 200 kWh;
- Spring (March–May): 1,200 kWh;
- Summer (June–August): 1,800 kWh;
- Autumn (September–November): 800 kWh.

The average monthly energy production was calculated for each season and then summed up to determine the annual value. This approach made it possible to take into account the difference in insolation levels characteristic of high latitudes, where daylight hours and solar activity are significantly lower in winter than in summer. The total annual output was 4,000 kWh, which corresponds to the data obtained during the experiment.

This value was used to calculate economic efficiency instead of the average value based on daily output. This approach allows for a more accurate assessment of the impact of seasonal changes in insolation on economic indicators.

Taking into account these data and the current electricity tariff (6 rubles 59 kopecks per 1 kWh), the annual savings will amount to 26,360 rubles. Calculations based on a 20-year system service life, rising electricity tariffs, and component replacement costs show that the system will pay for itself over its service life, providing savings of approximately 12% on electricity costs.

When calculating tariff rates and, accordingly, annual savings, it is necessary to take into account the discount rate, which is taken as the average annual growth in electricity tariffs for residents of Arkhangelsk (8%). The calculation is made using the formula [15, Kuryakova N., p. 73]:

$$FV = \sum_{n=1}^{20} PV \cdot (1+i)^n \quad (1),$$

where *FV* — economic benefit from use during the calculation period, reduced to present value;

PV — economic benefit in the first year of service, 23,065 rubles;

n — calculation period, 20 years;

i — average annual increase in electricity tariffs in the Arkhangelsk Oblast, 8%.

The calculation shows that over 20 years of operation, the solar battery set will save 1,055,500 rubles.

According to equipment manufacturers, the average service life of batteries is 9 years, and the average service life of controllers and inverters is 14 years. Accordingly, the batteries will be replaced in the 9th and 18th years of operation, and the controller and inverter — in the 14th year of operation. We assume an inflation rate of 4%. Replacement costs are calculated using the formula [15, Kuryakova N., p. 73]:

$$З = З_а \cdot (1+i)^9 + З_а \cdot (1+i)^{18} + З_{к/и} \cdot (1+i)^{14} \quad (2),$$

where $З_а$ — batteries replacement costs, 104,000 rubles;

$З_{к/и}$ — controller and inverter replacement costs, 130,800 rubles;

i — inflation rate, 4%.

The overall economic efficiency of using solar batteries as a source of electrical energy [15, Kuryakova N., p. 73]:

$$R = FV - З_{пр} - З, \quad (3),$$

where *FV* — economic benefit from using solar batteries over the calculation period, reduced to present value, 1,055,500 rubles;

$З_{пр}$ — cost of purchasing a set of solar panels, 369,600 rubles;

З — total cost of replacing components, 585,212 rubles.

Calculations using the above method showed that 20 years of operation of the equipment used for the experiment will result in savings of 100,687 rubles. This amount is approximately 10% of the cost of electricity for the calculation period, adjusted for inflation.

Conclusion

As a result of the study of solar panel operating parameters under various weather conditions, a conclusion was made about the most effective months for using this installation. To increase the efficiency of the SPP in northern latitudes, further analysis of the spatial orientation of the panels and its impact on energy production is required. It is worth noting that the efficiency of SPPs is highest in snowy weather due to reflected solar radiation.

Based on the results of the experiment, an assessment of the economic efficiency of using SPP in Arkhangelsk was conducted, taking into account seasonal variations in solar insolation. Calculations showed that annual electricity generation is approximately 4,000 kWh, which takes into account differences in solar activity levels in winter, spring, summer and autumn. This approach provides a more accurate representation of the SPP's efficiency in high-latitude conditions.

The economic benefit of using SPP over a 20-year operating period, taking into account the cost of replacing components and the increase in electricity tariffs, will be approximately 12% of the total electricity costs for the specified period.

Further research is planned using a more detailed accounting model, including the impact of cloud cover, panel tilt angle and other climatic factors in order to more accurately assess the efficiency of SPPs under various operating conditions.

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Public Involvement in the Investment Process as a Factor in the Formation of Additional Financial Instruments in the System of Sustainable Development of the Arctic Region (Based on Sociological Surveys of Experts and the Population in 2024)

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Abstract. The article discusses the issues of ensuring the sustainable development of the Arctic region by attracting investments from the population as a factor influencing the formation of additional financial instruments. Sociological tools are used to identify opportunities for the population living in the Far North and Arctic regions of the Russian Federation to form savings and the most attractive financial instruments for the population when investing them, to assess the characteristics of financial instruments that are most significant for the population, and to identify regional financial instruments that are alternatives to bank deposits (regional bonds, regional investment funds, etc.) that may be in demand among the population when choosing investment options. The study used data from sociological surveys conducted by the authors in two stages during 2024. The first stage involved analyzing the results of an expert survey conducted among representatives of the scientific community within the framework of the scientific and practical conference "Luzin Readings 2024". The second stage included a mass survey of the population living in the Arctic agglomerations (using the Murmansk Oblast as an example). It is concluded that there is a significant potential for public investment in improving the sustainability of the region's development. The transformation of population savings creates prerequisites for ensuring more stable conditions for the development of the Arctic regions, since they fill their economies with additional financial resources.
Keywords: *population investments, savings, additional financial instruments, sustainable development, Arctic region, expert survey, Murmansk Oblast*

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Introduction

The Arctic regions of the Russian Federation are in constant need of additional sources of financial resources. In the context of global transformations in the financial market, restrictions

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associated with the introduction of sanctions by some countries against the Russian Federation, problems with attracting external sources of financing and the withdrawal of foreign investors from the country, household savings are becoming increasingly important.

The long-term socio-economic development forecast developed by the Ministry of Economic Development of the Russian Federation for the period up to 2030, approved by Decree of the Government of the Russian Federation No. 2816-r of 6 October 2021 [1], contains information on investment resources, including household savings. According to this forecast, it is necessary to stimulate the investment potential of the population by increasing the reliability of financial institutions, including the banking sector, creating new financial instruments that are attractive to the population, and improving its financial literacy.

The limited capabilities of the regional financial system are prompting a search for ways to attract financial resources from private investors, which could include the local population. At the same time, solving this problem remains quite difficult, as the amount of money accumulated by the population is still not very significant compared to even some Asian countries. For example, in India and China, household investment accounts for approximately 5% of GDP, while in Russia, this figure barely exceeds 0.25% of GDP. In more developed economies, the value of household population investment can reach 10% of GDP [1].

The problem of attracting private investment to the Russian financial system has been addressed for decades. Mutual investment funds (MIFs) were created in the 1990s. The total value of MIF assets increased to 10.2 trillion rubles in 2023, and the number of shareholders reached 10 million people [2]. At the same time, other financial instruments may be less popular among the population. However, there has been an increase in the volume of contributions to non-state pension funds: for example, in the first half of 2024, investments in NPFs amounted to 91.6 billion rubles, of which 58.2 billion rubles were investments by the population. Compared to the same period in 2023, the growth of investments made by the population amounted to 45% [3]. Common financial instruments also include individual investment accounts, life insurance savings programs, investments in bonds, stocks, and other investment funds.

Currently, a partial recovery of the Russian stock market compared to 2023 can be observed. Investment funds with net asset values exceeding 500 million rubles demonstrated growth in share value in the first half of 2024, whereas a year earlier, two-thirds of the funds were unprofitable [4].

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At the same time, there are factors that constrain the use of this financial instrument by the population. For example, there is a certain threshold, in other words, a minimum share value for making an initial contribution [2]. For shareholders in closed-end funds, the minimum amount is 100,000 rubles, and in some cases it can be set as high as 250,000 rubles [3]. In open-end funds, it is significantly lower. This significantly impacts the public's ability to invest in MIFs. The Central Bank of the Russian Federation is considering the possibility of removing the minimum threshold for closed-end MIFs, which should significantly increase the accessibility of investing in these financial instruments [5]. Furthermore, the accessibility of MIFs is also influenced by the average size of management companies' commissions, which vary from 1 to 4.5% of assets per annum. It is legally established that the cost of such a commission should not exceed 10% per annum [6].

However, there are prospects for the formation of household investments as additional financial instruments to ensure the sustainable development of the Arctic region, despite the challenges associated with the presence of individual investors in the stock market [4]. The population of the Arctic regions remains quite conservative in terms of conducting financial transactions and using them as assets invested in various financial instruments. This is due to historical memory, which has led to skepticism and mistrust, and also has objective preconditions caused by population migration processes from the Arctic regions and the decline of its active part [5].

In order to improve the investment culture of the local population, it is necessary to implement measures aimed at increasing financial literacy and popularizing financial knowledge through all available sources of information [6]. This work should be carried out starting with the younger generation in schools and ending with explaining the basics of financial literacy to elderly [7]. However, even in this case, one should not expect a quick effect from the measures implemented, since even in Western Europe and the United States, the level of financial literacy is not directly related to the level of investment activity of the population. For example, a survey conducted by FINASTRA Financial Services State of the Nation for 2023 revealed that only 14% of all respondents demonstrated excellent knowledge, while approximately 80% of US residents invest[7].

New financial technologies can also have a significant impact on the level of investment activity, as they make financial services accessible and convenient, reduce barriers to regular investment, and generally increase confidence in the financial system.

Thus, specifying proposals for the population of the Far North and the Arctic regarding the conditions for forming savings and using investment instruments, and determining the most significant characteristics of financial instruments can expand the range of opportunities for the development of the regional financial system.

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Methodological foundations for assessing and regulating the investment behavior of the population in the regional financial market

In this paper, we consider the population's investments in financial market instruments from the perspective of their impact on the sustainable development of the Arctic region. Other researchers use different definitions of the population's investment behavior.

In the work of O.S. Litvinova, investment behavior is understood as a set of specific actions of both individuals and legal entities making financial and non-financial investments [8]. This interpretation has similar features to the concept of "investment activity", as it describes the investment process itself rather than defining the direction of investment behavior.

A.A. Pereverzeva proposes a different interpretation of the concept of "investment behavior", which is considered as a characteristic of the actions of people investing in various financial instruments for the purpose of making a profit, as well as investing in other objects that provide a beneficial effect [9].

Another researcher, Ya.M. Mirkin, examines investment behavior from the perspective of the actions of securities market actors as part of the financial market and offers his own classification of investment behavior models used in different countries. He identifies the characteristic features of the Anglo-Saxon, German, Japanese, Islamic, and mixed models of investment behavior [10]. According to Ya.M. Mirkin, elements of the Japanese and German models prevail in Russian practice, as the population chooses a savings model of behavior with a predominance of investment in traditional financial instruments, such as bank deposits, while the level of activity in the financial market remains consistently low.

Along with investment behavior, Russian researchers consider the concept of "investment potential" in their works. For example, L.S. Valinurova, O.B. Kazakova and N.A. Kuzminykh define it as the material basis that makes it possible to ensure the necessary dynamics of the socio-economic development of a territory. They include not only financial assets but also tangible and intangible assets in the categories of investment potential [11].

Another group of researchers, including G.V. Zakharova and T.N. Morgun, defines investment potential as the ability of a regional economy to achieve maximum results under current conditions [12].

The approach of R.A. Karmov is of particular interest, as the researcher considers investment potential to be a significant element of investment behavior. He attributes the population's own resources, which enable them to achieve specific results through their use, to investment potential [13].

O.Yu. Bestuzheva stands out among the researchers analyzing the factors of investment behavior. She concludes that the population's investment behavior in the regional financial market is influenced by socio-economic factors, including savings, age and gender differences, level of education, investment preferences and some others [14].

Yu.B. Podgornaya identified five factors of the population's investment behavior. Firstly, these include socio-economic conditions that determine the level of real income of the population, the level of consumption, the level of confidence in the future, and the presence of crisis phenomena. Secondly, these are the population's capabilities, determined by the share of savings in the income structure, limited credit opportunities, the limitations of the financial market itself, and the low prevalence of collective investment. Thirdly, there is a lack of financial literacy, which leads to a misunderstanding of the specifics of various financial instruments. The fourth factor is the investment interest and desire to invest. The fifth factor, according to the researcher, is the investment climate, conditioned by political and economic conditions [15].

Foreign literature also offers various approaches to defining investment behavior. For example, in the work of D. Jorgenson, the origin of investment behavior is the neoclassical theory of optimal accumulation, which is based on the provisions regarding the desired amount of capital to be achieved at a certain time point, and the focus shifts to maximizing consumption utility [16].

In the work of O. Aregbeyen and S. Mbadiugha, the factors of investment behavior are divided into four main groups. The authors include economic factors in the first group, among which are, for example, financial indicators of organizations, expert forecasts regarding the probable return on shares, stock exchange reports, etc. The second group, in their opinion, consists of social factors, including broker recommendations, information about majority shareholders, and data on the ownership structure of companies. The third group includes cultural factors, such as the investor's own investment behavior model, awareness of investment prospects, willingness to be engaged in financial market transactions, and recommendations from friends and acquaintances. The authors classify psychological factors as the fourth group, including the assessment of the security of savings, an increased willingness to conduct transactions in the financial market as a result of studying relevant financial literature and improving the investor's financial literacy, a rational assessment of risk factors and readiness for possible failures, the factor of "confidence in the future" and fear of possible job loss, the presence of successful examples in investing funds [17].

Based on a summary of the approaches by Russian and foreign authors, it can be concluded that the investment behavior of the population is considered exclusively from the perspective of investing in financial instruments, with a description of the various factors influencing investor's behavior in the financial market. At the same time, aspects of the population's investment behavior in the regional financial market and the choice of financial instruments (regional bonds, regional investment funds, etc.) that may be relevant to the population in the Far North and Arctic regions of the Russian Federation remain insufficiently studied.

Analysis of the Arctic region population's involvement in the investment process as a factor in the formation of additional financial instruments

We conducted a series of sociological studies to assess the population's involvement in the investment process and to analyze the demand for additional financial instruments in the Arctic region's sustainable development system.

At the initial stage, data was obtained from an expert survey conducted among representatives of scientific organizations dealing with socio-economic issues of development of the northern and Arctic regions of the Russian Federation [8]. The survey was conducted from May 30 to June 1, 2024, as part of the international scientific and practical conference "Luzin Readings 2024", during which the main characteristics of the population's investment behavior were studied and the financial instruments most in demand in the regions of the Far North and the Arctic were characterized.

The second stage of the study involved conducting a mass sociological survey among the population of key Arctic cities in the Murmansk Oblast [9, 10]. This survey examined various aspects of investment behavior, including assessing savings opportunities for residents of the region, identifying the most popular financial instruments, revealing behavior patterns characteristic of various population groups, and determining the primary financial management methods chosen by residents of Arctic cities. The survey was conducted using a quota sampling method, with a sample population determined for each city. The total sample size was 360 people. Overall, the combination of expert and mass sociological surveys allowed obtaining a number of original results.

As part of the survey, experts were asked to assess the savings opportunities of residents living in the Far North and Arctic regions of the Russian Federation (Fig. 1).

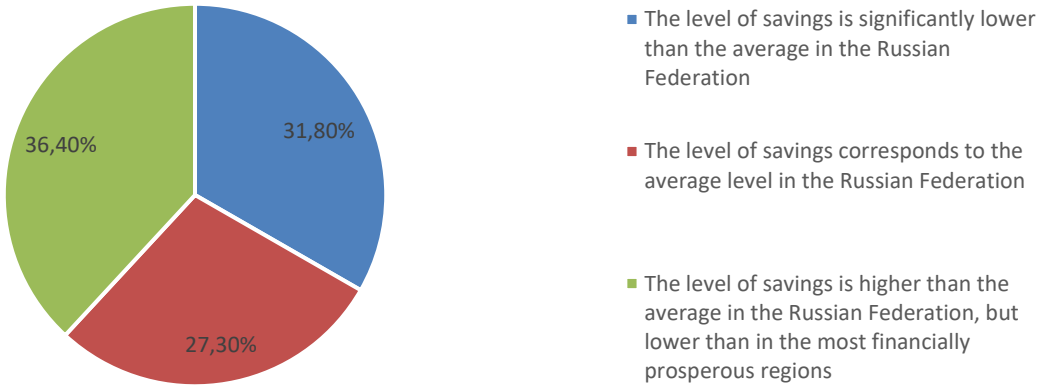


Fig. 1. Please assess the savings opportunities of residents living in the Far North and Arctic regions of the Russian Federation [11].

It should be noted that experts expressed mixed opinions on this issue. Approximately 36.4% of experts believe that the population's savings potential is higher than the average for the Russian Federation, but lower than in the most financially prosperous regions. Almost third of experts

[8] The survey involved 35 experts from the Murmansk Oblast, St. Petersburg, Moscow, and several other cities.
[9] Order of the Government of the Russian Federation of November 28, 2023 No. 3377-r "On approval of the list of key settlements (municipalities) of the Arctic zone of the Russian Federation, including those performing functions to ensure national security and (or) functions as a base for the development of mineral resource centers, the implementation of economic and (or) infrastructure projects in the Arctic". URL: https://www.garant.ru/products/ipo/prime/doc/408019009/ (assessed 25 October 2024).
[10] The town of Polyarnye Zori was added to the list of key settlements of the Russian Arctic zone. The Murmansk Oblast Government. URL: https://gov-murman.ru/info/news/527267/ (assessed 25 October 2024).
[11] Results of the expert survey conducted by the authors from May 30 to June 1, 2024, as part of the international scientific and practical conference "Luzin Readings 2024". Source: compiled by the authors.

(31.8%) believe that these opportunities are lower than the Russian average, and 27.3% indicate that this potential is in line with the Russian average. This means that a significant number of experts tend to believe that there are no obvious peculiarities in the savings formation and accumulation processes in the Far North and Arctic regions of the Russian Federation.

At the same time, the population's assessments of their opportunities for forming savings in this Arctic region are of interest. An analysis of a mass sociological survey of the population in key Arctic cities of the Murmansk Oblast revealed that in a number of cities, the percentage of respondents with incomes above the Russian average is quite high (Fig. 2). For example, in the city of Kirovsk, the proportion of people with a high savings rate reaches 17.1%, slightly less than in the cities of Monchegorsk (15.2%) and Murmansk (12.4%). Moreover, the regional capital ranks only third in this category. Savings rates are quite high among those who have deposits below the Russian average size. For example, in Monchegorsk, 57.6% of the population has such deposits, in Polyarnye Zori — 40%, and in Murmansk — 38.6%. Meanwhile, in the Murmansk Oblast as a whole, almost half of the respondents (48.3%) have no savings at all. Respondents also indicated other forms of capital preservation, such as investing in real estate and using various financial instruments. Among all the cities surveyed, only Apatity has a slightly worse situation with household savings. This may be due to the lack of large industrial enterprises that provide their employees with a consistently high income.

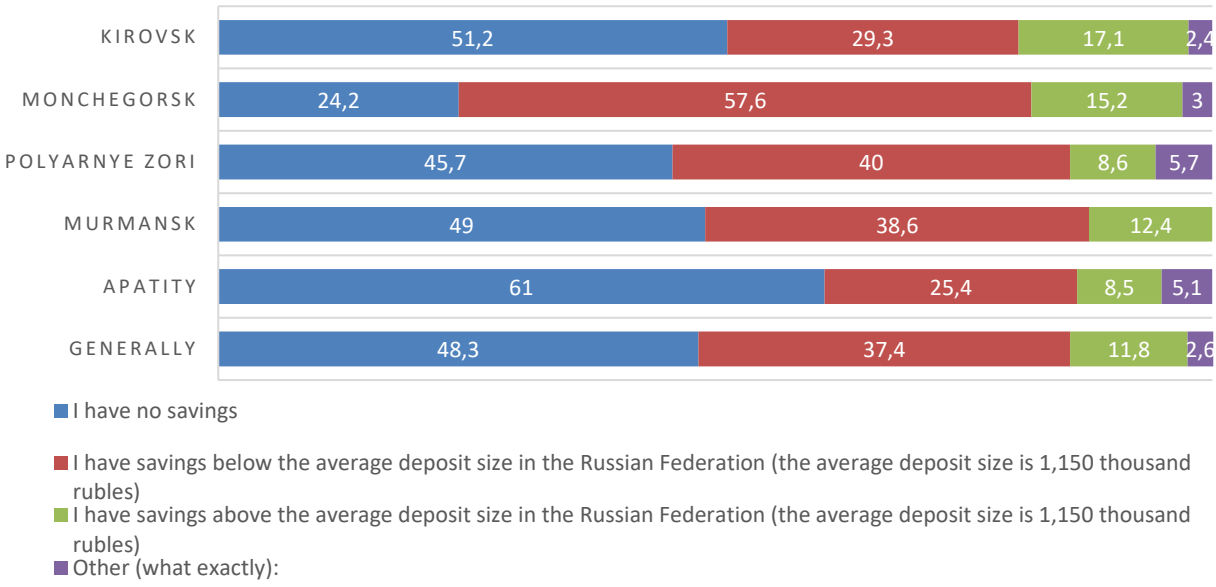


Fig. 2. Please assess your ability to form savings, % [12].

The distribution of responses by gender and age structure is of interest (Fig. 3). Data analysis reveals that men in the middle age category (45 to 59 years old) and the older generation of both men and women (over 60 years old) have the highest potential for forming savings. Among these categories, there are the most people with incomes above the Russian average for deposits.

[12] Results of the mass sociological survey of the population of the Arctic agglomerations of the Murmansk Oblast, conducted by the authors from October 1 to 20, 2024. Source: compiled by the authors.

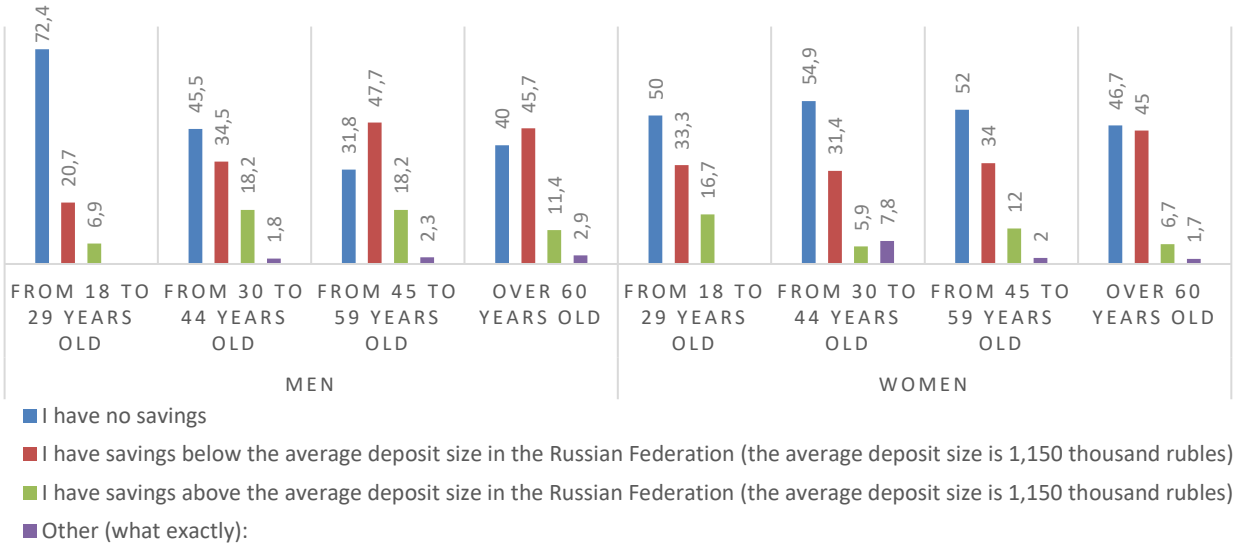
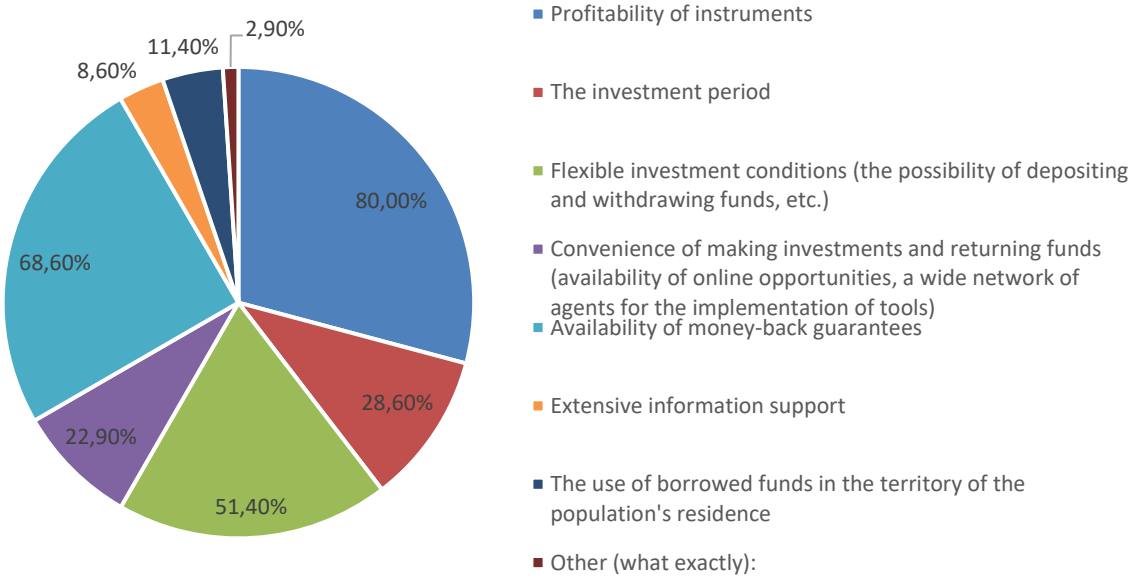


Fig. 3. Opportunities for savings (distribution of responses by gender and age), % [13].

Among those who have no savings, there is a significant number of young men aged 18 to 29 (72.4%), young (50.0%) and middle-aged women (54.9%), as well as older women aged 45 to 59 (52.0%). At the same time, among women in these categories and middle-aged men, there is significant potential for those with deposits above the Russian average; their number is approximately one-third of respondents.

To assess the most important characteristics of financial instruments when choosing investment options for the population in the Far North and Arctic regions of the Russian Federation, we consulted experts, who were asked to select no more than three priority options (Fig. 4).



[13] Results of the mass sociological survey of the population of the Arctic agglomerations of the Murmansk Oblast, conducted by the authors from October 1 to 20, 2024. Source: compiled by the authors.

Fig. 4. Which characteristics of financial instruments do you consider most important when choosing investment options for the population in the Far North and Arctic regions of the Russian Federation? (Please select no more than three options) [14].

The results revealed that the most significant characteristics are: the profitability of financial instruments (80%), the availability of return guarantees (68.6%), and the flexible investment terms, such as the ability to deposit and withdraw funds, etc. (51.4%). Experts also believe that important characteristics of financial instruments include the term of investment (28.6%) and the convenience of making investments and withdrawing funds, such as the availability of online options and a wide network of agents selling the instruments (22.9%).

A similar question was asked to residents of key Arctic cities in the Murmansk Oblast, specifically for their own needs (Fig. 5).

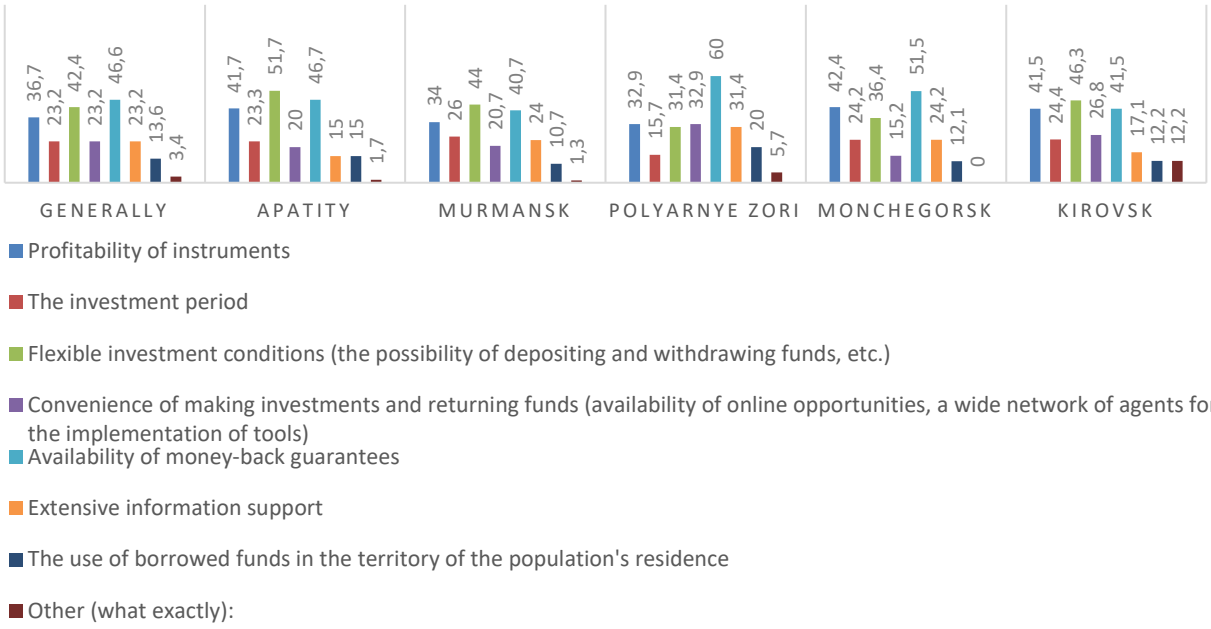


Fig. 5. Which characteristics of financial instruments do you consider most important when choosing investment options in your region?, % [15].

It should be noted that, in general, the most important characteristics for the population are the availability of a return guarantee (46.6%) and flexible investment terms (42.4%). The profitability of financial instruments ranks only third in this list in terms of importance (36.7%), which indicates a willingness to invest funds at lower returns, but with more understandable and flexible conditions and minimal risks.

[14] Results of the expert survey conducted by the authors from May 30 to June 1, 2024, as part of the international scientific and practical conference “Luzin Readings 2024”. Source: compiled by the authors.
[15] Results of the mass sociological survey of the population of the Arctic agglomerations of the Murmansk Oblast, conducted by the authors from October 1 to 20, 2024. Source: compiled by the authors.

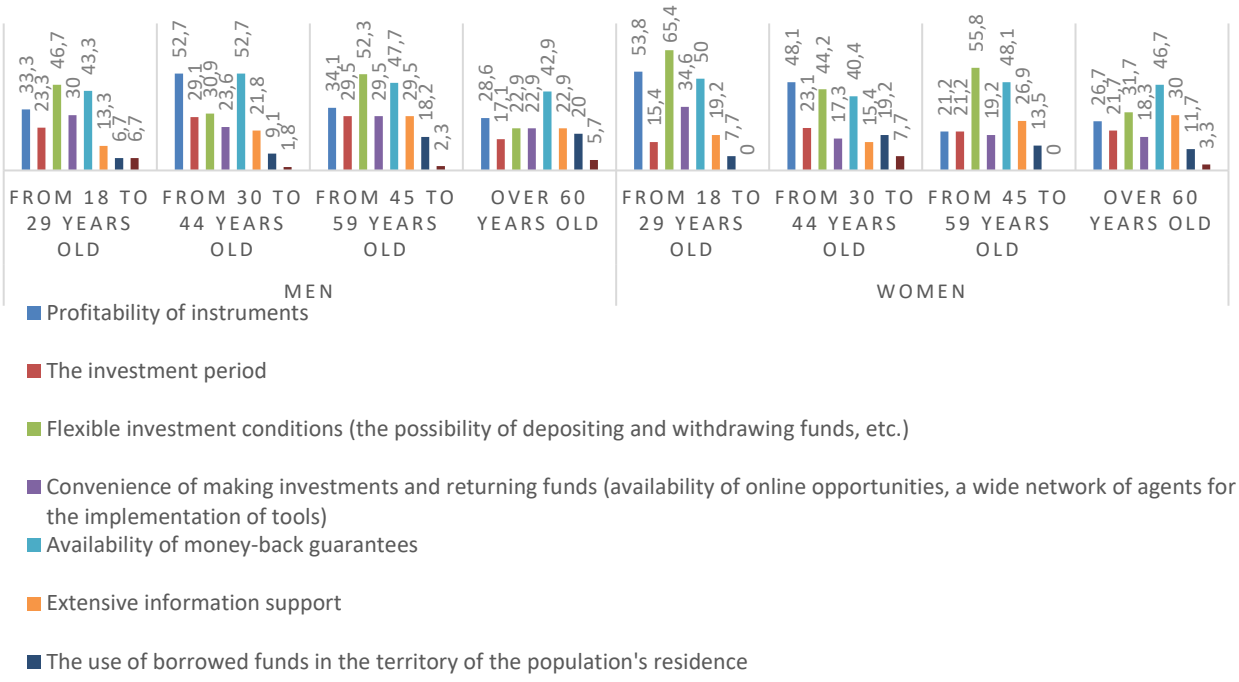


Fig. 6. Which characteristics of financial instruments do you consider most important when choosing investment options in your region? (distribution of responses by gender and age), % [16].

Both men aged 45 and older and women aged 30 and older place greater importance on using funds in their area of residence (Fig. 6). The importance of the three main characteristics of financial instruments remains unchanged for all gender and age groups, but with some peculiarities. For example, for men and women over 60, the main characteristic of financial instruments is the availability of guaranteed returns (52.3% and 46.7%, respectively). For younger generations, it is important not only to preserve their money, but also to take advantage of more flexible investment terms and higher returns on financial instruments.

Research shows that the population demonstrates a fairly high level of involvement in the investment process, understanding not only the possibilities for saving and preserving funds and the characteristics of financial instruments, but also assessing their advantages and disadvantages.

In order to form an idea of the most attractive financial instruments for the population of the Far North and Arctic regions of the Russian Federation, we analyzed expert opinions on this issue (Fig. 7).

[16] Results of the mass sociological survey of the population of the Arctic agglomerations of the Murmansk Oblast, conducted by the authors from October 1 to 20, 2024. Source: compiled by the authors.

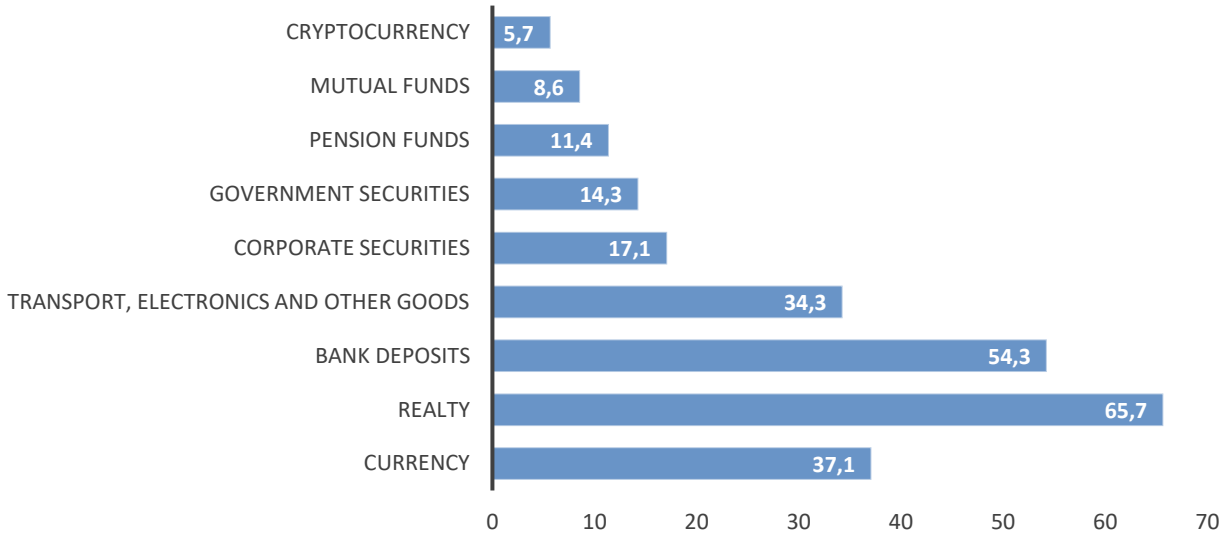


Fig. 7. Which of the following financial instruments are most attractive to the population when investing savings in the Far North and Arctic regions of the Russian Federation? (Please select no more than three options), % [17].

The results of the expert survey show that traditional financial instruments, such as real estate (65.7%), bank deposits (54.3%), foreign currency (37.1%), and the purchase of expensive goods (cars, electronics, etc.) (34.3%) remain the most popular among the population of the regions analyzed. Corporate and government securities may also be in demand. Despite the availability of higher-yield financial instruments, such as mutual funds and cryptocurrency, experts believe that they will be less in demand. This is confirmed by the results of a mass sociological survey of the population. The population prefers instruments that are more understandable and predictable in terms of return on investment. In addition, the use of these instruments requires certain knowledge, and due to insufficient financial literacy, the population prefers “traditional” investment instruments (Fig. 8).

Real estate remains the primary financial instrument for the majority of respondents in the Murmansk Oblast (68.4%). The next most popular financial instruments are bank deposits (46.0%) and foreign currency (26%). These assessments coincide with the above-mentioned results of expert surveys, which is not surprising, since these areas of investment are also popular in the rest of the Russian Federation.

[17] Results of the expert survey conducted by the authors from May 30 to June 1, 2024, as part of the international scientific and practical conference “Luzin Readings 2024”. Source: compiled by the authors.

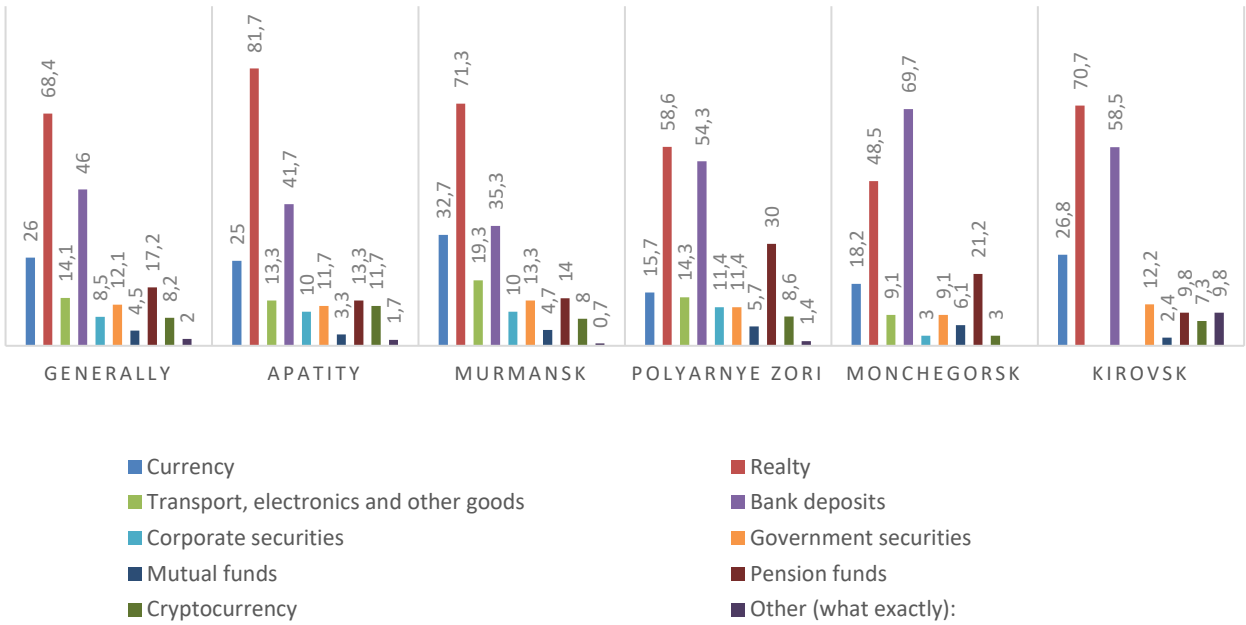


Fig. 8. Please indicate the most attractive financial instruments for the population when investing savings in your region, % [18].

At the same time, the popularity of these traditional financial instruments varies across the main Arctic single-industry towns. For example, while real estate investments are the most popular financial instrument in Murmansk, Apatity, and Kirovsk, bank deposits are the main financial instrument for residents of Monchegorsk: 69.7% of respondents chose this option. For Polyarnye Zori, these two instruments are almost equally important (real estate — 58.6%, bank deposits — 54.3%). Pension fund investments are also popular in this municipality (30.0%). Investing in foreign currency is more popular in the regional capital (32.7%) and among residents of Apatity (25.0%). Other financial instruments are significantly less popular.

Considering the situation in terms of the gender and age structure of the population (Fig. 9), the choice of financial instruments remains approximately the same for the majority of respondents: investments in real estate, bank deposits and currency. However, it is worth noting that young men aged 18 to 29 are willing to use financial instruments such as cryptocurrency. About 36.7% of respondents in this group chose this option, which is higher than “traditional” investments in bank deposits (26.7%).

[18] Results of the mass sociological survey of the population of the Arctic agglomerations of the Murmansk Oblast, conducted by the authors from October 1 to 20, 2024. Source: compiled by the authors.

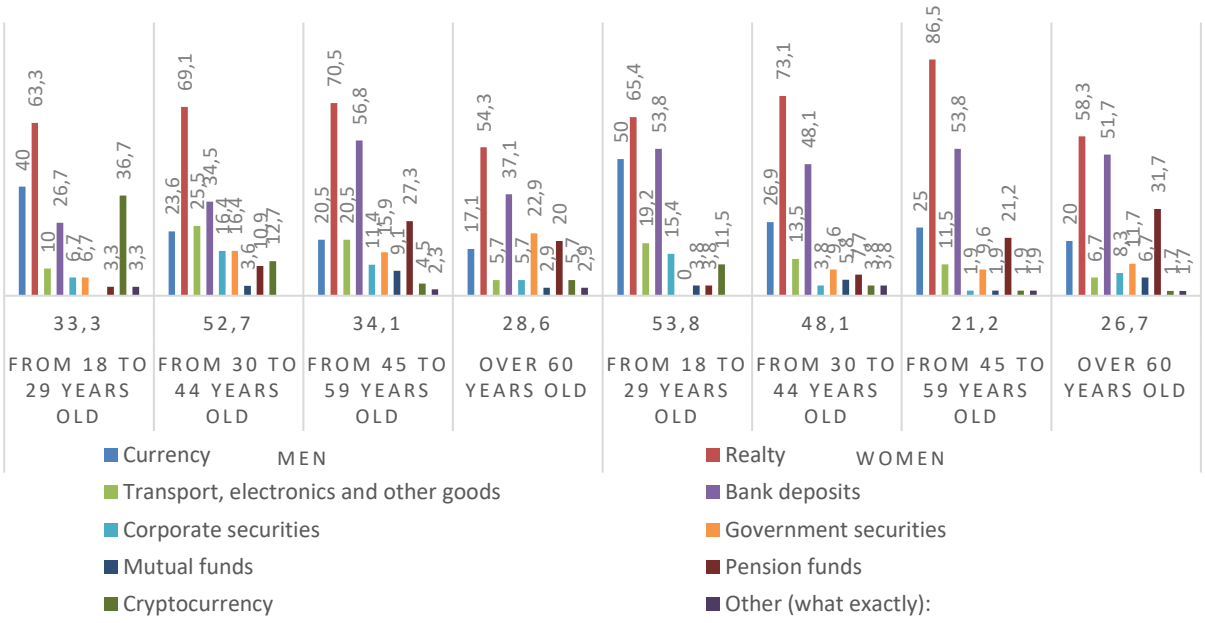


Fig. 9. Please indicate the most attractive financial instruments for the population when investing savings in your region (distribution of responses by gender and age), % [19].

Investing in foreign currency also remains popular among young people: 40% of men aged 18 to 29 invest in this category, while the figure for women in the same age group is 50%. For men and women over 45, investing in pension funds is popular, most likely due to the need to ensure a higher level of income upon retirement.

One of the objectives of our study was to determine the potential for regional financial instruments, such as regional bonds, regional investment funds, and others. We wanted to understand the conditions under which the population would be willing to invest in these instruments as an alternative option. For this purpose, we also consulted experts, asking them to answer the question about the population's demand for regional financial instruments when choosing investment options in the Far North and Arctic regions of the Russian Federation (Fig. 10).

About 11.4% of experts believe that regional financial instruments can serve as an alternative to traditional investments (e.g., bank deposits). More than half of the experts (51.4%) believe that if favorable conditions are created for regional financial instruments, they may become more popular. Experts also note that in order to promote these instruments, it is necessary to conduct a large-scale information campaign involving the media.

[19] Results of the mass sociological survey of the population of the Arctic agglomerations of the Murmansk Oblast, conducted by the authors from October 1 to 20, 2024. Source: compiled by the authors.

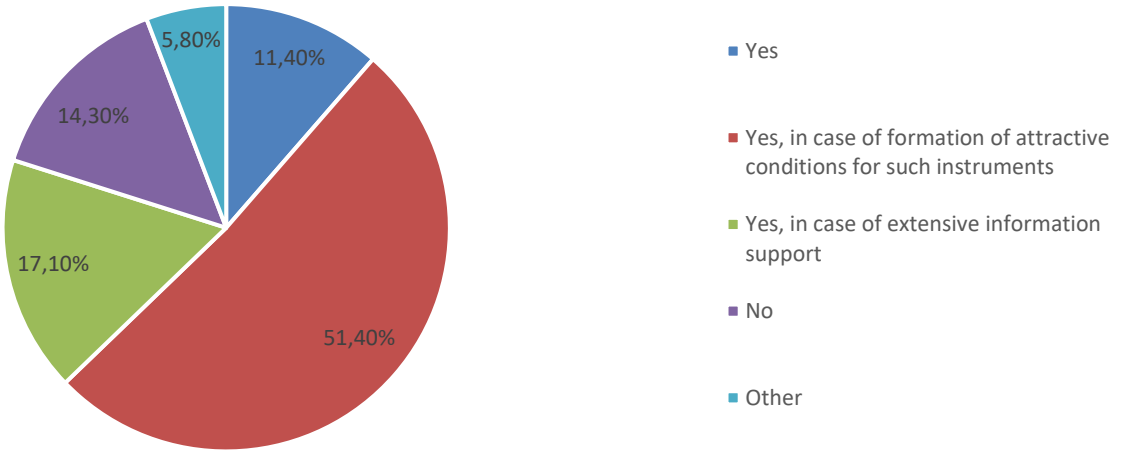


Fig. 10. Do you believe that regional financial instruments (regional bonds, regional investment funds, etc.), which are alternatives to bank deposits, could be popular among the population when choosing investment options in the Far North and Arctic regions of the Russian Federation? (%) [20].

Only 14.3% of experts believe that regional financial instruments will under no circumstances become an alternative to traditional financial instruments. About 5.8% of experts were unable to answer this question.

As shown by the results of a mass sociological survey among the population, regional financial instruments are perceived ambiguously (Fig. 11).

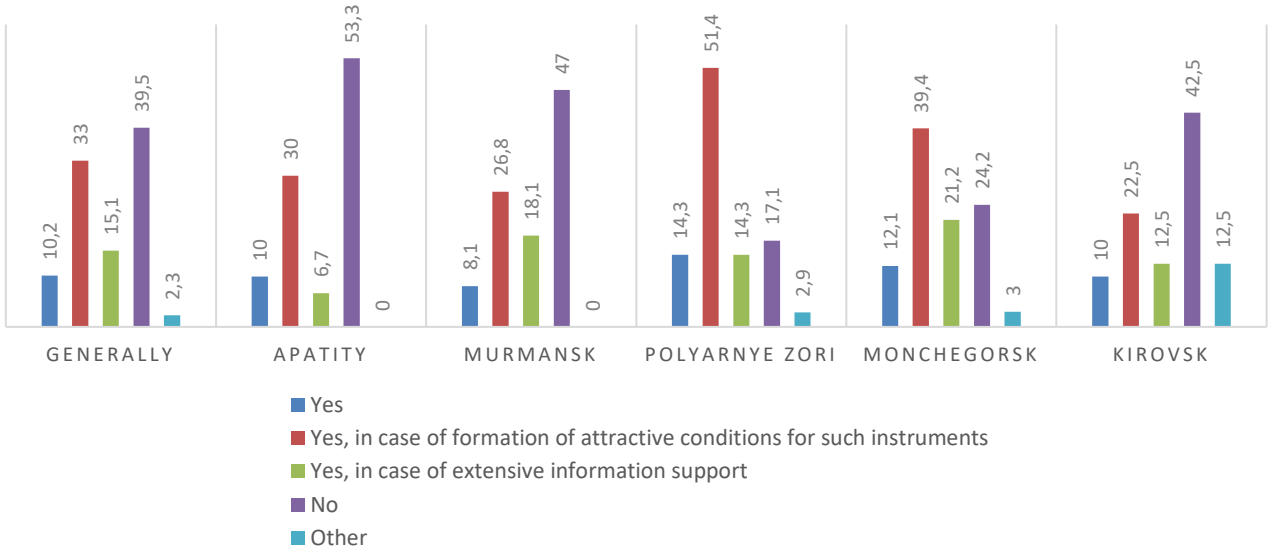


Fig. 11. Do you believe that regional financial instruments (regional bonds, regional investment funds, etc.), which are alternatives to bank deposits, could be of interest to you when choosing investment options? (%) [21].

Considering the responses as a whole, 39.5% of respondents were skeptical about such instruments. At the same time, a third of respondents (33.3%) admit the possibility of using such financial instruments as alternatives to bank deposits if attractive conditions are created for them. Another 16.7% of respondents stated that regional financial instruments could become an alternative if they receive broad information support.

[20] Results of the expert survey conducted by the authors from May 30 to June 1, 2024, as part of the international scientific and practical conference “Luzin Readings 2024”. Source: compiled by the authors.
[21] Results of the mass sociological survey of the population of the Arctic agglomerations of the Murmansk Oblast, conducted by the authors from October 1 to 20, 2024. Source: compiled by the authors.

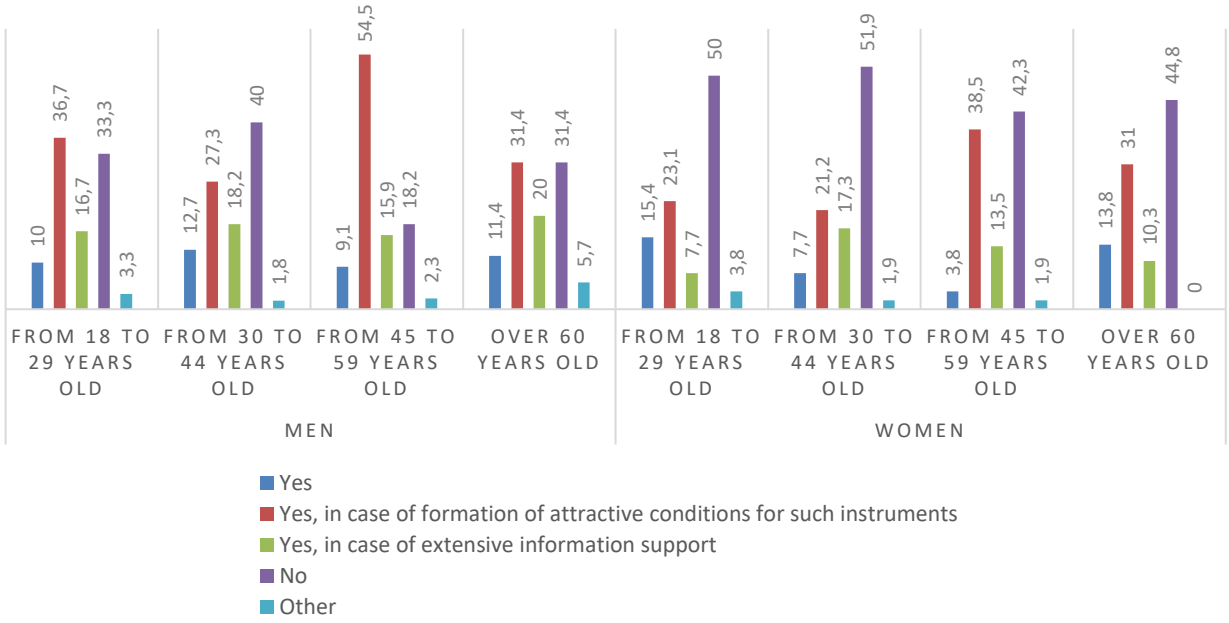


Fig. 12. Do you think that regional financial instruments (regional bonds, investment funds, etc.), which are alternatives to bank deposits, may be in demand by you when choosing investment options? (distribution of responses by gender and age), % [22].

It should also be noted that, in general, the population expresses moderate optimism about investments in regional financial instruments (Fig. 12). Moreover, among men, the proportion of those who view the possibility of investing in these instruments positively, provided that attractive conditions are offered and the level of information support is improved, is significantly higher than the proportion of women who express a certain degree of skepticism. Nevertheless, slightly less than half of the women surveyed aged 18 to 44 are willing to invest in regional financial instruments under certain circumstances. The percentage of women aged 45 and older who are willing to consider such an alternative is significantly higher. This indicates that regional financial instruments could become an alternative to bank deposits when choosing investment options.

One of the important questions that needed to be answered was determining the preferred investment timeframes for the population (Fig. 13). This question was posed to respondents, and it was found out that, in general, the population of the key cities in the Murmansk Oblast is ready to invest in short-term (up to 1 year) and medium-term (1 to 3 years) financial instruments.

[22] Results of the mass sociological survey of the population of the Arctic agglomerations of the Murmansk Oblast, conducted by the authors from October 1 to 20, 2024. Source: compiled by the authors.

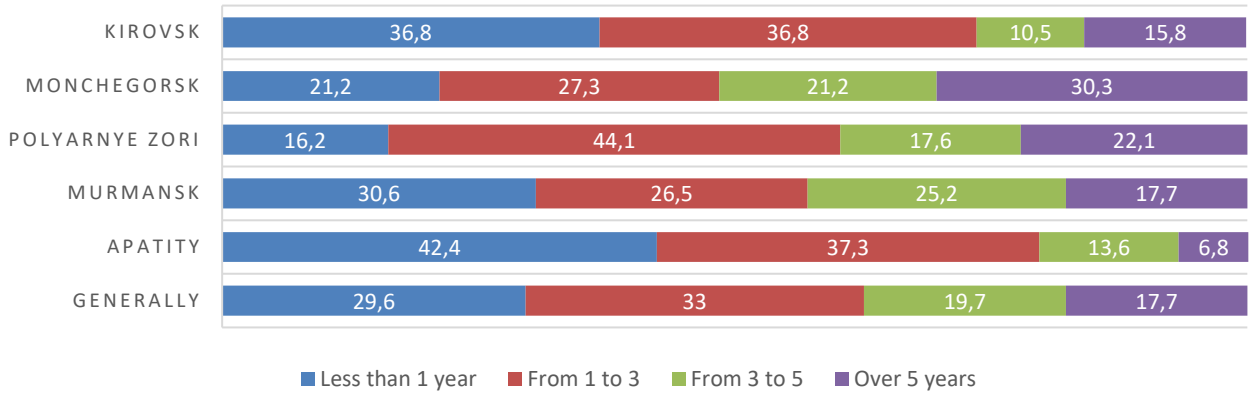


Fig. 13. Please indicate the term of investment that is most preferable for you, % [23].

However, when analyzed by city, the percentage of those willing to invest in long-term instruments may vary slightly in some cases. For example, more than half of Monchegorsk residents are ready for long-term investment, with their combined share reaching 51.5%, while in Apatity, on the contrary, residents prefer short- and medium-term investments (about 80%), and about 20% of the population is ready to invest for a longer period.

Analyzing the preferred investment period in terms of the gender and age structure of the population also reveals several distinctive features (Fig. 14).

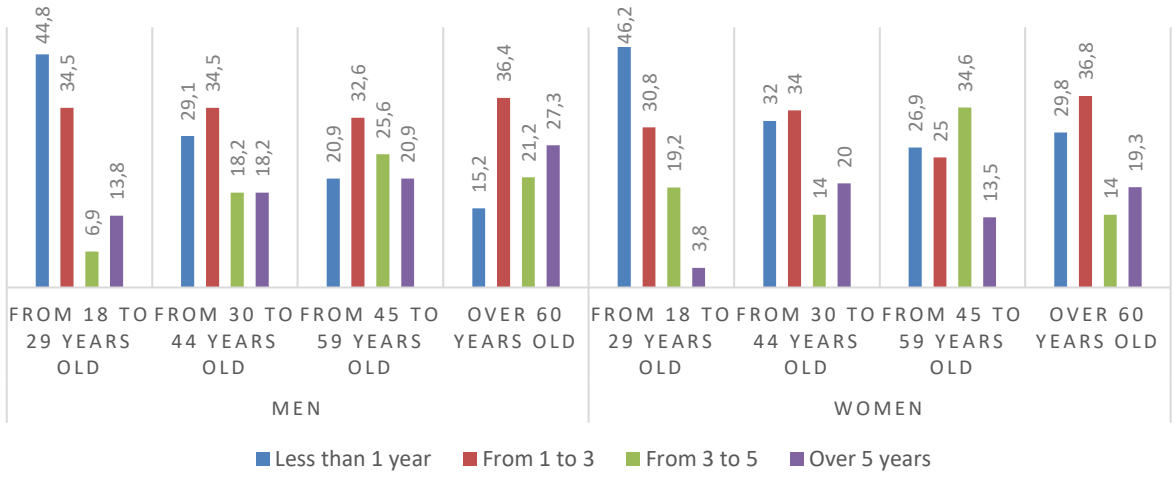


Fig. 14. Please indicate the term of investment that is most preferable for you (distribution of responses by gender and age), % [24].

For example, a significant proportion of men aged 18 to 29 are willing to invest in short-term (44.8%) or medium term (34.5%) instruments. At the same time, men over 30 prefer primarily medium-term investments, making up just over a third. Among men over 60, there are more those who are ready for long-term investments, accounting for almost half of the respondents (48.5%). Women's responses also show a similar trend, with the exception of the 45–59 age group, where the proportion of those willing to make long-term investments (3 to 5 years and over 5 years) is slightly higher, reaching 48.1%.

[23] Results of the mass sociological survey of the population of the Arctic agglomerations of the Murmansk Oblast, conducted by the authors from October 1 to 20, 2024. Source: compiled by the authors.
[24] Results of the mass sociological survey of the population of the Arctic agglomerations of the Murmansk Oblast, conducted by the authors from October 1 to 20, 2024. Source: compiled by the authors.

In order to determine the characteristics of the motivational mechanism that drives the population to engage in investment activities, we examined models that reflect the investment behavior of residents of key Arctic cities in the Murmansk Oblast (Fig. 15).

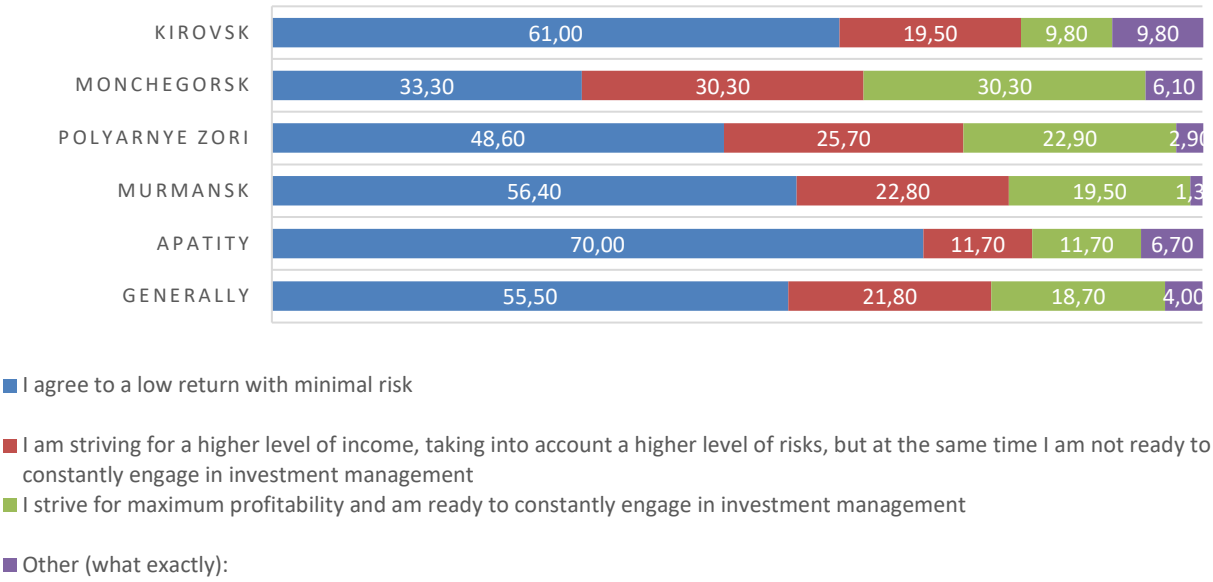


Fig. 15. Select the model that best corresponds to your investment behavior, % [25].

In general, most residents of the cities studied are characterized by an investment model that provides low returns with minimal risk (55.5%). A significant part of the population is ready to increase their income, taking into account higher risks, and does not have the opportunity to manage their investments on a regular basis (21.8%), while 18.7% of respondents can be classified as active participants in the investment process, seeking to maximize the return on their investments and are constantly engaged in investment management. Some respondents, representing approximately 4%, are not interested in investing at all. It should be noted that in a number of cities, the population is actively involved in investment processes. For example, in Monchegorsk, the number of participants in investment activities that provide maximum returns exceeds 66.5%, with the share of active investors accounting for almost a third of respondents (30.3%), indicating high investment potential. Residents of Polyarnye Zori and Murmansk follow an “active” investment model. The situation is somewhat worse in the Apatity-Kirov agglomeration, where a significant proportion of the population seeks to maintain a low level of return with minimal risk.

Based on the gender and age structure of the population (Fig. 16), it can be concluded that men in the broad age range from 18 to 59 are ready for more active management of their investments, while the share of women is significantly lower. They tend to favor a more stable investment model with low returns and minimal risk.

[25] Results of the mass sociological survey of the population of the Arctic agglomerations of the Murmansk Oblast, conducted by the authors from October 1 to 20, 2024. Source: compiled by the authors.

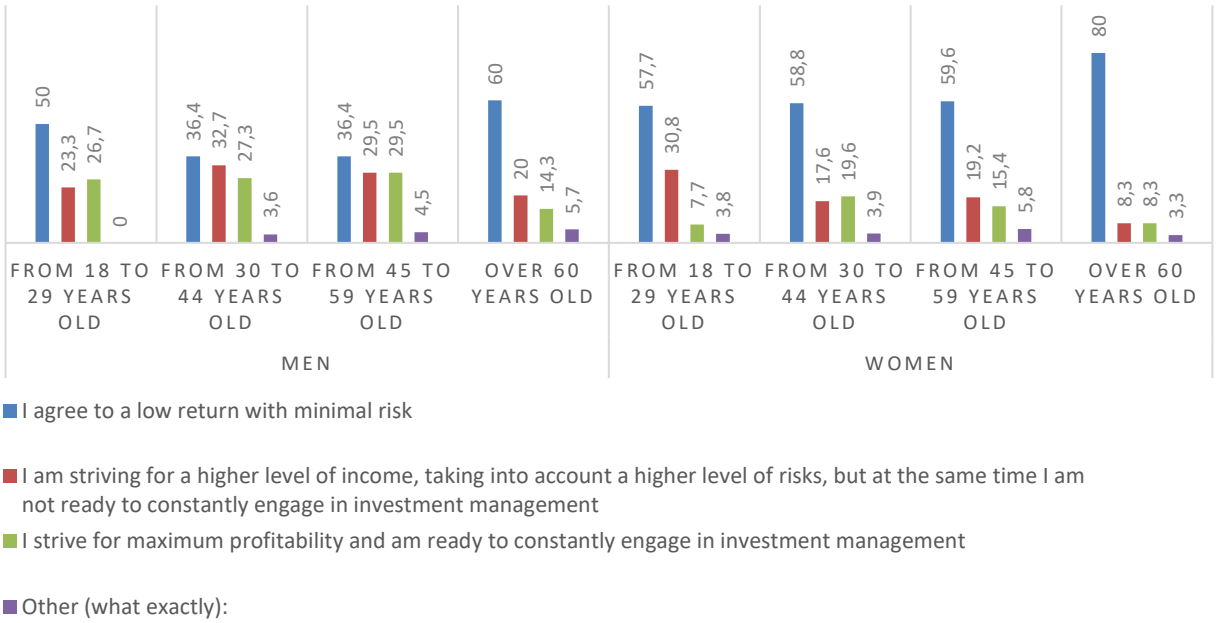


Fig. 16. Select the model that best corresponds to your investment behavior (distribution of responses by gender and age), % [26].

It should also be noted that pensioners over the age of 60 choose a similar model of investment behavior, and this applies to both men and women. Moreover, this is the main model of behavior for women in this age group (80% of respondents).

Taking into account that not all respondents are ready to manage their investments independently, it was necessary to determine the types of entities to which residents of the main Arctic cities of the Murmansk Oblast are ready to pass on the management of their savings (Fig. 17).

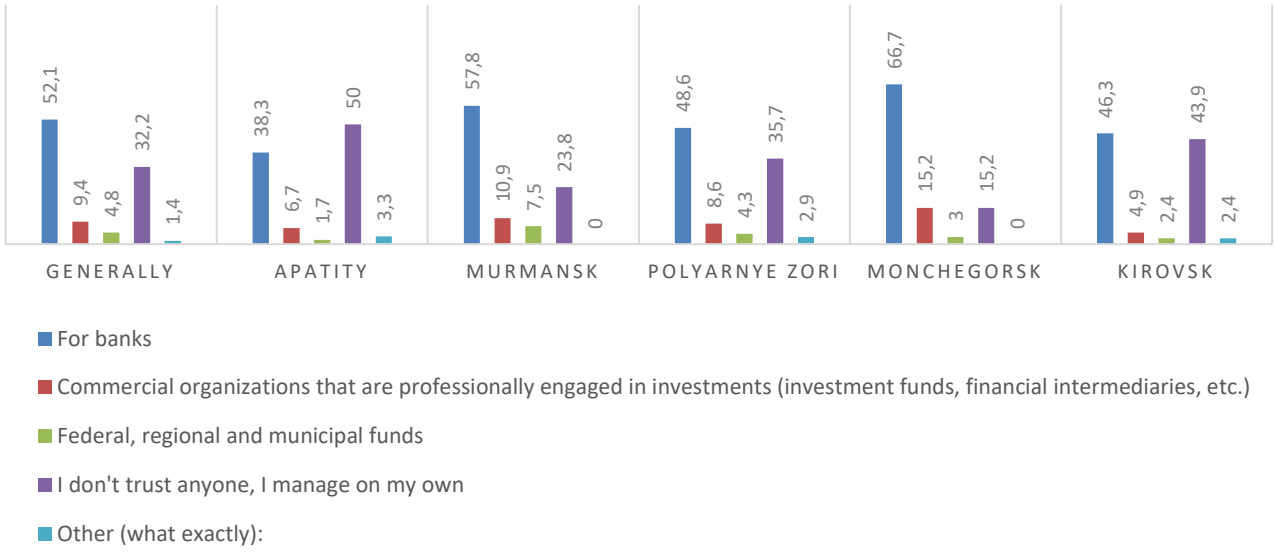


Fig. 17. What type of entity are you willing to entrust with the management of your savings?, % [27].

[26] Results of the mass sociological survey of the population of the Arctic agglomerations of the Murmansk Oblast, conducted by the authors from October 1 to 20, 2024. Source: compiled by the authors.
[27] Results of the mass sociological survey of the population of the Arctic agglomerations of the Murmansk Oblast, conducted by the authors from October 1 to 20, 2024. Source: compiled by the authors.

The overwhelming majority of respondents are ready to transfer management to banking structures (52.1%) or manage investments themselves due to a lack of trust in management organizations. Only 4.8% of all respondents are willing to entrust management to federal, regional and municipal funds. Other options mentioned included the Pension Fund of Russia and investment management through relative.

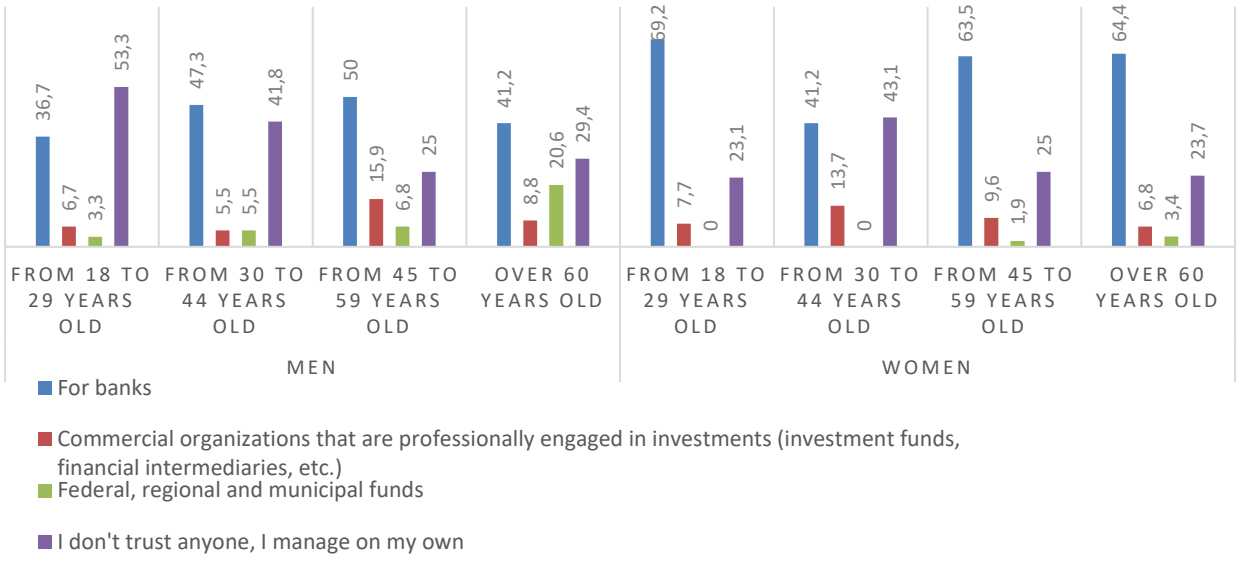


Fig. 18. What type of entity are you willing to entrust with the management of your savings (distribution of responses by gender and age), % [28].

Considering the responses in terms of gender and age structure, it can be noted that trust in federal, regional and municipal funds is slightly higher among men. This position is highest among men aged 60 and older. Women mainly choose banks as management companies, but some of those surveyed aged 30 to 44 are willing to manage their savings themselves. Among women aged 60 and older, there is also a higher percentage (3.4%) of trust in federal, regional and municipal funds, in addition to the most popular ones.

Conclusion

This empirical study was conducted in stages, which allowed us to take into account the opinion of the expert community on the formation of additional financial instruments and, based on a mass sociological survey, to analyze the involvement of residents of key Arctic cities in the Murmansk Oblast in the investment process.

The results of the sociological survey showed that there is significant potential for increasing the level of public involvement in the investment process as a factor in the formation of additional financial instruments within the sustainable development system of the Arctic region.

[28] Results of the mass sociological survey of the population of the Arctic agglomerations of the Murmansk Oblast, conducted by the authors from October 1 to 20, 2024. Source: compiled by the authors.

In order to increase the level of involvement of the population of the Arctic region in the investment process, a number of conditions should be taken into account. Firstly, as the survey results show, socio-demographic factors (age and gender structure, education level, financial status) are important. Secondly, indirect factors such as local cultural traditions, macroeconomic and geopolitical conditions, the level of development of financial infrastructure and institutions, etc. should be considered.

As the analysis conducted in the study showed, a significant part of the population in the main Arctic cities of the Murmansk Oblast has savings levels above the Russian average, which allows us to assess the savings potential as quite high.

Experts identified the following important characteristics of financial instruments when choosing investment options for the population in the Far North and Arctic regions of the Russian Federation: the profitability of financial instruments, the availability of return guarantees and flexible investment conditions, the investment term, and the convenience of investing and returning funds, i.e., the availability of online options and a wide network of agents selling the instruments. At the same time, the results of a mass sociological survey indicate that return guarantees and flexible investment conditions are the most significant factors for the population. The profitability of financial instruments ranked only third in terms of importance, which indicates a willingness to invest funds at lower returns, but with more understandable and flexible conditions and minimal risks. In general, the population of the Arctic region demonstrates a fairly high level of involvement in the investment process. They are not only aware of the possibilities for preserving and accumulating funds and the characteristics of financial instruments, but also have a good understanding of their advantages and disadvantages.

Investment in real estate remains the main financial instrument for residents of the Murmansk Oblast, followed by bank deposits and foreign currency. The same financial instruments were also mentioned by experts, which is not surprising, as these investment options are also popular in the rest of the Russian Federation.

Regional financial instruments can serve as an alternative to traditional bank deposits. At the same time, more than half of all experts believe that favorable conditions for regional financial instruments should be created first; this could increase their popularity. Experts also note that a large-scale information campaign involving the media is necessary to popularize these instruments. This is confirmed by the results of a mass sociological survey of the population, as only a third of respondents admitted the possibility of using regional financial instruments as an alternative to bank deposits if attractive conditions are created for them. Respondents also indicated that regional financial instruments could become an alternative if they received extensive information support.

Behavioral characteristics were identified for different age and gender groups, including the investment behavior model used. For example, more active investment management is predominantly characteristic of men. Women prefer more predictable options, so they tend to favor a low-return, low-risk investment model.

The study revealed that many residents of the main Arctic cities of the Murmansk Oblast either manage their investments themselves or are ready to entrust the management of their savings to banking institutions. Only 4.8% of all respondents are currently willing to entrust management to federal, regional, and municipal funds, with men showing slightly more confidence in federal, regional and municipal funds than women. Several factors influence this opinion. Firstly, the level of trust has a significant impact, which is formed in the absence of sufficient reliable data and large-scale information support to promote this form of investment management. Secondly, the level of financial literacy among the population does not allow many people to objectively assess all the advantages and disadvantages of such management. Thirdly, there is no accessible interactive investment management service or regional platform for synchronizing all participants in the regional financial market.

Additional regional financial instruments are formed under the influence of many factors, among which ensuring conditions for attracting external private investment is of particular importance. As the analysis has shown, the Murmansk Oblast has significant potential for increasing the level of involvement in the investment process. At the same time, the population is not sufficiently informed about the opportunities and conditions offered by various regional financial institutions, which requires the introduction of feedback mechanisms based on modern information technologies, work to improve financial literacy, and the organization of advisory events aimed at promoting regional financial instruments.

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"Blue Economy": Evolution of the Concept and Prospects for the Russian Arctic

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Abstract. The "blue economy" is a popular concept for the development of marine economic activity, implying social and environmental responsibility of its subjects. Key international actors present their strategies and use the "blue economy" as an area of international cooperation. The Russian Federation, despite its national interests related to both the development of the world ocean and the development of the Russian Arctic, does not have the "blue economy" strategy. The purpose of this study is to demonstrate the prospects of the "blue economy" for the Russian Arctic. The article describes the origin and evolution of the concept in the international arena and identifies the features of the conceptualization of terminology in the academic environment. The discrepancy in the interpretations of the "blue economy" in both political and scientific discourse is noted. An analysis of the approach to the "blue economy" in key Russian doctrinal documents showed that they enshrine the key measures for the development of the concept. This thesis was confirmed in the course of studying economic processes in the Russian Arctic. The authors point to the promising nature of conceptualizing the Russian approach to the "blue economy" and its doctrinal consolidation. The results of the study can be used as analytical material, as well as for academic purposes — to create an empirical basis for further scientific work on the selected and related topics.
Keywords: *blue economy, AZRF, concept, strategy*

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Introduction

At the turn of the 20th—21st centuries, the global community faced several structural economic crises. The process of globalization polarized uneven economic development, and international organizations emphasized the need for a comprehensive approach to managing crises while maintaining living standards and continuing intensive development. At the same time, the politicization of the environmental agenda led to a discourse on the need to take into account the environmental component of global economic issues.

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The first attempt to synthesize economic stability, implying symbiosis with environmental and social components, was the concept of sustainable development, which was published in a report by G.H. Brundtland in 1987 [1]. Despite the popularity of the concept of sustainable development, alternative approaches have emerged, characterized by different definitions of the object and methodology. The Blue Economy concept, which was developed in response to the growing importance of the world's oceans and the economic, social and environmental challenges of their development, is one of such examples.

The purpose of this study is to reveal the potential of this concept for the Arctic zone of the Russian Federation. This study presents a historical retrospective of the origins and evolution of the Blue Economy concept in the international arena, demonstrates its conceptualization in the academic community, characterizes the Russian understanding of the Blue Economy in strategic documents, and identifies the prospects for the Blue Economy in the Arctic zone of the Russian Federation.

The study is based on open empirical data and sources, which are divided into several groups, including statistical data, materials from international organizations and government documents, scientific literature on the issue under study, as well as media and news agency materials. Using an ecosystem approach, where all parts of the ecosystem are closely interconnected, the authors identify the water areas and coastal territories of the Russian Arctic as the object of the Blue Economy. The authors understand the Blue Economy of the Russian Arctic as the sustainable economic development of the water areas and coastal territories of the Russian Arctic.

Origin of the concept and approaches to defining the Blue Economy in the international arena

The need to define a legal framework for the use of the world's oceans at the international level was first considered in 1982, when the UN Convention on the Law of the Sea was adopted. Ten years later, the Conference on Environment and Development was held in Rio de Janeiro, where the need for sustainable management of marine resources was reiterated. However, this was rather declarative in nature and did not involve the development of a relevant concept for the competent use of the world's ocean resources.

In 2009, entrepreneur and scientist G. Pauli presented a report [2] to the Club of Rome outlining the economic theory he had developed. The idea was that in a circular economy, all materials, including wastes, are used in production. G. Pauli's methodology was based on the observation of natural processes, so his model assumes an analogy with the natural functioning of ecosystems, where the residual product arising at the end of one cycle becomes useful for the functioning of another. This scheme leads to the rationalization of resource use and the elimination of problems with the disposal of possible associated waste. The goal of G. Pauli's economic cycle model was to

[1] Our Common Future. Report of the World Commission on Environment and Development. 1987. URL: https://www.un.org/ru/ga/pdf/brundtland.pdf (accessed 10 September 2024).
[2] Pauli G. The Blue Economy: 10 Years, 100 Innovations, 100 Million Jobs Inspired by nature. A Report to the Club of Rome, 2009. URL: https://worldacademy.org/files/Blue%20Economy%202009.pdf (accessed 13 November 2024).

generate economic profit, but an important advantage of this model would be the environmentally safe use of natural systems and the availability of the final product to consumers [1, Zhilina I.Yu., pp. 18–19].

G. Pauli's concept, which he had been developing since the early 1990s with the direct participation of the UN [2, Krivichev A.I., p. 10], was received positively: following the 2012 UN Conference on Sustainable Development, a document was adopted [3], defining the Blue Economy as an innovative model of sustainable development, particularly relevant for coastal countries and small island states. However, the interpretation of the concept by global political actors varied significantly depending on national characteristics, level of economic development, and geopolitical interests.

In September 2015, the concept was formally presented in the UN General Assembly resolution "Transforming our world: the 2030 Agenda for Sustainable Development", which included 17 UN global sustainable development goals. The Blue Economy concept is part of Goal 14, "Conserve and sustainably use the oceans, seas, and marine resources for sustainable development" [4].

In early 2021, the UN General Assembly tasked UNESCO's Intergovernmental Oceanographic Commission with becoming the coordinating institution for the Decade of the Ocean, an initiative that provides an opportunity for interaction and cooperation in the interests of sustainable development of the world's oceans. This program includes activities aimed at bringing together resources, world governments, businesses, NGOs and civil societies to gain scientific knowledge and develop partnerships necessary to support a functioning, productive, viable and sustainable ocean [5]. However, the official website of the Decade of the Ocean hardly mentions the concept of the Blue Economy, which is inextricably linked to more than just water resources development. This suggests a certain caution in the use of the term, which can probably be explained by the vagueness of its interpretation.

A sustainable Blue Economy is discussed by the United Nations Environment Programme (UNEP), which notes the importance of coordinated policies across environmental, social, and economic spheres by all countries to further sustainable development [6].

In 2022, at the UN Conference to Support the Achievement of Goal 14, the term "Blue Economy" was, by contrast, regularly mentioned by state representatives in their reports, demonstrating its international adoption and continued development. Representatives from Namibia, Palau, Tanzania, Tonga, São Tomé and Príncipe, Timor, Angola, Guinea-Bissau, Cape Verde, and Equatorial Guinea identified the development of the Blue Economy as a priority for their countries and

[3] Blue Economy Concept Paper. URL: https://sustainabledevelopment.un.org/content/documents/2978BEconcept.pdf (accessed 13 November 2024).
[4] United Nations (2017) Resolution adopted by the General Assembly on 6 July 2017, Work of the Statistical Commission pertaining to the 2030 Agenda for Sustainable Development. URL: https://ggim.un.org/documents/a_res_71_313.pdf (accessed 13 November 2024).
[5] Ocean Decade Alliance. URL: https://oceandecade.org/ru/ocean-decade-alliance/ (accessed 13 November 2024).
[6] Sustainable blue economy. URL: https://www.unep.org/topics/ocean-seas-and-coasts/ecosystem-based-approaches/sustainable-blue-economy (accessed 13 November 2024).

expressed their willingness to provide support for marine preservation and combating piracy. Representatives of Portugal expressed the need to create a "Blue Economy Hub", which would significantly increase the number of state-funded startups in this area [7].

A World Bank report (2017) defines the Blue Economy as "joint actions by states aimed at promoting economic growth, social integration and the preservation of the environmental sustainability of oceans and coastal areas" [8]. It is important to note that the report pays particular attention to small island developing states and least developed coastal countries, although nation states are identified as the actors for cooperation across all aspects of the Blue Economy.

The World Bank report identified five types of marine activities that define areas of responsibility for the Blue Economy, namely:

- harvesting and trade of marine living resources;
- extraction and use of marine non-living resources (non-renewable);
- use of renewable non-exhaustible natural forces;
- commerce and trade in and around the oceans;
- indirect contribution to economic activities and environments [9].

The World Bank also identifies the following components necessary for the successful implementation of the blue economy concept:

- provide social and economic benefits for current and future generations;
- restore, protect, and maintain the diversity, productivity, resilience, core functions, and intrinsic value of marine ecosystems;
- be based on clean technologies, renewable energy, and circular material flows that will reduce waste and promote recycling of materials [10].

The ocean is described as a "new economic frontier, a source of resource wealth and great potential for boosting economic growth" in the 2016 report "The Ocean Economy in 2030" [11] by the Organisation for Economic Co-operation and Development (OECD). The term "Blue Economy" is rarely mentioned in the title or the text of the document, although the report emphasizes the need to use the ocean's potential wisely and to find sustainable approaches for its further development. The authors of the report point out that the terminology relating to the economy of the seas and oceans varies from country to country. For example, the concept of the ocean economy is typical of

[7] Report of the 2022 United Nations Conference to Support the Implementation of Sustainable Development Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development. URL: https://documents.un.org/doc/undoc/gen/n22/454/53/pdf/n2245453.pdf (accessed 13 November 2024).
[8] The potential of the Blue Economy. Increasing Long-term Benefits of the Sustainable Use of Marine Resources for Small Island Developing States and Coastal Least Developed Countries. URL: https://openknowledge.worldbank.org/server/api/core/bitstreams/cee24b6c-2e2f-5579-b1a4-457011419425/content (accessed 13 November 2024).
[9] Ibid.
[10] Ibid.
[11] The Ocean Economy in 2030. URL: https://www.oecd.org/en/publications/the-ocean-economy-in-2030_9789264251724-en.html (accessed 13 November 2024).

Ireland and the United States, while the concept of the sea economy is widely used in Australia, Canada, the EU countries, New Zealand and the United Kingdom [12].

The OECD divides Blue Economy sectors into traditional (fisheries, shipping and port infrastructure, marine construction and shipbuilding, marine and coastal tourism) and emerging (marine biotechnology, renewable energy, deep-sea mineral resource extraction). According to OECD estimates, by 2030, the global ocean economy could double its contribution to global GDP, reaching over $3 trillion [13].

The European Union (hereinafter referred to as the EU) has become one of the world's leading centers for the development and implementation of sustainable circular economy models. The significance of its experience is explained by its leading position in the global climate agenda and its active development of strategic documents aimed at supporting the Blue Economy. The growth of the Blue Economy is predicted primarily in the EU member states [3, Yasser M.M., Halim Y.T., Elmegaly A.A.].

The first EU "maritime" documents aimed at sustainable water resource management and the development of sustainable maritime strategies by member states were the Integrated Maritime Policy [14] and the EU Marine Strategy Framework Directive [15], adopted in 2007 and 2008, respectively. In 2012, EU documents identified five drivers of Blue Economy growth and introduced the term "blue growth" [16]; in 2014, the Marine and Coastal Spatial Planning Directive was adopted [17].

In 2018, the Blue Economy was defined by the European Commission as "maritime activities that use and/or produce products and services, as well as maritime activities, including seafood processing, marine biotechnology development, shipbuilding and repair, port activities, and communications" [18].

The further evolution of the EU's approach to defining the concept of the Blue Economy can be traced in a number of key strategic documents: the European Green Deal [19], a strategy for

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[12] The Ocean Economy in 2030. URL: https://www.oecd.org/en/publications/the-ocean-economy-in-2030_9789264251724-en.html (accessed 13 November 2024).
[13] Ibid.
[14] An Integrated Maritime Policy for the European Union. URL: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52007DC0575 (accessed 13 November 2024).
[15] Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive). URL: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0056 (accessed 13 November 2024).
[16] Blue Growth opportunities for marine and maritime sustainable growth. URL: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52012DC0494 (accessed 13 November 2024).
[17] Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning. URL: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0089 (accessed 13 November 2024).
[18] European Commission: Directorate-General for Maritime Affairs and Fisheries and Joint Research Centre, The 2018 annual economic report on EU blue economy, Publications Office of the European Union, 2018. URL: https://data.europa.eu/doi/10.2771/305342 (accessed 13 November 2024).
[19] European Green Deal. URL: https://www.consilium.europa.eu/en/policies/green-deal/ (accessed 13 November 2024).

achieving climate neutrality by 2050; the Circular Economy Action Plan [20], which optimizes resource use, minimizes waste, and develops recycling technologies; and the European Climate Law [21], which contains binding targets to reduce carbon dioxide emissions by 55% by 2030 and achieve climate neutrality by 2050. Under the auspices of the European Commission, the Blue Economy Report is published annually [22], which includes indicators of the socio-economic performance of blue economy sectors, their contribution to the EU economy in terms of turnover, added value, operating surplus, and job creation. According to the definition presented in the report, the Blue Economy is "economic activity related to the use of the resources of the oceans, seas, and coastal zones, including fisheries, aquaculture, marine resource extraction (oil, gas), offshore wind and ocean energy projects, desalination, shipping and marine tourism, as well as a wide range of related services (seafood processing, shipbuilding, port activities, marine biotechnology, insurance, and monitoring)" [23].

In 2021, the European Commission adopted a new approach to developing a sustainable Blue Economy, which identified objectives in terms of spatial planning, decarbonization, biodiversity restoration, science and technology development, application of circular models and solutions, improving the sustainability of food systems and coastal areas, as well as promoting employment and professional skills development [24].

Today, the concept of the Blue Economy is expanding beyond the generally accepted understanding of exclusively maritime activities, becoming a global economic project in which participation is essential for both developed and developing countries, as well as international organizations, NGOs, and civil society.

Thus, approaches to the Blue Economy have evolved from general management to more detailed strategies integrating the economic, environmental, and social aspects of the sustainable use of marine resources. The global community recognizes the need for synergy between economic growth and environmental protection. This synergy enables countries to achieve sustainable development goals in the face of global environmental challenges.

Green Economy vs. Blue Economy

In the context of global environmental and socio-economic challenges, the concepts of the Green Economy, already accepted by the global community, and the rapidly developing Blue

[20] European Commission. A new Circular Economy Action Plan for a cleaner and more competitive Europe. COM/2020/98 final. URL: https://eur-lex.europa.eu (accessed 13 November 2024).
[21] Regulation (EU) 2021/1119 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law'). URL: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32021R1119 (accessed 13 November 2024).
[22] European Commission (2024). The EU Blue Economy Report. 2024. Publications Office of the European Union. Luxembourg. URL: https://medblueconomyplatform.org/wp-content/uploads/2024/05/the-eu-blue-economy-report-2024.pdf (accessed 13 November 2024).
[23] Ibid.
[24] A new approach for a sustainable blue economy in the EU Transforming the EU's Blue Economy for a Sustainable Future. URL: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021DC0240 (accessed 13 November 2024).

Economy are becoming increasingly important. Let us consider the main characteristics of these concepts and present them in a comparative table.

Table 1

Green Economy vs. Blue Economy

	Green Economy	Blue Economy
Formation period	1989–2000	2009 – present
Main goal	Achieving sustainable development by reducing pressure on natural systems and resources, implying a balance between economic development, social progress and environmental protection	Achieving sustainable development of marine and coastal areas, ensuring long-term economic growth and employment from marine resources while maintaining the sustainability of marine ecosystems
Scale	Global	Regional
Key priorities	•Reducing the carbon footprint •Energy efficiency, development and implementation of renewable energy sources •Sustainable resource management and greening all sectors of the economy	•Preservation of marine ecosystems (corals, fish stocks) •Combating ocean pollution •Development of marine-related sectors (fisheries, aquaculture, maritime transport and tourism, renewable energy)
Target economic sectors	•Energy (including renewable energy) •Sustainable agriculture and forestry •Green transport •Waste management (recycling) •Ecology	•Fisheries and aquaculture •Maritime transport and transport infrastructure (including green ports) •Coastal and marine tourism •Marine renewable energy •Marine biotechnology and pharmaceuticals

Based on the data presented in the table, it can be concluded that the Green and Blue economies are not competing, but rather complementary strategies for achieving the SDGs. The Green Economy sets the general framework for greening all sectors and reducing anthropogenic pressure on the biosphere, while the Blue Economy represents a narrow application of these principles to a unique and critically important environment — oceans and coastal zones — focusing on the sustainable use of their resources and ecosystem services.

In addition, there is synergy between the Blue and Green economies, as the "greening" of marine sectors directly contributes to the achievement of decarbonization goals. At the same time, "healthy" oceans are a global climate regulator and a source of biodiversity, which is critical for the overall sustainability of the planet.

In terms of key differences, we can talk about varying objectivity. The Green Economy aims to transform all land and marine economic systems globally to reduce their overall environmental footprint (carbon, resource, pollution), while the Blue Economy focuses on managing a specific environment — the oceans — with their specific ecosystems, resources and traditional maritime activities.

Conceptualization of the Blue Economy in academic circles

Despite growing attention to the potential of the Blue Economy, uncertainty remains both in its conceptualization and approaches to its implementation. The Blue Economy generally refers to the management of water resources and the marine ecosystem. However, there is still no single definition or unified classification for this concept in scientific discourse that would include all the "blue" aspects under consideration and allow for the measurement of quantitative and qualitative indicators.

A number of recent studies point out that, despite a clear definition of the components of the Blue Economy, the concept is difficult to separate from the long-established concept of sustainable development [4, Singh R., Kumar P., 5, Germond-Duret C.]. Nevertheless, the conceptual framework outlined by R. Singh and P. Kumar is useful for structuring the analysis of current practices and identifying the missing elements necessary to achieve sustainable ocean development. The complementarity and synergy of the Blue Economy and the concept of sustainable development are indicated by the results of a review of articles published in Web of Science from 2014 to 2023, conducted by M. Keen, A. Schwartz, L. Wini-Simeon [6].

The concept of the Blue Economy is associated with any economic activity that uses ocean resources. A bibliometric analysis of the concepts of Blue Economy, marine economy, ocean economy, and blue growth, conducted by R.M. Martínez-Vázquez and co-authors highlights the interconnection between the concepts of Blue Economy and Blue Growth: in order to achieve the necessary results of the Blue Economy, it is necessary to create alliances between Blue Growth sectors [7]. P. Tripathi, S. Kapoor, and S. Alavi define the Blue Economy as the sustainable use of the world's ocean resources, based on the principles of environmental sustainability [8]. This thesis is confirmed by the fact that such an economy includes various types of ocean-related activities: from harvesting marine living resources to offshore energy.

Studies devoted to the applicability of the Blue Economy to the Arctic Zone of the Russian Federation also identify the Blue Economy of the Arctic as an economy of the sea [9, Druzhinin A.G., Lachininskii S.S.] or see it as a tool for sustainable development, noting the need to develop government and business projects [10, Kokurina A.D., Monastyrskiy D.I.], focused on the Arctic sea area, the development of shipping and seaports, decarbonization, further digitalization, the use of new technologies and the creation of sustainable supply chains [11, Krivichev A.I., Nyudleyev D.D., Sidorenko V.N., pp. 415–424]. G. Tianming and co-authors note that the Russian Arctic is characterized not only by its marine economy, but also by a number of coastal activities related to the sea (aquaculture, shipping, offshore oil and gas production, etc.) or affect marine bioenergy (e.g., reduction of emissions into the coastal atmosphere and water, waste management, coastal tourism, creation of nature reserves and parks, etc.) [12].

Blue Economy in the AZRF: the Russian perspective

Russia's seas cover approximately 8.6 million km^2, which is 2.4% of the world's oceans, with the Arctic waters covering 6.8 million km^2 [25], demonstrating the potential of the Blue Economy concept (and future strategy) for Russia. However, despite the noted [9, Druzhinin A.G., Lachininskii S.S., pp. 336–348] increase in the priority of developing the maritime economy in the Russian Federation, no strategic document defines or mentions the term Blue Economy. Therefore, the presence of individual Blue Economy measures in Russia's conceptual documents deserves more detailed consideration.

The Maritime Doctrine of the Russian Federation (hereinafter referred to as the Doctrine) and the Strategy for the Development of the Arctic Zone of the Russian Federation (hereinafter referred to as the Strategy) were selected for the analysis of the presence of blue economy components. The criteria for analyzing the level of conceptual development of the Blue Economy will be the compliance of the measures in the documents under review with the definitions, classifications, and development directions of the Blue Economy of leading international actors presented in the section. The units of analysis and comparison of strategic documents were the presence of a definition of the Blue Economy concept, the presence of an environmental component of the Blue Economy in the strategies (measures to eliminate accumulated damage to ecosystems, to preserve biodiversity, to reduce negative impacts on the ecosystem), the economic component (measures to create/improve innovative development sectors, including investments in scientific research into new technologies for the industries of the marine and coastal economy, measures to create new jobs and increase employment in the maritime sector), and the development of commercial infrastructure.

Table 1 demonstrates that both the Strategy and the Doctrine aim to integrate economic incentives for development and consideration of environmental aspects of industrial process management. Both the Strategy and the Doctrine are distinguished by a comprehensive approach to the implementation of state policy through synergy in the development of marine and coastal areas.

At the same time, the Strategy clearly emphasizes the need to maintain a balance between economic development and environmental sustainability in the region, as evidenced by the inclusion of measures to reduce environmental impacts. Thus, the Strategy highlights the preservation of the traditional way of life of indigenous peoples, the need to develop renewable energy sources, measures to adapt to climate change, and the creation of specially protected natural areas [9, pp. 336–348] as key priorities, which is consistent with the first and second components of the successful development of the Blue Economy, according to the World Bank. Furthermore, the Strategy's economic objectives for maritime and coastal activities include: state support for small businesses, private investment in projects related to the Northern Sea Route, further development of natural resources, fishing sector and fish production. Despite the Strategy's obvious focus on sustainable

[25] Seas washing the territory of Russia // National Atlas of Russia. URL: https://nationalatlas.ru/tom2/244.html (accessed 08 December 2024).

development, it establishes a "special economic regime for the transition to a circular economy" for the maritime area, which is an important feature of the Blue Economy, according to the EU definition.

The Russian Federation's Maritime Doctrine defines maritime activities as "activities aimed at studying, developing and using the World Ocean in the interests of sustainable development and ensuring the national security of the Russian Federation" [26]. This definition is close to the EU's approach to the Blue Economy, as set out in the European Commission's 2021 framework document. According to the OECD classification, the Doctrine specifies innovative sectors of the Russian maritime economy (development of renewable energy sources (hereinafter referred to as RES), aquaculture, and mariculture) and declares an innovative focus on the development of "old" industries (development of maritime transport, port infrastructure, all types of fleet, etc.). The development of RES corresponds to the third component of the successful development of the Blue Economy, according to the World Bank. The Doctrine's measures, such as the development of state environmental monitoring systems, mandatory environmental insurance for maritime transport, and response to damage to water bodies and bio-resources, correspond to the second component of the Blue Economy, according to the World Bank. Only the social component is developed to a lesser extent in the Doctrine.

Thus, an analysis of doctrinal documents aimed at developing Russia's maritime and coastal Arctic territories revealed that, although the Blue Economy concept is not defined or formally enshrined in the Russian Federation's strategy, it nevertheless includes most of the components of Blue Economy development.

Table 2

Blue Economy in Russian Federation doctrines

	Maritime Doctrine	Strategy for the Development of the AZRF
Definition / reference to the Blue Economy	No	No
Ecological component		
Measures to eliminate accumulated damage to ecosystems	Maritime transport: a system of compulsory environmental risk insurance	Identification, assessment, and organization of the elimination of accumulated damage to the environment
Measures to conserve biodiversity	Monitoring threats and responding to damage to water bodies and bioresources, compliance with fisheries requirements for offshore marine activities;	Creation of specially protected natural areas
Measures to reduce negative impacts on the ecosystem	"An integrated approach to the development of state environmental monitoring systems for coastal territories,	Development of a unified system of state environmental monitoring, including hydrometeorological monitoring; minimization of harmful

[26] Maritime Doctrine of the Russian Federation. URL: http://www.scrf.gov.ru/security/military/document34/ (accessed 08 December 2024).

	territorial seas, exclusive economic zones, and the continental shelf" [27]	atmospheric emissions and discharges into water bodies; assessment of the consequences of environmental impact; regular assessment of the impact of nuclear energy on the environment; improvement of the waste management system
Economic component		
Measures to create (improve) innovative development sectors (investments in scientific research of new technologies for marine industries) of the marine and coastal economy	Innovations in the fisheries industry, electric power (tidal, wind, thermal, and biomass energy); development of marine research and innovation centers; "implementation of new technologies using marine bioresources, aquaculture, construction of fishing vessels, and application of new bioresource reproduction technologies" [28]; innovations in shipbuilding and cartographic production	A special economic regime for the transition to a circular economy, the development of knowledge-intensive and high-tech industries, the development and implementation of engineering solutions for infrastructure operation in the face of climate change, and a "state support mechanism for projects to improve the efficiency of electricity generation in isolated and hard-to-reach areas" [29]
Providing new jobs and increasing employment in the maritime sector	An increase in the number of jobs in the field of aquatic bioresource research and shipbuilding is projected	A gradual increase in the number of jobs at new enterprises in the AZRF, a reduction in the unemployment rate by 0.2% by 2035.
Commercial infrastructure	"Renewal of maritime infrastructure assets, development of icebreaker and research fleets, modernization of the Arctic port network; infrastructure of coastal processing plants; development of port infrastructure (construction and reconstruction of railways)" [30], highways, and modern transport and logistics centers	"Comprehensive development of seaport infrastructure and shipping lanes in the waters of the Northern Sea Route, the Barents, White, and Pechora Seas; construction of nuclear-powered icebreakers; construction of hub ports and the creation of a Russian container operator for international and cabotage shipping along the NSR" [31]; Expanding navigation capabilities on rivers and canals, dredging, and developing ports and port terminals; Construction (reconstruction) of airport complexes

[27] Maritime Doctrine of the Russian Federation. URL: http://www.scrf.gov.ru/security/military/document34/ (accessed 08 December 2024).
[28] Ibid.
[29] Decree of the President of the Russian Federation of October 26, 2020 No. 645 "Strategy for Developing the Russian Arctic Zone and Ensuring National Security until 2035" (as amended and supplemented). URL: https://base.garant.ru/74810556/ (accessed 08 December 2024).
[30] Maritime Doctrine of the Russian Federation. URL: http://www.scrf.gov.ru/security/military/document34/ (accessed 08 December 2024).
[31] Decree of the President of the Russian Federation of October 26, 2020 No. 645 "Strategy for Developing the Russian Arctic Zone and Ensuring National Security until 2035" (as amended and supplemented). URL: https://base.garant.ru/74810556/ (accessed 08 December 2024).

Prospects for the "Blue Economy" in the Arctic Zone of the Russian Federation

The authors consider the Blue Economy of the Arctic Zone of the Russian Federation as the comprehensive development of maritime and coastal economies. To illustrate the potential and prospects of the Blue Economy in the AZRF, it is necessary to describe the development of the maritime and coastal economic sectors. The Blue Economy sectors in the Russian Arctic include both traditional and emerging industries (Fig. 1).

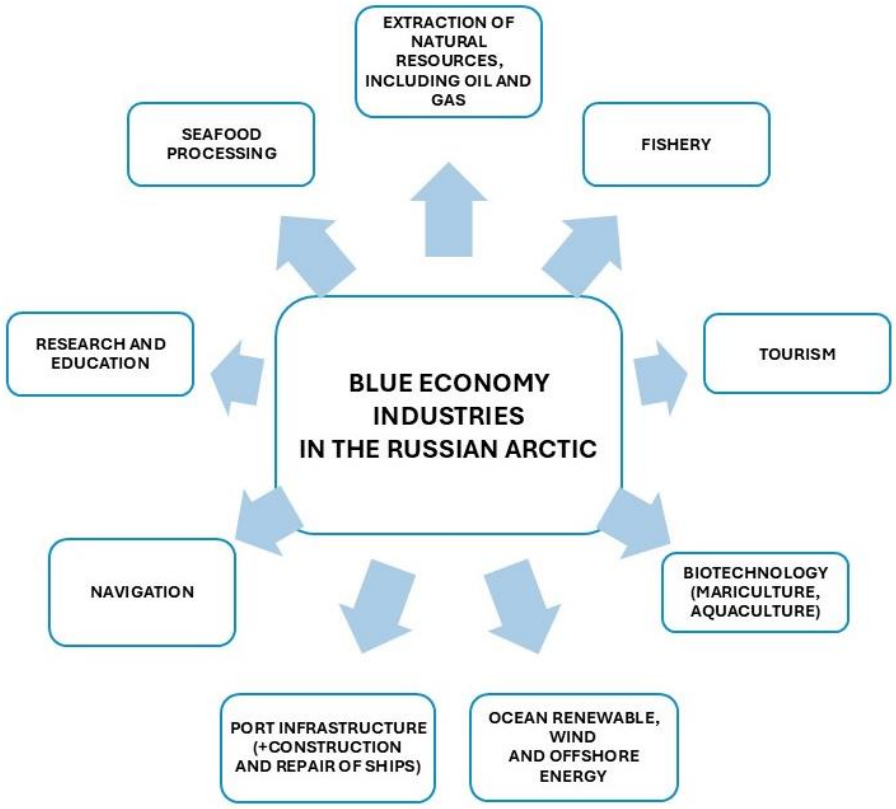

Fig. 1. Blue economy sectors in the AZRF (compiled by the authors).

The Northern Sea Route is a key shipping project in the AZRF. Its potential for economic development lies in the potential increase in Russia's share of global cargo transit and budget revenue [32], the attraction of foreign investment, and the creation of new jobs. According to statistics, 2023 was the peak year for cargo transportation (36.254 million tons) [33], and shipping volumes are expected to grow, along with ports' capacity [34]. The development of the NSR is associated with the intensification of work in the field of port infrastructure, shipbuilding and cargo repair, as well as

[32] The Northern Sea Route as Russia's flagship project. URL: https://rosacademtrans.ru/smp/ (accessed 16 November 2024).
[33] The Northern Sea Route's historical record: cargo transportation volume in 2023 exceeded 36.254 million tons. URL: https://atommedia.online/2024/01/10/istoricheskij-rekord-sevmorputi-obe/ (accessed 16 November 2024).
[34] Roman Starovoit spoke to senators about the role of the transport industry in achieving national development goals. URL: https://mintrans.gov.ru/press-center/news/11270 (accessed 16 November 2024).

work on deepening the seabed, which are planned in the NSR Development Plan until 2030 [35] and cover several sectors of the Blue Economy. According to this Plan, shipping volumes will increase to 110 million tons by 2030, creating 35,000 new jobs [36].

Despite strict compliance by vessels navigating the NSR with the International Convention for the Prevention of Pollution from Ships [37] and the Polar Code [38], which require the prevention of marine pollution, researchers point to some legislative shortcomings [13, Bhagwat D., p. 20], as well as the risk of pollution "as a result of accidents or crew negligence" [14, Baghdasaryan A.A., p. 20]. Therefore, increasing shipping volumes on the NSR opens up opportunities for Russia to conceptualize and formalize a Blue Economy, which involves the implementation of new technologies with greater environmental sustainability potential [39]. One of the possible solutions could be the introduction of LNG-powered vessels (for example, the Arktika icebreakers), which would reduce SO_2 emissions by 90% and NO_2 by 85% compared to diesel-powered ships [40].

The development of the NSR is closely linked to the extraction of oil, gas, and other natural resources in Arctic waters. The AZRF development strategy in this area does not separate offshore resource extraction from onshore production and prioritizes, until 2030, "the development of new solid mineral deposits and hard-to-recover hydrocarbon reserves, increasing deep oil refining capacity, producing liquefied natural gas and gas chemicals, and the beneficial use of associated petroleum gas" [41]. Russia has the largest hydrocarbon reserves in the Arctic: natural gas reserves amount to 55 trillion m^3, and oil reserves — 7.3 billion tons (75% and 23.5%, respectively) of Russia's total reserves [42].

The Arctic shelf is becoming the most promising area for energy resource exploration [15, Fu S., Malashenkov B.M., p. 403], where the large-scale Prirazlomnaya project is being implemented. Among the promising offshore deposits, gas, oil, oil and gas condensate fields are located on the Barents shelf and in the waters of the Kara Sea [43]. The main task of the extractive industry in line with the Blue Economy concept should be to include "ensuring fairness, security, and the

[35] Northern Sea Route Development Plan for the Period until 2035. URL: http://static.government.ru/media/files/StA6ySKbBceANLRA6V2sF6wbOKSyxNzw.pdf (accessed 16 November 2024).
[36] Ibid.
[37] International Convention for the Prevention of Pollution from Ships. URL: https://docs.cntd.ru/document/901764502 (accessed 20 November 2024).
[38] International Code for Ships Operating in Polar Waters (Polar Code). URL: https://docs.cntd.ru/document/420376046 (accessed 20 November 2024).
[39] Shipping 2030: New Technologies in the Maritime Industry. URL: http://www.sur.ru/ru/news/lent/2019-06-17/sudokhodstvo_2030_novye_tekhnologii_v_morskoj_industrii_17778/ (accessed 07 December 2024).
[40] European Maritime Safety Agency (EMSA). «LNG as a Marine Fuel: Safety and Environmental Performance». Lisbon: EMSA, 2023. 89 p.
[41] Decree of the President of the Russian Federation of October 26, 2020 No. 645 "Strategy for Developing the Russian Arctic Zone and Ensuring National Security until 2035" (as amended and supplemented). URL: https://base.garant.ru/74810556/ (accessed 08 December 2024).
[42] Russia's strategic reserves of gas and oil are located in the Arctic. URL: https://www.ttelegraf.ru/news/v-arktike-nahoditsya-strategicheskij-zapas-gaza-i-nefti-rossii/ (accessed 07 December 2024).
[43] Arctic Resources. Central dispatching board for the fuel and energy complex. URL: https://www.cdu.ru/tek_russia/issue/2023/6/1152/ (accessed 08 December 2024).

preservation of natural capital" in the measurement of success ratio, along with economic indicators [1, Zhilina I.Yu., p. 27].

Arctic fisheries, like the development of the NSR, are at the intersection of old and new sectors of the Blue Economy. At a conference on aquatic biological resources, held in Arkhangelsk in 2023, the head of the Federal Agency for Fisheries noted that "the fish catch in the Arctic amounted to more than 500,000 tons — more than 10% of the total Russian catch" [44]. Fishing is prohibited in the open part of the Arctic Ocean [45], so Russian Arctic fisheries are limited to a 200-mile economic zone, with the most regular fishing taking place in the Barents Sea [16, Dusayeva E.M., pp. 29–46]. In order to maintain the Barents Sea cod stock at the 880,000-ton TAC level, it is advisable to refer to Norway's experience in managing fish stocks, as the introduction of scientifically based quotas has increased the cod population by 40% over 10 years (2010–2020) [46].

At the same time, climate change, water pollution, and depletion of fish stocks require innovations in Arctic fishing technology, including the construction of fish processing plants, the development of trawling fleets, the advancement of biotechnology, modern mariculture (aquaculture).

The development of renewable energy sources is also promising for the Arctic. Currently, energy supply in the Arctic is provided by traditional sources, but due to geographical remoteness, high costs and the complexity of implementation in northern conditions, it has not been possible to achieve universal coverage of all remote Arctic territories. A partial solution to the problem is the development of renewable energy sources. Their potential is the possibility of creating closed energy systems, minimizing environmental damage and the risks of technological disasters. The experience of developing solar power plants in Yakutia has also shown significant budget savings (35 million rubles per year), replacing 20% of diesel generation [17, Sokolov A.N., p. 11]. Due to weather conditions, the Arctic has high potential for wind, wave, and geothermal energy. However, the development of these renewable energy sources is associated with a lack of necessary technologies and a shortage of personnel. Both of these types of renewable energy sources are seasonal in nature, which means that they can only be used in combination with traditional sources. At the same time, Norway's experience shows that it is possible to provide 98% of the Arctic's energy balance using renewable energy, including hydropower [47].

[44] Summary of the plenary session "Aquatic Biological Resources. Fisheries and Conservation in the Arctic", held at the Arctic Bioresources and Fisheries Conference on May 11, 2023, Arkhangelsk. URL: https://as.arctic-russia.ru/analytics/analiticheskie-materialy/vodnye-biologicheskie-resursy-rybolovstvo-i-sokhranenie-zapasov-v-arktike/ (accessed 07 December 2024).

[45] Order of the Government of the Russian Federation "On the signing of the Agreement on the Prevention of Unregulated Fishing on the High Seas in the Central Part of the Arctic Ocean". URL: https://docs.cntd.ru/document/551032531 (accessed 07 December 2024).

[46] Joint Norwegian-Russian Fisheries Commission. Annual Report 2022–2023. Tromsø: JNRFC, 2023. 120 p.

[47] International Energy Agency. Renewables 2023: Analysis and forecast to 2028. Paris: IEA, 2023. 240 p. URL: https://www.iea.org/reports/renewables-2023 (accessed 20 June 2025).

The inclusion of nuclear energy in renewable energy sources is controversial [48] and is a topic for separate research. Russia possesses closed nuclear fuel cycle technologies, which make it possible to reduce environmental damage to zero [17, Sokolov A.N., p. 12]. The Rosatom State Corporation has already begun implementing the floating nuclear power plant project (Port of Pevek) [49] and plans to replace outdated and expensive energy sources with similar projects. In general, the concept of the Blue Economy implies self-sufficiency and a closed energy cycle, which will be facilitated by the development of renewable energy sources in the Arctic. The complete replacement of traditional sources with renewable energy sources is a long-term prospect. The example of renewable energy sources demonstrates the Blue Economy in action: in the near future, renewable energy sources will contribute to the energy transition and, consequently, to reducing the burden on the environment, which will contribute to the conservation of resources. In social terms, renewable energy sources will improve the quality of life of the Arctic population and create jobs. From an economic perspective, renewable energy contributes to budget savings and infrastructure development.

Arctic tourism is a developing potential area of the Blue Economy, aimed at promoting the historical, cultural and natural potential of the Arctic [50]. As a result of the analysis, V.Yu. Zhilenko identified the following strengths of Arctic maritime tourism: promoting the development of science and technology, ensuring environmental safety, comprehensive management of marine and coastal areas, developing eco-tourism, attracting investments, creating public-private partnerships, etc. [18, Zhilenko V.Yu., p. 154]. The main problems, hindering marine and coastal tourism in the Western Arctic, are low awareness and attractiveness [19, Grushenko E.B., p. 29]. The general problems of tourism in the Arctic, as identified by respondents to a survey of polar explorers, can be applied to marine tourism: inadequate infrastructure, lack of tourist cashback in the AZRF, and poor information support [51]. Scientific studies also point to the need to organize transport corridors to areas of increased tourist interest, including through water transport as a means of organizing river and sea cruises [20, Tsvetkov A.Yu., p. 241]. Infrastructure issues are already a matter of national interest, and potential tourists will attract investors who are capable of accelerating positive infrastructure changes. Solving these problems and developing tourist routes, including along the Northern Sea Route, will stimulate economic growth while preserving the stability of the marine ecosystem.

Despite the significant potential of the Blue Economy for the sustainable development of the Russian Arctic zone, its implementation is associated with a range of risks that require systematic management. Let us consider three key categories of challenges: ecological, social, and economic.

[48] Will nuclear energy go green? URL: https://vpost-media.ru/texts/pozeleneet-li-atomnaya-energetika (accessed 08 December 2024).
[49] Rosatom plans to complete the design of a floating nuclear power plant based on the RITM-200M by the end of the year. URL: https://www.interfax.ru/business/987840 (accessed 08 December 2024).
[50] National Standard of the Russian Federation. Arctic Tourism. URL: https://docs.cntd.ru/document/1200182152?marker (accessed 08 December 2024).
[51] Arctic Tourism: statistics and expert opinions. URL: https://murmansk.ru/40569 (accessed 08 December 2024).

Table 3

Risks to the development of the Blue Economy concept in the AZRF

Ecological	Social	Economic
• Pollution of the world's oceans due to increased cargo traffic along the NSR • Degradation of benthic ecosystems due to expansion of port infrastructure • Biological invasions	• threat to the traditional way of life of the indigenous peoples of the North • demographic imbalance • loss of cultural identity	• decarbonization costs • hypertrophy of the hydrocarbon sector • sanctions risks

A possible solution for minimizing ecological risks could be the introduction of an environmental reserve mechanism, which would involve allocating 15% of revenues from the NSR to a fund for the rehabilitation of Arctic ecosystems. Regarding social challenges, preserving the traditional way of life of the indigenous peoples of the North requires the introduction of mandatory ethnological expertise for projects, with veto rights for indigenous communities to protect and represent their interests. To overcome economic risks, it is necessary to introduce differentiated taxation for large Arctic companies, for example, by reducing the mineral extraction tax for renewable energy projects. Furthermore, a mechanism of green state guarantees for the financing of Arctic start-ups in biotechnology and hydrogen energy could become a key tool.

Undoubtedly, implementing the Blue Economy concept in the Arctic Zone of the Russian Federation requires significant socio-ecological-economic transformation, which entails the development and adoption of appropriate legislation, the implementation of effective mechanisms for sustainable management, and the formation of a unified Arctic technology cluster for the development of compensation solutions.

Conclusion

The authors' analysis of scientific literature and the Blue Economy definitions from international organizations demonstrates that there are several approaches to interpreting the concept of a Blue Economy, which can be divided into three groups. The first approach focuses on the fact that the Blue Economy is an integral part of the concept of sustainable development, which details the methodology by identifying the world's oceans as a reference object. The second approach does not consider the concept of the Blue Economy to be a qualitatively new phenomenon and refers to it as the Green Economy applied to global waters. The third approach, also characteristic of the EU, is based on the idea that the Blue Economy refers to any economic activity related to the economic development of the resources of the world ocean and its coastal zones.

The multiplicity of definitions and approaches to the Blue Economy in the international arena demonstrates, on the one hand, a lack of consensus on which industries are new or traditional, and which reference objects the concept is aimed at: should only water areas or coastal territories associated with maritime activities also be included in the concept of the Blue Economy? On the other hand, it is clear that the Blue Economy implies the implementation of a comprehensive strategy aimed at conserving resources, restoring ecosystems and transitioning to new technologies.

The Russian Arctic and maritime doctrinal documents do not mention or define the Blue Economy. However, all economic sectors related to the Blue Economy in one form or another are developing in Russia with varying degrees of success. The goals set by the doctrinal documents are fully consistent with individual development areas and the Blue Economy. Furthermore, there is a clear complementarity between the sustainable development of the Russian Arctic and the Blue Economy.

A study of economic processes in Russia's northern territories demonstrates the de facto development of Blue Economy sectors. Many of these projects are promising in terms of their contribution to the national economy. Furthermore, the potential of the blue economy as a circular economy, independent of external resources and capable of full self-sufficiency, is of undoubted interest for the Russian Arctic. The authors believe that, if Russia's approach to the Blue Economy is conceptualized and doctrinally enshrined, it could become a driver for the development of the key Russian Arctic project, the Northern Sea Route, and the Arctic zone of the Russian Federation as a whole.

Considering the potential and strategic development vector of the Arctic Zone of the Russian Federation, it can be predicted that by 2035, the AZRF's contribution to Russia's GDP will tend to grow from 3% to 7% due the increase in maritime logistics, the launch of LNG projects and the development of renewable energy technologies, as well as the implementation of sustainable development concepts. This makes the Arctic a territory of balanced development, where economic efficiency is combined with environmental responsibility and social justice.

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The Current State and Development of Small Innovative Technology Companies in the Arctic Regions of North-Western Russia

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Abstract. The article examines the current state of development of small innovative technology companies in the Arctic regions of North-Western Russia. Statistical surveys, questionnaires and in-depth interviews were conducted to identify the most promising forms of support for innovation in small innovative companies, allowing for the differentiation of mechanisms to maximize the effects of regional support measures. The basic factors influencing the interaction of business and science within the framework of technological innovations are presented. The analysis allows identifying current problems and difficulties that hinder the implementation of effective innovations: weak human resources potential of the Arctic regions; low interest of small and medium-sized enterprises in innovations. In order to form the innovative infrastructure of the Arctic regions, it is important to adopt regional programs for the development of cluster formations, especially industrial ones, as well as to develop projects aimed at mobilizing the innovative potential of the regions and including them in the strategy of socio-economic development of the territories. Accordingly, to implement these intentions, it is necessary to carry out coordinated work on a range of issues. It is required to develop a legislative framework for the creation of innovative spaces, industrial, environmental and tourist territorial clusters. At the same time, the introduction of new types of activities by small innovative companies requires the creation of a comprehensive list of organizations supplying innovative products that are in demand by residents of the Arctic zone, with the application of appropriate preferences.
Keywords: *innovations, small businesses, innovation development institutions, innovative infrastructure, special economic regime, Arctic zone of Russia*

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Introduction

In the current conditions, when innovative activity is one of the main priorities of the state policy, the most important factor in the development of the regional economy is the innovative development of economic entities of any forms of ownership [1, Lukashenok T.R.; 2, Korobov S.A.,

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Epinina V.S.; 3, Khetagurova Yu.I.; 4, Alekseev A.A.]. For the Arctic territories, the development of innovative activity is critically important. This is due to the need to implement advanced technological solutions in the extractive sector of the economy [5, Pilyasov A.N.], including for ensuring environmental safety [6, Cherepovitsyn A.E.], as well as, for example, in the formation of transport corridors [7, Tsvetkov V.A.]. The harsh climate of the Arctic territories also requires innovative approaches to the processes of organizing environmental monitoring in order to minimize environmental risks [8, Kachur A.N.]. Obviously, this is far from an exhaustive list of human activities in the Arctic where it is advisable to implement innovations. In general, the competitiveness of the socio-economic territorial systems of the Arctic depends on innovative activity [9, Druzhinin P.V.]. At the same time, small innovative and technological companies make a significant contribution to these processes. In this regard, the study of various approaches to the development of small innovative companies in the Arctic zone of North-Western Russia is a highly relevant scientific and practical task [10, Yeaple R.; 11, Tirpak T.M., Miller R., Schwartz L.].

The works of S.L. Ivanov [12], V.P. Klavdienko [13], S.V. Terebov [10], M. Kautonen [14] and others [15; 16] are devoted to the problems of entrepreneurship development in the innovation sphere, as well as interaction between the scientific and educational spheres at the regional level. At the same time, the authors focus on solving the problems of small and medium-sized innovative companies in the field of scientific and technological development [17; 18; 19]. However, despite the significant amount of research conducted, there is an obvious discrepancy in the development of methods for determining criteria and evaluating the effectiveness of interaction between structures that support the innovation process. Consequently, the development of small and medium-sized scientific and service innovation companies is particularly important.

Data collection and analysis methodology

The aim of the study is to assess the level of innovative development of enterprises and to identify promising forms of support for the Arctic regions. The objectives of the study are: determining the structure of innovative technology enterprises by industry, assessing the level of their innovative (technological) development strategy, assessing the level of innovative development of enterprises based on their type of activity, and identifying promising forms of support in the innovation sphere.

Data for subsequent analysis was collected using questionnaires and interviews. The respondents for the interviews included 25 experts from government agencies in the field of small innovative entrepreneurship, as well as heads of research and scientific and educational organizations. The questionnaire consisted of the following sections.

Questionnaire

SECTION 1: GENERAL INFORMATION

1.1. Name of the enterprise: _____

1.2. Location of production (district, town, region):_____

1.3. Full name of respondent:_____

1.4. Position of respondent: _____

1.5. I would like to receive the survey results: Yes □ / No □

1.6. Preferred method of contacting you:

— Phone: _____

— Email: _____

SECTION 2. INNOVATIVE DEVELOPMENT

2.1. Does your company have a strategy for innovative (technological) development?

□ Yes

□ No

2.2. If there is a strategy, how would you assess its effectiveness over the past 3–5 years? What benefits has it brought to your company?

□ The existing strategy has significantly increased revenue or profit over the past 3–5 years

□ The development of the strategy has enabled the launch of a sufficient number of projects to achieve the goals of innovative development

□ The development of the strategy has enabled targeted promotion and development of the main product

□ Other (specify):_____

2.3. Rate your company according to the following characteristics

(from 1 — “the development of this area of the company's work is extremely insufficient at present” — to 5 — “this area of work is developing very well”):

Characteristics	1	2	3	4	5
Organization of production, management and development strategy					
Personnel policy (employee qualifications, motivation)					
Quality and range of products/services					
Use of modern technologies, equipment, and information systems; implementation of innovations					
Market demand for products					
Innovativeness of products, services or technologies used					

2.4. What forms of support do you consider most important for innovative activities (currently and in the future)?

(Rate the importance of each form of support on a scale of 1 — not important at all; 2 — slightly important; 3 — moderately important; 4 — very important; 5 — extremely important)

(multiple answers possible)

Form of support	Score				
	1	2	3	4	5
Subsidies to reimburse part of the costs (expenses) related to innovation activities (including the cost of purchasing fixed assets directly used to create innovative products)					

Subsidies to cover part of the interest rate on commercial bank loans					
Provision of budgetary credit resources					
Assistance in attracting extra-budgetary funds					
Joint public-private financing of innovation					
Venture capital investment					
Regional state order for innovative products					
Tax incentives					
Guarantees for bank loans					
Assistance in insuring commercial risks					
Other financial instruments (specify)					
Obtaining information, analytical, legal, and methodological materials on innovation activities from the administration					

Form of support	**Score**				
	1	**2**	**3**	**4**	**5**
Providing information on potential innovation investors					
Providing information on potential innovation buyers					
Providing information on new innovative products					
Other informational support (specify)					
Assistance in participation in exhibitions, conferences, seminars, and presentations of innovative projects					
Assistance in product certification					
Assistance in obtaining patents for innovative products					
Assistance in marketing research					
Arctic instruments — Arctic hectare, Arctic mortgage, preferential economic regime instruments (specify)					
No support required					

2.5. Indicate which instruments of state support or support from development institutions you have used:

(multiple answers possible)

□ RVC

□ Skolkovo

□ Bortnik Foundation (Innovation Promotion Fund)

□ Industry Development Fund

□ VEB

□ Subsidies from the Ministry of Economic Development of Russia

□ Subsidies from the Ministry of Industry and Trade of Russia

□ Regional programs

□ Other (specify): _____

SECTION 3: EFFECTS OF INNOVATION IMPLEMENTATION

3.1. What is the main strategic goal you are trying to achieve by implementing modern innovative technologies at your enterprise?

□ Growth in production, sales and revenue as the main factors of the enterprise's financial stability

□ Reduced likelihood of risks

□ Reduced amount of routine work for employees, freeing up human resources for more important and creative tasks

□ Reduced operating expenses by downsizing the staff

□ Gradual transition of the company to comprehensive automation of all business processes

□ We do not set a specific goal, but are guided by the fact that innovation will have a positive effect in any case

□ We trust the experience of our international colleagues in this field and have the financial capacity to purchase foreign innovative technologies for implementation at our enterprise

Other goals:_____

Representatives of 171 companies, grouped by industry, participated in the survey. The survey was conducted from July to October 2024 (Table 1).

Table 1

Industries of companies participating in the survey [1]

Construction, engineering and telecommunications services	Trade and service enterprises	Scientific research and consulting	Extractive and manufacturing industries	Information technology and automation	Other	Total
26	23	30	30	38	24	171
15.2%	13.4%	17.6%	17.6%	22.2%	14.0%	100%

The general population in the study is a list of small and medium-sized innovative companies in the Arctic regions of North-Western Russia (218 companies) [20, Tishkov S.V.]. The sample of representatives was selected randomly: the sample constitutes 80% of the total population [20, Tishkov S.V.].

Research results

The survey results highlight the need for innovative development among small and medium-sized companies in the Arctic. Most enterprise representatives responded in the survey that they have an innovative development strategy. In addition to an innovative development strategy, the majority of Arctic innovative enterprises (56.1% of the total number of respondents) emphasize the importance of developing their own innovation programs. For most companies, innovation is primarily focused on the application of information technology, including IT and AI development, the implementation of new software, and the automation and digitalization of production and technical processes.

According to the managers of innovative companies, the main factors in the field of innovation are: “increased competitiveness”, “optimization of production processes”, “technological development”, “improved quality”, and “increased productivity”. With an effective approach and development of innovation, enterprises are able to ensure the production of high-tech equipment and the professional development of employees. Every third company (39.8% of all

[1] Source: compiled by the authors on the basis of survey data.

respondents) is engaged in the commercialization of intellectual property and its implementation in production.

More than half of the company representatives indicated that management is directly involved in the development of innovation at their company. The remaining respondents (49.7% of the total number) found it difficult to answer the question of how important innovation is to company management. In conditions of uncertainty and restrictions, the majority of Arctic companies surveyed (87.1%) prefer to collaborate with Russian manufacturers offering technological and digital solutions for innovative developments. As part of the survey, Arctic small and medium-sized companies with a strategy assessed their success in achieving innovation goals over the past 3–5 years (Table 2).

Table 2

Assessment of the effectiveness of the innovative development strategy over the past 3–5 years, taking into account the company's type of activity [2]

Type of activity / Assessment of the effectiveness of the innovative (technological) development strategy over the past 3–5 years	Construction, engineering and telecommunications services	Trade and service enterprises	Scientific research and consulting	Extractive and manufacturing industries	Information technology and automation	Other	Total
The strategy enabled targeted promotion and development of the main product	36.4%	47.1%	17.4%	30.4%	34.6%	40%	33.3%
The strategy enabled the launch of a sufficient number of projects	13.6%	5.9%	65.2%	39.1%	46.2%	40%	36.5%
The strategy enabled a significant increase in revenue or profit over the past 3–5 years	50%	47.1%	17.4%	30.4%	19.2%	20%	30.2%
	100%	100%	100%	100%	100%	100%	100%

Analysis of the survey results (Table 2) shows that most companies in the fields of scientific research, extractive and manufacturing industries use their strategies primarily to launch new and promising innovative projects (65.2%, 39.1%, and 46.2%, respectively) [20, Tishkov S.V.]. In trade, construction, engineering, and telecommunications services, the presence of a strategy largely enables companies to increase profits (47.1% and 50%, respectively) [20, Tishkov S.V.]. In this regard, the use of various methods for applying the innovative (technological) development strategy should be emphasized.

During the survey, respondents assessed the level of enterprise development, taking into account the type of activity (Table 3).

[2] Note: closed-ended question, one option, % of all companies with a strategy. Source: compiled by the authors on the basis of survey data.

Table 3

Level of enterprise development by type of activity [3]

Level of enterprise development / Type of activity	Innovativeness of products, services or technologies used	Market demand for products	Use of modern technologies, equipment, information systems, implementation of innovations	Quality and range of products / services	Personnel policy (employee qualifications, motivation)	Organization of production, management and development strategy
Information technology and automation	4.1053	4.2895	4.3684	4.3158	4.1316	3.8947
Extractive and manufacturing industries	4.2667	4.2667	4.4333	4.3333	4.0667	3.9
Scientific research and consulting	4.1	4.1667	4.3667	4.1667	4.0333	3.5333
Trade and service enterprises	4.3043	4.3913	4.3913	4.3043	4.0435	3.4783
Construction, engineering and telecommunications services	4.2083	4.2917	4.0833	4	4.0833	3.7917
Other	3.9615	4.1154	4.2308	4.3462	4.2692	3.8077
Total	4.152	4.2515	4.3216	4.2515	4.1053	3.7485

Based on the assessment results, it should be emphasized that all of the areas mentioned are highly developed. This can be explained by the fact that only innovative companies were included in the sample. The significant level of development confirms the availability of certain resources in such companies and demonstrates the high potential of the innovation sector [20, Tishkov S.V.].

Companies readily use various instruments of state support for the development of the innovation sector (Table 4) [20, Tishkov S.V.].

Table 4

Instruments used to support innovation activities [4]

Instruments to support innovation activities	%
Subsidies from the Ministry of Economic Development of Russia	9.6
VEB	4.2
Industry Development Fund	10.2
Bortnik Foundation (Innovation Promotion Fund)	22.3
Skolkovo	15.7
RVC	7.8
Subsidies from the Ministry of Industry and Trade of Russia	6.6
Regional programs	64.5

Moreover, the majority of companies (64.5%) use various regional programs for their innovation activities, which allows them to strengthen regional specificity and mitigate competition

[3] Note: Closed question, average score for each criterion, where 1 — the area is insufficiently developed, 5 — the area is highly developed. Source: compiled by the authors on the basis of survey data.
[4] Source: compiled by the authors on the basis of survey data.

between regions. According to the survey results, the geographical location of companies has little impact on the current level of innovation development.

The study analyzed the interaction of enterprises with scientific, educational and research organizations, as well as with government authorities. As a result, the most popular forms of support for the innovative activities of enterprises were identified (Fig. 1).

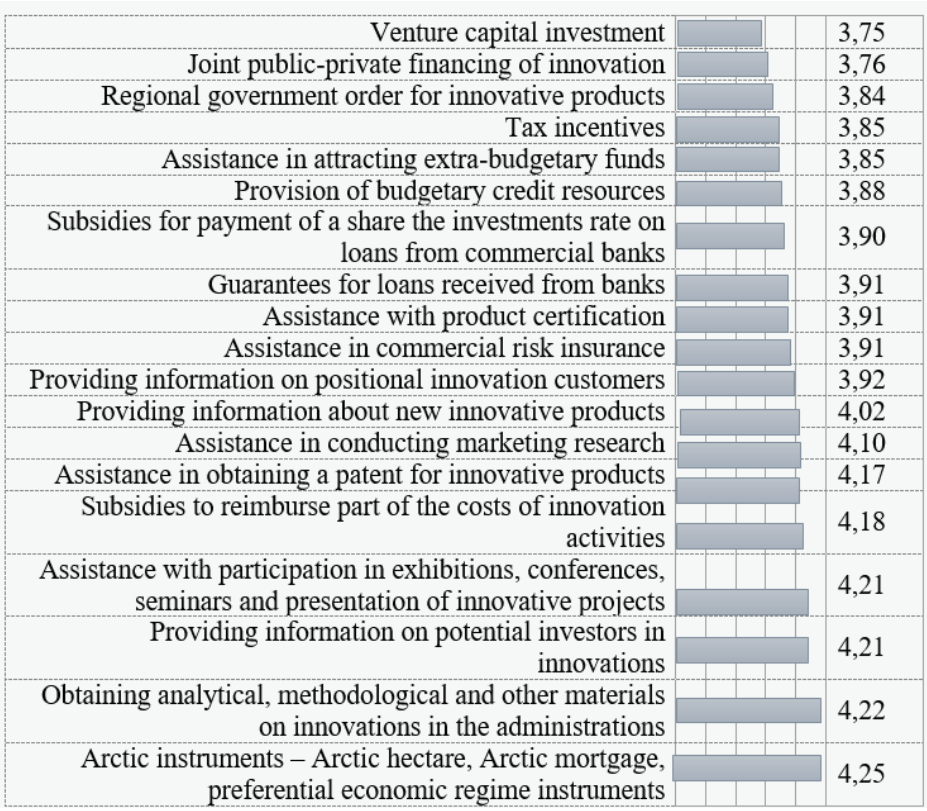

Fig. 1. Relative level of demand for forms of support in the innovation sphere (5-point scale).

The majority of enterprise representatives participating in the survey confirmed that the main goal of strategic development is to obtain a positive effect from innovations in the future. A quarter of respondents (24.6%) use innovative activities for transitioning enterprises to comprehensive automation of all business processes (Table 5) [20, Tishkov S.V.].

Table 5

What is the main strategic goal you are trying to achieve by implementing modern innovative technologies at your enterprise? [5]

The role of innovation as a strategic goal	Percent
Innovation will have a positive effect in any case	44.4
Gradual transition of the enterprise to comprehensive automation of all business processes	24.6
Reduced operating expenses by downsizing the staff	0.6
Freeing up human resources for more important and creative tasks	10.5
Reduced likelihood of risks	2.9
Increase in production, sales and revenue as the main factors of the enterprise's financial stability	17

[5]Source: compiled by the authors on the basis of survey data.

Conclusion

The results of the study showed a high rating of the innovative and production activities of small and medium-sized companies in the Arctic region. This fact once again confirms that the innovative activities of small and medium-sized enterprises can contribute to significant growth both in a specific area and in the region as a whole [6, 7] [22, Araujo D., Diego R., Reis A. et al.; 23, Adner R., Feiler D.; 24, Talmar M., Walrave B., Podoynitsyna K.S. et al.; 25, Hannah D., Eisenhardt K.M.; 26, Jacobides M.G., Cennamo C., Gawer A.; 27, Kubus R.]. The structure of innovative and technological enterprises by industry was determined. The most representative group included enterprises operating in the field of information technology and automation. The smallest group consisted of enterprises in the field of trade and services. At the same time, according to the representatives of the surveyed companies, the level of innovative development was high in all identified areas. The assessment revealed that the most popular forms of support for innovative activities of enterprises were Arctic support instruments, such as the Arctic hectare, Arctic mortgages, and other preferential measures, which can be considered as confirmation of their effectiveness. Moreover, almost half of the surveyed companies consider innovative activity to be unconditionally positive and necessary for the gradual transition of the enterprise to comprehensive automation of business processes.

The field of activity of small innovative companies influences the methods of creating and applying strategies for innovative (technological) development, which requires the development of approaches to supporting innovation, taking into account the specifics of the work of organizations in a particular region [28, Falk M., Figueira de L.; 29, Ortega-Argilés R., Voigt P.].

Preferential economic regime measures include the impact of innovation system components on the national level and on sectoral consequences in the economies of Arctic regions. They also involve the integration of ESG factors and innovation-related institutions, thereby increasing the science intensity of Arctic zone residents. These measures contribute to economic diversification and stimulate the development of innovation infrastructure for the expanded reproduction and capitalization of innovations.

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Industrial Gas Potential of the Western Arctic in the Strategic Perspective

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Abstract. The state of the mineral resource base of natural gas requires special control, as it is a strategic resource necessary for the sustainable functioning and development of the Russian Federation's economy, ensuring national security and defense, competitive advantage in foreign trade in hydrocarbons and deep-processing products, and meeting the domestic needs of high-tech sectors of the economy for hydrocarbon raw materials. An analysis of the state of the mineral resource base in terms of the country's energy and economic security was carried out, and an assessment of natural gas reserves replenishment based on the reproduction coefficient was given. A study was conducted on the level of resource potential and prospects for increasing the mineral resource base of natural gas in the Western Arctic. It has been determined that the requirement for guaranteed gas production necessitates a change in subsoil use strategy. The depletion of profitable Cenomanian deposits in several traditional fields has become an incentive to develop projects for the development of hard-to-recover natural gas reserves — Upper-Cenomanian and deep-lying Neocom-Jurassic and Achimov. It has been concluded that it is necessary to compensate for the depletion of profitable gas reserves in traditional gas production regions, primarily in the Nadym-Purskaya and Pur-Tazovskaya fields, by shifting the raw material base to the Yamal and Gydan regions; development of transit fields in the Kara Sea, Ob, Tazovskaya and Gydanskaya bays; development of complex hydrocarbon deposits within the developed fields of traditional gas production centers.
Keywords: *natural gas reserve reproduction, industrial gas-bearing capacity, hard-to-recover reserves, low-pressure gas*

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Introduction

One of the geo-economic instruments for Russia's spatial development, ensuring its foreign policy interests and strengthening its economic positions and national security in the Arctic, is the creation of conditions for the growth of the mineral resource base (MRB) and increasing the efficiency of industrial development of Arctic hydrocarbon deposits. The MRB Development Strategy,

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updated in 2024, defined areas of development, including through MRB growth; increase in the investment attractiveness of geological prospecting work (GPW); exploration of new deposits; development of identified deposits; introduction of modern technologies to increase the efficiency of field development, comprehensive extraction of mineral resources (MR), and deep processing of MR.

New geo-economic and political conditions are necessitating changes in domestic subsoil use. The adjustment to the development strategy affected not only production and processing, but also geological exploration, which is a driver of the development of the national economy and Russian regions.

The problems of natural gas reproduction and the search for technical and technological solutions for the development of complex hydrocarbon deposits in the Arctic region are addressed in the following works: [1, Laverov N.P., Bogoyavlenskiy V.I., Bogoyavlenskiy I.V.; 2, Kontorovich A.E.; 3, Kontorovich V.A., Kontorovich A.E.; 4, Markelov V.A., Cherepanov V.V., Filippov A.G. et al.; 5, Panikarovskiy E.V., Panikarovskiy V.V., Tulubaev A.B. et al.; 6, Skorobogatov V.A.] and others.

The spatial organization of oil and gas resource development and the assessment of factors determining the feasibility of oil and gas projects in the Arctic are the subject of research [7, Kazanin A.G.; 8, Ulchenko M.V., Fedoseyev S.V.; 9, Agarkov S.A., Saveliev A.N., Kozmenko S.Y. et al.; 10, Gautier D.L.] and others.

A significant contribution to the study of the influence of factors (climatic, infrastructural, anthropogenic, social, geopolitical, etc.) on the prospects for hydrocarbon production in the Arctic regions was made by scientists [11, Harsem, T., Eide, A., Heen, K.; 12, Kokko K.T., Buanes A., et al.; 13, Kozmenko S., Saveliev A., Teslya A.; 14, Semenova T.] and others.

The study and analysis of scientific sources and geological data show the need to update the economic assessment of industrial gas potential in terms of the prospects for the reproduction of natural gas reserves in the Arctic zone of the Russian Federation.

The aim of this study is to address the scientific problem of assessing the level of gas content and evaluating the prospects for natural gas reproduction in the Arctic zone of the Russian Federation in a strategic perspective.

The study is based on geological and field data from oil and gas companies, data from the State Balance of MR reserves, and the results of the author's previous research. The work uses statistical processing of geological and geophysical data, graphical and comparative-analytical methods of economic analysis.

Efficiency of development of Russia's natural gas resource base

Despite unprecedented sanctions in the energy sector and pressure on its partners, Russia continues to rank second in terms of natural gas production, although its share of global production has declined over the past two years (Table 1).

Table 1

Share of global natural gas production by top 10 exporting countries [1]

Country	Share of global natural gas production (excluding associated gas), %									
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
USA	20.5	21.1	20.7	20.3	21.9	23.4	23.9	23.4	24.5	25.5
Russia	17.2	16.7	16.8	17.3	17.4	17.1	16.5	17.3	15.3	14.4
Iran	5.1	5.2	5.7	5.8	5.7	5.8	6.1	6.0	6.2	6.2
China	3.8	3.9	3.9	4.1	4.2	4.5	5.0	5.2	5.5	5.8
Canada	4.6	4.6	4.7	4.7	4.6	4.3	4.3	4.3	4.6	4.7
Qatar	4.9	5.0	5.0	4.6	4.5	4.5	4.5	4.4	4.4	4.4
Australia	1.9	2.1	2.7	3.0	3.3	3.7	3.8	3.7	3.8	3.7
Norway	3.1	3.3	3.3	3.4	3.1	2.9	2.9	2.8	3.0	2.9
Saudi Arabia	2.8	2.8	3.0	3.0	2.9	2.8	2.9	2.8	2.9	2.8
Algeria	2.3	2.3	2.6	2.5	2.4	2.2	2.1	2.5	2.4	2.5

PJSC Gazprom has suffered the largest decline in production in recent years. In 2023, natural and associated gas production amounted to 358.95 billion m^3 (a decrease of 13.07%, compared to 30.4% for the period 2021–2023). A change in the structure of total gas production is observed. Independent gas producing companies have shown growth in production in recent years: PJSC NOVATEK — 3.13% for the period 2021–2023 (production volume in 2023 — 82.4 billion m^3), PJSC Rosneft — 43.28% for the same period (production volume in 2023 — 92.7 billion m^3). The Russian Ministry of Economic Development (MED) provided cautious forecasts for natural and associated gas production in 2024, with an expected annual increase of 4.8% compared to 2023, reaching 668.2 billion m^3. The reorientation of export supply directions, schemes and methods over the past two years has led to an increase in natural gas production in the development zone focused on natural gas liquefaction.

The effectiveness of MRB development in terms of the country's energy and economic security is characterized by a balance between the growth and depletion (production) of natural gas reserves. An assessment of the equilibrium ratio between the growth and depletion of natural gas reserves in category $A+B_1+C_1$ for 2014–2023 is presented in Figure 1.

[1] Source: compiled by the author on the basis of data from the Statistical Review of World Energy, 72nd edition, 2023. URL: http://assets.kpmg.com/content/dam/kpmg/nl/pdf/2023/services/statistical-review-of-world-energy-kleiner.pdf (accessed 21 September 2024).

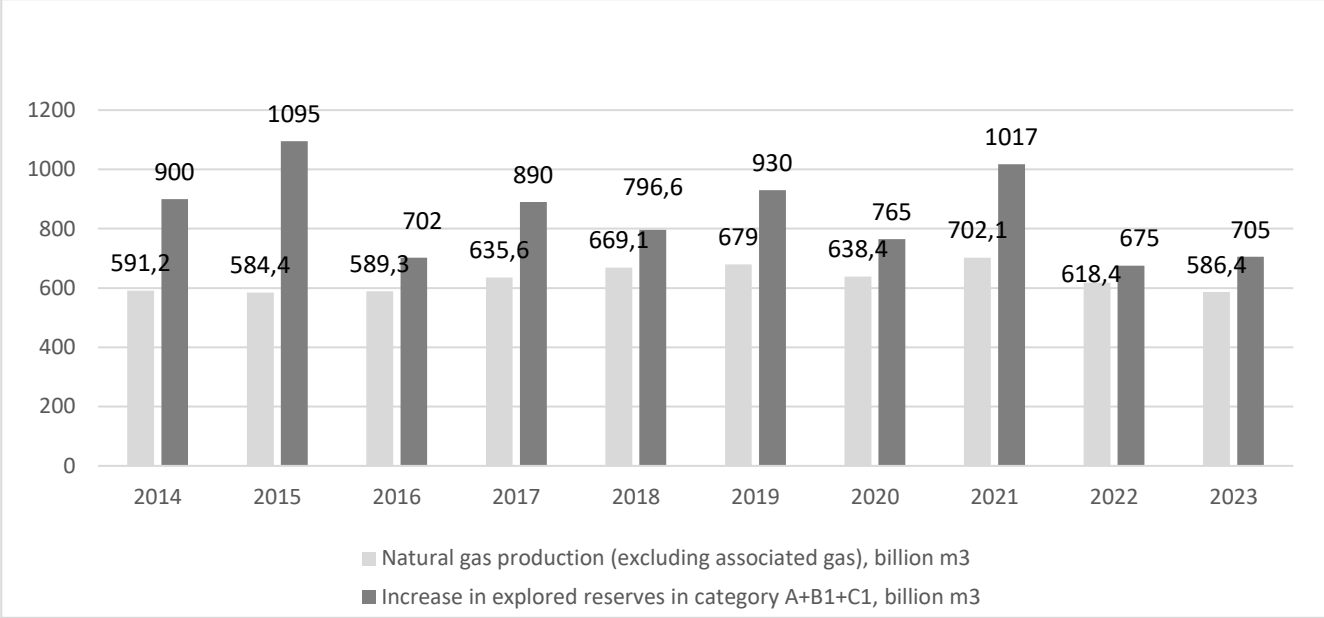

Fig. 1. Ratio between the growth and depletion of natural gas reserves in category A+B_1+C_1 for 2014–2023 (compiled by the author).

At the beginning of 2022, current recoverable natural gas reserves, according to the Russian Ministry of Natural Resources, remained stable and were estimated at 64.8 trillion m^3 (according to the State Balance, the volume of category A+B_1+C_1 natural gas reserves was 43.9 trillion m^3, and category B_2+C_2 – 20.9 trillion m^3). PJSC Gazprom accounts for 62.5% of natural gas reserves, PJSC NOVATEK — 13.2%, LLC RusGazAlyans — 9.3%, and LLC RusGazAlyans — 5%. Arctic deposits account for over 80% of the projected volume. The share of profitable reserves, according to the State Balance, is 62%.

The rate of natural gas reserve reproduction is characterized by the reproduction coefficient. Figure 2 shows the dynamics of the coefficient for the period 2014–2023.

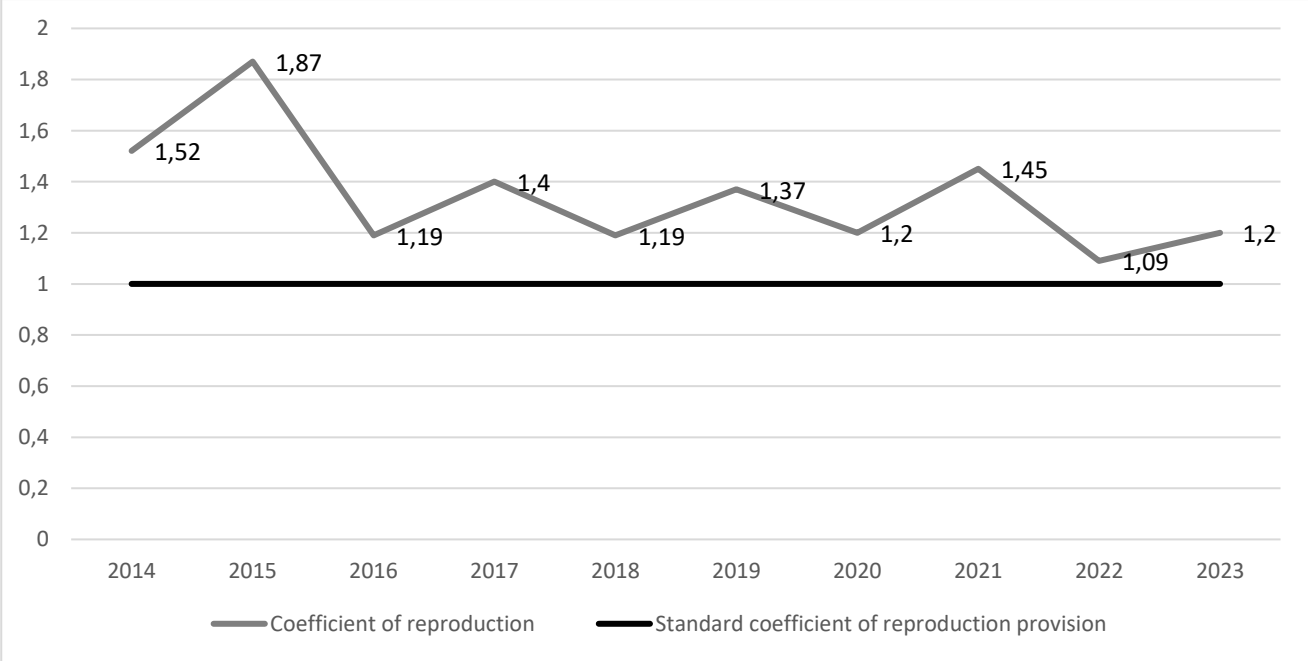

Fig. 2. Reproduction coefficient for 2014–2023 (compiled by the author).

As can be seen from the graph, there is a steady increase in natural gas reserves: according to the results of geological exploration and State Balance data, the increase in current recoverable natural gas reserves in the ABC_1+C_2 category from 2018 to 2022 amounted to 5 trillion m^3. The weighted average indicator of natural gas reserve reproduction for the period under study is 1.35. The parity between the growth and depletion of explored reserves is maintained, which ensures the reproduction of natural gas in the future [15, Shchegolkova A.A.].

Resource potential and prospects for the reproduction of the mineral resource base of natural gas in the Arctic zone of the Russian Federation

The main volume of gas exploration was carried out on the Yamal and Gydan Peninsulas, in the waters of the Baydaratskaya and Ob Bays, and on the Kara Sea shelf. The resource base of the Yuzhno-Tambeyskoe gas condensate field (Yamal OGR) was reassessed due to an increase in the area and commercial development of Jurassic deposits. The Achimov deposits at the Urengoyskoe oil and gas condensate field and the Yevo-Yakhinskoe gas condensate field (Nadym-Pur OGR) are being involved in commercial development. Further exploration of the Jurassic deposits of the Bovanenkovskoe and Tambayskoe industrial groups is underway. A gas deposit was discovered and put into production at the operating Yuzhno-Khadyryakhinskoe oil and gas condensate field (Pur-Taz OGR). The commercial potential of the Cretaceous deposits of the Arkticheskoe gas condensate field (Yamal OGR) has been confirmed. In 2020, unique fields were discovered on the Kara Shelf (Prednovozemelskaya OGR) — the Zhukov and Rokossovskiy gas condensate fields (with a total C_1+C_2 volume of 1.3 trillion m^3). In total, over 30 promising deposits have been identified on the shelf of this oil and gas region. In 2023–2024, no new hydrocarbon deposits were discovered in the AZRF, and the increase in natural gas reserves was ensured by the discovery of new gas deposits in the area of existing fields. Table 2 provides an assessment of the resource potential and prospects for increasing the natural gas reserves in the western Arctic.

Table 2

Prospects for natural gas reproduction in the Western Arctic fields [2]

Oil and gas regions (OGR)	Assessment of reserves and resources of natural gas (NG)	Level of exploration	Prospects for increasing natural gas MRB
West Siberian oil and gas province (WSOGP)			
Nadym-Pur Pur-Taz	120 fields with NG reserves are discovered. Initial NG reserves of the ABC_1+C_2 category are 32 trillion m^3. Remaining NG reserves are >10 trillion m^3 (including: high-pressure gas – 2.7 trillion m^3; low-pressure gas (LPG) – 3.8 trillion m^3; Turonian and Jurassic deposits >1 trillion m^3; Neocomian gas deposits >5.2 trillion m^3).	12 fields entered a stage of declining production, with overall regional depletion exceeding 75%. (Vyngapurovskoe and Medvezhye OGCFs have depleted 95–97%) Stage III of development.	New deposits are being developed within existing fields. Reserve volumes are being recalculated through the development of integrated projects for the extraction of complex, deep-lying hydrocarbon deposits (LPG; Achimov and Neocomian-Jurassic deposits).

[2] Source: compiled by the author.

Yamal	33 fields with NG reserves are discovered. NG reserves of the ABC_1+C_2 category are 16.3 trillion m³. The key dominant complexes are the Albian-Cenomanian (32.2%) and Aptian (42.8%). NG resources in the D_1+D_2 category — 7.1 trillion m³. Over 50% of these resources are concentrated in Jurassic and pre-Jurassic deposits.	Level of exploration — 70%. Initial/current NG reserves in terms of development are at the beginning of stage II (gas production is growing).	New deposits are being developed within existing fields. Reserve volumes are being recalculated as a result of exploration and development of Neocomian-Jurassic deposits.
Gydan	16 fields with NG reserves are discovered. NG reserves of the ABC_1+C_2 category are 2.2 trillion m³. NG resources in the $D_0+D_1L+D_2$ categories are 7.9 trillion m3. The Gydan OGR is divided into the following regional reservoirs: - Albian-Cenomanian deposits (northwest of the Gydan OGR, Taz Bay) – 18.2% of the initial reserves; - Middle-Upper Aptian deposits (southern Gydan OGR).	Level of exploration — 22%. Initial/current NG reserves in terms of development are at stage I (reserves have been identified but not developed)	Further exploration of deposits and development of new deposits within existing deposits are underway. Reserve volumes are being recalculated as a result of exploration and production.
Sverdrupskaya, Prednovozemelskaya, Yuzhno-Karskaya	8 fields have been discovered. NG reserves of the ABC_1+C_2 category are > 6.1 trillion m³. Natural gas resources of the $D_0+D_1L+D_2$ category are 47.5 trillion m³. The most promising is the Aptian-Albian-Cenomanian complex.	Level of exploration — 11.4%. The depletion rate of drilled reserves is 2.23%. Exploratory drilling phase.	Development is only possible after confirmation of NG reserves through geological exploration. Commercial development has been frozen due to high production costs, lack of logistics infrastructure, production and transportation technology.
Yenisei-Khatangskaya (within the AZRF)	"NG reserves of categories ABC_1+C_2 are 461 billion m³. NG resources of categories D_1+D_2 are 8.8 trillion m³. 95% of NG and condensate reserves are concentrated in Lower Cretaceous deposits in the Berriasian-Lower Aptian formations." [15]	Level of exploration <5%	"GPW and seismic surveys are underway to prepare the Vostok-Oil resource base (oil production and LNG production)" [15]
West and East Barents Sea oil and gas province (WEBOGP)			
Shtokman-Luninskaya, Yuzhno-Barentsevskaya, Finmarkenskaya	5 fields have been discovered. NG reserves of the ABC_1+C_2 category are > 4.7 trillion m³. NG resources of the $D_0+D_1L+D_2$ category are 28.3 trillion m³. The most promising is the Jurassic complex.	Level of exploration — 14.2%. Exploration drilling phase.	The Shtokmanovskoe GCF, the Ludlovskoe GF, and the Ledovoe GCF are ready for industrial development; their industrial development has been frozen due to high production costs, lack of infrastructure, production technology, and transportation.
Timano-Pechorskaya oil and gas province (TPOGP)			
Pechora-Kolvinskaya, Khoreyverskaya	This OGP is primarily oil-bearing. Exploratory drilling has proven commercial oil and gas potential, and two fields with NG reserves have been discovered. ABC_1+C_2 >73.7 billion m³. NG resources in the $D_0+D_1L+D_2$ category are 2.5 trillion m³.	Level of exploration — 2.9%. Exploration drilling phase.	Oil production is underway at the Prirazlomnaya offshore ice-resistant oil production platform. Commercial development of NG fields is possible only after their reserves are confirmed by geological exploration.

Since the development of the West Siberian oil and gas province, more than 21 trillion m³ of natural gas have been extracted, with current reserves estimated at 50 trillion m³. The MRB of this gas production center is at a mature stage of development, but individual oil and gas fields are at different stages, as the fields of the Nadym-Pur and Pur-Taz OGRs have entered a stage of declining

production. In this oil and gas region, exploration work is actively underway at traditional fields aimed at exploring the complex deep-lying deposits of the Achimov and Jurassic sediments, allowing for regular recalculation of recoverable reserves.

The Yamal OGR is showing growth in gas production, while new deposits are being developed within the existing fields, including the Jurassic deposits, allowing for reassessment of the region's potential reserves. The Gydan OGR is in the initial stages of development, with additional exploration underway. Like the Yamal OGR, the Gydan oil and gas region possesses significant resources, and its geographic location near the Gydan, Taz, Ob, and Yuratskaya Bays has made it attractive for development and implementation of natural gas liquefaction projects by PJSC NOVATEK [16, Ulchenko M.V., Bashmakova E.P.].

The Arctic shelf deposits have high potential; according to a number of Russian and Western experts, the volume of natural gas resources in the D_0+D_1L+D_2 categories amounts to 95 trillion m^3. Exploration and prospecting are actively underway, but there is currently no development concept, including proven technological solutions for the development of Arctic shelf deposits, either in domestic or foreign practice [15, Shchegolkova A.A.]. The Eastern Arctic OGRs are characterized by a low degree of geological and geophysical study; exploration work is unsystematic and is being conducted within the boundaries of licensed areas.

In order to maintain production at the level specified in the General Scheme for the Development of the Oil and Gas Industry until 2035 (approved in 2021), it is necessary to compensate for the depletion of profitable gas reserves at fields in traditional gas production regions, primarily in the Nadym-Pur and Pur-Taz OGRs [17, Shchegolkova A.A.].

Previous studies have identified the following elements of the natural gas MRB reproduction program:

- shifting the raw material base to the Yamal and Gydan regions;
- development of transit fields in the waters of the Kara Sea, Ob, Taz and Gydan Bays [17];
- development of complex hydrocarbon deposits within the boundaries of the developed fields of traditional gas production centers.

Previous studies have examined in detail the prospects of shifting the raw material base to the hard-to-reach areas of Yamal and Gydan, development of transit fields in the waters of the Kara Sea, Ob, Taz and Gydan Bays, and concluded that "it is necessary to expand the resource base through the development of accompanying fields in the Yamal and Gydan oil and gas regions and a number of coastal fields that have already developed production, processing, transport and social infrastructure, as well as through additional exploration of discovered and developed fields and deposits [17]".

Assessment of the prospects for developing Neocomian-Jurassic, Cenonian-Turonian, and Achimov deposits and low-pressure gas

Natural gas production in the West Siberian oil and gas province (WSOGP) was initially carried out at the unique Nadym-Pur and Pur-Taz fields, with the development of Cenomanian deposits containing dry gas that does not require processing and is free of methane homologs (C5+) and heavy hydrocarbons impurities. The depletion of profitable Cenomanian deposits (over 75% of total production in the region) led to an increase in the share of condensate-containing gas in the total volume of production. This can be observed at the Zapolyarnoe, Yamburgskoe, Urengoyskoe, and Yurkharovskoe OGCFs, where the main production sites are the Valanginian (Neocomian) and Achimov deposits, as well as the LP gas. In the Yamal OGR, the largest natural gas reserves are concentrated in the Aptian-Albian-Cenomanian strata (approximately 75%), while projected and prospective resources are concentrated in Jurassic and pre-Jurassic deposits. Natural gas development in Jurassic and pre-Jurassic deposits is being carried out jointly with the Lower Cretaceous deposits at the Yurkharovskoe OGCF, the Novoportovskiy cluster fields, the Yuzhno-Tambeyskoe GCF, and others. Natural gas in Neocomian-Jurassic deposits lies at depths of 1,600 to 3,300 m, and the deposits are gas condensate (methane content up to 80%). Unlike dry gas, it requires additional processing: separation from moisture, extraction of gas condensate, and cleaning of mechanical impurities. Table 3 presents an analysis of comprehensive projects by gas production companies for the extraction and industrial utilization of low-pressure gas and gas from Neocomian-Jurassic deposits.

Table 3

Projects aimed at developing gas from Neocomian-Jurassic deposits and low-pressure gas [3]

Deposit / Characteristics of deposits	Project features	Year of project implementation
Neocomian-Jurassic deposits		
Nadym-Pur and Pur-Taz oil and gas region, Stage III of development (Remaining NG reserves > 10 trillion m³, including Neocomian and Jurassic gas deposits > 5.2 trillion m³)		
Yurkharovskoe OGCF A transit field with access to the Taz Bay waters. The deposits are predominantly Neocomian-Jurassic, with depths (including Jurassic sediments) ranging from 1,000 to 4,400 m.	**PJSC Novatek, PC — 37 billion m³/year (NG), 2.7 million tons/year (GC)** • Use of ERD-wells (K_{ERD} 2.28) for onshore development; • Application of multi-stage hydraulic fracturing (HF) technology; • Commissioning of a gas and condensate integrated treatment unit (GTU); • Commissioning of a NG desulfurization unit (based on GTU); • Commissioning of a gas pipeline (GP) from the field to the junction point of the Urengoy-Yamburg gas pipeline interceptor and to the Yamburgskaya compressor station (CS), then along the central corridor of the Arctic GTS (two 52 km lines, total capacity of 54 billion m3/year); • Commissioning of a condensate pipeline (326 km, GTU of 3 million tons/year) to the Purovskiy GC processing plant; • Commissioning of an integrated pilot plant for methanol production (12.5 thousand tons/year);	Stage 1 — July 2004 Stage 2: September 2008 — Launch Complex 1, October 2009 — Launch Complex 2, October 2010 — Launch Complex 3, October 2012 — Launch Complex 4.

[3] Source: compiled by the author.

	• Application of environmental technologies — a climate technology project — to reduce the negative impact on the ecosystem (planned reduction in greenhouse gas emissions—255 thousand tons/year of CO_2 equivalent).	
Vostochno-Urengoyskoe OGCF, Severo-Esetinskoe OGCF. Neocomian deposits at depths of 1,700–3,200 m and Achimov deposits at depths of 3,400–4,000 m. Neocomian NG reserves: C_1+C_2 — 98 billion m³.	**OJSC Arcticgas (a joint venture of Novatek and Gazprom Neft), total PC: NG — 16.7 billion m³/year; GC — 4.5 million tons/year; propane-butane fraction — 1 million tons/year** • Application of multi-stage HF technology; • Application of cycling technology to maintain reservoir pressure; • Commissioning of a gas and condensate integrated treatment unit (GTU); • Application (based on GTU) of methanol recovery technology in a distillation column; • Commissioning of 1.5 km of field pipelines.	Commissioned into operation in 2019.
Zapolyarnoe OGCF Valanginian (Neocomian) deposits, depth 1,700–3,200 m. Neocomian NG reserves: C_1 — 735 billion m³, C_2 — 20 billion m³. GC reserves: C_1+C_2 — 137 million tons.	**Extraction of NG and GC from Neocomian deposits, total PC (two fields): NG — 15 billion m³/year; GC — 3 million tons/year, PJSC Gazprom** • 140 production wells were drilled (61 wells in the 1st field, 79 wells in the 2nd field), using directional drilling technology; • Use of HF technology with the injection of scale inhibitors; • Use of secondary formation penetration technology; • Use of an automated process control system (APCS) for the collection, processing, and storage of information on well operating parameters; • Commissioning of a gas and condensate integrated treatment unit (GTU); • Application (based on GTU) of low-temperature hydrocarbon separation technology with rectification; • Commissioning of a condensate pipeline (Zapolyarnoe — Novy Urengoy, 211 km, PC – 3.4 million tons/year) to the Novy Urengoy plant for the preparation of GC for transportation; • Commissioning of a gas connection from the field to the junction point to the Zapolyarnoe – Urengoy gas pipeline system (190 km).	Stage 1 UKPG-2V — April 2011 Stage 2 UKPG-1V — December 2012
Yamal oil and gas region, beginning of the Stage II of development Reserves of NG of the ABC_1+C_2 category are 16.3 trillion m³, the share of Neocomian and Jurassic deposits is 24%.		
Bovanenkovskoe OGCF, Kharasaveyskoe OGCF Neocomian-Jurassic deposits, depth including Jurassic sediments 1,700–4,400 m Reserves (Neocomian, Jurassic): NG C_1+C_2 — 1.8 trillion m³ GC C_1+C_2 — 222 million tons	**Kharasavey-Bovanenkovo project, Gazprom PJSC** • Application of multi-stage HF technology using a polymer-based insulating compound; • Commissioning of a gas and condensate integrated treatment unit (GTU); • Application (based on GTU) of low-temperature, medium-pressure separation technology; • Transportation of treated NG via the Bovanenkovo-Ukhta-Torzhok 1, 2, 3 gas pipelines; • Construction of a loading terminal for GC; • Transportation of GC via the Obskaya-Bovanenkovo-Karskaya-Ust-Luga railway line	
Novoportovskoe OGCF (Yamal OGR), primarily oil. Deposits are predominantly Valanginian (Neocomian) — 62.2%, Jurassic — 32.4%. NG reserves: $A+B_1+C_1$ — 267.9 billion m³; B_2+C_2 — 33.4 billion m³.	**The Novoportovskoe oil and gas cluster, PJSC Gazprom,** includes: **Novoportovskoe OGCF:** • Integrated multi-stage HF technology (up to 30 stages) with reusable sliding couplings with a sand carrier fluid containing proppant; • Commissioning of a gas and condensate integrated treatment unit (GTU);	October 2021

GC reserves: $A+B_1+C_1$ — 16.8 million tons; B_2+C_2 — 1.6 million tons.	• Associated petroleum gas (APG) compression (based on GTU) — 8.59 billion m^3; • Utilization of APG — 95%, including: APG injection into the reservoir — 89–93%; fuel for gas turbine power plants — 2–3%; • Commissioning of the Gaz Yamala gas pipeline connection — Yamburg — Tula I, II (115.5 km, including the underwater section of the gas pipeline — 58.4) [15] **Malo-Yamalskoe GCF:** • further exploration of the deposit is underway • design and survey work (D&S) for development has been completed **Khambateyskoe GCF:** • further exploration of the deposit is underway • design and survey work (D&S) for development has been completed NG transportation is expected via the gas pipeline connection of the Khambateyskoe – Malo-Yamalskoe – Blizhneno-Novoportovskoe – Novoportovskoe – Gaz Yamala GP.	
Malo-Yamalskoe GCF (Yamal OGR) Deposits are predominantly Jurassic—78.8%. NG reserves: $A+B_1+C_1$ —114.7 billion m^3; B_2+C_2 —114 billion m^3. GC reserves: $A+B_1+C_1$ —7.1 million t; B_2+C_2 —12.3 million t.		Start of industrial operation (project) – 2026
Khambateyskoe GCF (Yamal OGR) Deposits: Valanginian (Neocomian) — 100% NG reserves: $A+B_1+C_1$ — 15.7 billion m^3; B_2+C_2 – 18.7 billion m^3 GC reserves: $A+B_1+C_1$ — 1.2 million t; B_2+C_2 —1.4 million tons NG resources: D_0 — 247 billion m^3; GC: D0 — 20 million tons.		Start of industrial operation (project) – 2026
Yuzhno-Tambeyskoe GCF $(A+B_1+C_1)+(B_2+C_2)$ — 953.9+332.9 billion m^3. Albian-Cenomanian — 27.9%; Aptian — 47.1%; Valanginian (Neocomian) — 17.8%; Jurassic — 7.2%.	**The Yamal LNG project, PJSC NOVATEK, has 112 Neocomian GC wells and 10 Jurassic GC wells.** • Managed pressure drilling (MPD) technology is used; • ERD wells are used; • Multistage HF technology is used with propane injection at each stage.	The Yamal LNG project commenced in 2017. Commissioning of Neocomian-Jurassic wells — in 2022.
Low-pressure gas (LPG)		
Nadym-Pur and Pur-Taz oil and gas region, Stage III of development (Remaining NG reserves > 10 trillion m^3, including LPG of the Cenomanian deposits — 3.8 trillion m^3)		
LPG fields in the Nadym-Pur and Pur-Taz petroleum regions; LPG in the Cenomanian deposits — 3.8 trillion m^3.	**Extraction of residual reserves of NG and GC from Cenomanian deposits** • well operation using concentric and plunger lift (Medvezhye, Yamburgskoe, Urengoyskoe OGCFs); • use of modular compressor stations (CS), low-stage separation CS, vacuum CS, and wellhead CS for compressing LPG; • implementation of technical solutions to reduce liquid accumulation and its removal from gas gathering manifolds when supplying gas to booster compressor stations (BCS); • reconstruction of sections of the gas gathering network (reduction of pipeline diameters); • “use of a three-way valve for launching and receiving cleaning pistons” [18]; • consolidation of fields.	2011 — Medvezhye OGCF, 2012 — Vyngapurskoe OGCF, 2014 — Urengoyskoe OGCF, 2017 — Severo-Urengoyskoe OGCF 2018 — Yamburgskoe OGCF.

The production of natural gas from Neocomian deposits is carried out at fields currently under development. Therefore, despite the high cost of rich gas production, the availability of the necessary field infrastructure allows for its industrial use with a high level of profitability. In the Yamal and Gydan OGRs, sufficient gas potential for industrial development has been recorded, with a high prospect of discovering large natural gas deposits in the Neocomian-Jurassic sediments, larger in volume than the discovered Cenomanian ones, at the Severo-Kamennomysskoe, Kamennomysskoe-More, Obskoe, Semakovskoe and other GCFs [15, Shchegolkova A.A.]. The economic feasibility of exploiting LPG in the developed fields of the Nadym-Pur and Pur-Taz OGRs is noted, as this allows for extension of the life of the gas fields. However, its use as a raw material for the gas

chemical complex and for small-scale energy needs requires a comprehensive approach to the development of technological and design solutions.

The depletion of profitable Cenomanian deposits in a number of fields in the Nadym-Pur and Pur-Taz OGRs has stimulated the development of projects for the extraction of hard-to-recover natural gas reserves (HRR) — supra-Cenomanian (Cenonian-Turonian) gas, as well as deep-lying Achimov gas. Information on the gas content of Cenonian-Turonian deposits was obtained during exploration work at the initial stages of gas exploration in the Nadym-Pur and Pur-Taz OGRs. Experts [6, Skorobogatov V.A.], [19, Davydova E.S., Pyatnitskaya G.R., Skorobogatov V.A. et al.] claim that the supra-Cenomanian gas is of "Cenomanian" origin, which is confirmed by the geological and geochemical conditions of its distribution. They also note the insignificance of the volume of reserves of the supra-Cenomanian gas deposits (category $A+B+C_1$ – 1.2 trillion m^3, category B_2+C_2 – 0.3 trillion m^3), while the volume of category D_0 resources is estimated at 3.3 trillion m^3, which is incomparable with the natural gas deposits in the Albian-Cenomanian complex of the northern region of the WSOGP. Despite their shallower depth compared to traditional Cenomanian reserves, the geological and physical characteristics of natural gas in the Cenonian-Tourounian deposits are more complex. The low permeability of the reservoirs and the heterogeneity of the formations require the use of drilling technologies such as hydraulic fracturing (HF), horizontal and sub-horizontal, multilateral, and multi-bore wells.

Natural gas of the Achimov deposits is characterized by a complex geological structure with a depth of 3,500–3,700 m, low reservoir permeability, abnormally high formation pressure (up to 62 MPa) and temperatures [15], high content of intermediate hydrocarbons and paraffin fractions, high condensate content (220–450 g/m^3) in gas, which suggests the use of hydraulic fracturing (HF) technologies and gas condensate separation technologies [20, Davydova E.S., Izvekov I.B., Pyatnitskaya G.R. et al.]. The cost of extracting natural gas from Achimov deposits exceeds the cost of extracting Cenomanian gas by 10–15 times, according to various estimates [15, Shchegolkova A.A.]. Table 4 presents an analysis of comprehensive projects by gas production companies for the extraction and industrial utilization of gas from the supra-Cenomanian and Achimov deposits.

Table 4

Projects aimed at developing gas from the supra-Cenomanian and Achimov deposits [4]

Deposit / Characteristics of deposits	Project features	Year of project implementation
Post-Cenomanian deposits (gas from Turonian and Cenonian deposits) (Cenonian-Turonian natural gas deposits: 1.5 trillion m^3)		
Nadym-Pur and Pur-Taz oil and gas region, Stage III of development		
Yuzhno-Russkoe OGCF, Turonian gas (supra-Cenomanian deposits), stratum depth 800–850 m. NG reserves (Turonian) $A+B_1$ – 285.7 billion m^3, B_2 – 52.1 billion m^3.	**Turonian gas development program, PJSC Gazprom** • Application of innovative technology for drilling a directional well with a downward profile; • Application of multi-stage HF technology using a high-viscosity hydrocarbon-based gel; • Development of an innovative NG loss management system (IMS).	2007 – start of field exploitation; 2011 — implementation of the Turonian gas development program.

[4] Source: compiled by the author.

Kharampurskoe OGCF, NG reserves (Turonian): A+B_1 – 603.2 billion m^3, B_2 – 129.5 billion m^3.	**Turonian gas development program, total PC – 1 billion m^3/year, PJSC Rosneft** • design and survey works (D&S) for the construction of a complex of gas production facilities and gas pipeline connections were completed.	Experimental production began in 2014.
Zapolyarnoe OGCF, NG reserves (Turonian): A+B_1 — 206.8 billion m^3.	**Turonian gas development program, PJSC Gazprom** • further exploration and assessment of the industrial potential of the Turonian deposits is underway, design and survey work for the development has been completed.	Pilot production in 2021. Start of commercial operation (project) — 2026.
Medvezhye OGCF, NG reserves (Cenonian): A+B_1 — 9.7 billion m^3.	**Cenonian gas development program, PJSC Gazprom** • further exploration and assessment of the industrial potential of the Cenonian deposits is underway, design and survey work for the development has been completed.	Launch in pilot industrial mode in 2024.
Komsomolskoe OGCF, Yamburgskoe, Vyngapurovskoe Padinskoe GCF.		No data
Achimov deposits		
Nadym-Pur and Pur-Taz oil and gas region, Stage III of development		
Urengoyskoe OGCF, North of WSOGP in the Pur River basin, Purovskiy district Yamalo-Nenets Autonomous Okrug, Achimov deposits with a depth of 3400–4000 m: Initial NG reserves: C_1 – 1,389.491 billion m^3; C_2 – 282.268 billion m^3. Initial GC reserves (recoverable): C_1 – 251.389 million tons; C_2 – 49.571 million tons. Initial oil reserves (recoverable): C_1 – 15.004 million tons; C_2 – 26.549 million tons.	**Development of hard-to-reach Achimov deposits, total production capacity (five sites) — 37 billion m^3/year (Gazprom)** • Application of large-volume hydraulic fracturing (HF) technology in wells; • Use of a directional well with an S-shaped (up to 45°) borehole profile; • Use of subhorizontal wells with multi-stage HF; • Commissioning of a gas and condensate unit; • Construction of an oil pumping station (Urengoyskaya OPS); • Commissioning of the Urengoy-Pur-Pe gas pipeline (125 km).	Site: A1 — 2008 (PC: NG — 9.6 billion m^3/year, GC — 2.8 million t/year), A2 — 2009 (PC: NG — 8.7 billion m^3/year, GC — 1.5 million t/year), A3 — 2024 (PC: NG — 5 billion m^3/year, GC — 1.5 million t/year), A4/A5 — 2021 (PC: NG — 13.9 billion m^3/year, GC — 3.8 million t/year).

Currently, joint development of gas from the Cenonian-Turonian deposit and traditional reserves of the Cenomanian deposit is underway. The necessary production infrastructure allows for the maintenance of profitable production levels. The productivity of Cenonian-Turonian deposits has been established at most fields where Cenomanian formations are productive. A full assessment of the geological and recoverable natural gas resources of the supra-Cenomanian section is difficult, so its production is currently of no significant commercial importance. The production potential of supra-Cenomanian gas in the Nadym-Pur and Pur-Taz OGRs does not exceed 8 billion m^3 per year. As for the Yamal, Gydan, and Yuzhno-Karskaya OGRs, the prospects for commercial gas production in the supra-Cenomanian gas deposits are minimal [21, Cherepanov V.V., Menshikov S.N., Varyagova A.S. et al.].

The Achimov formation is currently considered the most promising. Achimov hydrocarbon deposits have been discovered at 51 fields in the Nadym-Purskaya, Pur-Tazovskaya and Gydanskaya OGRs. The geological reserves of the Achimov deposits are preliminary estimated at: 4.4 trillion m^3 of natural gas, 1.4 billion tons of gas condensate, and 10.4 billion tons of oil. The prospective development zone for the gas potential of the Achimov formation is 183,000 km^2.

Most of the Achimov gas is located in the Urengoyskoe OGCF (initial reserves of natural gas in category C_1+C_2 amount to 1.67 trillion m^3, geological reserves of gas condensate in category C_1+C_2 — 500.9 million tons). Significant reserves have been discovered at the Yamburskoe OGCF (a project for oil production from Achimov deposits is being developed) [4, Markelov V.A., Cherepanov V.V., Filippov A.G. et al.]. The joint development of Achimov and Cenomanian gas deposits and the multicomponent nature of Achimov gas make it possible to involve it in industrial development. According to seismic exploration and geological survey data, promising natural gas deposits have been identified in the Achimov formation at the Gydan OGR fields (Geofizicheskoe and Utrennee OGCFs; Gydanskoe, Trekhbugornoe, Tota-Yakhinskoe, and Shtormovoe GFs) and the Yenisei-Khatanga OGR within the Arctic Zone of the Russian Federation (Deryabinskoe GCF).

Conclusion

1. An analysis of the state of the MRB sector in terms of the country's energy and economic security was carried out using the reproduction coefficient indicator. The parity between the increase and depletion of proven reserves is maintained, which ensures the replenishment of natural gas in the future. The weighted average reproduction rate for the period under review is 1.35. A stable level of natural gas reserve reproduction is achieved not only due to reduced production against the backdrop of sanctions pressure, dependence on imports of technology, equipment and software, withdrawal of foreign partners, reduced investments, loss of the European pipeline gas market, but also due to growth in exploration and production, including in the AZRF. Over the past five years, the increase in current recoverable natural gas reserves in the ABC_1+C_2 category amounted to 5 trillion m^3. Despite the challenging geo-economic and political conditions, subsoil users continue to invest in hydrocarbon exploration and production, with this indicator remaining stable and averaging 300 billion rubles per year, while the share of the federal budget financing in 2023 amounted to 3.8% (11.3 billion rubles). The state funding program needs to be reviewed, primarily in terms of exploration drilling in promising, highly explored subsoil areas. This requires updating Russia's oil and gas map and regularly conducting geological and economic assessments of hydrocarbon reserves recorded in the state balance, taking into account production costs, profitability, and the availability of necessary technologies, as well as actualizing forecasts of resource volumes, considering the degree of their geological study. The expansion of the hydrocarbon industry is impossible without import substitution of exploration and production technologies and equipment. Dependence on imported drilling equipment (90%), laboratory equipment and software (90%), mining machinery (50%), and geophysical tools (10-30%) requires the development of a comprehensive state program aimed at achieving technological sovereignty in domestic geological exploration and gas production.

2. An analysis of the spatial distribution of resource potential and an assessment of the prospects for natural gas reproduction in the Arctic region were carried out. The Nadym-Pur and Pur-Taz oil and gas regions remain the strategic hub for gas production. They are in a mature stage of

development, with relatively high levels of commercially viable natural gas reserves in Cenomanian formations. However, some fields have entered a stage of declining production. To maintain production, subsoil users are developing programs to utilize new methods to intensify hydrocarbon production and to bring low-pressure and hard-to-recover natural gas reserves into commercial development.

New gas production centers are being established in the Yamal and Gydan OGRs. These regions are in the initial stages of development, with additional exploration and reassessment of potential reserves underway, including deeper Neocomian-Jurassic deposits. The high potential of the Yamal and Gydan OGRs is related to the implementation of geological exploration and prospecting aimed at converting the projected and prospective resources of mainland and transit fields into industrial reserves. The discovery of large natural gas deposits in Neocomian-Jurassic sediments, which are larger in volume than previously discovered Cenomanian deposits, has been noted to be highly promising. Overall, the forecast for the growth of category $B+C_1$ natural gas reserves in the Yamal, Gydan, and Yuzhno-Karskaya OGRs, as estimated by all subsoil users, is 17.5–18 trillion m^3 [17, A.A. Shchegolkova].

The Arctic shelf deposits also have high potential (category $D_0+D_1L+D_2$ resources — 95 trillion m^3), and active exploration is underway. The most significant constraint hindering the development and exploitation of Arctic shelf deposits is the lack of proven technological solutions, both in domestic and foreign practice, for the development of gas deposits at extreme depths in complex geological and industrial conditions in an ice environment. The Eastern Arctic's OGRs are characterized by a low level of geological and geophysical exploration. Geological exploration is unsystematic and is carried out within the boundaries of licensed areas. Currently, there is no commercial gas potential.

3. In the current geo-economic and political reality, the requirement for guaranteed gas production dictates the need to change the subsoil use strategies. The following elements of the natural gas reproduction program can be identified:

- *Shifting the resource base to the Yamal and Gydan regions.* The peculiarity of developing hard-to-reach areas in the northern and north-western parts of the WSOGP, where there are practically no developed fields, has determined the main directions for natural gas reproduction through the development of accompanying fields within the mineral resource clusters of the gas industry with existing industrial, transport and social infrastructure;
- *Involvement in the development of transit fields in the Kara Sea, Ob, Taz, and Gydan Bays.* As already noted, the main challenge in exploration work at offshore fields is the assessment of actual natural gas reserves. The development of these fields is hampered by the lack of proven technological solutions. In the future, expansion of the commercial gas-bearing zone will be achieved through the development of transit fields (onshore-offshore) using ERD wells with a large deviation from the vertical (K_{ERD} 2.28) to develop gas resources from the shore, following the example of the Yurkharovskoe OGCF;

- *Involvement in the development of complex hydrocarbon deposits within the developed fields of traditional gas production centers.* There are still prospects for an increase in natural gas reserves in the oldest Arctic gas production center — Nadym-Pur and Pur-Taz OGRs — through the development of deposits located above (Cenonian-Turunian) and below (Neocomian-Jurassic and Achimov) traditional Cenomanian gas, as well as low-pressure Cenomanian gas, provided that traditional (Cenomanian) deposits are jointly exploited at fields where the necessary industrial infrastructure already exists, which allows for maintaining a profitable level of production.

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Social Policy of Mining Companies as an Institution for the Development of Rural Areas in the Arctic Zone of the Russian Federation

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Abstract. This study examines the social policy of mining companies in rural areas of the Arctic zone of the Russian Federation, which forms the institution of corporate social responsibility. The aim of the study is to describe this institution, i.e. the set of mechanisms used by the enterprise to interact with its operating environment (authorities and population), the process of forming the object of interaction and directions. The novelty of the research is determined by the voluntary nature of corporate social responsibility, i.e. the absence of a direct regulatory institutional environment. The social policies of JSC Severalmaz (Arkhangelsk Oblast) and LLC LUKOIL-Komi (Republic of Komi) are selected as the object of the study. The research methods include dynamic horizontal analysis of socio-economic indicators for 2012–2023, case method and content analysis. The data sources are corporate reports, official notes on the websites of companies and municipalities for 2023. The collected data was quantitatively assessed and systematized in terms of the areas of social initiatives, geography of implementation, and beneficiaries. Based on the analysis of social activities, it was found that the focus areas differ in the administrative center, where "social sphere" and "education and science" predominate, and rural settlements, where corporate activities depend on development disparities. Among the formal mechanisms for participation in solving problems, agreements, cooperation contracts and grant support prevail. At the same time, informal mechanisms are actively used: targeted assistance and employee initiatives. Social responsibility policy tends towards the "strategic" type, where measures with both long-term and short-term effects are implemented. As a result, mining companies are becoming a significant part of the development of rural areas in the Arctic zone of the Russian Federation, which determines the emergence of the institution of corporate social responsibility. The data obtained will serve as a basis for the development of social policies by corporations and municipal authorities.
Keywords: *corporate social responsibility, rural areas, Arctic, AZRF, mining company*

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Introduction

Companies play an important role in the socio-economic development of regions and territories of their operation, which is confirmed by their inclusion in various regional and federal

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strategies, such as the Strategy for Spatial Development [1]. For the Arctic Zone of the Russian Federation (hereinafter referred to as the AZRF), extractive companies are not only a growth driver, but also a primary factor in regional development [1, Shelomentsev A.G., Doroshenko S.V., Dzhabiev V.V. et al., pp. 13–14; 2, Minaev Yu.N.; 3, Agarkov S.A., Ivanova M.V.]. However, the activities of extractive companies are most critical for rural settlements in the Arctic. Due to the remoteness of municipalities from each other, low population density and its uneven distribution [4, Korchak E.A., p. 123], as well as difficult climatic conditions for effective agriculture [5, Samarina V.P., Skufina T.P.], resource enterprises are the main driver of growth and often the only basis for the existence of a municipal entity. At the same time, there are about 16 municipal okrugs and districts (20% of all municipal formations in the AZRF) where only the rural population lives [2] [6, Yakusheva U.E., Maksimov A.M., Malygina M.V., p. 191]. The importance of partnership between business, the rural population and the authorities is identified as one of the principles for achieving the goals of the Strategy for the Sustainable Development of Rural Areas of the Russian Federation for the Period until 2030 [3]. However, the most interesting aspect to consider is the social impact created in the process of this interaction, as well as the formation of a mechanism as a result of the company's implementation of social policy within the framework of corporate social responsibility (hereinafter referred to as CSR). The dichotomy of CSR lies in the company's performance of some of the social functions initially assigned to the state, and in this case, to municipal authorities, limited in budget formation due to "centralization" and the transfer of the bulk of taxes to the regional and federal levels [7, Lytkina T.S., Yaroshenko S.S., pp. 106, 116]. This situation serves as a prerequisite for the formation of an institution in the form of corporate social responsibility within rural settlements, often to ensure the viability of the rural area.

Thus, the purpose of this article is to analyze the institution of corporate social responsibility of mining companies as an element of the socio-economic development of rural municipalities in the Arctic zone of the Russian Federation. In this study, the analysis of the CSR involves the identification of a set of predominant areas of corporate social activities, the tools used by the company to build interactions within the territory of its presence, and the mechanisms of participation in decision-making on the implementation of social policy. For a number of reasons, the social activities of JSC Severalmaz, a diamond mining company in the Arkhangelsk Oblast and a subsidiary of ALROSA Diamond Company, and LLC LUKOIL-Komi [4], which operates in the Komi Republic and the Nenets Autonomous Okrug and is a subsidiary of PJSC LUKOIL, were chosen as the object of study. Firstly,

[1] Order of the Government of the Russian Federation of February 13, 2019 No. 207-r "On approval of the Strategy for Spatial Development of the Russian Federation for the period until 2025". URL: https://base.garant.ru/72174066/ (accessed 08 November 2024).
[2] Official website of the Federal State Statistics Service. URL: http://www.gks.ru (accessed 10 September 2024).
[3] Order of the Government of the Russian Federation of February 2, 2015 No. 151-r "On approval of the Strategy for sustainable development of rural areas of the Russian Federation for the period up to 2030". URL: https://base.garant.ru/70861426/ (accessed 08 November 2024).
[4] Since 2024, LLC LUKOIL-Komi was merged with LLC LUKOIL-Perm during reorganization, but its regional divisions continue to operate under the same regime in the Nenets Autonomous Okrug and the Komi Republic. This article will use the name LUKOIL-Komi, as the company operated under this name during the period of analysis.

the companies have a long history of development. JSC Severalmaz has been actively mining diamonds at the M.V. Lomonosov deposit since 1994. The deposit's reserves, consisting of six kimberlite pipes, are estimated at 194 million carats, making it the largest in the European part of Russia [5]. LLC LUKOIL-Komi has been operating since 2001 and extracts hydrocarbon resources at deposits in the Timan-Pechora province of the Komi Republic [6]. Secondly, the companies' activities are concentrated in municipalities, some of which are entirely rural. For example, Severalmaz operates in the Primorskiy Municipal District of the Arkhangelsk Oblast, and LUKOIL-Komi — in several municipalities of the Komi Republic, including the Ust-Tsilemskiy Municipal District. Thirdly, the companies adhere to sustainable development policies and corporate social responsibility principles, have documents such as the "Sustainable Development and Corporate Social Responsibility Policy of JSC Severalmaz" [7] and the "Sustainable Development Policy of the LUKOIL Group" [8], and openly publish information about their events on their official websites, which allows identifying patterns of their social activity.

Theoretical framework

A considerable number of studies by both domestic and foreign researchers are devoted to issues of corporate social responsibility [8, Frederick W.C.; 9, Greening D.W., Turban D.B.; 10, Sarbutts N.]. However, it is worth noting the limited number of works addressing aspects of organizational behavior, the portrait of a socially responsible company with the identification of key areas of influence, the mechanism of building communications, and the process of CSR institutionalization. This phenomenon can be explained by the still uncertain interpretation of social responsibility in domestic literature: there are neither clear identification criteria, nor defined implementation mechanism, etc.

Among the studies of international researchers on the systematization and classification of CSR styles and policies, it is worth noting the works of S. Zadek, A. Carroll, and W. Visser. S. Zadek developed a mechanism for implementing companies' social programs based on the relationship between the stage of development of a social problem and organizational learning. This process was described by the author as "civil learning", as a result of which the organization can choose any of five models of behavior in response to the need to solve social problems of the region: defensive, rule-following, managerial, strategic, or being a responsible citizen [11, pp. 125–132]. A similar concept was proposed by W. Visser, who made an analysis of companies' activities in 60 countries and identified five stages of CSR: defensive, when the company relies only on current legislation;

[5] Mineral Resources. Official website of JSC Severalmaz. URL: https://www.severalmaz.ru/proizvodstvo/mineralno-syrevaya-baza/ (accessed 01 August 2024).
[6] Official website of PJSC LUKOIL. URL: https://lukoil.ru/Business/Upstream/traditional-regions (accessed 10 September 2024).
[7] Sustainable Development and Corporate Social Responsibility Policy of PJSC Severalmaz. URL: https://www.severalmaz.ru/investoram/ustoychivoe-razvitie/ (accessed 04 August 2024).
[8] See: LUKOIL Group Sustainable Development Policy. URL: https://lukoil.ru/FileSystem/9/572570.pdf (accessed 14 September 2024).

promotional, characterized by the use of social activity to increase attractiveness in the market; strategic, involving the engagement of stakeholders; charitable, implying respect for the interests of the municipality; and universal (transformative), when the company seeks to give back more than it took [12]. All of the stages and strategies outlined above are, in turn, a detailed version of A. Carroll's pyramid with four levels of corporate responsibility: economic, legal, ethical, and philanthropic [13, p. 499] (see Fig. 1).

Fig. 1. Correlation of CSR styles and models [9].

The institutional aspect of a company's involvement in social issues is reflected in the studies of M. Porter and R. Kramer. The authors identified four main reasons for applying CSR practices: reputation support, moral legitimacy, permission to operate from one of the actors, and sustainable policy. However, CSR practices are based on the conflict of regional development institutions, rather than their interaction. The authors propose implementing CSR activities with a focus on the problems of the region and its residents [14]. The legitimate side of CSR considers issues of influencing public opinion through four strategies: information campaigns targeting stakeholders, manipulative influence on them, changing public expectations, and changing perceptions while maintaining current activities [15, Piedade L., Thomas A.; 16, Moir L.; 17, Rai G., Hooda K.].

H. Jenkins identified the phenomenon of "false dependence" when describing the interaction model between a mining company and its region of operation. False dependence occurs when a company is the main driver of economic growth and at the same time actively creates the illusion of contributing to the sustainable development of the region where it operates [18, p. 26]. L. Shen, K. Muduli, and A. Barve identified a list of 63 practices that influence the successful implementation of green supply chains for the mining industry, demonstrating the complexity and hierarchical nature of this process [19].

A large block of Russian studies is focused on describing CSR practices without any systematization of the activities carried out by companies [20, Potravnyy I.M., Gassiy V.V., Chernogradskiy

[9] Source: The diagram is based on the text [11, Zadek S.; 12, Visser W.; 13, Carroll A.B.].

V.N., Postnikov A.V.; 21, Nefedyeva E.I., Gavrisenko D.M.]. Among the studies of domestic researchers on the mechanisms of interaction and directions of CSR, the studies of B.S. Bataeva should be highlighted. The author identifies the following models of interaction: "city-factory", characteristic of single-industry towns, "bargaining" and "voluntary-compulsory" corporate social activity, and outlines the steps for creating a regional concept of CSR [21, p. 27]. The main beneficiary of CSR in Russia is a company's employee. Russian companies are typically focused on quick results; this is reflected in the internal orientation of CSR activities: employee incentives, health support, and social assistance to employees' families. This motive is most clearly expressed in a quote from one of the respondents to the study by O.V. Rogacheva: "A person works, goes on vacation, gets some rest and treatment, and then works better and treats the organization itself like a family" [23, p. 355]. It is precisely the focus on achieving quick and visible results that determines the low popularity of environmental programs, especially among small and medium-sized businesses. Moreover, environmental issues are not a priority for the public or the authorities, and therefore do not constitute institutional pressure on the company. In general, the characteristic features of CSR practices in Russia include disorder, public distrust of business, uncertainty in the business environment, collectivism in the implementation of corporate social activities, and a predominance of initiative on the part of employees. These features are shaped not only by current legislation, but also by the cultural and cognitive force of regulation [24, Bataeva B.S., Cheglakova L.M., Melitonyan O.A., pp. 35–50].

In relation to the CSR practices in the AZRF, the issue of interaction with the indigenous peoples of the North, Siberia, and the Far East of the Russian Federation has been discussed in sufficient detail [25, Samsonova I.V., Neustroeva A.B., Pavlova M.B.], as well as an assessment of individual company CSR costs without territorial differentiation among the regions and municipalities of the Arctic [26, Gavrilyeva T.N., Yakovleva N.P., Boyakova S.I., Ivanova M.A., pp. 127–128]. Moreover, the authors note that companies' activities in terms of creating social effects are institutional in nature and are based on concluded agreements.

Thus, when considering social responsibility, most studies focus either on a regional perspective or on the activities of a company in several regions. At the same time, the institution of CSR in rural areas remote from the administrative center is described rather poorly, and in rural municipalities of the AZRF is practically ignored.

Methodological framework of the study

The study aims to describe the formation and implementation of corporate social responsibility policies by JSC Severalmaz and LLC LUKOIL-Komi in rural areas of the AZRF (Primorskiy Municipal District and Ust-Tsilemskiy Municipal District) and consists of two stages:

- socio-economic characteristics of municipal formations to identify the main development trends;

- compiling a profile of the social activities of JSC Severalmaz and LLC LUKOIL-Komi through a quantitative assessment of CSR activities and identifying mechanisms for participating in addressing development imbalances.

The following indicators were used for the socio-economic characteristics:

- demographic characteristics: population size, natural and migration growth/decline;
- standard of living: average number of employees, average monthly wages, number of health care facilities, number of public service facilities, and area of residential premises per person;
- economic sustainability: area under cultivation crops, agricultural production index, crop production index, livestock production index, number of retail and catering facilities. Indicators related to agricultural activity characterize the ability to ensure the viability and sustainability of the territory.

The selection of this set of indicators allows for a clear presentation of the main imbalances in the municipality's development and is limited by the published data. The data collection period was from 2012 to 2023. The source of the data was the Rosstat Database of Indicators of Municipalities of the Russian Federation. In addition, reports and presentations of district heads, as well as decisions of the Council of Deputies for 2023, were reviewed to identify problems based on the qualitative characteristics of the municipality's development.

When compiling the profile of companies' social activity, the concept of "corporate social responsibility" was used, allowing for a focus on activities "beyond the law". Corporate social responsibility is defined as "the activities of a law-abiding company in relation to the citizens of any territorial entity, aimed at providing social benefits to citizens and leading to improved quality of life, preservation of biodiversity, reduction of negative impacts, and comprehensive development of a given territorial entity" [27, Yakusheva U., pp. 64–65]. Only those activities that the company carried out voluntarily and that were not mandatory under current legislation were selected as actions. This approach allows us to focus on the synergistic effects created as an additional factor in the development of rural areas. The collected activities were categorized by beneficiary group, geography, and focus of their implementation. The following CSR areas were used: "Culture", "Sports", "Education and Science", "Mass Events", "Healthcare", "Ecology", and "Social Sphere". Each area included both infrastructure projects and public events. The "Social Sphere" area included all activities that could not be integrated into other events: targeted support for vulnerable groups, kindergarten renovations, summer camp funding, creation of parks and public gardens, etc. For quantitative calculations, events that lasted several months were counted for each month and summed up in the final calculation. On the one hand, this increases the number of activities in the area under consideration, but on the other hand, it allows for the long-term nature of corporate social initiatives to be taken into account, which increases the effect for stakeholders. The logical criterion for calculation was the principle of the presence of an effect and its volume for a single stakeholder.

The data collection period was 2023, broken down by month. The sources of data were corporate reports for 2023 (annual, accounting, and sustainability reports), news items on the official websites of Severalmaz (350 items) and LUKOIL-Perm (60 items); news items on the official websites of municipalities (250 items). Some data was verified on the official websites of third-party organizations or events. The limitations of the study include the researcher's subjective interpretation of the activities carried out and partial access to data on the organization's activities, in particular with regard to financial expenditures. Therefore, the number of events was used as a metric for measuring CSR.

Results and discussion

An analysis of the socio-economic situation of the municipalities under consideration revealed a number of imbalances, which were then compared with the CSR activities carried out. Thus, for the Primorskiy Municipal District (see Table 1), natural population decline is a significant negative development trend, despite the municipality's population growth. This is explained by its proximity to the regional administrative center, Arkhangelsk, where some residents purchased houses during the COVID-19 pandemic. The Ust-Tsilemskiy Municipal District is characterized by natural population decline and a decrease in the number of workers. Furthermore, both municipal districts had seen a reduction in cultivated areas and a slight decrease in agricultural production indices, reflecting a decline in economic activity in these territories.

Table 1

Matrix of socio-economic development of the Primorskiy Municipal District and Ust-Tsilemskiy Municipal District for the period 2012–2023

Indicator	Primorskiy Municipal District				Ust-Tsilemskiy Municipal District			
	2023	Absolute change	Increase rate, %	Dynamics of change	2023	Absolute change	Increase rate, %	Dynamics of change
Population size, people	28 793	2 507	9.5	increase	10 478	-2 178	-14	decrease
Natural growth/decline, people	-166	-174	-2 175	decrease	-64	-80	-500	decrease
Migration growth/decline, people	281	412	-307	sinusoidal	-54	263	-64	sinusoidal
Number of employees, people	7 198	280	4	sinusoidal	2 146	-377	-16.5	decrease
Wages, rub.	76 505.2	52 402.1	217	increase	60 296.9	36 162.5	150	increase
Area of cultivation crops, ha	1 584.9	-88.8	-5	sinusoidal	138.69	-503	-78	decrease
Agricultural production index, %	99	-6.6	-6.3	sinusoidal	95.1	-8.8	-8	stable
Crop production index, %	99.8	1.1	1.1	stable	73.1	-29.1	-28	sinusoidal
Livestock production index, %	95.6	-23.9	-20	decrease	110.3	5.3	5	sinusoidal
Retail and catering facilities, units	265	-43	-14	decrease	324	-25	-7	stable
Health care facilities, units	29	-1 [10]	-3.3	stable	26	-2[9]	-7	stable
Public service facilities, units	35	22	169.2	increase	35	3	9	sinusoidal

[10] The data was calculated since 2014 due to the lack of indicators in the Municipal Statistics Database for 2012.

Residential premises, m^2/pers.	44.2	9.2	26.1	increase	35.77	7.6	26.8	increase

A review of reports by heads and meetings of municipal deputies showed that, in addition to the above-mentioned imbalances, there are problems with transport accessibility, a lack of space for educational, healthcare and cultural institutions, as well as their poor material and technical equipment [11, 12].

Further consideration of the CSR framework in relation to the areas of social activities carried out in the region (see Tables 2 and 3) reveals that the primary focus is on supporting various segments of the population and public associations (the "Social Sphere" area), as well as the development of science and education. The combined weight of the three leading areas (for Severalmaz, "Sports" is third, and for LUKOIL-Komi, it is "Culture") reaches 67%, demonstrating the companies' targeted contribution to the development of regions. At the same time, most of Severalmaz activities are focused on the internal environment: employees and their families. For example, the company provides additional payments to employees on parental leave, pays for a second-class or first-class ticket to and from their holiday destination [13] and provides additional medical insurance. An analysis showed that Severalmaz's total contribution to the development of the Arkhangelsk Oblast exceeded 50 million rubles in 2023 and 150 million rubles from 2020 to 2023 [14]. According to the explanatory notes to the accounting balance sheet, charitable expenses for 2023 amounted to 53.241 million rubles, while social expenses — 6.9 million rubles. Severalmaz employs approximately 1,300 people, 90% of whom are residents of the Arkhangelsk Oblast, and the company's total tax contributions to the regional budget exceeded 3 billion rubles. Another company, LUKOIL-Komi, is actively implementing infrastructure projects related to construction of hospitals, renovation of premises for educational institutions, and preservation of cultural sites. For example, the company was a financial partner in the renovation of the roof of a kindergarten in the village of Denisovka, the replacement of 240 windows in the Secondary School No. 1 in Nizhniy Odes, the construction of a sports complex with a swimming pool in the village of Yarega, the renovation of lecture halls and the purchase of equipment for the Ukhta State Technical University worth more than 45 million rubles , the construction of a children's playground and sports ground in the village of Novikbozh at a cost of 20 million rubles, etc. [15] Summarizing the data obtained, in the regional

[11] Rudkina V.A. Report of the Head of the Primorskiy Municipal District of the Arkhangelsk Oblast on the achieved values of indicators for assessing the effectiveness of local government bodies of urban districts and municipal districts of the Arkhangelsk Oblast for 2023 and their planned values for a three-year period, dated April 26, 2024. URL: https://www.primadm.ru/mcy/the_head/doclad_glavi.php (accessed 08 November 2024).

[12] Kanev N. M. Report of the head of the Ust-Tsilemskiy municipal district – head of the district administration on the achieved values of indicators for assessing the effectiveness of local government bodies of urban districts and municipal districts for 2023 and their planned values for a 3-year period dated April 24, 2024. URL: http://mrust-cilma.ru/doc/doklady/doklad_2023.pdf (accessed 08 November 2024).

[13] According to Article 325 of the Labor Code of the Russian Federation, employees of organizations located in the Far North and equivalent areas have the right to request from the employer, once every 2 years, compensation for travel to and from the vacation spot, calculated at the lowest cost and by the shortest route.

[14] The amount is taken from the Cooperation Agreements between JSC Severalmaz and the Government of the Arkhangelsk Oblast.

[15] Official website of PJSC LUKOIL. URL: https://lukoil.ru (accessed 15 September 2024).

context, Severalmaz has a “managerial” style of working with social problems in accordance with the classification of S. Zadek or “strategic” style according to W. Visser; LUKOIL-Komi tends towards the “strategic” type according to S. Zadek and the “charitable” type according to W. Visser [11; 12]. As a result, the companies are not yet “responsible citizens”, i.e. they do not try to give back to society more than they have taken, but the institution of CSR is not used as a measure of protection against public attacks. Both companies have neglected the aspect of participation in the development and support of the local economy, which makes it impossible to describe their behavior as “civic” or “transformative” in the regional context.

Table 2

Social activity areas of JSC Severalmaz in the Arkhangelsk Oblast in 2023 (units)

Direction	Period, months 2023											
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Culture	-	1	-	2	4	2	4	-	-	1	1	-
Sports	5	4	5	2	5	4	2	3	3	8	3	7
Education and science	1	2	2	2	3	4	4	6	4	8	6	4
Mass events	-	-	-	-	-	2	3	3	1	1	1	1
Healthcare	1	1	2	2	1	1	1	1	1	1	1	1
Social sphere	3	1	2	4	6	3	2	6	5	8	7	9
Ecology	3	3	3	3	3	3	3	3	3	3	3	3

Table 3

Social activity areas of LLC LUKOIL-Komi in the Komi Republic in 2023 (units)

Direction	Period, months 2023											
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Culture	-	2	-	1	1	1	1	4	4	5	3	5
Sports	-	1	2	-	-	-	1	3	4	-	3	3
Education and science	-	-	1	3	1	3	3	4	3	4	2	-
Mass events	-	-	-	1	-	1	4	1	1	1	2	1
Healthcare	-	-	-	-	-	-	1	-	2	1	-	18
Social sphere	2	-	-	-	-	-	2	4	3	4	2	-
Ecology	1	1	1	1	1	2	4	1	1	2	1	1

An analysis of the social activity profile by municipality revealed that companies are focused not only on creating social value in the areas where they operate (which account for about 50% of all social activities implemented), but also in other municipalities, including administrative decision-making centers: the cities of Arkhangelsk, Ukhta, Usinsk, and Pechora. This fact can be explained by the specifics of the shift work method: some employees live in cities, which ultimately drives companies to participate in improving the quality of life in the areas where their employees live. However, the broad geographical coverage of CSR across the entire region potentially reduces the role of the company in the development area due to budget constraints.

The author’s analysis of the dominant areas of social activities carried out by extractive companies in rural settlements in the Arctic zone made it possible to form a CSR profile with distinctive characteristics for each municipality (see Fig. 2).

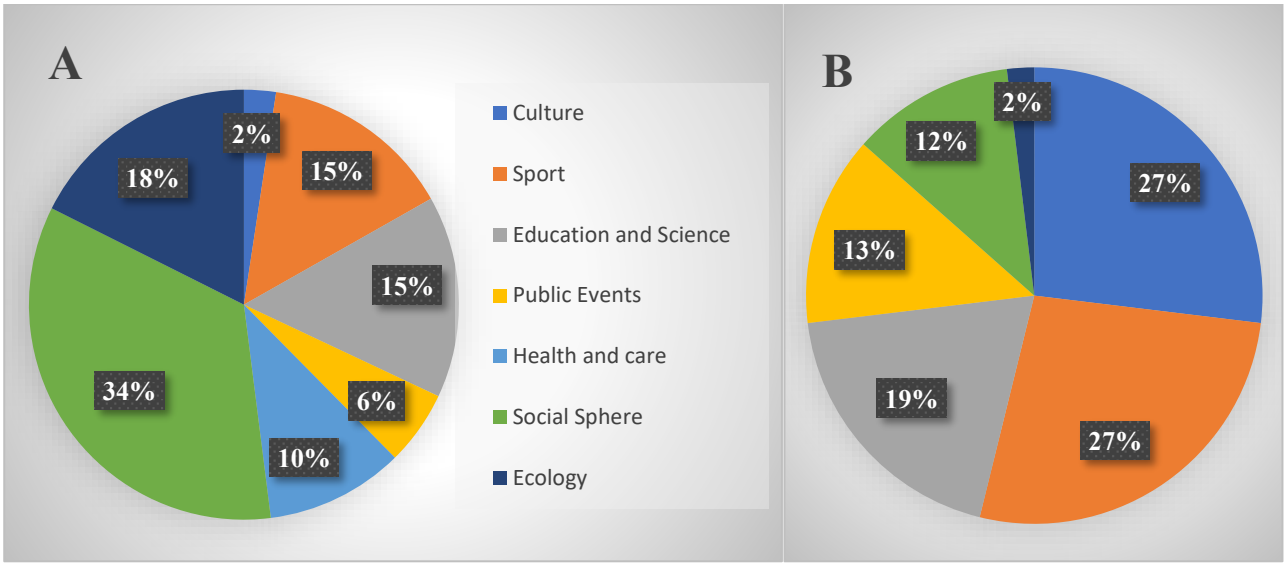

Fig. 2. Structure of social activities conducted in 2023: a) JSC Severalmaz in the Primorskiy Municipal District, b) LLC LUKOIL-Komi in the Ust-Tsilemskiy Municipal District, % [16].

Almost 100 social initiatives were implemented in the Primorskiy Municipal District, with the leading areas being “social sphere”, “ecology”, and “education and science”. These areas primarily involve long-term programs, such as research of vegetation, sand, and rocks, river stocking, and local community support. An example from the “social sphere” category is the initiative to finance school meals in remote and hard-to-reach areas of the Primorskiy Municipal District, where since 2018, around 58 students received free meals annually. In 2023, the cost of this support amounted to approximately 1 million rubles [17]. LUKOIL-Komi implemented over 50 social events in the Ust-Tsilemskiy Municipal District, focusing primarily on “culture”, “education and science”, and “sports”. It is worth noting that most of these activities were carried out through a grant competition organized by the LUKOIL Charitable Foundation and the support of local non-profit organizations. For example, in the 2023 project competition, the total funding amounted to 5 million rubles, distributed among 19 winners from the Ust-Tsilemskiy Municipal District. Participants were able to purchase materials and equipment for kindergartens and music schools, as well as to begin renovating a 100-square-meter former printing house to create a 50-seat theater [18]. There is a practice of funding grant applications outside of the competition, which also increases the amount of support for rural communities. Companies are most active in conducting social events in the second half of the year (70% of social activities), which is explained by the large number of festive events to which the activities are timed, and the policy of budget savings in the first half of the year. Other examples of social initiatives shaping the institution of corporate social responsibility in rural communities are presented in Tables 4 and 5.

[16] Source: compiled by the author.
[17] Organization of transportation for students to municipal budgetary general education institutions of the Primorskiy Municipal District of the Arkhangelsk Oblast in the 2023–2024 academic year. Official website of the Primorskiy Municipal District. URL: https://www.primadm.ru/social/roo/so/food.php (accessed 15 August 2024).
[18] Official website of the Ust-Tsilemskiy Municipal District. URL: http://mrust-cilma.ru/ (accessed 15 August 2024).

Table 4

Examples of CSR activities implemented by Severalmaz in 2023 in the Primorskiy Municipal District (Arkhangelsk Oblast)

Description	Effects created	Beneficiaries	Area
Christmas ski race was organized in January among employees across nine age and gender groups; the winners received commemorative prizes.	33 employees participated; reduction in sickness rates	employees	sport
Opening of the community center in the village of Laiskiy Dok, where the company co-financed the renovation through the state program “Integrated Rural Development”. A 75-seat auditorium was built; sound and computer equipment, a LED screen, etc. were purchased.	total project funding — 69.2 million rubles; preservation of cultural traditions	local community	culture
Financial assistance was provided to two creative groups from the Lyavlenskiy rural community center for participation in the “For the Glory of the Fatherland!” festival-competition in the Ustyanskiy municipal district.	preservation and dissemination of cultural capital	local community	culture
The company purchased and donated paintings depicting front-line soldiers to the Primorye Museum of Folk Arts and Crafts; the book “Scorched by War” was presented to the Primorskiy District Central Library.	preservation of cultural heritage, fostering patriotism	local community	culture
Presents to the kindergarten for participating in the illustration exhibition held at the Uemskaya School.	10 people received commemorative prizes; development of human capital	children	social sphere
The men’s team took part in the Primorskiy District Men’s Volleyball Championship at the sports complex in the village of Vaskovo.	reduction in sickness rates, improvement of work performance	employees	sport
The company organized a darts tournament to celebrate National Athlete’s Day. The winners received commemorative prizes.	approximately 78 people participated in the event; reduction in stress and sickness rates	employees	sport
The company renovated the facility and donated it to the Primorskaya Sports School, where school participants can change clothes before physical activities.	reduction in sickness and injury rates	schoolchildren	sport
At the request of employees, the company repaired and replaced shower stalls in dormitories for shift workers.	reduction in sickness and injury rates	employees	social sphere

Table 5

Examples of CSR activities implemented by LUKOIL-Komi in 2023 in the Ust-Tsilemskiy Municipal District (Komi Republic)

Description	Effects created	Beneficiaries	Area
Providing presents to veterans as part of their honoring ceremony in the hall of the Ust-Tsilemskiy Cultural Center named after T.G. Shishelova.	15 people received commemorative prizes; preservation of generational continuity	local community	culture
Participation in organizing the military field training “Northern Fortress-2023” at the Cadet Secondary School named after Hero of Russia V.N. Nosov.	reduction of social tension	local community	public event

Co-financing of the trip of the VIA "Original Copy" to participate in a creative event.	4 participants received support; development of local talent	local community	culture
Sponsorship and organizational support for the concert "Oh, the Front-line Road!" for GPW veterans at the Ust-Tsilemskiy Cultural Center named after T.G. Shishelova.	preservation of generational continuity, preservation of traditions	local community	culture
Participation in the fishing competition as part of the "Hunter's Festival".	approximately 74 people participated in the event; reduction of social tension	local community	public event
The Church of St. Nicholas the Wonderworker was insulated and covered with siding.	preservation of cultural sites	local community	culture
Thanks to financial support, a memorial sign to GPW participants was installed 5 km from the village of Ust-Tsilma, which features 13 names of village natives.	preservation of generational continuity, fostering patriotism	local community	culture
The company provided presents to the winners and runners-up of the classic style cross-country ski race, where 43 participants from the rural settlements of Ust-Tsilma and Korovіy Ruchey competed over distances from 0.5 to 10 km.	26 people received commemorative prizes; reduction in sickness and injury rates	schoolchildren	sport
Provided assistance in purchasing food for the parents of 20 departed SMO participants	reduction of social tension	local community	social sphere
The company presented New Year's gifts to children from kindergartens in the villages of Chukchino, Stepanovskaya, Zamezhnaya, Ust-Tsilma, and Korovіy Ruchey.	45 children received presents; reduction of social tension	children	social sphere

The difference in the types of social activities supported in rural municipalities determines the specific nature of CSR: a focus on generating "tangible" effects for Severalmaz versus creating value for LUKOIL-Komi at the request of stakeholders. This conclusion is most clearly confirmed by an analysis of CSR beneficiaries (see Figure 3).

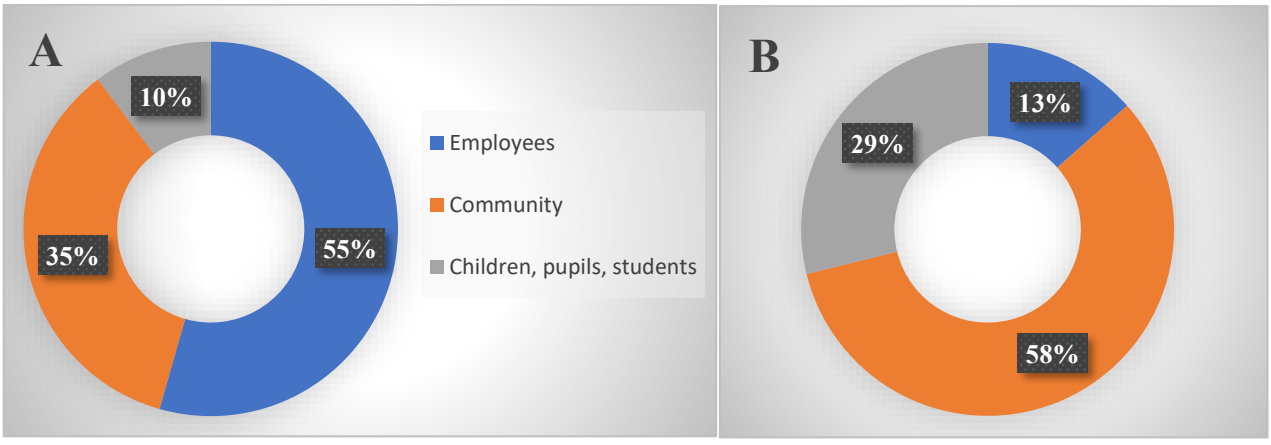

Fig. 3. Social activity of companies in 2023 in terms of beneficiaries of the effects: a) Severalmaz in the Primorskiy Municipal District, b) LUKOIL-Komi in the Ust-Tsilemskiy Municipal District [19].

[19] Source: compiled by the author.

Severalmaz has demonstrated a focus on internal corporate activities and value creation within the company, which is why approximately 54% of beneficiaries are company employees. This policy is explained by the company's need to achieve rapid results and see outcomes in the short term. Moreover, the focus of CSR on the internal environment allows the company to minimize the risks of its activities, which are significantly increased when interacting with the local community. Overall, the company maintains a balance between internal and external beneficiaries. A significant proportion of beneficiaries of CSR of LUKOIL-Komi are the local community, represented by local creative groups, veterans, and residents of the district. Activities targeting this group primarily focus on cultural events and public celebrations, which ultimately have the effect of reducing social tension and preserving cultural traditions. It is worth noting that the company is also actively involved in supporting children, who account for about 28% of beneficiaries, which implies participation in the formation of labor resources and the preservation of labor potential. Social initiatives aimed at creating value for the external environment account for 86.5%, indicating that LUKOIL-Komi is actively involved in the development of the rural municipality. Differences between the predominant areas of CSR activities at the regional and municipal levels are explained by the companies' adaptive policies regarding territorial issues.

The analysis of CSR activities in terms of areas of focus and beneficiaries, compared with the identified disparities in the development of municipal entities, shows that companies are actively involved in supporting local culture, building social infrastructure (primarily LUKOIL) and educational programs. No measures aimed specifically at increasing the birth rate have been identified on the part of companies, which may serve as a recommendation for expanding the range of social activities. The relevance of this area is also confirmed by the national projects "Demography" and "Family" [20]. However, companies are actively involved in supporting the health and medical care of both employees and the population by creating healthcare infrastructure and promoting a healthy lifestyle, which also indirectly impacts natural growth. Another aspect that has been neglected among CSR activities is support for agriculture as an alternative type of economy for building the long-term viability and sustainability of the region.

The development of CSR practices among mining companies in rural areas of the AZRF is presented in Figure 4 and consists of the tools used by companies to analyze ongoing processes, the mechanisms used to participate in solving regional problems, and the prevailing areas of social activity.

[20] Tatyana Golikova presented the national project "Family" at the international exhibition and forum "Russia". Official website of the Government of the Russian Federation. URL: http://government.ru/news/52022/ (accessed 14 September 2024).

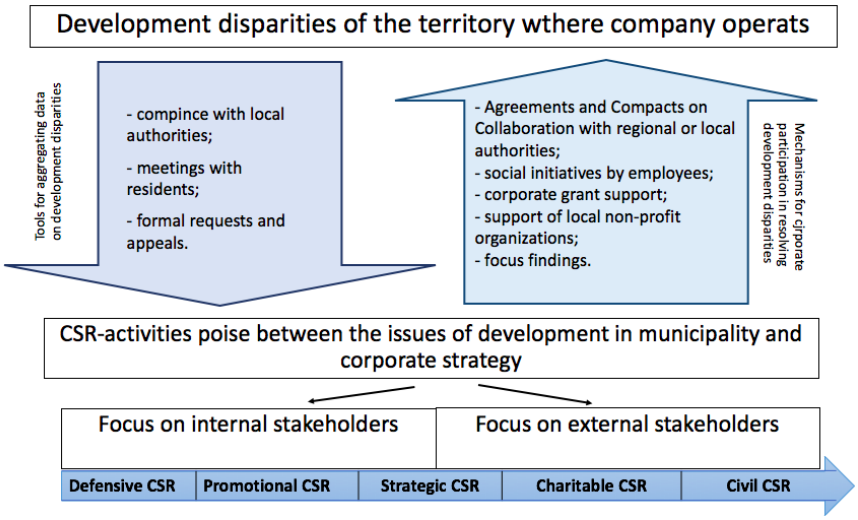

Fig. 4. Implementation of the socially responsible company practice in AZRF rural areas [21].

It should be noted that, specifically for rural areas, CSR practices have most often been implemented through cooperation agreements, which imply a more formal approach. The closer a municipality is to the administrative center of regional decision-making, the more diverse the company's mechanisms for contributing to the mitigation of imbalances. These agreements are regional in nature, and their implementation has become institutionalized. Thus, in 2016, a Cooperation Agreement was signed between the Arkhangelsk Oblast Government and PJSC Severalmaz, with additional agreements in 2022 and 2023 [22]. It is noteworthy that in 2017, the company also signed a framework agreement with the Arkhangelsk City Administration [23], and an "Agreement for Participation in the Comprehensive Socio-economic Development of the Municipality" was concluded with the Primorskiy Municipal Formation [24]. Furthermore, PJSC Severalmaz has had a cooperation agreement with Northern (Arctic) Federal University since 2014. The Komi Republic has had an agreement with PJSC LUKOIL since 2006 and annual supplementary agreements since 2011. An agreement with the Ust-Tsilemskiy Municipal District had already been signed with the subsidiary LLC LUKOIL-Komi since 2003 [25]. LUKOIL-Komi also signed agreements with public organizations of the Ust-Tsilemskiy Municipal District, Komi Voytyr and Rus Pechorskaya, and LUKOIL — with the Ukhta State Technical University in 2002 [26]. As a result, the issue of using financial resources within the framework of agreements falls on the shoulders of non-profit organizations or government

[21] Source: compiled by the author.
[22] Official website of JSC Severalmaz. URL: https://www.severalmaz.ru (accessed 16 August 2024).
[23] The Arkhangelsk City Administration and Severalmaz signed a cooperation agreement on June 8, 2017. Official website of the Arkhangelsk City Administration. URL: https://www.arhcity.ru/?page=0/42482 (accessed 16 August 2024).
[24] Resolution of the Head of the Primorskiy Municipal District "On approval of the procedure for spending funds provided to the budget of the municipality under the Agreement on participation in the comprehensive socio-economic development of the Primorskiy Municipal District for the purpose of social support and protection of citizens" dated April 8, 2022, No. 699. URL: https://www.primadm.ru/acts/resolution2.php?ELEMENT_ID=30124 (accessed 16 August 2024).
[25] LLC LUKOIL-Komi signed a new cooperation agreement. URL: https://gazetasv.ru/q-q-2/ (accessed 20 September 2024).
[26] Contracts and agreements with companies. Official website of Ukhta State Technical University. URL: https://www.ugtu.net/cooperation/dogovory/predpriyatiya (accessed 20 September 2024).

bodies and depends on those problems that are of an institutional nature, i.e., those that are recorded in reports or statements and serve as indicators of the activities of local government bodies. In addition to institutionalized mechanisms for the participation of companies in the development of rural areas (cooperation agreements and involvement of NPOs), practices such as organizing targeted assistance at the request of residents or personal participation of company activists in charitable events are actively used. In this regard, companies have developed, to varying degrees, such communication tools as meetings with residents and participation in public discussions on municipal development issues. For example, LUKOIL-Komi representatives actively attend public events and organize meetings with residents of rural communities. During one of the meetings, a bus was donated to transport residents from the village to the city at the request of local people [27].

Summarizing the data presented above, it should be noted that companies adapt by combining the rules of the institutional environment and their own interests, which is reflected in the analysis of beneficiaries and is expressed in the formation of a strategic style of corporate behavior in the companies' territories of presence, according to both S. Zadek's and W. Vesser's classifications [11; 12]. This results in a "win-win" situation, where not only internal corporate goals are achieved, but also the quality of life of the municipality's population is improved, and the social performance indicators of the authorities are fulfilled. A distinctive feature of companies' operations in the rural areas of the AZRF is their focus on creating value within the territory of their presence, where activities are aimed at addressing issues that are particularly important for the municipal formation: creating a comfortable environment, equipping cultural centers, preserving culture, and supporting children and schoolchildren. At the same time, the CSR institution is focused on creating long-term effects for the external environment and is practically the only driver of development in rural settlements in the Arctic. It should be noted that in this context, the "legitimized power of norms" [28] identified by W. Scott is applied, when "an organization carries out socially responsible activities, despite their financial impact, because they (the activities) have emerged as common social values that organizations must legitimately pursue" [29, Laine M., Tregidga H., Unerman J. et al., p. 157]. S. Zadek called this process "organizational learning", where a company adapts to the norms and demands of society [11, pp. 127–130]. In other words, the institution of CSR is focused on the expectations of the local community and is used to level out imbalances in territorial development. Among the risks for rural areas, vulnerability and emerging dependence on the company's presence should be highlighted.

Thus, the analysis revealed that extractive companies in Arctic rural settlements actively combine targeted support for the local community and participation in solving a number of regional problems, focusing on long-term measures. The implemented social policy, which involves organizing space not only for the work and life of company employees, allows rural communities to address

[27] A bus was purchased for a rural route in the Komi Republic. Official website of LLC LUKOIL-Perm. URL: https://perm.lukoil.ru/ru/News/News/priobreten-avtobus-dlia-selskogo-marshruta-v (accessed 20 September 2024).

social issues by redirecting limited budget funds to other problems. This ultimately leads to the development of a CSR institution that is significant for the rural areas of the AZRF.

Conclusion

Based on quantitative and qualitative research methods, it was established that companies play an important role in the development of rural areas of the AZRF through the implementation of social initiatives within the framework of corporate social responsibility. As a result of analyzing social activities of JSC Severalmaz in the Primorskiy Municipal District of the Arkhangelsk Oblast and LLC LUKOIL-Komi in the Ust-Tsilemskiy Municipal District of the Komi Republic for 2023, the following conclusions were formulated regarding the formation and implementation of the CSR institution:

- the focus of CSR in the area of operation is a combination of administrative tasks assigned to regional and municipal authorities, the expectations of local residents, and the company's goals;
- the mechanisms used by the company to participate in solving local problems include both formal mechanisms (agreements and grant applications), which represent an attempt to legitimize the CSR institution, and informal mechanisms (initiatives by company activists, targeted assistance at the request of citizens);
- the leading overall focus of impacts at the municipal level is "sports", which is explained by the universal involvement of both company employees and local residents. However, companies have neglected the aspect of supporting the local economy, which could potentially reduce its sustainability if the company leaves the region. There is also a lack of direct participation in programs to increase the birth rate;
- social initiatives are carried out primarily in the second half of the year due to the specific nature of spending;
- companies tend not only to generate effects at the location of mineral extraction, but also carry out social initiatives in the area where their head office and/or administrative center is located;
- the style of social policy pursued by companies is strategic and combines the creation of both short-term and long-term impacts.

As a result, extractive companies essentially navigate between the existing perceptions of various actors, where the specificity of the CSR in rural areas of the AZRF emerges as a product of the agreement between the interests of three parties: municipal authorities, the population, and the company itself. This fact determines the chosen communication tools, decision-making mechanisms, and areas of activity. Due to the legitimacy achieved by the three local actors, the voluntary social activity of extractive companies is becoming a significant institution for the development of rural settlements in the Arctic, which should be taken into account in the strategies of municipal formations as one of the main components of the development of these territories.

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The Arctic in the Post-Truth Era: Risks to International Security and Counteraction Scenarios

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Abstract. The article examines the impact of the post-truth phenomenon on the perception of international security in the Arctic region. The main focus is on analyzing information distortions in the media resources of leading foreign mass media outlets (The New York Times, The Washington Post, The Guardian, The Daily Telegraph). Based on content analysis and discourse analysis of 176 publications from 2022 to 2025, the study reveals that the Western media systematically constructs an image of the Arctic as a zone of permanent crisis and military-political confrontation, where Russia and China are presented as key sources of instability. The actions of Western states, in contrast, are presented as necessary and defensive. The authors identify characteristic post-truth techniques: use of emotionally charged headlines, selective presentation of facts, distortion of cause-and-effect relationships, and imposition of simplified narratives. The article assesses the risks of such destructive information influence, including growing mistrust between Arctic states, escalation of conflict potential, and reduction of opportunities for international cooperation in scientific, environmental, and economic spheres. Based on the identified trends, two key scenarios for the development of the situation in the region are developed: "acute escalation" and "freezing of cooperation". In response to these challenges, a system of comprehensive multi-level measures is proposed, including promotion of international information security, creation of objective information resources about the Arctic, improvement of media literacy among the population, and support for expert and scientific contacts to counter manipulative narratives and maintain stability in the Arctic.
Keywords: *post-truth, Arctic, international security, information distortions, mass media, media space, manipulation*

Introduction

In the current context of globalization and the development of information technology, the phenomenon of post-truth is becoming one of the key challenges to international security not only on a global scale, but also on a regional one. This is particularly evident in the Arctic context, as there is a distortion of the image of the region itself and the actions of individual states, primarily Russia.

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The subject of this study is the informational distortions of the image of Arctic security in foreign media resources. The goal is to determine the impact of informational distortions on international security in the Arctic. Growing attention to the phenomenon of post-truth is evident in the works of A.V. Manoylo, A.E. Popadyuk [1], N.N. Rostova [2], and A.E. Hyvönen [1]. The relationship between the concepts of post-truth and fake news is the subject of works by N.N. Koshkarova and N.B. Ruzhentseva [3]. Post-truth as an environment or reality in which political and communicative processes take place is considered by such authors as N.S. Danyuk, P.Ya. Feldman [4], A.G. Kostyrev [5]. Besides, M.K. Kovshar [6], V.P. Miletskiy, O.A. Nikiforova [7], A.V. Morozov [8], S.V. Chugrov [9], R. Kralli [10] analyze the influence, essence, and causes of post-truth in their works. Some characteristic manifestations of post-truth specifically in the Arctic region (its features within the framework of hybrid confrontation) are discussed by V.N. Konyshev [11]. The novelty of this study lies in the fact that the influence of post-truth is examined in the regional dimension, using the Arctic as an example. This aspect has almost never been analyzed in foreign and Russian literature.

For studying the impact of the post-truth phenomenon on international security in the Arctic region, the most appropriate concept is constructivism, since today's information channels use certain techniques to construct alternative interpretations of events that replace the real ones. This involves not only the reflection of factual information, but also the manipulation of public opinion through the distortion of facts or the incomplete provision of information.

Research methodology

Both general scientific and specific methods were used in this study. In addition to analysis, synthesis, and comparison, a forecasting method was applied to assess possible scenarios related to the presence of information distortions about the Arctic in the information space.

Using elements of discourse and content analyses, 176 publications from some of the most popular foreign news outlets were selected and studied: The New York Times, The Washington Post, The Guardian, and The Daily Telegraph. Content analysis was used to quantitatively assess the thematic distribution of publications, while discourse analysis was applied to identify media narratives, specific patterns, and structures.

Publications for content and discourse analyses were selected according to the following criteria:

- inclusion criteria: publications in The New York Times, The Washington Post, The Guardian, and The Daily Telegraph from January 2022 to October 2025, containing the keywords "Arctic", "Russia", "security", "militarization", or "climate" in the headline or main text;
- exclusion criteria: short articles (less than 200 words), duplicate publications, and materials not related to issues of international politics, security or ecology in the Arctic;

[1] Defining Post-truth: Structures, Agents, and Styles. URL: https://www.e-ir.info/2018/10/22/defining-post-truth-structures-agents-and-styles/ (accessed 17 November 2025).

- sample limitations: the study is limited to the English-language media field and does not claim to provide exhaustive coverage of all narratives. A number of limitations should be taken into account when interpreting the results. Firstly, publication activity on Arctic topics could increase sharply during periods of international tension, creating "peaks" in certain narratives. Secondly, the sample selection may have been influenced by the explicit or implicit editorial policies of the publications under study, aimed at supporting a particular foreign policy course, as well as by possible imbalances in publication activity on different topics at different periods.

Theoretical context of post-truth and media

The ways of information production and consumption are undergoing a radical transformation. Along with this, political and informational processes are also changing. One of the key phenomena defining these changes is post-truth, i.e. a state of public discourse in which emotional perceptions, personal beliefs, and subjective narratives begin to dominate over fact-based argumentation [2] [6, Kovshar, M.K.].

Based on an analysis of several studies, it can be assumed that we entered the era of "post-truth" between 2008 and 2016, with the lower boundary being the year when the global financial crisis started and the upper boundary — the year when Donald Trump was elected President of the United States [12, Ahlstrom-Vij, K., p. 3]. His election campaign featured the active use of emotional appeals (the promise to "drain the swamp in Washington" [3]), the dissemination of news that had been repeatedly proven incorrect, and the production of "alternative facts" (the phrase is attributed to Trump's campaign manager Kellyanne Conway).

A typical example of the use of a post-truth strategy is the campaign for the United Kingdom's exit from the European Union. During this campaign, Brexit supporters spread information that EU membership costs £350 million per week, despite expert refutations of this claim [4].

The term "post-truth" has become firmly established in academic discourse: it is used in contemporary political, media, and sociological literature. This lexical unit has evolved from an occasional expression into one of the most frequently used words in political commentary [13, Paliy O.L., p. 156]. Post-truth can be considered a hypernym encompassing manipulation, fact substitution, unreliable news, information warfare, psychological pressure on the mass audience, etc. O.L. Paliy believes that this term includes "the most egregious characteristic of the activities of politicians, political strategists, and the media — dishonesty" [13, p. 157].

[2] Word of the Year 2016. URL: https://languages.oup.com/word-of-the-year/2016/ (accessed 19 October 2025).
[3] Draining the swamp. URL: https://www.newyorker.com/news/news-desk/draining-the-swamp (accessed 19 October 2025).
[4] Vote Leave's £350m for the NHS pledge was 'just an example', says group's chair. URL: https://www.independent.co.uk/news/uk/politics/gisela-stuart-vote-leave-s-ps350m-for-the-nhs-pledge-was-just-an-example-the-group-s-chair-says-a7238451.html (accessed 19 October 2025).

It is important to understand the fundamental difference between the phenomenon of post-truth and simple deception: "If lies, dissembling and propaganda have always been part and parcel of politics, then what has changed is how publics respond to them" [5]. V.D. Solovey [*6] notes that post-truth is generated not by facts, but by how they are experienced [14, p. 291]. Thus, when analyzing the phenomenon of post-truth, the key is an understanding of agency. Post-truth is not a question of producing lies (fake news), but a question of their perception. Furthermore, there are several reasons why it is necessary to draw a line between the two concepts:

- post-truth emerged not in the socio-cultural, but in a purely political-communicative space as a "politically convenient truth";
- post-truth appeals to reflexes rather than reflection, resulting in the disappearance of real meanings;
- unlike fakes, which can be easily refuted, post-truth is quite difficult to refute [7, Miletskiy V.P., Nikiforova O.A., p. 67].

In this study, we analyze the phenomenon of post-truth, which can occur both in the modern media and in the information space. There are several spheres or spaces in which individuals, society, and the state carry out their activities. The category of space has been a subject of debate among philosophers since the time of Ancient Greece. There are many opinions about what a particular space represents: both from a physical perspective and from a socio-political and cultural point of view. In this regard, it is important to understand the concepts of media space and information space.

Media space is the range of sources that provide people with information on a professional basis and follow the patterns of social system development [15, Evdokimov V.A., p. 47]. In other words, media space is the field of mass media activity. It is an information environment created from messages that carry a specific meaning.

Information space is a complex of chaotic processes that includes messages of any nature (false or true), rumors and various versions that can be disseminated not only by the mass media, but also by individuals, government agencies, businesses, social networks, and other entities [15, Evdokimov V.A., p. 49]. Therefore, information space is difficult to regulate and control.

Thus, after conducting a comparative analysis, we can identify the key differences: the information space is a broader, more chaotic and difficult to regulate category, which involves all types of information flows (including rumors and personal communication). The media space, on the other hand, represents its institutionalized and professionally organized component, controlled by the media and more amenable to targeted formation, which makes it the main field for the promotion of post-truth politics.

[5] A Robert De Niro Theory of Post-Truth: "Are you talking to me?" URL: https://theconversation.com/a-robert-de-niro-theory-of-post-truth-are-you-talking-to-me-87606 (accessed 20 October 2025).

[*6] Recognized as a foreign agent in the Russian Federation.

The policy pursued in the post-truth era is aimed at gaining the trust of as large audience as possible, without regard for the accuracy of particular judgements [6, Kovshar M.K., p. 41]. This is a targeted manipulation of the audience and its attention. Taking this and the above-mentioned characteristics of media space and information space into account, it is worth noting that post-truth policies can be most effective within the media space, since such a space is much easier to control. It is quite difficult to organize information campaigns using fake news, disinformation and other mechanisms within the entire information space, where it would be necessary to use every subject of the space to build a line for the implementation of post-truth policies.

When discussing the subjects within the media space, it is important to distinguish between the concepts of “mass media” and “mass communications”, as they are not identical and have different definitions, content, and functions.

In a broad sense, mass media is a complex of channels for disseminating information. However, it would be accurate to say that each element of this complex can be called means of mass media. When studying the literature on this topic, one often encounters the overlap between the concepts of “mass media” and “mass communications”. In the United States, the country where the term “mass media” originated, its use was abandoned in 1960s–1970s, replaced by “mass communications”, which includes radio, television, the Internet, and other technologies for disseminating information [16, Abramyan N.L., Alekyan M.V., Tadevosyan M.R., p. 100]. Thus, the use of the term “mass media” ceased in the course of the development of scientific thought. It is also worth assuming that this transformation was caused, among other things, by the development of information technologies, since with the introduction of the Internet in the field of journalism, it became important not only to inform, but also to establish contact with the audience or a specific person. The situation is similar in other countries, such as Germany and France. Nevertheless, since Soviet times, the term “mass media” has become a kind of legacy, being firmly established in the consciousness, everyday life and scientific discourse [16, p. 100].

Despite the familiarity of the term “mass media”, there is now a need to introduce the term “mass communication” into scientific and legal discourse. Mass communication means are understood as the methods and institutions through which centralized providers transmit or distribute information and other forms of symbolic communication to a large, heterogeneous and geographically dispersed audience [8]. Mass communication means simultaneously include both a set of communication channels and a complex of specific institutions and agencies. While the mass media involves a one-way process of disseminating messages and information, the mass communication additionally implies the establishment of communication between the parties of the information process [16, Abramyan N.L., Alekyan M.V., Tadevosyan M.R., p. 101].

Mass communication means not only inform people, but also set certain trends and shape public opinion on various issues. Shaping public opinion in the political sphere is particularly

[8] Mass media. URL: https://rus-big-soc-dict.slovaronline.com/1744 (accessed 03 November 2025).

important, since politics determines all traditional components of society and state life: economy, social sphere, and culture. The actions of states on the international stage define the future of both the entire system of international relations and individual actors. In turn, the media can exert pressure on states to make decisions or to refrain from actions. Thus, national security depends on the nature of the media's activities within a state [17, Fominykh V.Yu., p. 59]. Furthermore, from the perspective of international relations, the mass communication means can be used by a particular state to exert pressure on another state, thereby increasing the potential for conflict in international relations in a certain region or between two or more states.

Thus, it should be noted that throughout the history of the media, this institution has played, and continues to play, an important role in shaping the global agenda and public opinion on any given issue. In his seminal work, "The Reality of the Mass Media", the eminent German sociologist Niklas Luhmann emphasizes that we gain knowledge about the society around us, and even about the world in which we live, from the media [18]. The media is indeed the "fourth estate", and this is due to its wide-ranging capabilities, the realization of which can directly or indirectly affect the security or perception of security of a state or an entire region. The Arctic region is no exception and is the subject of close attention from the global media.

Post-truth in the Arctic: impact on regional security

In order to analyze the image of security in the Arctic in the post-truth era, several media outlets and social media platforms were selected from among the most widely viewed and largest in terms of audience reach: The New York Times, The Washington Post, The Guardian, and The Daily Telegraph. Thus, the sample included publications from the United States and the United Kingdom. In 2023, Russian Presidential Press Secretary Dmitriy Peskov stated: "The global media monopoly, the hegemony of the global media, unfortunately still belongs to the Anglo-Saxons — that is, in Russian, to the Americans and the British. This is because the most powerful global media outlets are still British and American." [9] It is reasonable to assume that there may be several reasons for this hegemony in the media space. First of all, content in English, the language of global communication, is more accessible and disseminates much more quickly among information consumers. It is precisely English-language media that originally occupies leading positions today. Furthermore, during globalization processes, Western culture, including media culture, began to be perceived as a model for journalists worldwide. This is associated both with the continuing political influence of the United States and the United Kingdom throughout history and with the fact that the main network platforms that play a key role in disseminating information and shaping public opinion are physically based in the United States. These include, first and foremost, the Google search engine, as well as certain social networks, which use algorithms that can be configured to promote particular

[9] Peskov named the world's most powerful media outlets. URL: https://www.rbc.ru/rbcfreenews/6432a8059a7947da6a39a757 (accessed 20 October 2025).

information channels. Therefore, it is reasonable to analyze these media outlets for their role in shaping the post-truth agenda.

In the current circumstances, the Arctic has become not only a geopolitical, but also an information battleground. The media are playing an increasingly important role in shaping public opinion in and about the Arctic, supporting certain advantageous narratives. Various methods of information influence are used, including those characteristic of the post-truth era. This study analyzed 176 publications containing images or representations of the Arctic as a whole and within national sectors. The focus was on materials from the following publications: The New York Times, The Washington Post, The Guardian, and The Daily Telegraph.

During the period under review, from January 2022 to October 2025, The New York Times published a total of 62 articles mentioning the Arctic. The analysis revealed that some post-truth techniques were used in these articles to shape a certain perception of the region, which could potentially influence international relations and security in the future. First, we note the distribution of news articles by topic, taking into account that some of them overlap within a single article. Thus, the topic of climate was found in 17 publications, economics — in 2, politics — in 36, and the military sphere — in 24 (see Fig. 1).

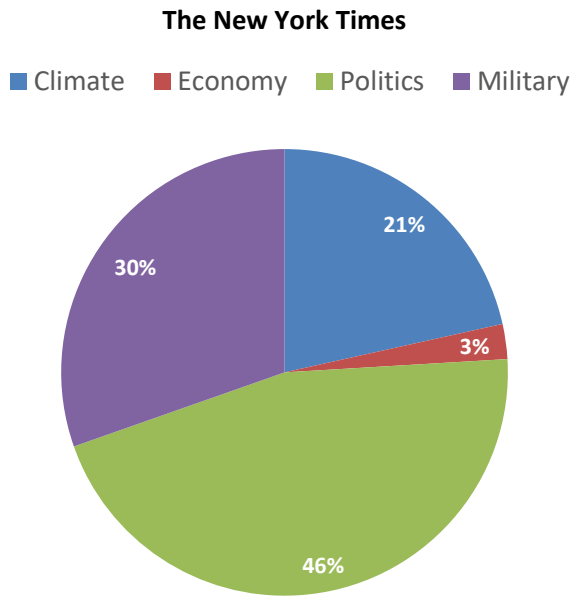

Fig. 1. Thematic distribution of news publications in The New York Times [10].

The New York Times has the largest number of publications on military and political topics. The increasing military presence of various countries in the region is often mentioned, but the greatest emphasis is placed on Russia and China, as well as their cooperation in the region, which is an indicator of the use of media priming. The actions of Russia and China are perceived as a threat to the West and stability in the Arctic. For example, one of the articles of 2022 notes that “against the

[10] Compiled by the authors.

backdrop of Russia's war in Ukraine", it is worth questioning the vision of the Arctic as a zone of peace and cooperation, as Arctic states no longer feel secure in the region [11]. Such publications persuade the public that the militarization of the Arctic is indeed necessary. The image of Russia as an "aggressor" and a potential threat in the region is often used for this. In addition, "espionage in the Arctic" by Russia and China is a frequently mentioned topic. Several articles are devoted to the "Chinese spy balloon" that was shot down off the coast of Alaska [12]. Thus, from a military-political perspective, according to The New York Times, Russia and China are factors of instability in the Arctic, and this requires a corresponding response. The inclusion of the Arctic in military-political discourse reinforces anti-Russian and anti-Chinese sentiments. It should be noted that at the same time, the active presence of NATO and the United States in the region is depicted as a necessary response to Russia's allegedly "aggressive military expansion in the Arctic" [13].

Having analyzed publications related to Russia's Arctic policy and its relations with its neighbors, it is worth noting that the narratives are constructed in such a way as to make it clear to readers that Russia is not a reliable party in the Arctic region. Furthermore, publications focusing primarily on the economy often provide arguments as to why foreign companies should not do business with Russia. Various reasons are given: harsh conditions, economic instability, "inappropriateness" of financing Russia during the conflict in Ukraine, and others [14, 15]. Causal relationships are distorted, creating the impression that Western companies' withdrawal from the Arctic is motivated solely by moral considerations, rather than sanctions and other factors. Readers are presented with information without mentioning the losses suffered by foreign partners as a result of their withdrawal from the Russian Arctic. This situation is reminiscent of a classic example of post-truth — Brexit, in which the losses that the UK could experience were actively concealed, and only favorable information was disseminated, contributing to the growth of support for Brexit among the population.

Distorting causal relationships is a common tactic used by The New York Times. For example, one of the publications states that Russia is exacerbating the situation related to climate change in the Arctic because it "began an invasion of Ukraine", which has prevented Western scientists from gaining full access to data, while at the same time the Russian Arctic is warming the most [16]. This

[11] Arctic Security Concerns Resurface in Canada's Territories Amid Russian War. URL: https://web.archive.org/web/20181206145654/https://www.nytimes.com/2022/03/12/world/canada/arctic-canada-territories-russian-war.html?searchResultPosition=66 (accessed 22 October 2025).
[12] U.S. Shoots Down High-Altitude Object Over Alaska. URL: https://www.nytimes.com/2023/02/10/us/politics/unidentified-object-shot-down-alaska.html (accessed 02 November 2025).
[13] With Eyes on Russia, the U.S. Military Prepares for an Arctic Future. URL: https://www.nytimes.com/2022/03/27/us/army-alaska-arctic-russia.html?searchResultPosition=75 (accessed 25 October 2025).
[14] Shell Quits Russia, Joining BP as Oil Giants Object to Attack on Ukraine. URL: https://www.nytimes.com/2022/02/28/business/russia-oil-companies.html?searchResultPosition=55 (accessed 25 October 2025).
[15] The Future Turns Dark for Russia's Oil Industry. URL: https://www.nytimes.com/2022/03/08/business/russian-oil-industry.html?searchResultPosition=61 (accessed 25 October 2025).
[16] Russia's Warming Arctic Is a Climate Threat. War Has Shut Scientists Out of It. URL: https://www.nytimes.com/2024/10/22/climate/russia-alaska-arctic-global-warming.html?searchResultPosition=455 (accessed 25 October 2025).

gives readers the impression that, in addition to being responsible for the conflict in Ukraine, Russia is also to blame for the warming of the Arctic.

The New York Times publications that touch on the topic of climate require special attention. The problem of climate change is considered not only from the ecological perspective, but also in a political context. An analysis of publications on this topic revealed the use of a "cascade of accessible information" technique, in which the same topic is repeated frequently. Initially, it may seem neutral, but then certain details are added, which, upon reading, influence the public's opinion. This creates the impression of the inevitability of the consequences of climate change and warming in the Arctic, and emphasizes the need for urgent action to address the situation. As an example, let us cite an article that acknowledges climate change, but simultaneously reports that China will use 49 million gallons of water to create artificial snow in preparation for the Olympic Games [17]. The inclusion of such information creates a connection in readers' minds between climate change in the Arctic and China's actions. It is worth noting that no information was provided about other countries' use of water for artificial snow during Olympic preparations. Specific countries and individuals are often directly accused, with rather sensational headlines being used. For example, in a publication titled "How to Defeat Putin and Save the Planet", Russia is accused of climate change and the purchase of Russian gas is noted as unacceptable [18].

Publications often alternate in the following manner. Climate change and rising temperatures in the Arctic are mentioned. At the same time, it is noted that this situation is beneficial to Russia in terms of opening up transport routes, extracting resources and increasing its military presence. One of the publications states: "The Kremlin has tried to take advantage of climate change to gain access to resources" [19].

Thus, after analyzing news reports in The New York Times, we can conclude that a certain image of the Arctic as an area of intensifying rivalry is being formed, for which Russia and China are allegedly to blame. In addition to the military-political component, these states are also accused of causing instability in the Arctic in an environmental context. There is a risk that readers will form a perception of the Arctic as an unstable region requiring active Western intervention.

Next, we will analyze publications from The Washington Post. We identified 37 news articles about the Arctic that demonstrate the use of manipulative and post-truth mechanisms. The topics are distributed as follows: 24 publications are devoted to politics, 14 — to the military sphere, and 14 — to climate (see Fig. 2).

[17] Here's How Climate Change and Covid Are Transforming Skiing. URL: https://www.nytimes.com/2022/01/07/climate/skiing-climate-change.html?searchResultPosition=5 (accessed 27 October 2025).
[18] How to Defeat Putin and Save the Planet. URL: https://www.nytimes.com/2022/03/29/opinion/how-to-defeat-putin-and-save-the-planet.html?searchResultPosition=82 (accessed 27 October 2025).
[19] Russia-Ukraine War What Happened on Day 16 of Russia's Invasion of Ukraine. URL: https://www.nytimes.com/live/2022/03/11/world/ukraine-russia-news?searchResultPosition=64#the-invasion-has-upended-diplomacy-in-the-arctic-where-russia-sought-resources (accessed 28 October 2025).

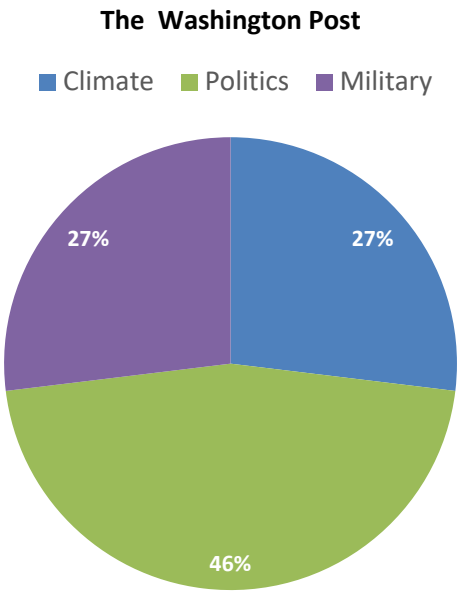

Fig. 2. Thematic distribution of news publications in The Washington Post [20].

The largest number of publications is related to politics or the military sphere. The militarization of the Arctic is noted [21]. As in The New York Times, it is stated that Russia and China are destabilizing actors in the Arctic. According to the publisher, Russia's well-known submarines off the coast of Northern Europe, as well as Chinese spy balloons, are matters that need to be addressed and defended against, despite the lack of clear evidence of the alleged behavior of Russia and China [22, 23].

A publication about NATO military exercises in the Arctic is of particular interest [24]. It notes that an American aircraft with four military personnel on board crashed during the exercises. This is followed by information that the exercises were launched against the backdrop of "Russia's invasion of Ukraine". Based on this, a certain connection between these events is established. The reader may blame Russia for the death of American servicemen, despite the fact that no real arguments are provided for Arctic exercises conducted thousands of kilometers from the site of the Russian-Ukrainian conflict.

It is precisely because of Russia's allegedly aggressive actions that Western countries justify their policies in the Arctic. There is a possibility of conflict in the Arctic not only with Russia, but also

[20] Compiled by the authors.
[21] After crisis talks with Russia, the threat of war in Ukraine still looms. Here's why. URL: https://www.washingtonpost.com/climate-environment/2022/01/11/permafrost-melting-arctic/ (accessed 28 October 2025).
[22] 'Wiped out': War in Ukraine has decimated a once feared Russian brigade. URL: https://www.washingtonpost.com/world/2022/12/16/russia-200th-brigade-decimated-ukraine/ (accessed 28 October 2025).
[23] U.S. jet shoots down 'high-altitude object' over Alaska. URL: https://www.washingtonpost.com/politics/2023/02/10/military-shootdown-alaska/ (accessed 28 October 2025).
[24] Four U.S. service members killed in Norway aircraft crash during NATO exercise. URL: https://www.washingtonpost.com/world/2022/03/19/norway-plane-crash-nato-american-soldiers/ (accessed 29 October 2025).

with China, as their "ambitions in the Arctic are growing" [25]. That is why, according to The Washington Post, the US is also conducting exercises in the Arctic, Canada is increasing its military spending, Finland and Sweden have joined NATO, etc. Based on the above, it is not difficult to conclude that, from a political and military point of view, The Washington Post presents the following view of the Arctic: NATO is in a defensive position, while Russia and China are on the offensive. If NATO conducts exercises, it is "preparing for defense", but if Russia does the same, it is "escalating the threat". Militarization by Western countries is a "strategic necessity", but when Russia does it, it is "aggression". Thus, the information is presented in the spirit of the post-truth era, with information manipulation and double standards.

Publications on climate change and Arctic warming are no less controversial. Like many other media outlets, The Washington Post reports on the disappearance of glaciers, the melting of permafrost, and other phenomena. This, in turn, harms animals, people, and entire cities. However, some details of the environmental discourse raise questions. For example, one of the publications notes that the Arctic is warming, and some cities, including Yakutsk, are at risk of collapse [26]. It also mentions the oil spill in Norilsk in 2000, which was also caused by the melting of permafrost. Based on this, the Russian Arctic is presented as a dangerous place from an environmental perspective, which also threatens the entire Arctic. Another publication claims that "fires are raging" in Siberia because Russian firefighters are currently stationed in Ukraine [27]. In this way, the publication seeks to establish a connection between these two events in readers' minds, thereby reinforcing anti-Russian sentiment. According to The Washington Post, it is Russia that is harming the Arctic. In some cases, causal chains are even provided: Russia "invaded" Ukraine, scientific cooperation in the Arctic has been suspended, and polar bears are suffering as a result [28]. However, the real reasons for the suspension of cooperation in the Arctic are not given.

Thus, based on an analysis of The Washington Post news coverage, it can be concluded that the publication is shaping the following discourse: the Arctic is either a new arena for military and geopolitical confrontation or a place where climate change will cause the death of humanity. In both cases, Russia (in some cases, China) is or will be blamed. One of the publications acknowledges that melting ice will inevitably lead to competition between powers in the Arctic [29]. The Washington Post

[25] How elite U.S. troops are preparing to fight in the Arctic. URL: https://www.washingtonpost.com/video/world/how-elite-us-troops-are-preparing-to-fight-in-the-arctic/2024/04/11/7df06c89-dc30-4a83-b563-20900d8ce9cb_video.html (accessed 29 October 2025).

[26] Warming permafrost puts key Arctic pipelines, roads at 'high risk,' study says. URL: https://www.washingtonpost.com/climate-environment/2022/01/11/permafrost-melting-arctic/ (accessed 29 October 2025).

[27] Fires burn in Siberia, but Russian firefighting assets are in Ukraine. URL: https://www.washingtonpost.com/weather/2022/04/26/siberia-fires-april-firefighting-ukraine/ (accessed 29 October 2025).

[28] Why Russia's war in Ukraine is bad news for polar bears, too. URL: https://www.washingtonpost.com/climate-environment/2023/04/15/polar-bears-russia/ (accessed 29 October 2025).

[29] The U.S. Army has released its first-ever climate strategy. Here's what that means. URL: https://www.washingtonpost.com/climate-solutions/2022/02/10/army-military-green-climate-strategy/ (accessed 30 October 2025).

presents scenarios for cooperation in the Arctic only in its military-political discourse, in the context of NATO member states collaborating to "contain Russia".

Analyzing The Guardian, it is worth noting that the publication also covers Arctic topics. A total of 49 news articles were found during the study period, which are thematically distributed as follows: 26 publications on political issues, 17 — on the climate in the Arctic, and 12 — on military issues (see Fig. 3).

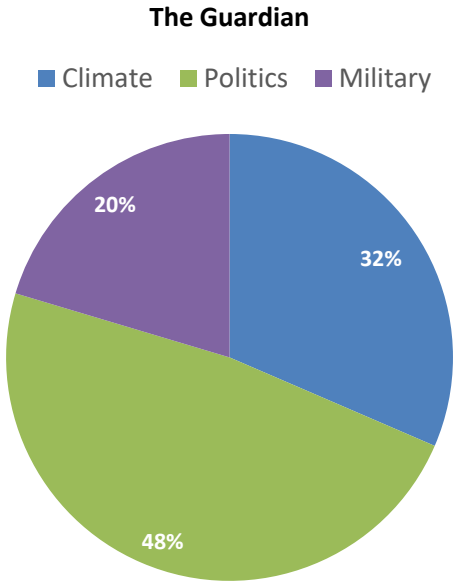

Fig. 3. Thematic distribution of news publications in The Guardian [30].

Military and political issues are mainly reflected in publications mentioning the militarization of the Arctic, sanctions against Russia and Russian military exercises. The Arctic is presented as an area where Russia is the main threat. Many articles note the presence of Russian bases in the Arctic, the country's desire to conduct military exercises in the region, and "aggression" in general. However, military bases of other states in the Arctic are not mentioned, even in the context of defense against the "threat" posed by Russia. Thus, the reader is made to believe that Russia is the only entity militarizing the Arctic, which is not true. According to The Guardian, China is also a destabilizing factor in the Arctic region. It is noted that both Russia (using submarines and whales) and China are engaged in espionage [31, 32, 33].

Some military-political publications intersect with environmental themes, with Russia often being blamed. One of the publications claims that Russia, in addition to building up its military

[30] Compiled by the authors.
[31] Suspected Russia-trained spy whale reappears off Sweden's coast. URL: https://www.theguardian.com/world/2023/may/29/suspected-russia-trained-spy-whale-reappears-off-swedens-coast (accessed 30 October 2025).
[32] Russia stepping up security at Black Sea base with spy dolphins, says UK intelligence. URL: https://www.theguardian.com/world/2023/jun/23/russia-security-sevastopol-black-sea-base-spy-dolphins (accessed 30 October 2025).
[33] Chinese warships spotted off Alaska coast, US Coast Guard says. URL: https://www.theguardian.com/us-news/article/2024/jul/11/chinese-warships-alaska-us-coast-guard (accessed 30 October 2025).

power, is also polluting the Arctic [34]. Furthermore, the alternation of accusations against Russia for damaging the Arctic environment with information about climate change in the region may lead readers to believe that Russia is responsible for all the negative processes taking place in the Arctic.

In general, it should be noted that there are some unfounded sensational headlines. For example, when readers come across a publication with the headline "Russia's Sami fight to save their language and traditions") [35], they will probably think that Russia has not created the conditions necessary to support the livelihoods of indigenous peoples. However, the news article itself makes no mention of this. Like other indigenous peoples, the Sami face the need to preserve their traditions. The only questionable aspect is the publication's decision to use the example of the Russian Sami with such a headline to convey this message. Numerous other examples were found: "Nature is being destroyed: Russia's arms buildup in the Barents Sea creating toxic legacy" [36], "How Russia is taking control of the Arctic", [37] and others.

Summarizing The Guardian's publications on the Arctic, we note that security in the Arctic is perceived negatively for two main reasons: climate and military-political. Russia in the Arctic is perceived as an exclusively destabilizing factor, threatening both the ecology of the region and the security of other Arctic states.

Next, let us consider news articles from The Daily Telegraph (The Telegraph). Of the 22 publications, 17 deal with political topics, 14 — with military topics, 2 — with climate topics, and 1 — with economic topics (see Fig. 4). Although the total number of references to the Arctic is not that high, it can be argued that the material demonstrates the use of various techniques characteristic of the post-truth era.

[34] 'Nature is being destroyed': Russia's arms buildup in Barents Sea creating toxic legacy. URL: https://www.theguardian.com/environment/2023/jul/24/russia-barents-sea-toxic-legacy-military-buildup-mining-shipping-indigenous (accessed 30 October 2025).
[35] Russia's Sami fight to save their language and traditions — photo essay. URL: https://www.theguardian.com/artanddesign/2022/jul/07/russias-sami-fight-to-save-their-language-and-traditions-photo-essay (accessed 30 October 2025).
[36] 'Nature is being destroyed': Russia's arms buildup in Barents Sea creating toxic legacy. URL: https://www.theguardian.com/environment/2023/jul/24/russia-barents-sea-toxic-legacy-military-buildup-mining-shipping-indigenous (accessed 30 October 2025).
[37] How elite U.S. troops are preparing to fight in the Arctic. URL: https://www.washingtonpost.com/video/world/how-elite-us-troops-are-preparing-to-fight-in-the-arctic/2024/04/11/7df06c89-dc30-4a83-b563-20900d8ce9cb_video.html (accessed 30 October 2025).

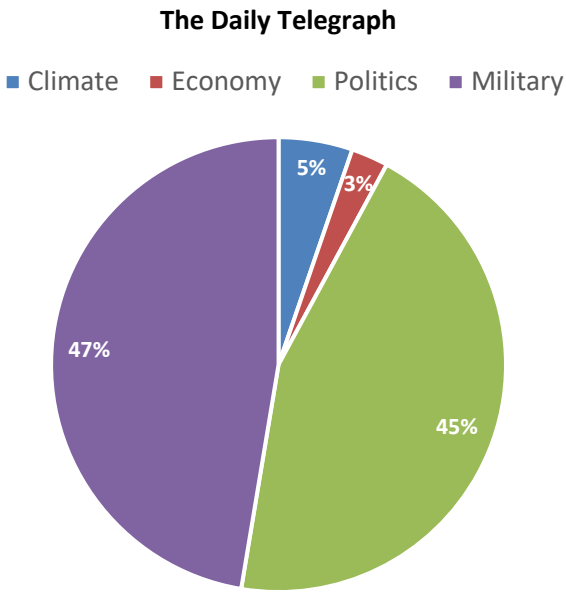

Fig. 4. Thematic distribution of news publications in The Daily Telegraph [38].

The military-political situation in the Arctic is characterized as unstable and unsafe. The threat posed by Russia and China is frequently mentioned. For example, according to the publication, Russia and China are strengthening their naval presence [39], Sweden is forced to defend itself against Russia [40], Finland has experience in confronting Russia, which could invade the country [41], etc. Such coverage of events may contribute to the formation of a certain public opinion that confrontation in the Arctic is inevitable. In turn, the formation of an image of states as aggressors may lead to an escalation of diplomatic conflicts and an arms race.

The Daily Telegraph uses emotional headlines and rhetoric in its articles on Arctic security issues involving Russia and China. Based on the distribution of topics covered in articles about the Arctic, we see that the main focus is on military activity and conflicts. The topics of ecology and climate are practically not mentioned in this media outlet. A significant amount of information about military maneuvers, tests and potential conflicts can create the impression that there is a real need to counter “threats”, even though these threats are often unsubstantiated. Furthermore, the selective reporting and one-sided coverage lead to the formation of stereotypes and biased opinions among the audience.

The analysis of the above-mentioned media outlets and the topics of their publications in which information distortions were found is presented in the form of a diagram (Fig. 5):

[38] Compiled by the authors.
[39] China and Russia have achieved naval success off Alaska — where the US Navy has no bases. URL: https://www.telegraph.co.uk/news/2023/08/08/china-russia-warships-alaska-aleutians/ (accessed 30 October 2025).
[40] As Ukraine tensions grow, Sweden shows its military strength on strategic Baltic island. URL: https://www.telegraph.co.uk/world-news/2022/01/30/ukraine-tensions-grow-sweden-shows-military-strength-strategic/ (accessed 30 October 2025).
[41] Will Russia invade Finland? Not if it remembers history correctly. URL: https://www.telegraph.co.uk/world-news/2022/05/12/will-russia-invade-finland-not-remembers-history-correctly/ (accessed 30 October 2025).

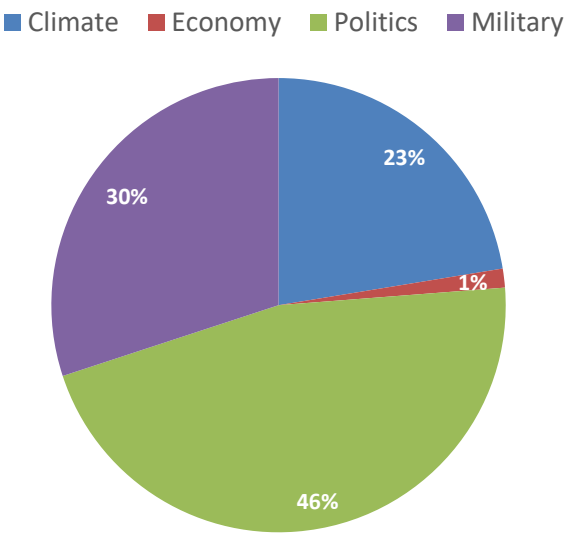

Fig. 5. Thematic ratio of news publications of all mass media outlets analyzed [42].

Table 1

Typology of post-truth narratives about the Arctic in Western media outlets (2022–2025) [43]

Narrative	Key message	Characteristic techniques	Example from publications
Russian / Chinese threat narrative	Russia and China are destabilizing actors, leading to militarization and confrontation	Media priming, hyperbole, omission of NATO actions	"Russia is taking control of the Arctic" (The Guardian)
Environmental guilt narrative	Russia is to blame for worsening climate problems in the Arctic	Distortion of causal relationships, "cascade of accessible information"	Connection between forest fires in Siberia and redirection of forces to Ukraine (The Washington Post)
Conflict inevitability narrative	The Arctic is a zone of permanent crisis; cooperation is impossible	Emotional headlines, selective choice of facts	Description of NATO exercises as "forced defense" (The Washington Post)
Economic insolvency narrative	The Russian Arctic is an unattractive and unsafe region for investment	Omission of losses by Western companies, emphasis on sanctions as a "moral choice"	Materials about Shell's withdrawal from Russia (The New York Times)

Based on the analysis of publications from the above-mentioned news outlets, it is possible to form an overall distribution of publications by subject area. Politics was reflected in 103 articles, the military sphere — in 67, climate — in 50, and economics — in 3. It was found that, in general, all of the above-mentioned media outlets portray the Arctic as an unsafe and unstable region in terms of the military sphere, politics, and climate. Russia and China are largely blamed for this.

[42] Compiled by the authors.
[43] Compiled by the authors.

Russia's militarization of the Arctic is noted without any mention of similar actions by other Arctic states. Even when such mention is made, it is only in the context of "necessary self-defense".

The image of Arctic security in Western media is shaped in such a way as to convey the impression that the region is in a state of permanent crisis. The analysis did not find any publications indicating opportunities for cooperation in the Arctic or any ongoing cooperation. The only possible framework for cooperation is military-political, directed against Russia and China. Based on this, it is possible to conclude that there is a desire to legitimize the current actions of NATO member states in the Arctic to militarize the region and effectively destabilize international security there.

Forecast and prospects

It is undeniable that post-truth narratives are leading to the formation of negative perceptions of each other among the states of the Arctic region. A spiral of mistrust is formed, which intensifies with every misinterpreted event by one actor or another. The process can be described as follows: information disseminators find a pretext for spreading misinformation and artificially inflate the threat using the mechanisms mentioned above. The population begins to feel fear and a sense of insecurity for no apparent reason. The results of well-conducted sociological surveys demonstrate a public demand for "forced" and tough measures to neutralize the threat (condemnatory statements, increased military presence, intensified reconnaissance activities, preventative measures in case of a full-scale military conflict, etc.). Politicians take these tough measures based on public opinion or regardless of it. It should be noted that the manipulation of facts can be used not only to prepare future decisions, but also to justify those already taken. Other states, often neighboring ones, perceive these actions as a threat and take their own security measures.

Furthermore, the development of the post-truth phenomenon in and about the Arctic has consequences for the humanities and sciences. The atmosphere of mistrust and attempts to isolate Russia in the region are leading to the cessation of scientific cooperation on Arctic development issues, as reflected in some publications. Joint efforts that were undertaken to study global warming and climate change in detail are fading away. Previously active expert networks, such as UArctic, are losing their effectiveness in intergovernmental cooperation, as Russia, the largest actor in the Arctic, is being pushed out and artificially isolated. Although the institutions themselves continue to exist, research conducted within them can be considered marginalized. The narratives of the largest Western media outlets accuse Russia of bringing scientific and educational cooperation in the Arctic to a standstill due to the start of a special military operation in 2022. This event was indeed a turning point, but Russia has never refused constructive cooperation in the Arctic, despite all the events that have taken place outside its borders. Thus, there is an unjustified shifting of blame, while at the same time an exclusively negative image of Russia is being formed in the public mind, including in the Arctic. If this trend continues, security in the region will indeed become vulnerable.

In the case of scenarios dominated by post-truth reporting on the security situation in the Arctic, the region's economic component is also at risk. For example, one of the key economic

consequences of the spread of post-truth could be a significant reduction in the investment attractiveness of the Arctic region. Western media outlets have a particularly strong tendency to publish materials devoted to unprecedented warming, melting Arctic ice and the destruction of permafrost. These publications are often accompanied by apocalyptic predictions and dramatic headlines. The constant fear-mongering and exaggeration of dangers makes investors to perceive the Arctic as an extremely unstable and unpredictable territory. As a result, there is a high probability that capital that could have been directed, for example, towards large-scale and long-term projects in the field of infrastructure, the exploitation and extraction of natural resources, the transport and logistical development of the Northern Sea Route and tourism, will shift from the Arctic to other regions of the world. The spread of false information about the Arctic in the media is becoming a factor that could significantly limit the region's development, make its economic future unpredictable, and lead to a prolonged economic downturn, the consequences of which will be felt in all spheres of life in the region. In this regard, the manipulation of information can be considered a weapon used to achieve specific goals.

There are two main scenarios for the development of international security in the Arctic in the post-truth era: acute escalation and freeze in cooperation. The first scenario, associated with an escalation of the current situation, is the most alarming. In this scenario, the continued spread of post-truth information increases mistrust between states and provokes a redistribution of power. The Arctic is finally becoming established in the information space as a territory dominated by militarization, espionage, and rivalry between great powers. Conflicts arise not from direct aggression, but as a result of a distorted perception of the actions of other actors.

The second scenario, which envisions only a freeze in Arctic cooperation, is less acute, but no less dangerous in the long term. States formally maintain diplomatic relations, but in practice refuse to work together within the Arctic Council, scientific platforms, environmental projects, and so on. Under the influence of negative media reports, trends are shifting toward isolation or loyalty to certain blocs and away from comprehensive cooperation. This leads to a decline in trust and a gradual erosion of previously stable collaborative formats. A barrier is emerging that divides countries even in areas where consensus had previously been reached. This also has a destructive impact on international security in the Arctic.

Possible scenarios for the development of international security in the Arctic are presented in Table 2:

Table 2

Scenarios for the development of international security in the Arctic in a post-truth environment [44]

Scenario	Characteristics	Consequences
Acute escalation	Security dilemma, information aggression	Local incidents, militarization, armed conflicts, diplomatic deadlock
Freezing cooperation	Final rejection of joint projects, decline in trust, deliberate blocking of communications	Degradation of mechanisms for cooperation in the Arctic, scientific and environmental interaction

[44] Compiled by the authors.

Controlled tension	Maintaining minimal dialogue on the least conflictual topics (science, emergency situations), maintaining a high level of militarization and mutual distrust	Low-intensity confrontation, limited cooperation on specific projects, slow degradation of multilateral institutions

In this regard, it is necessary to develop and implement comprehensive measures aimed at minimizing the consequences caused by the peculiarities of the post-truth era and preventing further deterioration of international security in the region. In order to effectively address the impact of post-truth on international security in the Arctic region, it is necessary to develop not simply linear solutions, but a flexible and multi-level system that takes into account the specifics of the information space, geopolitical contradictions, and public perception.

Attempts to formulate a convention on international information security have already been made. For example, in 2023, Russia, Belarus, North Korea, Nicaragua, and Syria proposed a draft UN Convention on International Information Security [45]. The document emphasized the growth of military ICT technologies and their potential use as weapons. However, the initiative did not receive widespread support, although the attempt itself demonstrates the urgent need for international regulation.

In 2009, the SCO member states signed an agreement on cooperation in international information security [46]. The document identifies key threats: from the development of information weapons to information terrorism, crime, and various distortions capable of harming the political, social, and spiritual spheres of society. The states identified areas of cooperation such as the development of norms to limit the spread of information weapons, combating crime, sharing experiences, and other coordination tools. A similar approach is also needed in the Arctic. Understanding the risks of post-truth should become a platform for restoring coordination mechanisms.

Obviously, effective international initiatives could play a significant role in countering the spread of post-truth; however, given the current heterogeneous geopolitical situation in the world, attention should be paid to implementing measures to ensure information security at the national level. A strategy to combat the post-truth phenomenon and its consequences should not be limited to government regulation, such as tightening laws or restricting access to information. More effective measures include a comprehensive approach covering various aspects, such as institutional, educational, technological, and others. The aim of these measures should be to strengthen society's ability to recognize manipulation and misinformation, as well as to form an objective image of international security in the Arctic and the processes taking place there. One of the approaches could be the creation of interdepartmental structures to monitor and analyze information threats. Their

[45] Letter dated 15 May 2023 from the Permanent Representatives of Belarus, the Democratic People's Republic of Korea, Nicaragua, the Russian Federation and the Syrian Arab Republic to the United Nations addressed to the Secretary-General. URL: https://documents.un.org/access.nsf/get?OpenAgent&DS=A/77/894&Lang=R (accessed 30 October 2025).
[46] Agreement between the governments of the member states of the Shanghai Cooperation Organization on cooperation in the field of ensuring international information security. URL: https://docs.cntd.ru/document/902289626 (accessed 30 October 2025).

task is not to block information, but to identify manipulation, bring it into the public sphere, and explain the nature and purpose of the distortions.

Another area of focus is the development of multilingual information resources dedicated to Arctic topics and aimed at a foreign audience. This task is set out in the Strategy for Developing the Russian Arctic Zone and Ensuring National Security until 2035 [47]. Scientifically substantiated and systematic presentation of information would strengthen the global audience's awareness of Russian initiatives and real processes in the region.

The most obvious and key method of responding in the post-truth era is to increase media literacy, especially among the population of the region where critical events are unfolding, including those that depend on the correct perception of information, as well as to double-check materials that are of interest or necessary for professional and educational activities. Society should understand the true causes, nature, characteristics, and consequences of post-truth narratives. Conducting educational campaigns, including subjects aimed at developing critical thinking in school and university curricula, and forming the habit of checking sources of information — all these measures can contribute to the formation of citizens' resistance to information manipulation.

In the Arctic, where official state formats of interaction are limited due to political confrontation between actors, or more precisely, due to the isolation of one actor, collaboration between scientists and experts, professional communities, and other non-state actors is particularly relevant. They can maintain space for constructive interaction. Joint scientific projects, even in the absence of political dialogue, can correct distorted facts in the media. Despite many media outlets reporting the cessation of scientific cooperation "due to Russia's fault", Russia is open to such collaboration and does not prohibit its scientists from interacting with foreign specialists.

The scientific community can counteract the negative aspects of the post-truth phenomenon by developing methodologies and tools to increase resilience to disinformation and awareness of manipulation techniques, etc. In this case, we are not talking about fact-checking, which was mentioned earlier, but about analyzing specific post-truth narratives about the Arctic. By systematizing linguistic patterns in media publications, it seems possible to develop an aggregated rating or database that would allow for tracking and recording information distortions, as well as data on which topics and with what frequency are articulated in the media environment. With relations between all Arctic states improving, it seems appropriate to create such an instrument based on consortia of scientific institutions and analytical centers. For now, it is important to support those international contacts that have been preserved. Furthermore, participation in scientific conferences, joint research, interpersonal scientific contacts, and participation in international Arctic development projects are all important components of restoring trust between countries.

Therefore, to maximize the effectiveness of countering the post-truth phenomenon, strategies should not be limited to individual states or institutional mechanisms. These should be

[47] The Strategy for Developing the Russian Arctic Zone and Ensuring National Security until 2035. URL: http://www.scrf.gov.ru/security/economic/Arctic_stratery/ (accessed 30 October 2025).

developed both in expert circles and in the technological and civil spheres. Only through coordinated actions at all levels — from international diplomatic platforms to local initiatives of research communities — it can be possible to weaken the polarizing effect of post-truth and to maintain the stability of international relations in the Arctic.

Possible levels and measures of response to manifestations characteristic of the post-truth era are summarized in Table 3:

Table 3

Main levels and measures of response to information threats in the Arctic [48]

Scenario	Characteristics
International level	Movement toward an international convention on information security; Creation of international platforms for interaction; Dialogue to reduce the cross-border risks of the post-truth phenomenon
National level (using the Russian Federation as an example)	Laws on de-anonymization and the fight against fake news; Creation of information resources about the Arctic for foreign audiences; Support for educational programs on media literacy; Use of modern technologies to verify facts and combat information bubbles
Civil and scientific community	Developing methodology and expert mechanisms for post-truth analysis; Supporting scientific contacts; Participating in international conferences, maintaining and developing academic ties; Creating independent analytical databases and rankings

Conclusion

In the post-truth era, the tools for exerting influence have expanded significantly. Their use by the media and other actors in international relations not only limits opportunities for constructive interaction, but also deliberately shapes public opinion, shifting it in the desired direction. Real and objective analysis is replaced by emotions based on bias and unverified information.

Several foreign media outlets and social media platforms with the largest audiences were selected to analyze the destructive influence of information on the Arctic region: The New York Times, The Washington Post, The Guardian, and The Daily Telegraph. Of all the publications since 2022, those related to the Arctic were sampled. A total of 176 publications were reviewed. It was concluded that all analyzed media outlets, in one way or another, pursue policies that can be described as post-truth in one way or another. Emotionally charged statements, formulations, and headlines are actively used, facts are presented selectively, and threats are exaggerated, creating dramatic narratives. The Arctic region is portrayed exclusively in a negative light. In most publications, Russia and China are blamed for destabilizing international security in the Arctic. Russia is accused of militarization, environmental damage, and creating obstacles to international cooperation. Such unfounded rhetoric directed at the largest actor in the Arctic region could undermine international security there.

It has been identified that the most alarming and worrying scenario is the one involving escalation, as mistrust between states will only increase and the balance of power in the Arctic will

[48] Compiled by the authors.

shift. According to this scenario, the Arctic will never return to its former status as a territory of dialogue and cooperation. If post-truth policies by foreign media and other actors intensify and become more active, the Arctic will finally become defined as a territory dominated by processes such as espionage, great power rivalry, militarization and environmental pollution.

It should be emphasized that, due to the complexity of the post-truth phenomenon, a response is required at many levels, from the international to the civil society and scientific. It is necessary to move toward an international convention on information security; create various platforms for cooperation to counter destructive trends in the information sphere; develop specialized information resources about the Arctic for international audiences; support and widely disseminate educational programs on media literacy and critical thinking; utilize modern technologies for fact-checking and combating the emergence of information bubbles; maintain mutually beneficial scientific contacts and academic ties; create analytical databases and ratings that will allow the general public to assess the accuracy of various sources of information.

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Russia and China in the Arctic: Current Status and Prospects for Cooperation

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Abstract. The article provides an assessment of strategic interests of Russia and China in the Arctic. The purpose of the study is to analyze the current state of relations between Russia and China in the Arctic, to determine the prospects for further cooperation. The authors believe that this cooperation should be examined systematically, i.e. from three possible perspectives: economics, politics and society. A significant part of the Russian Federation's territory lies above the Arctic Circle, so its interests in the region have a long history. China positions itself as a "subarctic state", and its interests in the region have become increasingly manifested over the last decade. In 2017, the countries announced their intentions to promote the alignment of the "One Belt, One Road" initiative and the EAEU and to link it with the Northern Sea Route project. Factors contributing to the convergence of the two countries' interests include: the deterioration of Russia's relations with the collective West, the increasing role of China in Russia's foreign economy and politics, and the growth of Russian hydrocarbon exports to China. The article provides examples of successful joint Russian-Chinese projects in the Arctic. The authors note that in the field of mineral extraction, successful joint initiatives include a project to drill two exploration wells in the Okhotsk Sea in the Magadan-1 and Lisyanskiy areas. The authors emphasize that there are no large infrastructure projects in the Russian Federation that are financed by Chinese investors, so the country is interested in Chinese investment for the advancement of infrastructure necessary for the development of the Arctic. Currently, cooperation between Russia and China in many areas is at its peak, and it is expected that the two countries will continue to deepen and diversify their interaction. At the same time, cooperation in the Arctic may become a central aspect of this interaction, as it is equally in the interests of both states.
Keywords: *geopolitical interest, Arctic, China, deposits, oil and gas resources*

Introduction

The deterioration of relations between Russia and the countries of the collective West, as well as China's reorientation from Western countries to Asian ones, have allowed both countries to build closer and mutually beneficial partnerships. In this regard, cooperation between Russia and China on Arctic development issues serves as further evidence of the rapprochement and strengthening of relations between the countries, not only in the political and security spheres, but also in the economic one. The Arctic, with its rich natural resources, is of particular interest to Russia, as Moscow seeks to intensify the development of its national resource base. In particular, Russia plans

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to develop energy production in the Arctic region and increase its supplies to China. For China, diversification of energy imports is extremely important, so the vast natural resource reserves in the Arctic are also of economic interest, but China is not limited to them. China is more interested in the prospect of developing a shorter and safer sea route for the delivery of its goods to Europe. As the world's largest trade exporter, China has an economic interest in reducing transportation costs and transit time. The Northern Sea Route, which runs along the coast of the Russian Arctic, connects Asia with Europe. The Arctic Ocean connects the Atlantic and Pacific Oceans. Currently, the average transit time via the Northern Sea Route is about 23 days, compared to 37 days via the Suez Canal. In this regard, the development of the NSR, as well as the logistics infrastructure in the Arctic, will speed up the transportation of Chinese goods to Europe, which is China's second largest trading partner, by 1.5–2 times.

Despite the common strategic interests of Russia and China in the Arctic, their cooperation is still very cautious and diplomatic. China does not hold a controlling stake in either of the two key LNG projects on the Yamal Peninsula in the Russian Arctic. Its share in Yamal LNG is 29.9%, while Russia's Novatek owns a controlling stake of 50.1%, and France's Total — 20%. In the Arctic LNG 2 project, China owns 20%, Novatek — 60%, Total — 10%, and the remaining 10% belongs to a Japanese consortium. It can be expected that upcoming Russian energy projects in the Arctic, located in close proximity to the existing Ob (LNG), Vostok (oil), Arktika-1 (LNG) and Arktika-3 (LNG) on the Yamal Peninsula, will attract various sources of capital, not only from China [1].

Chinese investments in the Arctic were previously directed to the United States, Canada and Greenland. However, their dynamics slowed down in the 2010s as China gradually lost the trust of its partners due to a series of incidents, such as the bankruptcy of a Chinese zinc mine in Yukon, which led to an environmental disaster. Other initiatives, such as a $230 million gold mining project in Nunavut and the purchase of an abandoned naval base in Greenland, were blocked as China began to be perceived as a security threat in the region. This prompted China to change the direction of its cooperation, strengthening its strategic alliance with Russia, which favored attracting Chinese investment to the region.

It is worth noting the development of joint investment funds, such as the Russia-China Investment Fund (RCIF). The fund supports projects in agriculture, logistics, high technology, ecology, and green energy. In particular, in 2024, the RCIF participated in the launch of several large agro-industrial clusters in the Russian Far East, focused on exporting products to China.

Over the past 10 years, Chinese-Russian cooperation in the Arctic has expanded significantly. Currently, it includes not only various joint ventures in the energy sector, but also infrastructure projects, military exercises, strengthening of diplomatic relations within the Arctic Council. In 2023, China invested in titanium mining in the Komi Republic, expressing interest in rare earth minerals. Other infrastructure projects, such as the Moscow-Kazan high-speed railway, were aimed at

[1] Prospects for cooperation among BRICS countries in the field of sustainable development of the Arctic region. URL: https://as.arctic-russia.ru/upload/docs/2023/think-arctic-report-brics-rus.pdf (accessed 04 March 2025).

expanding ties and cooperation in trade, investment, energy, and manufacturing. China and Russia signed a memorandum of understanding to strengthen cooperation in maritime law enforcement, with a particular focus on combating terrorism, smuggling, illegal migration, and protecting marine resources. Based on the above, it seems possible to conclude that bilateral cooperation will only expand in the short and medium term.

Literature review

The topic of Arctic exploration and development is highly relevant, as evidenced by the fact that more than 30 journal articles and research papers on various aspects of economics have been directly related to it. A large number of works are also presented in the scientific journal Arktika i Sever (Arctic and North), which has been covering political, economic, social and international issues in the Arctic since 2011. The Russian Arctic has enormous resources and infrastructure facilities that are important for international relations, which, in turn, are attracting increasing interest from investors, especially major players in the global market such as China and India. Therefore, the issue of the Arctic's investment potential has gained momentum, especially during periods of sanctions pressure on Russia in the financial and commodity sectors.

An analysis of previously published works on the development of the Russian Arctic allows us to identify the following areas for further study and research on this topic:

- developing the use of the Arctic region's resource base to diversify Russian economic growth [1, p. 95–107];
- increasing the competitiveness of the Northern Sea Route (hereinafter referred to as the NSR) as a significant logistics route [2, pp. 513–514];
- protecting the Arctic environment, preserving the habitats and way of life of local residents [3, pp. 513–516];
- increasing the attractiveness of Russia's Arctic regions as places of permanent residence [4];
- attracting partners for the development of shipbuilding in the Arctic region [5, pp. 99–100];
- increasing the attractiveness of the Arctic regions for tourism development [6, pp. 198–199];
- developing an investment policy aimed at increasing investment attractiveness of the Arctic region [7];
- features of scientific diplomacy in the Arctic under the sanctions pressure of the collective West [8, pp. 3–5].

With regard to the above-mentioned areas, the following can be noted. Thus, Irina Strelnikova, Candidate of Economic Sciences, emphasizes in her work that the issue of potential partners interested in the investment and infrastructure development of the NSR, namely China, India, and the UAE, deserves special attention. This is why the author of the article suggests paying attention

not only to the NSR, but also to the international “North — South” transport corridor, where, if the northernmost point of the corridor is extended to Murmansk or Arkhangelsk, the volume of cargo traffic passing through the NSR will increase sharply, connecting the NSR with the “North — South” corridor. In addition, the attractiveness and efficiency of the “North — South” transport corridor itself will increase [9, pp. 99–102]. The author also pays attention to problems related to investment: the unpreparedness of the engineering infrastructure for the possible negative consequences of global climate change processes, the inadequacy of the transport infrastructure, the lack of equipment and highly qualified specialists [9, pp. 104-105]. For this reason, the author proposes establishing strict requirements for infrastructure facilities, equipment, and control, as well as adopting a unified federal law on the Arctic [9, pp. 104–106].

The work of economists D.V. Timofeeva, N.E. Bychkova, and M.P. Moseev highlights the special role of China as the main investor in the development of the Russian Arctic. Cooperation between Russia and China in the Arctic region is of great strategic importance for both countries. They are major players in this region and have a common interest in developing its resources, transport routes, and scientific research. At the same time, in order to achieve success in further cooperation, it is necessary to understand mutual interests and seek balanced solutions [2, pp. 517–518]. The authors also emphasize the importance of the negative consequences that may arise from resource development in the Arctic. They propose developing transparency and interaction between countries for successful cooperation in the Arctic region [2, pp. 517–518].

Let us consider in detail the views of leading scholars in this field. The author [1] concludes that the Arctic has everything necessary for development and cooperation. This region is open to investments, and the Russian government is striving to create conditions for the implementation of numerous projects (including those involving BRICS countries) that will contribute to the region’s development [1, pp. 95–98]. One of the main areas for foreign investment is the development of the Arctic’s transport and logistics potential through transport corridors (the NSR, the North — South corridor, the Belkomur, the Northern Latitudinal Railway, the Barentskomur). This will not only improve infrastructure connectivity across the Eurasian continent, but will also facilitate cooperation between CIS countries in this space [1, pp. 95–107].

The authors of the article [3] focus on LNG projects, which will contribute to Russia’s increased competitiveness in the global market of LNG producers and exporters. They emphasize the need to attract foreign investors and technology partners due to the capital-intensive nature of these projects. The article notes the significant influence of China as a major financial sponsor of Russian LNG projects, which has a huge interest due to its growing demand for energy resources and diversification of suppliers, as well as its desire to generate income [3, pp. 12–16].

In the work [5], the author focuses on the environmental policies of Russia and China in the Arctic, their pros and cons. The article proposes that the State Commission for Arctic Development should be given supervisory functions, or that a specialized state body should be established with the authority to formulate and implement environmental policy in the Arctic and monitor the

implementation of planned measures, as well as to adopt a federal law “On the Arctic Zone of the Russian Federation” [5, pp. 130–139].

In the article [4], the authors examine areas of cooperation between Russia and China (sustainable development, polar tourism), as well as new opportunities for partnership during Russia’s chairmanship of the Arctic Council (the Snezhinka international Arctic station, the Russian Arctic National Park). The authors also highlight several challenges in developing new areas: the atmosphere of escalating militarization, which will inevitably affect the development of the Arctic region [4].

Based on the analysis of previously published works, it can be noted that there is a need to improve investment policies in Arctic regions aimed at increasing the region’s investment attractiveness, attracting long-term investments, including foreign ones, into transport projects, and reducing political and economic risks during their implementation [10, p. 125].

The purpose of this study is to assess the strategic interests of Russia and China in the Arctic, as well as to analyze the current state and prospects for bilateral cooperation in the region.

Research methodology:

- The analytical method is used to study the factors contributing to the convergence of the two countries’ interests in Arctic exploration. This method is important for analyzing projects in the mineral extraction sector, such as the two exploration wells in the Okhotsk Sea in the Magadan-1 and Lisyanskiy areas, where the Russian companies Magadanmorneftegaz, Lisyanskmorneftegaz, and joint ventures between Rosneft and Statoil ASA are successfully cooperating with China Oilfield Services Limited (COSL);
- The economic methods are used to forecast the prospects for cooperation between Russia and China in the Arctic, as well as to assess the strategic interests of both countries. The authors pay particular attention to the study of statistical material and its processing to confirm the conclusions made in the article;
- The generalization method is used to identify examples of successful implementation of joint Russian-Chinese projects in the Arctic, as well as to describe various areas of cooperation between the countries.

Results and discussion

This research article provides an assessment of the strategic interests of Russia and China in the Arctic and an analysis of the current state and prospects of bilateral cooperation in the region. The authors focus on the economic, political, and social impacts of this cooperation, while noting the threats to the Arctic’s natural heritage, climate, and biodiversity due to active development and intensified economic activity.

Russia owns a significant part of the territory beyond the Arctic Circle, and its interests in the region have a long history. China positions itself as a “subarctic state”, and its interests in the region have become increasingly manifested over the last decade. Since Xi Jinping became the president of China, the “One Belt, One Road” strategic initiative has emerged. In this context, cooperation

between Russia and China in the Arctic seems promising, despite its relatively short history. Initially, Russia was cautious about China's presence in the Arctic, but the introduction of Western sanctions prompted Russia to intensify and expand its partnership with China. Joint research in the Arctic was no exception. In 2017, the countries announced their intentions to promote the alignment of the "One Belt, One Road" initiative and the Eurasian Economic Union (EAEU), as well as to link this initiative with the Northern Sea Route (NSR).

This research identifies factors contributing to the convergence of the two countries' interests in Arctic exploration: the deterioration of Russia's relations with the collective West, the strengthening of China's role in Russia's foreign economy and politics, and the growth of Russian hydrocarbon exports to China. China is gradually becoming the leading consumer of Russian gas and oil. Joint cooperation in this area was marked by the Yamal LNG and Arctic LNG 2 projects, significant for both countries, in which China has become the largest minority shareholder, providing financial resources and equipment for capital-intensive and technologically complex production.

Historically, the Arctic has represented a model of cooperation among the eight circumpolar countries. However, in 2022, Canada, Denmark, Finland, Iceland, Norway, Sweden, and the United States issued a joint statement announcing the suspension of cooperation with Russia within the Arctic Council. As a result, Russia began strengthening new partnerships for the region's development.

The article explains in detail the background and factors driving the interest of Russia and China in the Arctic region. Since the early 2000s, Russia has been actively elaborating the Strategy for the Development of the Arctic Zone. Currently, the priority of state policy in the region is regulated by the Presidential Decree of March 5, 2020, which outlines the main directions of Arctic development until 2025, such as ensuring Russia's sovereignty and territorial integrity, maintaining peace and stability in the region, mutually beneficial cooperation, ensuring a high standard of living for the region's population, developing and rationally using the resource base, protecting the environment, preserving the cultural heritage of indigenous peoples, and developing the Northern Sea Route as a new transport artery.

The authors note the importance of the region for the Russian economy. The Arctic is rich in mineral resources. It produces 90% of Russia's nickel and cobalt, 60% of copper, more than 96% of platinum group metals, and about 80% of gas and 60% of oil [10, p. 201]. The region accounts for more than 10% of the country's GDP and 20% of its exports. The authors predict further growth in these indicators.

China's strategy in the Arctic is similar to its strategy in other regions of geopolitical interest to Beijing, based on the use of "soft power". The authors provide economic justification for the importance of Arctic development for China. Since 2015, China has been actively building relations with Russia on the development of the Arctic and the Northern Sea Route (NSR) – the Ice Silk Road. The NSR is safer than, for example, the Suez Canal, located along the Horn of Africa, where piracy is common, or the Strait of Malacca, controlled by the United States of America (USA). Moreover, the

use of the alternative NSR is advantageous due to the absence of queues for ships passing through the route, compared to traditional routes through the Indian Ocean [2].

The authors emphasize that the Northern Sea Route occupies a central place in the development of the Arctic. This shipping route could compete with the Panama and Suez Canals.

The article provides examples of successful joint Russian-Chinese projects in the Arctic. The authors note that in the field of mineral extraction, successful joint initiatives include a project to drill two exploration wells in the Okhotsk Sea in the Magadan-1 and Lisyanskiy areas, where Russian companies Magadanmorneftegaz, Lisyanskmorneftegaz, and joint ventures between Rosneft and Statoil ASA are successfully cooperating with China Oilfield Services Limited (COSL). Another successful example is the project involving the use by the Russian company Gazprom Geologorazvedka of the semi-submersible drilling platform (SSDP) Nanhai VIII, which belongs to the Chinese oilfield services company COSL [3].

However, not all energy cooperation projects are successful. Arctic LNG 2 is an example of a failed project. In April 2019, two major Chinese oil companies agreed to acquire a combined 20% stake in the project, instantly making Beijing Arctic LNG 2 the largest investor. However, in December 2023, CNPC and CNOOC withdrew from the project in response to sanctions from the United States. Despite withdrawing from the project, the Chinese companies continued to supply gas turbine equipment and other technologies for it.

In the field of NSR development, the Chinese company China COSCO SHIPPING Corporation Limited, together with the Silk Road Fund and the Russian company Sovcomflot, agreed to establish the Marine Arctic Transport (MAT) company. MAT's activities will be focused on building ice-class tankers and ensuring the safe year-round transportation of LNG from NOVATEK's natural gas liquefaction facilities in the Arctic [4].

This research paper emphasizes the importance of not only oil and gas resources, which are of particular interest to China, but also of polymetals, namely the Baimskoe deposit in the Chukotka Autonomous Okrug, currently being developed by the Kazakh company KAZ Minerals. This deposit contains significant copper and gold reserves, which is of great importance to China, interested in supplying concentrate [5].

The authors emphasize that there are no major infrastructure projects in Russia that are financed by Chinese investors, so the country is interested in Chinese investments in order to create the infrastructure necessary for the development of the Arctic.

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At the same time, increased economic activity is driving climate change in the Arctic. Global warming has affected the Arctic region more noticeably and significantly than any other place in the world.

On the one hand, the extraction, processing and logistics of minerals, shipping and fishing, and various types of tourism contribute to the socio-economic development of the Arctic region.

On the other hand, the intensification of these activities entails both environmental and social problems. In this regard, it seems appropriate to consider the need to preserve the unique and extremely vulnerable natural landscape of the Arctic, which will undoubtedly have a positive impact on the quality of life of the region's indigenous peoples, an important component of sustainable development.

The authors emphasize that protecting the environment of the Arctic region is an important task for Russian-Chinese cooperation. China accounts for about 30% of global carbon dioxide emissions, which is a major factor in global warming. In this regard, joint work on the development and use of modern technologies is a key tool for the potential resolution of the growing environmental crisis in the Arctic.

Russia and China are actively developing scientific and cultural cooperation on Arctic issues, but their practical benefits have not yet been particularly noticeable. Despite periodic conferences, roundtables among scientists, experts, and students, as well as joint expeditions to the Arctic, these initiatives do little to significantly deepen Sino-Russian cooperation on regional issues in practice. China fulfils Russian technological orders for energy projects in the Arctic and imports energy resources from the region, but it is very cautious in its investments in Russian Arctic initiatives due to fears of sanctions from the United States.

It is also worth noting that China is trying to maintain cooperation with other Arctic countries. Having become an observer in the Arctic Council, China is looking for opportunities to expand cooperation not only with Russia, but also with other countries in the region, including Iceland and Norway. In an effort to maintain the balance of power in the region, China continues to strive for the internationalization of Arctic projects and is committed to a multilateral approach to the region's development.

Conclusion

The authors of the study emphasize that rapprochement between Russia and China in the Arctic is in the interests of both countries. The ongoing deterioration of Russia's relations with the West and the worsening of US-China relations are complicating China's cooperation with Arctic states, thereby creating a solid foundation for a long-term partnership with Russia.

The authors note China's strategic interest in the region's energy resources due to growing demand and the need to diversify supplies, as well as to obtain profit in the form of a return on investment. Due to its cooperation with China in the region, Russia has the opportunity to attract

the necessary equipment and technology for the development of the Arctic. At the same time, protecting the Arctic environment is an important task for Russian-Chinese cooperation.

The authors conclude that cooperation between Russia and China is currently at its peak and believe that further deepening and diversification of interaction between the two countries will continue. Cooperation in the Arctic region could become a central aspect of this interaction, as it serves the interests of both countries equally.

The authors make a forecast that cooperation of Russia and China in the Arctic will expand and deepen, clearly reflecting the general trend of strengthening Russian-Chinese strategic ties.

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Multilingualism in Arctic Cities: Sociolinguistic Aspects of Language Interaction

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Abstract. The article provides a comprehensive analysis of the sociolinguistic aspects of multilingualism in Arctic cities. The research aims to systematize and critically examine existing studies on the peculiarities of language interaction in the context of intensive urbanization in the Arctic. The methodology includes a qualitative content analysis of 74 Russian and international publications from 1980 to 2024, selected from leading scientific literature databases. As a result, key areas of research have been identified: the impact of urbanization and migration on the language situation, the relationship between language and identity, the visual presence of languages in urban space, and the language initiatives and practices of various population groups. The study reveals that urbanization poses risks of linguistic assimilation for indigenous peoples, but also opens up opportunities for revitalizing minority languages and developing new forms of cultural expression. The common patterns and local specifics of language interaction, as well as the factors of preserving and losing linguistic diversity in Arctic cities, are determined. The need for a balanced language policy and planning to support multilingualism as a key component of sustainable development in the Arctic region is substantiated. Prospects for further interdisciplinary research are outlined, considering the dynamic nature of sociolinguistic processes in the Arctic. The results make a significant contribution to the development of Arctic sociolinguistics and can be used to develop evidence-based language policies and planning measures in the circumpolar region.
Keywords: *Arctic, city, urbanization, multilingualism, language interaction, indigenous peoples, minority languages, language revitalization, sustainable development*

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Introduction

The Arctic, as a unique geographical region with distinctive natural and climatic conditions and a rich cultural heritage, is attracting increasing attention of researchers in various fields of science, including social sciences and humanities. The development of Arctic territories and their resources challenges the scientific community to comprehensively study the natural and social systems and processes occurring in this region, taking into account the principles of environmental and

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cultural sustainability. The development of strategic plans for the Arctic requires a deep understanding of the current socio-economic situation, the characteristics of indigenous communities, their historical and cultural heritage, and linguistic diversity, which are an integral part of the global cultural heritage.

One of the key aspects of social life in the Arctic is urbanization and the associated transformation of traditional communities and their linguistic environment. Arctic cities represent a unique sociolinguistic phenomenon characterized by the complex interaction of indigenous and dominant languages. The historically established linguistic diversity of the Arctic region has undergone intensive changes in recent decades under the influence of globalization, industrialization, migration, and other socioeconomic processes. These processes are giving rise to contradictory trends in the development of Arctic cities: on the one hand, industrial growth and population influx, on the other, decline of traditional ways of life and outflow of indigenous peoples.

Studying the linguistic situation in Arctic cities is particularly relevant given the need to find a balance between modernization and preservation of cultural and linguistic heritage, ensuring the sustainable development of Arctic communities in the context of rapid sociocultural change. The urban environment offers new opportunities for intercultural dialogue and the expansion of the linguistic repertoire of Arctic residents, but simultaneously creates risks of linguistic assimilation and loss of indigenous languages. Despite the growing interest of researchers in the problems of linguistic interaction in Arctic cities, many issues related to the functioning and development of multilingualism in the urbanized environment of the Far North remain poorly studied. In particular, such aspects as the dynamics of language contacts and competition in urban spaces, the role of the education system and language policy in supporting multilingualism, and the impact of migration processes on the linguistic landscape of Arctic cities require further research.

This article aims to review and systematize existing Russian and international studies devoted to the sociolinguistic aspects of multilingualism in Arctic cities. The objectives of the article include:

- analyzing theoretical and methodological approaches to studying the linguistic situation in the urbanized environment of the Arctic;
- summarizing empirical data on the functioning of languages in individual Arctic cities;
- identifying general patterns and local characteristics of language interaction in the urban space of the Arctic;
- determining the factors contributing to the preservation or loss of linguistic diversity in the context of urbanization;
- discussing the prospects for the development of multilingualism in Arctic cities and possible research directions.

It should be noted that, despite growing interest among researchers in urban community issues, Arctic cities are still rarely the subject of specific scientific analysis. Difficult natural and climatic conditions, remoteness, and underdeveloped transport infrastructure significantly complicate field research in Arctic cities, which is reflected in the quantity and depth of scientific works on this

topic. Nevertheless, we have attempted to summarize and analyze available Russian and international publications that examine various aspects of language functioning in Arctic urbanization.

Materials and methods

This study is based on a comprehensive interdisciplinary approach, combining methods from sociolinguistics, sociology of science, and related disciplines. The main sources of data for analysis were scientific publications by Russian and international authors devoted to various aspects of language functioning in Arctic cities.

Leading Russian and international scientific literature databases, such as eLIBRARY.RU, Web of Science, Scopus, and Google Scholar, were used to identify relevant publications. The search covered the period from 1980 to 2024, allowing tracing the dynamics of scientific interest in the topic and identifying the most relevant trends in the development of the language situation in Arctic cities.

In total, approximately 150 publications related to the research topic were identified during the search. After analyzing the abstracts and keywords, 74 of the most relevant sources were selected for further consideration, including 32 articles in Russian and 42 — in English. The sample included works based on empirical data (results of field research, sociolinguistic surveys, linguistic landscape analysis, etc.). The selection criteria were: relevance to the research topic; reliance on empirical data; scientific novelty and significance. The research methodology included a qualitative content analysis of the selected publications aimed at identifying key themes, problems, and trends in the development of the language situation in Arctic cities.

Results and discussion

The topic of “urban language” has been developed in sociolinguistic science since the early 20th century. Considering that the stages of its development, methodological approaches and aspects, and the degree of study are analyzed in Russian articles [1, Ayupova L.L.; 2, Khorosheva N.V.; 3, Yunakovskaya A.A.; 4, Erofeeva E.V.; 5, Ismagilova N.V., Mayorova O.A.; 6, Leontovich O.A. et al.] and by foreign researchers [7, Dejmek B.; 8, Gregersen F., Pedersen I.L., Albris J.; 9, Smakman D., Heinrich P.; 10, Dittmar N., Schlobinski P.; 11, Karlander D.; 12, Busse B., Warnke I.H. et al.], we will limit ourselves to reviewing works that examine linguistic issues in Arctic cities. This focus is due to the specific nature of the object of our study — multilingualism in Arctic cities — and the need to take into account the special socio-economic, demographic, and cultural conditions that determine the language situation in the urbanized environment of the Far North.

An analysis of publications devoted to the linguistic issues of Arctic cities has revealed several key areas of research on multilingualism in Arctic cities:

- the impact of urbanization and migration processes on the linguistic situation in the Arctic: a number of scholars, analyzing socioeconomic and demographic changes in the Arctic region, pay particular attention to the preservation of the languages and cultures of indigenous peoples who traditionally inhabited Arctic territories in conditions of intensive urbanization and the influx of non-indigenous people;

- the relationship between language and identity in Arctic cities: in works devoted to the study of language functioning in the urbanized environment of the Arctic, research attention is often focused on analyzing the role of language as one of the main markers that construct ethnic identity and serve as the basis for its preservation in an urban environment;
- the visual presence of languages in the urban space of the Arctic: a significant number of studies focus on the linguistic landscape of Arctic cities, in particular on the use of indigenous languages in public spaces (signs, advertisements, signs, etc.) and their relationship with the dominant official languages;
- language initiatives, ideologies, and practices of various groups of the Arctic urban population: research teams are studying language behavior, attitudes, and perceptions regarding the languages of indigenous peoples and migrants living in Arctic cities, as well as analyzing public initiatives and projects aimed at supporting and developing minority languages in urban spaces.

Thus, research on the language situation in Arctic cities covers a wide range of issues: from the influence of macrosocial processes on the dynamics of language interaction to the characteristics of individual linguistic behavior and ideas about language in various groups of the urban population. Particular attention is paid to the problems of preserving and developing the languages of indigenous peoples of the Arctic in the context of intensive urbanization and linguistic contact with dominant languages.

The following sections provide a more detailed overview of key works and main research findings in each of the identified areas, with a particular focus on those aspects that are most relevant to understanding the specifics of multilingualism in Arctic cities.

The impact of urbanization and migration on the language situation in the Arctic

Studies analyzing the impact of urbanization and migration on the language situation in the Arctic demonstrate the ambiguity and contradictory nature of these processes. On the one hand, the relocation of indigenous peoples from traditional rural settlements to cities poses the threat of losing their ethnic languages and cultural traditions. For example, D. Patrick and G. Budach [13], considering the migration of Inuit to Ottawa, note that changes in residence and sociocultural environment negatively impact the use and preservation of their ethnic language. M. Laruelle [14] also emphasizes that urbanization dramatically transforms the identity of indigenous peoples, accompanied by the loss of their native languages and traditional ecological knowledge.

On the other hand, a number of researchers point to the potential of Arctic cities as spaces for the development of new forms of cultural and linguistic self-expression for Indigenous peoples. M. Rozanova [15], analyzing the processes of adaptation and integration of the Nenets in the urban environment, draws attention to the prospects for the development of ethnic languages in the context of urbanization. M. Laruelle [16] considers the arrival of indigenous peoples in cities as a factor

contributing to the recognition of their cultural and linguistic heritage and the transformation of Arctic cities into postcolonial spaces. At the same time, the author notes the role of labor migrants from abroad in the formation of a more cosmopolitan urban environment.

Of particular interest is the analysis of L. Grenoble [17], who, using the example of the Sakha Republic (Yakutia) and Greenland, describes the complex interaction of urbanization factors, the consequences of colonization and climate change that determine the dynamics of language processes among indigenous peoples of the Arctic. The author convincingly demonstrates that these factors have a significant impact on language shift and well-being. It is noteworthy that the work records an increased interest among representatives of indigenous peoples in their linguistic and cultural heritage, which is reflected in the intensification of various initiatives and projects aimed at preserving and developing minority languages in urban environments.

Thus, urbanization and migration of Arctic indigenous peoples to cities give rise to diverse trends in the development of the language situation. Along with the risks of linguistic assimilation and loss of ethno-cultural identity, urban space offers new opportunities for the revitalization of minority languages. In this context, a pressing task for further research is to find balanced and effective approaches to language policy and planning that would ensure the sustainable development and viability of Arctic indigenous languages in conditions of intensive urbanization.

Interrelationship of language and identity in Arctic cities

Research into the relationship between language and identity in Arctic cities convincingly demonstrates that language plays a key role in the construction and preservation of the ethnic identity of indigenous peoples and migrant communities in the context of urbanization. As a powerful symbolic resource, language allows ethnic groups to express their unique identity, transmit their cultural heritage, and resist assimilation processes in the dominant urban environment. Thus, M. Hoffman and J. Walker [18], examining the linguistic characteristics of representatives of the Chinese and Italian communities in Toronto, demonstrate how ethnic orientation influences the formation of specific features of the English language (pronunciation, vocabulary, grammar), and emphasize the close connections between language, ethnicity, and the urban environment. E. Elias [19], using the example of the Inuit community in Edmonton, analyzes the factors contributing to the preservation and strengthening of ethnic identity in the urban context, paying particular attention to linguistic and cultural aspects.

The work of Z. Varnay makes a significant contribution to the study of the relationship between language and identity of indigenous peoples in Arctic cities. In one of his articles [20], the author uses sociolinguistic interviews with young people in Dudinka to explore ways of constructing ethnic identity through the prism of language practices, attitudes towards languages and participation in language projects. Co-authored with A. Hamori [21], Z. Varnay applies a critical sociolinguistic and discourse analytical approach to analyze the representation of the Nenets, Dolgans, Nganasans, Evenks and Enets on online media platforms, focusing on the relationship between languages,

culture, and identity. In another work, written jointly with S. Szeverényi [22], the researchers examine the activities of organizations, language situation, language use patterns and language attitudes of representatives of the indigenous peoples of the North in Dudinka in the context of studying their ethnic identity.

These studies demonstrate that language is one of the key markers of ethnic identity for indigenous and "newcomer" communities in Arctic cities. Language practices, attitudes and perceptions are closely linked to processes of ethnic self-identification in a multilingual and multicultural urban environment. At the same time, urbanization not only creates risks of language shift and the blurring of ethnic boundaries, but also opens up new opportunities for redefining and rethinking the role of language as a symbolic resource of identity. In this context, it seems appropriate to conduct research aimed at studying the mechanisms of the mutual influence of language and identity in Arctic cities and identifying the factors that contribute to the preservation and development of minority languages as the basis of ethno-cultural identity in the urbanized Arctic.

Visual presence of languages in Arctic urban spaces

Studies of the linguistic landscape of Arctic cities reveal the important role of visual elements such as road and shop signs, advertising texts and public inscriptions in representing the linguistic and cultural diversity of indigenous peoples. M. Daveluy and J. Ferguson [23], analyzing public signs in the Canadian cities of Iqaluit and Kuujjuaq, note the coexistence of various fonts and languages, including the use of several graphic systems of the Inuit language. The researchers emphasize that visual elements of the urban environment reflect the specifics of language policy and the cultural identity of the Canadian Inuit.

A number of studies focus on the role of the linguistic landscape in shaping the authentic environment and developing the tourist appeal of cities. M. Moriarty [24], using the example of Dingle in Ireland, demonstrates how the Irish language is mobilized as a valuable resource and tourist commodity, influencing the local economy. M. Olnova [25], studying the linguistic landscape of the city of Kirkenes, reveals the connection between language and the development of the new economy and cooperation between Russia and Norway.

A comparative analysis of the linguistic landscape of northern cities is presented in the work of Z. Durai, C. Horváth and Z. Várnai [26], which examines the role of visual elements in the preservation and expression of the linguistic and cultural diversity of indigenous peoples living in Enontekö, Dudinka and Khanty-Mansiysk. The authors emphasize the importance of visual multilingualism as a form of communication for Arctic minorities in urban environments.

Studies devoted to the analysis of urbanonyms as an important component of the linguistic landscape are of particular interest. E.N. Egorova, K.A. Tikhonova and I.N. Feldt [27; 28; 29], using the example of the city of Arkhangelsk, reveal the influence of sociocultural situation on the processes of naming urban objects and the role of urbanonyms in shaping the linguistic and cultural environment of the city. R. L. Valijärvi and L. Kahn [30], studying the linguistic landscape of Nuuk,

the capital of Greenland, analyze the representation of West Greenlandic, Danish, and English in public spaces and their connection to language policy and the city's sociocultural dynamics.

In general, studies of the visual presence of languages in Arctic urban spaces emphasize the importance of the linguistic landscape as an indicator of the linguistic situation, a means of expressing cultural identity, and a tool of language policy. Visual elements of the urban environment not only reflect the linguistic and cultural diversity of Arctic communities, but also actively contribute to the formation of the symbolic value of minority languages and their mobilization as an economic and tourist resource. Promising tasks include identifying the role of the linguistic landscape in the revitalization and support of the languages of the indigenous peoples of the Arctic and studying the dynamics of the visual presence of languages in the context of globalization and the development of new technologies.

Language initiatives, ideologies and practices of various groups of the Arctic urban population

Studies analyzing the language initiatives, ideologies, and practices of various groups of the Arctic urban population demonstrate the complex interrelationships between sociocultural, psychological, and historical factors influencing the linguistic behavior and attitudes of urban residents. For example, T. Owens and P. Baker [31], studying the problems of language insecurity among the population of the Canadian city of Winnipeg, analyze the connection between psychological and sociocultural aspects and feelings of uncertainty in using Canadian English in a multilingual environment.

A number of studies focus on the role of language initiatives and programs implemented by indigenous peoples themselves in preserving and developing ethnic languages and cultures in urban environments. Using the example of urban Inuit in Ottawa, D. Patrick and J. Tomiak [32] demonstrate the importance of community-driven language and culture development programs for creating a sense of community and expanding access to employment and services in the city. D. Patrick, G. Budach and I. Muckpaloo [33], drawing on their experience of implementing a literacy project among the Inuit of Ottawa, describe the potential of such initiatives as a driving force for family language policies aimed at preserving and developing linguistic traditions.

Studies devoted to the analysis of new language practices and their role in constructing the identity of urban youth are of particular interest. For example, P. Quist and B. Svendsen [34], applying a multi-level approach to the study of language practices in Scandinavian cities, conduct a structural and phonological analysis of innovative language forms, examine their perception by city residents, and discuss the role of language in the formation of youth identity.

Researchers are also addressing the issues of integrating the languages and cultures of migrants into the urban space of the Arctic. In this regard, the study of P. McDermott [35] is of interest. Analyzing the situation of migrant languages in Belfast and Derry / Londonderry, he pays particular attention to describing the interactions of migrants with the local population and the role of cultural spaces in the processes of linguistic and cultural integration.

Studies devoted to the analysis of linguistic ideologies and attitudes in the context of language change deserve special attention. D. Morgunova-Schwalbe [36], comparing the stability of the Yupik language in the town of Gambell in Alaska and in the Russian-speaking village of Novoe Chaplino in the Far East of Russia, focuses on the study of linguistic ideologies and the attitudes of native speakers toward language change.

Thus, studies of language initiatives, ideologies, and practices of various groups of the urban population of the Arctic reveal a diversity of factors influencing linguistic behavior and attitudes in the context of urbanization and language contact. Of particular importance are the initiatives of indigenous peoples and migrants themselves to preserve and develop their native languages and cultures, as well as the role of urban cultural spaces in the processes of linguistic and cultural integration. In this regard, research is required to reveal the significance and characteristics of the mechanisms of formation and transformation of linguistic ideologies and practices in the context of Arctic urbanization, as well as the potential of "bottom-up" language initiatives in the revitalization of minority languages.

Special monitoring studies conducted by the Ob-Ugric Institute of Applied Researches and Development in the Khanty-Mansi Autonomous Okrug – Yugra make a significant contribution to the study of the functioning of the languages of the indigenous peoples of the North in the context of urbanization. The works of A.A. Galyamov [37–39], devoted to the analysis of the language situation in the cities of Surgut and Khanty-Mansiysk, focus on describing the language preferences and level of native language proficiency among representatives of the indigenous peoples of the North. These studies provide a detailed overview of the linguistic behavior and attitudes of the urban population and identify factors influencing the preservation and development of minority languages in an urbanized environment.

Another important aspect of studying the language situation in the cities of the Khanty-Mansi Autonomous Okrug – Yugra is the analysis of the linguistic attitudes of the indigenous peoples of the North in the field of ethno-cultural education. An article by S.Kh. Khaknazarov [40], devoted to the study of this issue using the cities of Kogalym and Langepas as examples, makes a valuable contribution to understanding the role of educational institutions in shaping the linguistic ideologies and practices of the urban population.

It should be noted that the regular nature of monitoring studies conducted by the Ob-Ugric Institute allows not only to record the current state of the language situation, but also to track the dynamics of linguistic processes in the cities of the Khanty-Mansi Autonomous Okrug – Yugra over a long period. These data can serve as a basis for the development of effective language policy and planning measures aimed at supporting and revitalizing the languages of the indigenous peoples of the North in the context of urbanization. Overall, specialized monitoring studies of the functioning of the languages of indigenous peoples of the North in the cities of the Khanty-Mansi Autonomous Okrug – Yugra make a significant contribution to the development of Arctic sociolinguistics and can

serve as an example for organizing similar research in other regions of the Russian and international Arctic.

Conclusion

The review and systematization of studies devoted to the sociolinguistic aspects of multilingualism in Arctic cities allow us to draw a number of conclusions. First of all, it should be noted that the study of the linguistic situation in the urbanized Arctic environment is based on a comprehensive interdisciplinary approach that combines methods of sociolinguistics, urban studies, anthropology and related disciplines. The theoretical and methodological basis of the research consists of the concepts of language shift, language ecology, language landscape, and critical sociolinguistics.

Empirical data on individual Arctic cities reveal the complex dynamics of linguistic interaction, conditioned by the influence of urbanization, migration, globalization, and industrialization. Despite the risks of linguistic assimilation and the loss of indigenous languages, urbanization simultaneously creates the conditions for their revitalization and the development of new forms of ethno-cultural self-expression. Although there are local specifics, the functioning of languages in the urban space of the Arctic is characterized by a number of common patterns, such as a reduction in the use of minority languages, an increase in linguistic diversity due to both internal and external migration, activation of “bottom-up” language initiatives, and transformation of linguistic ideologies and practices in the context of multiculturalism.

The key factors in preserving linguistic diversity in Arctic cities include institutional support and linguistic loyalty of native speakers, as well as mobilization of language as a cultural and economic resource. At the same time, assimilation processes, the limited use of minority languages, and the declining linguistic competence of the younger generation are factors contributing to language loss. The prospects for the development of multilingualism in Arctic cities are linked to the implementation of balanced language policies and planning aimed at supporting and revitalizing the languages of indigenous peoples, expanding the functionality of minority languages in the public sphere, and shaping attitudes towards the value of linguistic diversity.

As the analysis demonstrates, only a comprehensive, interdisciplinary approach to this issue, based on a combination of sociolinguistic analysis with methods from urban studies, anthropology, geography, and other disciplines, will make it possible to develop scientifically sound recommendations for the preservation and development of linguistic diversity as a key component of sustainable development in the Arctic region in the context of rapid socio-cultural change. A comparative study of linguistic situations in different Arctic cities will help to identify universal patterns and local specifics of linguistic interaction and to develop effective models and indicators for assessing multilingualism in the urbanized Arctic environment.

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Mechanisms of Interaction between the Labor Market and Higher Education in the Arctic Zone of the Russian Federation

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Abstract. This paper examines the problem of interaction between the labor market and the higher education system in the Arctic Zone of the Russian Federation (AZRF) using the Murmansk and Arkhangelsk Oblasts as examples. The relevance of the topic is determined by the structural imbalances between the demand for qualified personnel and the supply from educational organizations, which leads to a shortage of specialists in key sectors of the regional economy. The aim of the work is to identify key coordination mechanisms between these institutions to reduce the unemployment rate, increase employment, and supply the AZRF regions with specialists capable of working effectively in Arctic conditions. The research is based on an integrated approach, combining the analysis of Rosstat data, results from a survey of students and graduates of AZRF universities, and expert interviews with representatives of universities, employers, and public authorities. Key problems were identified: mismatch between graduates' competencies and employers' requirements, lack of practical training, low awareness of the labor market situation, and the outmigration of young people. Based on the data obtained, the authors propose a model of interaction that includes an analytical and forecasting unit for monitoring personnel needs, modernization of the personnel training unit through joint educational programs with employers and strengthening the practice-oriented component of training, as well as a unit to promote employment and retention of young specialists in the region. The implementation of the proposed mechanism will reduce the structural gap between education and the economy, mitigate the labor shortage in the Arctic regions, and improve the quality of specialist training.
Keywords: *mechanisms of interaction, labor market, higher education, Arctic zone of the Russian Federation*

Introduction

The problem of aligning labor market requirements with the outcomes of higher education remains relevant in the context of economic development of the Arctic zone of the Russian Federation (AZRF).

The imbalance is manifested in the fact that a significant proportion of university graduates are employed in positions that do not correspond to their qualifications, which indicates that educational programs are not sufficiently adapted to the real needs of the economy [1, Zaikov K.S., Kondratov N.A., Kudryashova E.V., et al.]. This problem, which has become more acute since the 1990s during systemic economic transformations, is complex in its socio-economic nature and

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requires a systematic approach to its solution. This study focuses on identifying and analyzing mechanisms capable of ensuring effective interaction between the labor market and educational organizations in the specific conditions of the Arctic Zone of the Russian Federation. The development of such mechanisms is of considerable importance to employers interested in skilled personnel and to universities seeking to increase the employment rate of their graduates. Overcoming the gap between market demands and the quality of educational services will enable the training of specialists in demand in the region, which, in turn, will contribute to reducing unemployment, increasing employment, and improving the efficiency of labor activity in the Arctic regions.

Thus, the aim of this study is to develop a model of interaction between the labor market and the higher education system in the Arctic zone of the Russian Federation based on an analysis of the situation in the Murmansk and Arkhangelsk Oblasts. To achieve this goal, the following tasks were set:

- to analyze the dynamics of key labor market indicators (unemployment, employment, and graduate employment) in the Arctic regions of the Russian Federation with universities for the period 2017–2024;
- to identify key problems and to assess the effectiveness of existing forms of interaction based on a sociological survey of students and graduates, as well as expert interviews with university representatives and employers;
- to develop and to describe an authors' model of interaction mechanism, including analytical, forecasting, organizational, and practical components.

Materials and methods

The methodological basis of the study was a comprehensive approach combining statistical data analysis, sociological methods (surveys), and qualitative methods (expert interviews). The purpose of this approach was to assess the extent to which the competencies of AZRF university graduates correspond to the current and future needs of the regional economy.

The quantitative analysis was based on data from:

- Federal State Statistics Service (Rosstat): employment and unemployment indicators in the Arctic regions;
- Ministry of Labor and Social Development: information on vacancies, requirements for applicants, and the number of registered unemployed graduates;
- Internal reporting of AZRF universities: statistics on graduate employment, their specializations, places of work and income levels.

The qualitative component of the study included a questionnaire survey of students and graduates of leading universities in the Murmansk and Arkhangelsk Oblasts. The sample of regions was determined by the criterion of the presence of universities — centers of higher education that train personnel for the entire macro-region. A total of 256 people took part in our study: 67.2% were students and 32.8% were graduates; 56.6% were women and 43.4% were men, aged 18 to 57. The

sociological survey was conducted from October 2025 to May 2025 and was based on a target sample representative of the student contingent and recent graduates of the above-mentioned universities. The survey was conducted online. It covered leading educational institutions in these regions, including Northern (Arctic) Federal University named after M.V. Lomonosov and its branches, Northern State Medical University, Murmansk Arctic University, Murmansk Academy of Economics and Management, and Fedorovsky Polar State University. Respondents represented a wide range of specialties: from the humanities (sociology, pedagogy, journalism) to technical (mining, engineering, electrical engineering, shipbuilding) and medical fields.

Five semi-structured expert interviews were conducted (April–May 2025) with representatives of career centers, university administrations (NArFU, NSMU, Institute of Creative Industries and Entrepreneurship), and employers (e.g., JSC Sevmash). The criterion for selecting experts was at least 10 years of experience in education management, career counselling or personnel management, allowing their statements to be classified as expert assessments.

The interviews focused on assessing the current state of interaction, effective cooperation mechanisms, the quality of graduate training, and the role of the state in regulating this process. Integration of the data obtained made it possible to formulate a comprehensive assessment of the situation and propose a model for effective interaction.

Discussion

The interaction between the labor market and higher education in the Arctic zone of the Russian Federation is one of the key aspects of sustainable socio-economic development of the region. Current scientific literature emphasizes that training qualified personnel in the Arctic requires a systematic and comprehensive approach that takes into account the specific natural and climatic conditions of the region and the dynamics of technological development [2, Sigova S.V.]. A team of authors from the Northern (Arctic) Federal University (NArFU) highlights the strategic importance of training highly qualified personnel for the implementation of national projects in the Arctic. The main focus is on modernizing educational standards, developing network-based forms of learning, and creating specialized research and educational centers to improve the quality of specialist training [3, Zaikov K.S., Kondratov N.A., Kuprikov N.M., et al.]. These approaches make it possible to adapt the education system to the needs of the Arctic labor market, contributing to increased labor efficiency and work safety.

The research by I.P. Efimova, V.A. Gurtov, I.S. Stepus provides quantitative parameters of this problem. Using a macroeconomic methodology and survey data from 3,413 employers, the authors created a consolidated forecast of labor force needs for the entire Arctic zone of the Russian Federation. The calculations show that the annual additional demand (AAD) for the Arctic zone economy is 73,800 people, of which approximately 70% are required for replacing natural attrition and maintaining current growth, and the rest are needed to implement new investment projects. The details of the demand are particularly valuable: 33% of the required specialists are to have

higher education, and 46% — secondary vocational education. A list of the 64 most in-demand professions has been compiled, divided into four categories: regional, industry-specific, specific to the Northern Sea Route, and new ("professions of the future"), such as UAV operator for deposit exploration or Arctic navigation specialist [4].

The statistical study by E.A. Pitukhina et al. provides empirical evidence of the systemic nature of the challenges faced by the Arctic regions. Applying cluster analysis methods to official statistics, the authors classify most regions of the Arctic zone of the Northwestern Federal District and the Far East as clusters with the lowest educational migration rates (9% in Cluster 1 versus the Russian average of 27%) [5]. This quantitatively confirms the thesis about their low attractiveness to applicants and, consequently, about the risks of chronic staff shortages, formulated in the study by I.P. Efimova, V.A. Gurtov, and I.S. Stepus.

The study by A.A. Saburov et al. reveals current problems of assessing the competencies of employees of enterprises in the leading industries of the Arkhangelsk Oblast — shipbuilding, forestry, and fishing — in the context of digitalization and automation of production. The authors note the existing gap between the competencies of educational institution graduates and the requirements of modern employers, particularly in terms of professional and "soft" skills. The need to enhance the role of "soft" skills in educational programs to increase the adaptability of specialists and their competitiveness in the regional labor market is emphasized [6].

The analysis conducted in the article by S.V. Sigova and I.S. Stepus, using the example of Petrozavodsk State University, makes an important empirical contribution to this discussion, demonstrating that the key mechanism for improving the effectiveness of interaction is the implementation of a system of strategic planning and monitoring of university activities based on key performance indicators (KPIs). This approach, which covers all levels of the university, allows educational outcomes to be directly linked to the development priorities of the macro-region. The study reveals that even within the Arctic zone's extensive educational network, significant structural imbalances remain. A forecast of personnel needs, aligned with regional development strategies, is a necessary tool for "fine-tuning" the structure of admissions and graduations. Furthermore, the authors emphasize the critical role of interregional graduate migration and cooperation with neighboring territories (using the Republic of Karelia as an example) in compensating for personnel shortages, which indicates the effectiveness of network forms of interaction in recipient regions [2].

The article by I.S. Stepus and S.V. Shabaeva, "Present and Future of the Russian Arctic Zone Regions Labor Market: Occupations in Demand", makes a significant contribution to understanding the current and future needs of the labor market. Based on an analysis of employment service data, TOP-region lists, and recruitment portals, the authors compile a detailed list of the 200 most in-demand professions, grouped by priority sectors of the Arctic Zone of the Russian Federation economy (mining, transport, shipbuilding, energy, etc.). The study demonstrates the dominance of blue-collar professions (70–80% of demand) and confirms the long-term nature of the strategic priorities for the development of the Arctic. Of particular value is the forecast section of the study, in which

the authors identify the “professions of the future” that are being transformed by technological trends (digitalization, robotization) [7].

The article by M.A. Kazanina, “Human Resource Potential and Human Capital in the Development of the Arctic Regions: The Role of Education”, offers a theoretical understanding of the problem through the prism of related categories such as “human resources”, “labor potential”, and “human capital”. The author systematizes existing research and identifies key, highly controversial issues: structural imbalances between university graduation rates and economic needs, as well as the loss of human capital due to migration outflow. An important conclusion is that the problem often lies not in a physical shortage of specialists, but in their unwillingness to work in the Arctic regions, which indicates the inadequacy of purely “quantitative” measures and requires comprehensive solutions to increase the attractiveness of these territories [8].

A review of scientific publications reveals the following key trends:

- the presence of a significant and structurally complex human resource demand in the AZRF, estimated at 73,800 people annually, with a high proportion of the need for specialists with secondary vocational and higher education;
- the increasing role of digitalization and automation as factors influencing employee qualification requirements and shaping demand for “professions of the future”;
- the persistent negative trend in educational migration from Arctic regions and the catastrophic decline in the capacity of the local higher education system, quantitatively confirmed by statistical methods;
- the critical dependence of the AZRF economy on external labor resources (rotation work, migration), the volume of which should be increased;
- the need to develop flexible educational programs that take into account not only regional characteristics and strategic focus, but also factors of quality of life that are important to young people (culture, infrastructure, safety);
- the importance of developing interdisciplinary skills, including “soft” skills necessary for the successful integration of graduates into production teams;
- strengthening cooperation between universities and employers in order to promptly update the content of educational programs and improve the quality of training.

Modern scientific discussion focuses on searching for effective mechanisms of interaction between the labor market and higher education, which is particularly relevant for the extreme conditions of the Arctic zone. This study aims to fill these gaps by identifying and systematizing specific mechanisms for interaction between the labor market and higher education in the Arctic Zone of the Russian Federation and analyzing the effectiveness of existing coordination tools (network-based forms, targeted training, and specialized departments).

Thus, this article contributes by shifting the focus from identifying problems to analyzing and designing specific mechanisms capable of improving the effectiveness of the labor market higher education system, using the Arkhangelsk Oblast as an example.

Research results

We have analyzed the unemployment rates in the constituent entities of the Arctic Zone of the Russian Federation with higher education institutions for 2017–2024 (Fig. 1).

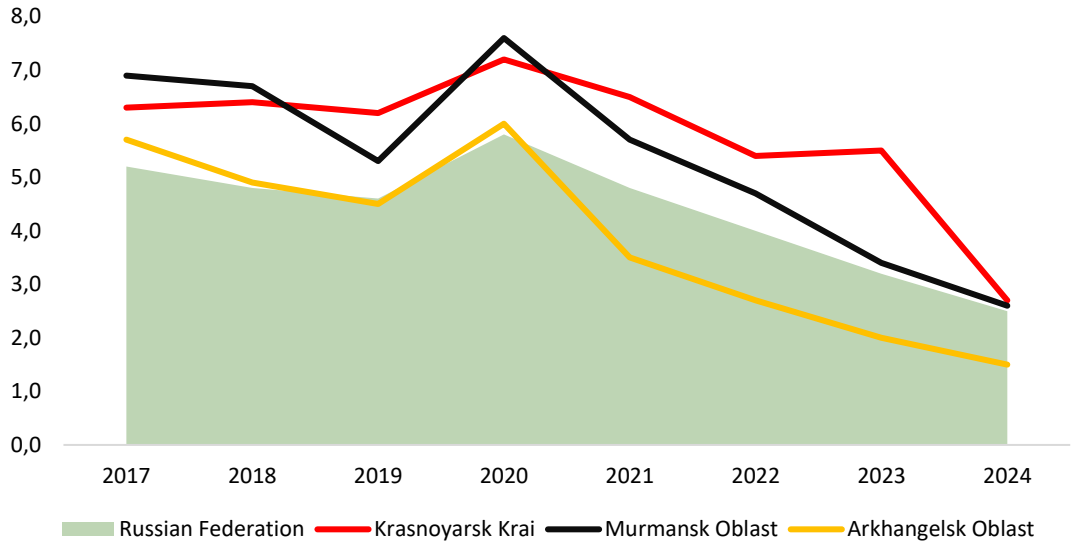

Fig. 1. Unemployment rate of the population aged 15 and older in the AZRF for 2017–2024 [1], %.

An analysis of the dynamics of the unemployment rate in the constituent entities of the Arctic Zone of the Russian Federation with higher education institutions for the period 2017–2024 (Fig. 1) revealed significant interregional differences. For most of the period under review, the unemployment rates in most Arctic regions, with the exception of Krasnoyarsk Krai, exceeded the Russian average. This situation suggests an imbalance between the higher education system and labor market demands, including a mismatch between training profiles and the economic needs of the regions, as well as challenges with the adaptation and retention of young specialists in the region.

By 2024, all regions of the Arctic Zone of the Russian Federation demonstrate positive dynamics, with a decline in unemployment rates. “The most significant reduction in this indicator was recorded in Krasnoyarsk Krai, where, starting in 2021, the unemployment rate not only steadily declined, but also became lower than the national average. In the Arkhangelsk Oblast, by 2024, the indicator’s value had halved compared to 2017, and in the Murmansk Oblast, it had decreased by 2.6 times” [2], which generally correlates with national trends.

An analysis of the employment rates (Fig. 2) also confirms regional variability. In the Arkhangelsk Oblast, the employment rate remained consistently below the Russian average throughout the entire period, indicating systemic problems in the interaction between the educational and

[1] Rosstat. Labor Force, Employment, and Unemployment. URL: https://rosstat.gov.ru/labour_force (accessed 07 April 2025).
[2] Ibid.

economic spheres. Meanwhile, in other regions of the Arctic Zone of the Russian Federation, the employment rate exceeded the national average, which may indirectly indicate more effective co-operation between educational institutions and employers, the relevance of educational programs, and the demand for graduates in the local labor market. It is noteworthy that some regions, such as the Murmansk Oblast, have high employment rates combined with high unemployment rates. This phenomenon can be explained by the influence of seasonal employment, internal labor migration, and structural unemployment, where existing vacancies do not match the qualifications of job seekers.

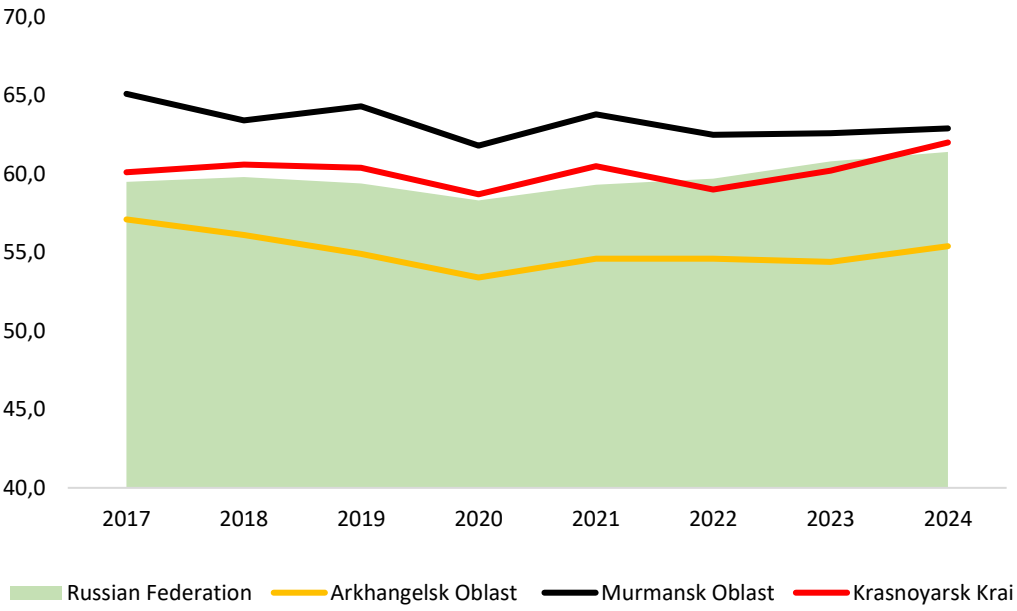

Fig. 2. Employment rate of the population aged 15 and older in the AZRF for 2017–2024 [3], %.

Employment rates in the regions of the Arctic Zone of the Russian Federation are unstable. There is no consistent trend in any of the constituent entities of the AZRF towards either a decline or an increase in employment. Differences in employment rates between regions are due to the diversity of economic development, demographics, and the effectiveness of interactions between education and the labor market.

Analyzing the relationship between employment and unemployment rates, it should be noted that in the Arkhangelsk Oblast, the employment rate is below the Russian average, while the unemployment rate is higher, which is typical for a region experiencing economic difficulties. At the same time, the Murmansk Oblast demonstrates a high level of employment, despite an unemployment rate that exceeds the Russian average. Let us consider the employment rates of university graduates in the Arctic Zone of the Russian Federation for the period 2016–2020 (Table 1).

[3] Ibid.

Table 1

Employment structure of graduates of educational institutions in 2016–2020, who sought employment after graduation, by duration of job search, by AZRF regions [4]

	Total number of graduates seeking employment (%)	including								
		employed	of these ,during							not employed
			less than 1 month	1–3 months	3–6 months	6–9 months	9–12 months	1–3 years	more than 3 years	
Russian Federation	100	93.2	34.7	14.5	20.5	9.3	2.7	9.7	1.7	6.8
Arkhangelsk Oblast	100	86.2	44.9	15.1	7.8	5.0	-	9.6	3.7	13.8
Murmansk Oblast	100	97.4	35.1	19.3	13.5	5.3	4.8	14.5	4.9	2.6
Krasnoyarsk Krai	100	90.6	30.5	9.6	17.4	9.6	3.4	17.6	2.5	9.4

Analysis of the data presented allows us to make the following conclusions. Overall, in the Russian Federation, the majority of university graduates (93.2%) find work after graduating, while 6.8% remain unemployed. The largest share of graduates (34.7%) finds employment within the first month after graduation, followed by 3 to 6 months (20.5%) and 1 to 3 months (14.5%). Long-term job searches lasting more than 3 years are rare.

In the Arkhangelsk Oblast, the graduate employment rate is below average, at 86.2%. In contrast, in the Murmansk Oblast, the employment rate reaches 97.4%. The majority of graduates in the Arkhangelsk Oblast find work in less than one month (44.9%). A long job search of more than one year is noted for 13.3% of graduates, which is significantly higher than the national average. These data indicate the varying effectiveness of interactions between educational institutions and employers across the Arctic Zone of the Russian Federation. The faster graduates find work, the higher the consistency of educational programs with the needs of the labor market. A long job search may indicate that graduates' qualifications do not meet employers' requirements or that there is a shortage of jobs.

In 2021, the Federal State Statistics Service conducted a special study aimed at identifying the main difficulties faced by university graduates when seeking employment [5]. According to a survey of 2016–2020 graduates in the AZRF, the main obstacles are a lack of practical experience, a shortage of suitable vacancies, and low salaries. These problems coincide with nationwide trends (Fig. 3).

[4] Rosstat. Federal statistical sample survey of employment of graduates with secondary vocational and higher education. URL: https://rosstat.gov.ru/free_doc/new_site/population/trud/itog_trudoustr_2021/index.html (accessed 07 April 2025).
[5] Ibid.

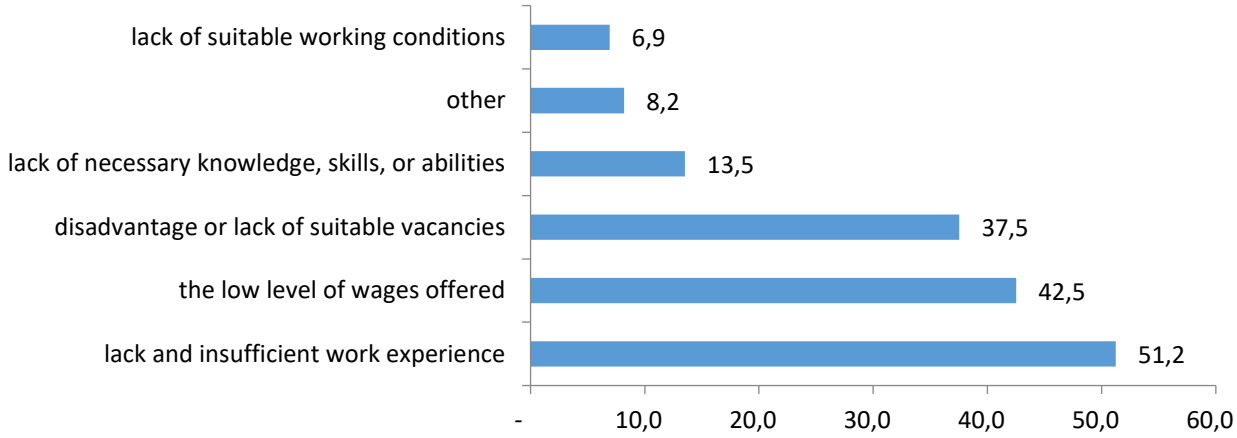

Fig. 3. Difficulties in finding work in the Russian Federation in 2016–2020, % [6].

Key problems with the quality of education and interaction with the labor market

The first problem is related to the low quality of education, the absence of modern technologies, and the lack of practical training in universities. To improve efficiency, it is necessary to develop practical training programs for students, expand internship opportunities at enterprises in the Arctic Zone of the Russian Federation, and more actively involve employers in the educational process. This includes the creation of specialized internship bases, the organization of joint projects and the adjustment of training programs to meet the requirements of employers.

The second problem is the graduation of specialists who do not meet the current needs of the regional labor market. To successfully solve this problem, it is necessary to conduct a systematic analysis and forecasting of labor demand, adjusting educational programs and training volumes. It is also important to stimulate the creation of new jobs, taking into account the specifics of the northern region.

The third problem is related to the level of economic development of the territories, which affects the attractiveness of work for young specialists. It is necessary to increase the attractiveness of the region through the development of social infrastructure, the provision of benefits and compensation, as well as the stimulation of employers to offer competitive salaries.

An analysis of the federal study for 2016–2020 identified the key reasons for job dissatisfaction: low wages, lack of career prospects, and uninteresting work tasks [7]. In the AZRF, these factors are compounded by excessive management demands, conflicts with superiors, and tense relationships within the team (in the Murmansk Oblast), as well as work below the level of qualification (Krasnoyarsk Krai).

[6] Source: compiled by the authors based on the results of a sociological survey.
[7] Rosstat. Federal statistical sample survey of employment of graduates with secondary vocational and higher education. URL: https://rosstat.gov.ru/free_doc/new_site/population/trud/itog_trudoustr_2021/index.html (accessed 07 April 2025).

Results of the sociological study

A study of graduates' motivation for choosing a specialization showed that when seeking employment, 50.1% of respondents chose their specialization based on career prospects in the AZRF, 39.4% — on their interests, and 7.5% — on the advice of friends and family. The passing score on the Unified State Examination (USE) also played a significant role, limiting their choice. Currently, 60.5% of respondents are employed in their specialty or in a related field in the region, while 25.8% — in a non-related field, most often due to temporary work during their studies, which allows them to combine both. About 9.4% are unemployed and are not looking for work (mostly students), while 4.3% are in active search of employment.

The search for their first job after graduation took less than a month for 34.9% of respondents, 1 to 3 months for 18.9%, and 3 to 6 months for 14.1%. About 10.2% spent more than six months to a year looking for job, and 4.7% — more than a year. At the same time, 9.4% started working while studying, primarily in medical specialties.

Alignment of competencies with market requirements

A total of 65.2% of respondents believe that knowledge and skills acquired at university partially or fully meet the requirements of employers (16.4% — fully, 8.5% — partially). Only 2% assess their competencies as inadequate.

The most valuable skills for work are considered to be information processing (26.5%), communication skills (22%), practical (15.8%) and theoretical (10.6%) knowledge in the field of specialization. Self-education skills (0.2%) and knowledge of foreign languages (3.2%) are significantly less valuable.

Respondents cited a lack of practical skills, outdated training programs and limited knowledge of specialized software as the main obstacles to successful employment and work. Only 51.6% are satisfied with the level of practical training at the university, 37.1% rate it as neutral, 5.9% are completely satisfied, and 5.4% are rather or completely dissatisfied. About 52.3% believe that universities partially inform students about the situation and trends in the labor market, 30.9% are convinced that there is almost no information, and only 6.6% are satisfied with the current level of information.

Students and graduates noted several forms of cooperation with employers:

- targeted training commissioned by companies — 34.3%;
- organization of internships and practical training — 26.5%;
- job fairs and career days — 22.4%;
- participation of employers in adjusting educational programs (1.5%) and research projects (3.4%);
- guest lectures and master classes from company representatives — 6.4% (see Fig. 4).

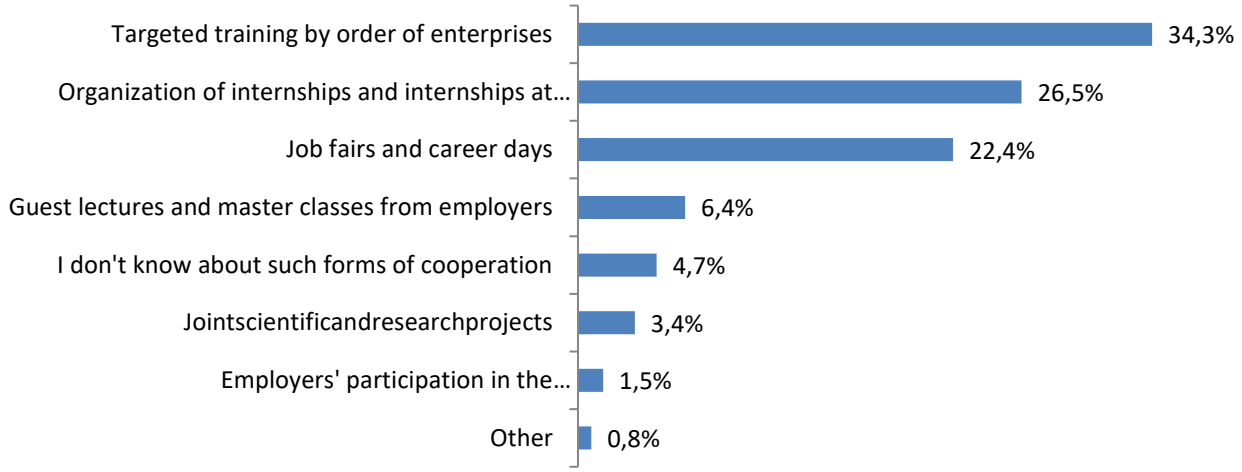

Fig. 4. Forms of cooperation between universities and employers, % [8].

The study revealed a significant gap between the potential for interaction between universities and companies and actual practice. The vast majority of respondents (93%) did not participate in any joint events between educational institutions and employers, such as job fairs, workshops, or meetings with company representatives. The extremely low level of engagement (7%) indicates that communication channels aimed directly at the student audience in the Arctic region are underdeveloped or unsystematic. It is important to note that students who participated in such events generally rated them as useful (6.3% of respondents), highlighting their potential effectiveness if they were more widely spread.

Forms of cooperation between AZRF higher education institutions and employers

The central issue of the study was the respondents' assessment of the effectiveness of various forms of cooperation between higher education institutions and business structures in the AZRF. According to the respondents, the most effective form of interaction is the participation of employers in the development and updating of educational plans and programs (32.7%). This mechanism allows the demands of the real sector of the economy to be integrated directly into the educational process, ensuring its practical orientation and contributing to the training of specialists whose competencies best meet the requirements of the Arctic labor market.

The second most important measure is the involvement of practicing specialists in teaching activities (23.2%). This form of cooperation contributes to the transfer of relevant professional experience, strengthens the link between theoretical training and practical tasks, and increases student motivation.

The organization of industrial training and internships was also highly rated (19.6%), as it is traditionally considered a key element of practical training. In the context of the Arctic zone, where the specifics of industrial activity have a distinct regional component, the importance of well-organized practical training cannot be overestimated.

[8] Source: compiled by the authors based on the results of a sociological survey.

At the same time, such forms as the creation of specialized departments at enterprises (4.1%) and conducting excursions (1.4%) were considered by respondents as the least effective (Fig. 5). Low ratings for specialized departments may be explained by their limited availability or the formal nature of their work in the realities of the AZRF, while excursions are probably perceived as a passive and unsystematic way of interaction.

These data indicate that students prioritize in-depth, integrated forms of cooperation within the educational process, which directly influence the quality and content of their training. This sets the direction for the further development of mechanisms for interaction between education and the labor market in the Arctic zone of the Russian Federation.

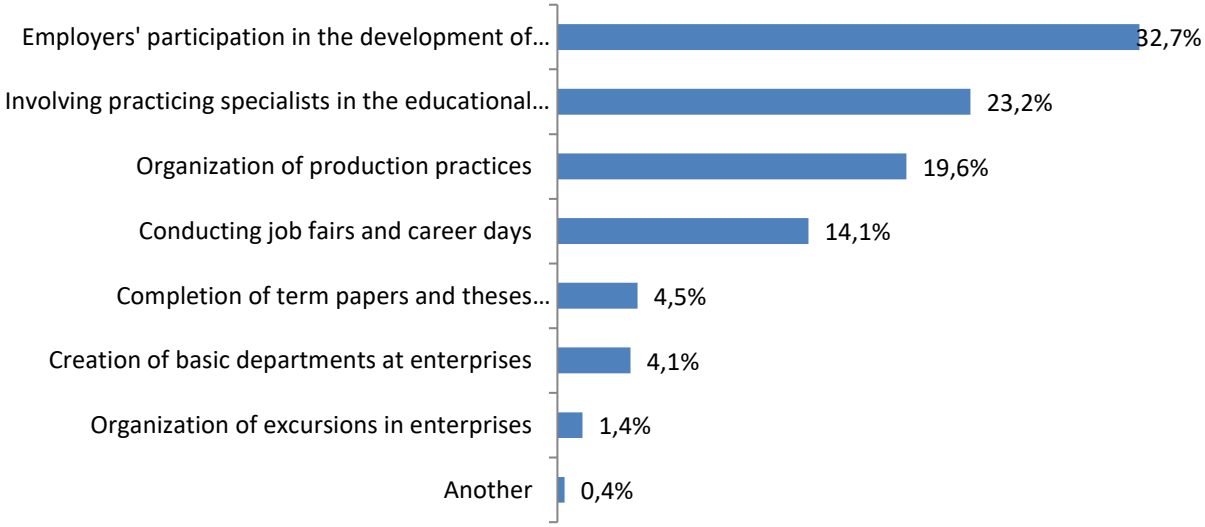

Fig. 5. Effective forms of cooperation between universities and employers, % [9].

Analysis of graduate employment and career expectations

Empirical data shows that 54.2% of respondents did not encounter difficulties in finding employment in their field of study at AZRF. However, for the rest of the graduates (45.8%), the main barriers were: low salaries (54.2% of those who encountered difficulties), lack of work experience (11%), excessive employer requirements (7.1%), a shortage of vacancies in their field (5.1%) and a lack of practical skills (2.7%). The dynamics of priorities are noteworthy: while previously the main problem was a lack of work experience, today graduates cite insufficient income as the key constraint.

Optimism prevails in the assessment of their own career prospects: 58.6% of respondents rated them as “good”, and 23.8% — as “very good”. Nevertheless, a significant proportion of respondents (18%) do not consider their prospects to be positive (12.9% found it difficult to answer, 3.9% rated them as satisfactory, and 0.8% as poor). This indicates a structural problem, whereby the profession obtained is not fully perceived as relevant and in demand in the modern labor market.

According to the respondents, universities need to implement a set of measures to increase the competitiveness of their graduates. These include improving the quality of education,

[9] Source: compiled by the authors based on the results of a sociological survey.

intensifying cooperation with employers, creating new specialties in line with market demand, updating educational programs, modernizing material and technical facilities, and strengthening career guidance and practical training.

The most effective mechanisms for interaction are joint projects, employer participation in the development of educational programs, organization of job fairs, compulsory industrial training, employment assistance systems, and targeted training.

Expert assessment of the current state of cooperation

Expert interviews conducted with representatives of NArFU (Career and Employment Center), the Institute of Creative Industries and Entrepreneurship, and NSMU confirmed both positive practices and systemic challenges. One of the strengths is the well-established process of student internships at enterprises. During internships, students not only develop professional competencies, but also audit the companies' activities: strengths and weaknesses are identified, and the research findings often form the basis of their theses and are implemented in production. There have been cases when students, starting with their training, have been "assigned" to an organization and subsequently employed there.

However, the weaknesses include the limited base for internships, which does not always meet the needs of students, and the passive position of a number of employers, who expect "ready specialists" but are unwilling to be engaged in the educational process at the training stage. An effective solution could be their participation in the development of educational programs and the creation of a "labor reserve" while students are still studying.

Using the example of the Arkhangelsk Oblast, where two leading higher education institutions operate, respondents note the relatively high effectiveness of the higher education system in preparing graduates for the demands of the modern labor market. According to representatives of the Career and Employment Center of the Northern (Arctic) Federal University, this is indirectly confirmed by the steady demand for university graduates from employers.

Expert interviews made it possible to forecast the professions that will be in demand in the Arkhangelsk Oblast over the next 5–10 years. These include specialists in the "support" sector: medical workers, teachers, psychologists, as well as engineers, IT specialists, economists and managers.

As the respondents emphasize, the key factor will be the implementation of large infrastructure projects in specific Arctic territories. In this context, universities face a dilemma: the need to simultaneously respond to the demands of applicants and the requirements of employers. To resolve this dilemma, the state should play an active role in making accurate and informed forecasts of the demand for professions in the medium term.

The state's involvement in regulating the interaction between the labor market and higher education is primarily manifested in the formation of educational standards and the determination of admission quotas (AQ). However, respondents point to the problem that AZRF universities are

included in the general list of educational institutions when setting AQs, without taking into account their specific Arctic focus and the region's staffing needs.

Another acute problem noted by experts is the "educational gap": graduates often leave university with knowledge that is already partially outdated. Acquiring practical skills is hampered by the low effectiveness of industrial internships. The proposed solution is to closely integrate business into the educational process through master classes, excursions to enterprises, and other forms of cooperation. In a global sense, it is necessary to adapt the production process to the educational process.

A striking example of effective collaboration is the "Plant–Higher Technical University" program, implemented at the NArFU branch in Severodvinsk. This program is characterized by a high proportion of practical training and close integration with the specific workplace, which allows for the graduation of highly qualified specialists fully adapted to their future work.

Among successful cases of cooperation between universities and businesses, respondents highlight the following:

- JSC Sevmash, where the graduate employment rate reaches 20–30%.
- Severodvinsk ISMART, with an employment rate of 80% by the fourth year.
- Severalmaz, which develops scholarship programs and encourages student innovation.

The study confirms the existence of a gap between the labor market and the higher education system in the AZRF, which manifests itself in the mismatch between graduates' skills and employers' requirements, low wages and the migration of young people.

Thus, a comprehensive approach is required to create an effective model of interaction:

- on the part of employers — deeper integration into the educational process: from participation in the development of educational programs and teaching to the organization of high-quality, meaningful internships and practical training, where students are active participants rather than observers;
- on the part of universities — strengthening the practice-oriented component of education, developing employment assistance programs and systematically informing students about the real demands of the labor market;
- on the part of students — developing personal initiative in finding places for internships and shaping their own professional trajectories.

The most effective mechanisms today are targeted training and long-term partnerships. However, this is not enough for the sustainable development of the Arctic region. A flexible, future-oriented system is needed, in which employers, universities and students are equal partners in training competitive and motivated personnel.

Mechanism of interaction between the education services and the labor market in the AZRF

Improving the effectiveness of interaction between higher education and the labor market in the Arctic Zone of the Russian Federation is a strategic objective, the solution to which determines

the socio-economic development of the region, its human resources, and the implementation of large-scale infrastructure projects. The unique natural, climatic, and social conditions of the Arctic necessitate the development of a comprehensive and balanced mechanism for such interaction.

The mechanism for interaction between the labor market and higher education is understood as a system of socio-economic and institutional relations between entities (universities, employers, the state) aimed at reproducing labor potential and providing the region's economy with qualified personnel adapted to the specifics of the AZRF.

The key goal of the mechanism is to achieve a match between graduate competencies and current labor market demands, as well as to retain young specialists in the Arctic regions.

An effective mechanism should be based on the following principles:

- the principle of equality and partnership among all participants (universities, employers, government agencies, and recruitment centers);
- the principle of flexibility and adaptability, ensuring a prompt response to changes in the economic and technological environment;
- the principle of practice-oriented approach, integrating real production tasks into the educational process;
- the principle of monitoring and forecasting, based on continuous research into labor market trends and economic needs;
- the social principle, aimed at creating attractive living and working conditions for young professionals in the Arctic Zone of the Russian Federation;
- the principle of continuity of education, providing opportunities for ongoing professional development and retraining.

The proposed mechanism includes several key units.

Analytical and forecasting unit:

- creation of a permanent analytical center with the participation of federal and regional authorities (Ministry of Education and Science, Ministry of Labor, Ministry of Development of the Russian Far East), representatives of universities, the scientific community and large corporations (Rosneft, Gazprom, Rosatom). Its functions include: monitoring current personnel needs, long-term forecasting (5–10 years) taking into account the Arctic Zone's development strategies, and publishing open reports;
- development of a publicly accessible Internet platform, "Arctic Personnel", for aggregating job vacancies and graduate CVs, direct interaction between job seekers and employers, and providing information on government support measures.

Personnel training unit:

- formation of admission quotas (AQs) based on data from the analytical center, with a focus on specializations that are critical to the development of the AZRF;

- joint development and updating of educational programs with employers to ensure their compliance with professional standards and real production tasks;
- introduction of practice-oriented training formats: creation of basic departments and laboratories at enterprises, involvement of students in the implementation of real projects during internships;
- engagement of business representatives in teaching activities to transfer practical experience;
- regular job fairs to inform students about career opportunities.

Employment and staff retention unit:

- development of a targeted training system with tripartite agreements (university-student-employer) providing for financial support and employment guarantees;
- implementation of a package of state support measures for young professionals ("Arctic mortgage", housing programs, preferential medical care, compensation for transport costs).

Teaching staff development unit:

- introduction of mandatory annual professional development for teachers, including internships at AZRF enterprises, with the aim of continuously updating the content of educational programs.

The organizational basis of this mechanism should be a two-tier coordination system: at the federal level — an interdepartmental working group chaired by the Deputy Prime Minister responsible for Arctic development; at the regional level — coordinating councils with the participation of government agencies, employers, and universities.

The proposed model of interaction has a number of distinctive features compared to existing practices:

- Comprehensiveness: the model combines analysis, forecasting, training, employment and retention of personnel, as well as the development of teaching staff into a single framework;
- Mandatory training for teaching staff: a key new element is the principle of mandatory annual professional development for teachers at AZRF enterprises, which ensures that the content of educational programs is constantly updated;
- Specific tools: the model involves the creation of a specific tool — the publicly accessible digital platform "Arctic Personnel" — which increases its practical applicability and transparency;
- Clear organizational framework: a two-tier coordination system at the federal and regional levels is proposed, ensuring consistency of action.

The implementation of this mechanism will have a comprehensive positive impact on the socio-economic situation in the Arctic zone. First and foremost, it will lead to a significant reduction in the labor shortage in key regional economic sectors. This will be achieved by improving the quality of higher education and ensuring its targeted alignment with current employer requirements. Flexibility and continuous adaptation of educational programs will allow for a rapid response to changing labor market conditions. The most important social outcome will be a reduction in migration outflow and the effective retention of young specialists in the Arctic regions, facilitated not only by guaranteed employment but also by a system of support measures. Synergy between universities and businesses will be further developed through the stimulation of joint research projects focused on solving practical problems in Arctic development. Ultimately, the implementation of this mechanism will contribute to socio-economic stability in the Arctic Zone of the Russian Federation, reduce unemployment, and create a sustainable environment for the professional development of highly qualified personnel.

Thus, the proposed mechanism is comprehensive in nature and aimed at creating a sustainable, self-developing system of interaction capable of providing the Arctic Zone of the Russian Federation with highly qualified human resources, which is a necessary condition for its long-term strategic development.

Conclusion

The study confirmed the existence of a persistent structural gap between the labor market and the higher education system in the Arctic Zone of the Russian Federation. This imbalance manifests itself in the incomplete alignment of graduates' competencies with employers' requirements, a shortage of personnel in key sectors, low wages, and the outflow of young people.

An analysis of statistical data and the results of a sociological survey revealed the key problems faced by graduates: lack of practical experience, mismatch between vacancies and expectations, and low quality of practical training in universities.

The proposed solution is an authors' model for a comprehensive, multi-level interaction mechanism. It is based on the principles of equal partnership, flexibility, practice-oriented approach, and continuous monitoring of market needs.

The key elements of the model are:

- creation of an integrated analysis and forecasting system, including an analytical center and a publicly accessible digital platform "Arctic Personnel", which will improve the validity of management decisions and ensure labor market transparency;
- improvement of the training process through the joint development of educational programs with employers, the introduction of project-based learning formats, the expansion of internships and practical training at enterprises, and the active involvement of practicing specialists in teaching activities;

- formation of a system for retaining specialists in the Arctic Zone of the Russian Federation, based on the development of targeted training and the implementation of a package of state support measures for young specialists ("Arctic mortgage", housing programs, and benefits);
- implementation of a system of continuous professional development for teaching staff, providing for compulsory internships for teachers at AZRF enterprises to update the content of educational programs.

The organizational core of the mechanism should be a two-tier coordination system at the federal and regional levels, ensuring the coordination of actions by all participants. It is expected that the implementation of the proposed model will not only help to reduce staff shortages and unemployment, but also create conditions for socio-economic stability in the Arctic regions. The long-term goal is to form a self-developing system of interaction that can flexibly adapt to changing challenges and provide the Arctic zone of the Russian Federation with highly qualified and motivated specialists, which is a prerequisite for its sustainable and strategic development.

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The Potential of Industrial Tourism Sites in the Karelian Arctic

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Abstract. This article, devoted to unknown industrial sites in the Karelian Arctic, is based on materials from field research carried out in 4 regions of the Karelian Arctic: Segezhskiy, Belomorskiy, Loukhskiy, Kemskiy. The aim of the study is to analyze the potential for the development of industrial tourism in the Karelian Arctic based on expedition data in order to identify industrial tourism sites and develop recommendations for the formation of a new Concept for Arctic Tourism in the Russian Federation. During the study, four types of industrial tourism characteristic of the Arctic zone of the Republic of Karelia were identified: mining tourism; pulp and paper industry tourism; gastronomic tourism; water tourism. The development of the Kemsko-Belomorskaya agglomeration in the Arctic zone of the Republic of Karelia would enable year-round tourism activities, which would lead to growth in Arctic tourism. According to forecasts by the Government of the Republic of Karelia, tourist traffic to the Karelian Arctic will increase fivefold by 2035 (to 180,500 people). The practical objectives of the expedition were to identify and assess the potential of industrial tourism sites in the Karelian Arctic; to attract new audiences interested in non-standard types of tourism; to raise awareness of the geological and natural heritage of Arctic Karelia. The theoretical purpose of the expedition was to develop a concept for industrial tourism in the Karelian Arctic as part of the formation of a new Concept for the Development of Arctic Tourism in the Russian Federation. During the study, conclusions were made regarding the prospects for the development of industrial tourism in the Karelian Arctic, and the potential for development and risks were identified. The obstacles to the development of industrial tourism in the Karelian Arctic include the inconvenient location of industrial facilities and insufficient transport accessibility for tourists. The need to improve the infrastructure and transport accessibility of industrial facilities is a key factor for the development of industrial tourism.
Keywords: *Karelian Arctic, industrial tourism, Arctic tourism, mining and industrial heritage, field research*

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Introduction

In 2024, a Tourism Commission was formed within the State Council of the Russian Federation; in 2025, it will begin reviewing the Concept for the Development of Arctic Tourism in the Russian Federation. It is extremely important that industrial tourism is reflected in this concept, as the development of this type of tourism was not previously included in strategic documents.

Industrial tourism, focused on familiarizing visitors with industrial facilities, technological processes and the history of production, has been the subject of active and long-standing discussion [1, Nabiev S.R. et al.; 2, Buiok P. et al.; 3, Andrade M., Caamaño-Franco I.]. The potential of industrial tourism for the development of the regional economy and socio-cultural space is being studied, and its impact on the preservation of industrial heritage is being considered [4, Otgaar A.H.J. et al.; 5, Shabalina N.V. et al.; 6, Jia Y.].

In 2024, during a strategic session on the development of the Kemsko-Belomorskaya agglomeration and the formation of a master plan, the Government of Karelia identified two key development areas: the construction of a commercial seaport in Belomorsk and the development of year-round Arctic tourism in the agglomeration.

Tourism is considered as a significant area of socio-economic development for the municipalities of the Karelian Arctic. However, one of the limiting factors is the "lack of tours and tourist routes, insufficient number of events" [7, Kondratyeva S.V.]. The development of industrial tours to enterprises in Arctic Karelia is a potential direction which, on the one hand, will expand the tourist offer for visitors to the region and, on the other hand, will contribute to promoting the region's image and reducing population outflow, especially among young people.

The State Program of the Republic of Karelia "Tourism Development" (2016–2030), approved by the Decree of the Government of the Republic of Karelia (as amended on March 29, 2024, No. 94-P, on June 19, 2024, No. 198-P), plans to develop Arctic tourism. For example, the development of the Kemsko-Belomorskaya agglomeration in the Arctic zone of the Republic of Karelia will enable year-round tourism, leading to a fivefold increase in Arctic tourism in the region by 2035 [1].

Research data from a 2022 sociological survey conducted by the ScanMarket agency for the Karelian Arctic showed that cultural and educational tourism, including gastronomic tourism, accounts for 43% of all tourist traffic to the north of the region, nature tourism accounts for 24%, family tourism by car accounts for 20%, and fishing and hunting tourism accounts for 14%. Industrial tourism is not included in this list.

The total tourist flow to Karelia in 2023 was 722,000 people [2]. The Kemsko-Belomorskaya agglomeration accounts for approximately 5%, or 36,100 people, of the total tourist flow in the

[1] The head of Karelia presented the potential of the Kemsko-Belomorskaya agglomeration to investors. URL: https://karelinform.ru/news/2024-06-06/glava-karelii-predstavil-investoram-potentsial-kemsko-belomorskoy-aglomeratsii-5103254 (accessed 02 November 2024).

[2] In 2023, the number of tourists in Karelia almost doubled compared to the previous year. URL: https://gov.karelia.ru/news/26-09-2023-v-2023-godu-chislo-turistov-v-karelii-uvelichilos-pochti-v-dva-raza-po-otnosheniyu-k-proshlomu-godu/ (accessed 02 November 2024).

region. According to forecasts by the Government of the Republic of Karelia, tourist flow to the Karelian Arctic will increase to 180,500 people by 2035.

The purpose of the study is to analyze the potential for industrial tourism development in the Karelian Arctic on the basis of data from an expedition conducted in the Segezhskiy, Belomorskiy, Loukhskiy and Kemskiy districts. This study aims to identify industrial tourism sites and to develop recommendations for the formation of a new Arctic Tourism Concept in the Russian Federation.

Literature review

According to the Strategy for Tourism Development in the Russian Federation for the period up to 2035, industrial tourism is defined as "visits and events at a site that allow visitors to understand the processes and secrets of production related to the past, present, or future" [3].

The National Standard "Tourism Services. Industrial Tourism. Provision of Services" states that visits to operating enterprises and tours to industrial heritage sites are two different and complementary realities of industrial tourism [4].

The article by S.S. Polyanina and L.V. Dokashenko, "The Essence of Industrial Tourism and Its Types", proposes a classification of industrial tourism according to the following criteria: the number of sites visited at a time and the composition of the group of tourists. Based on the number of sites visited at a time, industrial tourism is divided into one-time excursions to an enterprise and thematic tours. Based on the composition of the group of tourists, industrial tourism can be divided into excursions for schoolchildren, excursions for mixed groups, and excursions for professionals [8].

The PromTourism project is being implemented in Russia with the support of the Agency for Strategic Initiatives for the Implementation of New Projects and the Ministry of Industry and Trade of the Russian Federation. The project aims to create a tool for forming a positive image of Russian industrial enterprises and factories, as well as providing various target audiences with the opportunity to visit manufacturing and service organizations demonstrating their achievements and successful work experience [5]. The PromTourism portal offers tour selection based on various criteria, including tour purpose and industry. The following tour objectives are offered: business tours for experience exchange, investment tours, short-term internships, introductory tours to enterprises, Russian regional brands, tours for professional buyers, and lean manufacturing tours. There are 23 industry sectors, including winemaking, the rocket and space industry, and folk arts and crafts. Currently, the catalog offers only two enterprises in Karelia for visits: JSC Segezha Pulp and Paper Mill (pulp and paper industry) and LLC Amkodor-Onego (mechanical engineering).

[3] Order of the Government of the Russian Federation of September 20, 2019 No. 2129-r (as amended on February 7, 2022) "On Approval of the Strategy for Tourism Development in the Russian Federation for the period up to 2035". URL: http://government.ru/docs/all/123838/ (accessed 02 December 2024).
[4] National standard of the Russian Federation GOST R ISO 13810-2016 "Tourism services. Industrial tourism. Provision of services" (approved and put into effect by order of the Federal Agency for Technical Regulation and Metrology dated November 25, 2016, No. 1799-st). URL: https://base.garant.ru/71942792/ (accessed 02 December 2024).
[5] PromTourism. URL: https://promtourism.ru (accessed 02 December 2024).

The article by T.N. Menshikova analyzes the specifics of tourism development in the regions of the Russian Arctic using a cluster approach. The study focuses on the challenges arising in the formation of tourism and recreational clusters in the Arctic zone. It is noted that for the successful promotion of tourism products, it is necessary to establish cooperation with the business community, as well as to attract government attention to the development of tourism in the regions of the Arctic zone. The work discusses the need to create a separate Arctic tourism development strategy and close interregional cooperation in this area. It is proposed to develop mechanisms for promoting the entire Russian Arctic under a single brand [9].

The work by O.N. Genenko and co-authors examines the development of industrial tourism in Russia, with a focus on the Belgorod region. The article emphasizes that "industrial tourism" is a new type of tourism that involves organized excursions to operating or former industrial enterprises, allowing tourists to become familiar with production processes. The authors focus on the fact that industrial tourism is an all-season product capable of solving socio-economic problems, stimulating the development of territories and increasing the prestige of industry both within the country and abroad. The article analyzes the key criteria of industrial tourism, the factors of its organization and specific features, and identifies barriers to its development. The authors emphasize the strategic role of industrial tourism in shaping the brand of the territory and increasing the tourist attractiveness of the region, which contributes to the growth of tourist flow and economic development [10].

The article by A.V. Tanina and co-authors analyzes the characteristics of this relatively new type of tourism, identifying two main segments: visits to operating enterprises and exploration of industrial heritage sites of closed enterprises. The authors note the growing popularity of industrial tourism, describing it as a joint activity between an enterprise and a tourism company, as well as an opportunity for territorial reorganization with the participation of government agencies and tourism organizations [11].

The article by H.W. Chow and co-authors examines the relationship between industrial tourism offerings and brand formation using Taiwanese companies as examples. The article notes that over the past two decades, many Taiwanese companies have moved their production abroad due to rising costs. To support local industry, the Taiwanese government has encouraged the conversion of factories into tourist destinations since 2003, promoting the development of industrial tourism. Brand associations and perceived product quality have a positive impact on brand loyalty. Researchers recommend companies involved in industrial tourism to focus on interactive experiences to strengthen brand associations and demonstrate transparency in the production process to highlight product quality, which ultimately contributes to increased brand loyalty [12].

The study by M.A. Pitukhina and A.D. Belykh emphasizes the growing role of tourism in realizing China's Arctic ambitions. China views tourism as a key tool for expanding its influence in the region, counting on the development of Russian infrastructure to increase tourist flow to the northern territories. The Karelian government sees this as an opportunity for regional development, since

local attractions, including UNESCO sites, historic quarries and ancient settlements, could attract Chinese tourists [13]. In the context of industrial tourism, Karelia is actively developing eco-routes and eco-trails through mountain mining and industrial heritage sites (factories, tunnels), organizing eco-festivals and rafting trips. This approach, proposed by the authors as one of the ways to increase the effectiveness of environmental policy in the Arctic single-industry towns, not only attracts tourists but also breathes new life into Arctic settlements, creating jobs and stimulating improvement of the environmental situation in the region [14, Pitukhina M.A., Belykh A.D.].

Results and discussion

The main objectives of the study:

- to systematize information about little-known industrial sites in the Segezhskiy, Belomorskiy, Loukhskiy and Kemskiy districts of the Karelian Arctic, identified during the expedition;
- to assess the potential of the identified sites for the development of four types of industrial tourism: mining, pulp and paper, gastronomic, and water tourism;
- to analyze the existing tourism infrastructure in the study areas and to determine the needs for its development to ensure year-round industrial tourism.

The industrial heritage of the Karelian Arctic is impressive. Deposits of crushed stone, steel pellets, ore, molybdenum, and other critically important raw materials are located within the boundaries of the Karelian Arctic. This is important for the development of Karelia as a mineral resource center, both in terms of production and export. Currently, the potential of the Karelian Arctic mining industry faces the risks of high costs for developing new deposits, lack of funding for deposit development projects, and high cost of crushed stone transportation by rail.

Considering the history of industrial development in the region, as well as modern enterprises, it seems appropriate to highlight the following types of industrial tourism most characteristic of the Arctic zone of the Republic of Karelia:

- mining tourism – the operating enterprise of JSC Karelskiy Okatysh in Kostomuksha, inactive quarries in Kemskiy and Belomorskiy districts, the man-made and natural workings of Medvedka, Plotina, Hetalambina, and the ruins of the Chupinskiy MPP in Chupa, Loukhskiy district;
- pulp and paper industry tourism – JSC Segezha Pulp and Paper Mill;
- gastronomic tourism – “Salt of the Russian North”, “Northern Mussel”, “Berries of Karelia”;
- water tourism – a traditional attraction in the Karelian Arctic is a tour to the locks of the Belomorkanal, organized by the Karelian Front Museum in Belomorsk. The tour tells the story of the construction of the Belomor-Baltic Canal and the fate of its builders, using the final 19th lock, which leads the Canal into the White Sea, as an example.

In 2023, the author of this article created an interactive map of industrial sites in Karelia, entitled “Mining and Industrial Heritage of Karelia” [6]. Most of the best-known industrial sites in the Republic of Karelia are marked on this map. However, the majority of the sites are concentrated in the south of Karelia. It should be noted that most of these attractions are located in the Loukhskiy district, while the Belomorskiy and Kemskiy districts are insufficiently studied in terms of industrial tourism sites.

In the summer of 2023, the authors of this article, together with Karelian tour operators, conducted an expedition to unknown industrial sites in the Karelian Arctic. It covered four districts: Segezhskiy, Belomorskiy, Loukhskiy, and Kemskiy (Fig. 1). The aims of the expedition were to study the diverse mining and geological landscape of Karelia, to assess the potential of unknown industrial tourism sites in the Karelian Arctic, and to open these industrial sites to the public.

Fig. 1. Map of the expedition to industrial sites in the Karelian Arctic [7].

The first stop on the expedition route was the Voitskiy mine in the Segezhskiy district (Fig. 2). The Voitskiy mine was the largest ore mining enterprise in the northwestern region of Russia in the 17th century, located in the Arctic Segezhskiy district of the Republic of Karelia. The mine played a significant role in the industrial development of the region and the country as a whole. Copper ore and the first placer gold of the Russian Empire were mined here, with mines reaching depths of 120 meters. Catherine the Great’s decision to close the mine was motivated by several factors: it became increasingly difficult to pump water from the lower levels, which created complications and required

[6] Map of industrial facilities in the Republic of Karelia. URL: https://indtour-rk.ru/ (accessed 02 November 2024).
[7] Source: compiled by the authors.

significant expenditure on engineering systems; according to some estimates, the mine's reserves had already been exhausted, making it unprofitable for further extraction. Today, the Voitskiy mine is an interesting tourist attraction that fascinates history and industrial heritage enthusiasts.

Fig. 2. The Voitskiy mine, Segezhskiy district [8].

The second stop on the route was the Sosnovets quarry in the Belomorskiy district (Fig. 3). The quarry in the village of Sosnovets in the Belomorskiy district of Karelia is known for its extraction of crushed stone, asbestos, and talc. In previous years, it played a significant role in the industrial development of the region, providing it with raw materials for construction and manufacturing. Crushed stone mining allowed it to be used in road and building construction. Asbestos and talc were used in various sectors of economy, including construction, chemical, and textile industries. The quarry in Sosnovets was an important source of jobs and contributed to the economic development of the Belomorskiy district of the Republic of Karelia. According to geologists' estimates, the volume of stone reserves in the deposits of the Belomorskiy district — 142 thousand m^3 — will provide Arctic construction sites with 38 years of supply, with a demand of 5 million tons per year [9]. In the same area, molybdenum reserves at the Lobash deposit are estimated at 128 thousand m^3 —5% of all Russian reserves. The Sosnovets quarry in the Belomorskiy district has the potential to

[8] Source: photo taken by the authors during the expedition.
[9] According to investment project materials provided by the region.

become a major tourist attraction, especially if a second mountain park is created in Karelia, similar to Ruskeala in the Sortavala district.

Fig. 3. The Sosnovets quarry, Belomorskiy district [10].

The third stop on the route was the Loukhskiy district, which is famous for its history of mineral extraction, including belomorite at the Hetalambina quarry (Fig. 4). Karelia is one of the few places where this “moonstone” can be mined. The mineral was discovered by Academician A. Fersman of the Kola Branch of the Russian Academy of Sciences, who wrote the first description of belomorite and established its scientific name. Belomorite has become a real pride of the region; it is of magmatic origin and is found in granites and granite pegmatites. The unique properties and appearance of belomorite attract the attention of not only local residents but also tourists who want to purchase jewelry made from this stone. Belomorite has become popular both in the world of jewelry and in gemstone collecting. The Hetalambina quarry is of interest to tourists who would like to mine their own Belomorite.

[10] Source: photo taken by the authors during the expedition.

Fig. 4. The Hetalambina quarry, Loukhskiy district [11].

The urban-type settlement of Chupa, also located in the Loukhsky District, is the capital of the largest pegmatite region in the country. Rubies and garnets were mined near Chupa. The development of metallurgy in Karelia received a powerful impetus during the Northern War due to the efforts of Peter the Great, who actively developed the fleet in both Chupa and Arkhangelsk. Mica, an important material for the construction of carriages and ships, was actively mined and exported from Chupa, confirming the importance of this place for industry and the country's development.

Less than half a century ago, the Chupinskiy Mining and Processing Plant (formerly known as "Karelslyuda") was the pride of Karelia. This enterprise was the largest supplier of muscovite mica in the USSR, and at the peak of its development, it included 10 mines and 1,500 pegmatite lodes. As a result of its active operations, the Chupinskiy MPP attracted significant investment, contributed to the development of local infrastructure, and provided jobs for the region's residents. At its peak, the plant employed approximately 2,500 people. However, in the 1990s, amid the economic crisis, the Chupinskiy MPP faced serious problems and was forced to reduce its production. Along with the decline of the mining industry in the Loukhskiy district, the population of these settlements also decreased. Over time, the mines of the plant were flooded (Fig. 5). Mica mined at the Chupinskiy MPP is still used in Russian Aerospace Forces spacecraft.

[11] Source: photo taken by the authors during the expedition.

Fig. 5. The Chupinskiy MPP mines, Loukhskiy district [12].

The development of industrial tourism may become promising for the Karelian Arctic. For example, the Medvezhka Forest Park was created on the site of the former Chupinskiy MPP, symbolizing the transition from the past to the future and recalling the significance of the historical heritage of the Loukhskiy district.

The Valitov Kamen Museum in Chupa is also an important industrial tourism and heritage site in the Loukhskiy district. It includes a large collection of minerals (belomorite, garnet, mica, and quartz) mined in the area, which was created as part of the Chupinskiy MPP Museum. In the Loukhskiy district alone, not far from the Keret River, geologists have discovered 700 pegmatite lodes — sources of mica. The largest mica sheet in Russia was found here and is now kept in the Valitov Kamen Museum. The museum offers visitors an excellent opportunity to learn about the history of Karelia's mining industry and discover fascinating facts about the region's minerals.

The last stop on the expedition route was the Kemskiy district of Karelia and the famous Kemskiy garnet quarry (Fig. 6). Garnet mining in the Kemskiy district of the Republic of Karelia is a significant industry. Garnet mining attracts industrial tourists and mineralogy enthusiasts who want to study, mine, and purchase this beautiful stone.

[12] Source: photo taken by the authors during the expedition.

Fig. 6. Garnet lode of the Kemskiy quarry, Kemskiy district [13].

Conclusion

The following conclusions were formulated as a result of the expedition conducted jointly with Karelian tour operators in four districts of the Karelian Arctic: Segezhskiy, Belomorskiy, Loukhskiy, and Kemskiy. Both growth opportunities and challenges for the development of industrial tourism in northern Karelia were identified.

1. The development of industrial tourism can and should become a promising area for the Karelian Arctic, given the region's rich industrial heritage. It is clear that new tours should be created in new industrial tourism destinations in the Arctic regions of Karelia. The authors identified four types of industrial tourism characteristic of the Arctic zone of the Republic of Karelia. Given the Belomorkanal modernization program for the period up to 2035, the development of water tourism focusing on the history and present-day aspects of the Belomor-Baltic Canal is particularly important.

2. Obstacles to the development of industrial tourism in the Karelian Arctic include the inconvenient location of industrial facilities and insufficient transport accessibility for tourists. The need to improve infrastructure and transport accessibility for industrial facilities is key to the development of industrial tourism. Demographic problems in the Karelian Arctic (population decline and depopulation) negatively impact the development of the service, trade, and tourism sectors,

[13] Source: photo taken by the authors during the expedition.

limiting demand and hindering the growth of small and medium-sized businesses (hotels, restaurants, cafes).

3. Most of the best-known industrial sites in the Karelian Arctic are located in the Loukhskiy district, while the Belomorskiy and Kemskiy districts are insufficiently studied in terms of industrial tourism heritage. Much work remains to be done in this area.

4. Recommendations for the development of industrial tourism in the Arctic will be submitted to the Commission on Tourism of the State Council of Russia, which will be responsible for formulating the Concept for the Development of Arctic Tourism in the Russian Federation in 2025.

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Comparative Analysis of Electoral Behavior Patterns and Preferences in the Kalevalskiy District of the Karelian Arctic (2015–2024)

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Abstract. The article examines the specifics of electoral behavior and preferences of voters in the Kalevalskiy District of the Republic of Karelia from the moment it was included in the Arctic zone of the Russian Federation in 2015 until the 2024 presidential elections. The author points out that, despite increased research interest in the Arctic national territory, electoral practices and the will of voters are not given due attention, while they allow to identify not only the value preferences of the electorate, but also to localize existing problems in the area that require measures to be taken to resolve them. The paper studies the election participation behavior of the residents of the Kalevalskiy District at the federal, regional and local levels in comparison with the population of the Republic of Karelia and its Arctic territories. The paper establishes the values of voter turnout, the indicator of protest potential in relation to the degree of elections' alternativeness. The author also analyzes the role of political powers that traditionally participate in the elections and their influence on the voting preferences of residents of the Arctic Karelian border region. As a result of the study, a model of the typical voter in the Kalevalskiy District is created (in terms of demographic structure, it is predominantly a person older than working age, not inclined to protest, with an established system of values, and diligent civic participation in elections at various levels) that determines voting behavior and preferences. Using a neo-endogenous approach and identifying the cleavages structures based on multifactor analysis, a pattern of the Arctic national region of the Russian Arctic was constructed as a possible case for future comparative researching of national territories of the Arctic zone.
Keywords: *Kalevalskiy District, Republic of Karelia, Arctic, electoral behavior, electoral preferences, elections, voter turnout, protest potential, alternativeness of elections*

Introduction

The Arctic is an important strategic region for the Russian Federation. The rich resource potential of the Arctic Zone of the Russian Federation (AZRF) is relevant not only to domestic policy issues, but also to socio-economic and political processes related to the country's external security. The main priority of Russia's policy in the Arctic is to preserve its status as a territory of peace, stability and mutually beneficial cooperation.

The AZRF is diverse and includes territories with special jurisdictional and closed status, border regimes, single-industry municipalities that influence the investment climate and capital inflows, national regions, languages of indigenous and small peoples, and historical sites protected by UNESCO and have historical and cultural value of global significance. The economic activities of the residents are linked to the traditional crafts of indigenous peoples.

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The Republic of Karelia includes six Arctic territories of different status, including both industrial and national northern areas. This influences the specifics of ongoing socio-economic and political processes [1, Khare N., Khare R.; 2, Elias S.], and highlights issues of civic identity in the context of global challenges and threats, the militarization of the Arctic [3, Petersen M.B., Pincus R.], etc., particularly affecting the daily practices of border residents.

The Kalevalskiy District is the only national border area in the Karelian Arctic, with about 36% of its residents being Karelians (as of January 1, 2020) [1]. The district is a place where the titular nation and the cultural and historical heritage of the northern territories are preserved, which influences the value matrix of its residents. “The region’s location, its natural environment, and its cultural heritage contribute to the emergence of a specific spirit of the region, its ethno-cultural uniqueness” [2].

For the Karelian Arctic, the Kalevalskiy National District plays the role of a “territory brand” [4, Kostyaev A.I., p. 104], due to such cultural and ethnic sites as the Kalevala National Park, protected marshes, rapids, abundant water bodies, rune-singing and historical villages, the KALEVALATALO Ethno-cultural Center, and others. The Arctic National District has the potential to preserve, maintain, and revive national cultural traditions, crafts, local customs, and way of life [3]. Of all the Arctic territories of the Republic of Karelia, it has the largest proportion of rural to urban population (42.20% to 57.80%, respectively) [4], and does not contain any single-industry municipalities within its boundaries [5].

The peripheral nature of the Russian Arctic territories in relation to the rest of the country, due to the geographical features of the region, determines the specifics of its socio-economic and political potential. The Karelian Arctic, as part of the AZRF macro-region, has both strengths and weaknesses in its development [5, Volkov A.D., Tishkov S.V., pp. 14–21]. The Kalevalskiy National District is the subject of study due to the implementation of Presidential Decrees No. 164 “On the

[1] Results of the 2020 All-Russian Population Census. Volume 5. Ethnic Composition and Language Proficiency. Table 1. Ethnic Composition of the Population // Federal State Statistics Service. URL: https://rosstat.gov.ru/vpn/2020/Tom5_Nacionalnyj_sostav_i_vladenie_yazykami (accessed 20 January 2025).

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[4] Republic of Karelia. Statistical yearbook 2024. URL: https://10.rosstat.gov.ru/storage/mediabank/02011_2024.pdf (accessed 30 December 2024).

[5] Resolution of the Government of the Russian Federation of July 29, 2014 No. 709 "On the criteria for classifying municipalities of the Russian Federation as single-industry (single-industry towns) and categories of single-industry municipalities of the Russian Federation (single-industry towns) depending on the risks of deterioration of their socio-economic situation". URL: https://base.garant.ru/70707142/ (accessed 20 January 2025); Information on single-industry municipalities of the Republic of Karelia // Ministry of Economic Development of the Republic of Karelia. URL: https://economy.gov.karelia.ru/about/6289/ (accessed 20 January 2025).

Fundamentals of State Policy of the Russian Federation in the Arctic until 2035" [6] and No. 645 "On the Strategy for Developing the Russian Arctic Zone and Ensuring National Security until 2035" [7]; besides, it is covered by the state program "Socio-Economic Development of the Arctic Zone of the Russian Federation" [8].

It should also be noted that at present, the national Arctic region is experiencing deterioration in the socio-economic situation caused by the outflow of the working-age population and the ageing demographic structure of the Kalevalskiy District. At the same time, the territory demonstrates a general development trend, whereby "rural territories of border regions are located on the distant periphery in relation to regional centers or large industrial centers, with lower population density and lower degree of economic development, specific demographic conditions and other features. A significant part of the border areas is in a state of depression, despite the presence of various resources for their development" [4, Kostyaev A.I., pp. 93–94]. Natural population decline, including among native speakers of the Karelian language, resulted in the inclusion of this language in the UNESCO Atlas of the World's Languages in Danger in 2010 [6, Suvorova I.M., Korobaynikova S.V., p. 790].

The Kalevalskiy District borders the Kainuu region of Finland, which demonstrates not only the existence of cultural and socio-economic ties between Russia and Finland, but also the emerging risks of complications in relations between the inhabitants of the two countries, especially in the border areas, due to changes in the modern international agenda. There is a crisis in established cross-border ties in terms of political, socio-economic and everyday interaction, since "a specific feature of border regions is that, in addition to their peripheral location, their development potential depends primarily on inter-state relations" [7, Bacsi Z., Kovács E., p. 486].

Modern scientists are researching various aspects of development and processes taking place in the Kalevalskiy District, organizing complex expeditions based on the project activities of the innovation parks of Petrozavodsk State University and the Karelian Scientific Center of the Russian Academy of Sciences. Issues of the region's resource potential, tourism development, as well as the historical and socio-cultural significance of the territory, its "phantom borders" manifested "in various forms and modes of economic, social and political activity today" [8, Kolosov V., Medvedev A., Zotova M., p. 49], ethnicity, and intensifying socio-economic and political problems and practices are being studied.

[6] Decree of the President of the Russian Federation of March 5, 2020 No. 164 "On the fundamentals of the state policy of the Russian Federation in the Arctic for the period up to 2035" (as amended and supplemented). URL: https://base.garant.ru/73706526/ (accessed 03 January 2025).
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Despite the scientific community's interest in the Kalevalskiy District as a research subject, we believe that electoral practices and voter participation have not received due attention in studies of this Arctic territory. We suppose that election results and voter participation not only reveal the value preferences of the electorate, but also localize existing problems in the area and suggest specific measures to resolve them, which specifies the subject area of this work and defines its purpose — to identify the specific behavior and preferences of voters in the Kalevalskiy National District in elections at various levels.

The scientific value of this work lies in the systematization of the available socio-economic characteristics of the northern regions of the Republic of Karelia, which were used to identify social cleavage structures and compile a "Socio-economic map of the Karelian Arctic territories", allowing us to determine the specific features of the national regions of the AZRF. All electoral practices of residents of the Kalevalskiy District during the period under review have been studied, cases of electoral behavior and preferences of voters in the border national territory of Karelia in elections at various levels have been created, indicators have been identified, and a comparison of the Kalevalskiy District with other regions of the Karelian Arctic and locally has been carried out. As a result, the study of the electoral experience of residents of the Arctic border Kalevalskiy National District of Karelia can be used as an example for future studies of the specifics of voter behavior and preferences in the national districts of the Russian Arctic.

The chronological framework of the study covers the period from 2015 to 2024. The lower time limit is related to the classification of the Kalevalskiy District as part of the Arctic zone of the Russian Federation, and the upper time limit is associated with the presidential elections of the Russian Federation on March 17, 2024, as the latest data available at the time of analysis.

From 2015 to 2024, voters of the Kalevalskiy National District of Karelia participated in the elections of the President of the Russian Federation (RF), the Head of the Republic of Karelia (RK), the heads of the Luusalmskiy, Yushkozerskiy and Borovskiy rural settlements, deputies of the State Duma of the Russian Federation (SD RF) of the 7th and 8th convocations, the Legislative Assembly of the Republic of Karelia (LA RK) of the 6th and 7th convocations, and deputies of local councils of the district.

Methodology

The research methodology is determined by the border landscape of the transboundary Arctic national region, which serves as a marker indicating "the peculiarities and differences in the economic, political, and legal space of neighboring countries" [8, Kolosov V., Medvedev A., Zotova M., p. 48], manifested in the specifics of regional policy in the context of security issues and the diversity of aspects of state influence on the economic and social activities of residents.

Using Western and Russian theories of electoral behavior [9, Rozhneva S.S., pp. 90–91], the methodological basis of this work was formed by an interdisciplinary approach that allowed us to combine the theory of social cleavages by S. Lipset and S. Rokkan [10], the neo-endogenous concept

of rural border areas development [4, Kostyaev A.I., p. 95], and a comparative analysis of models of electoral behavior and preferences of residents of the Kalevalskiy National District in elections at various levels.

The theory of cleavages emerged in the mid-20th century, when S. Lipset and S. Rokkan, using statistical analysis, identified the structures of social cleavages that influence the preferences and voting behavior of electors for particular political parties in Western countries. The researchers studied electoral behavior in alternative and non-alternative ("monolithic" [10, p. 206]) party systems ("polities") using the dichotomy "conflict — integration" [10, p. 207].

However, the current trend of the United Russia party dominating the political system of the Russian Federation allows us to use the approach of S. Lipset and S. Rokkan only partially, taking into account the adaptation of the theory of "cleavages" to the study of electoral behavior and preferences of voters in the Kalevalskiy National District. The dominance of United Russia in the structure of government at various levels of power has an impact on the lack of noticeable dynamics in the electoral preferences of voters regarding the leading forces in the elections. This, in turn, indicates not cleavages, but rather differences along social cleavages in the absence of obvious conflict. Thus, the author of this work supports the view that "cleavages" in the terminology of S. Lipset and S. Rokkan [10] should be interpreted not as "division", but as "separation", "difference", which does not contain the semantic connotation of conflict.

The study should take into account the borderline and peripheral status of the Kalevalskiy District and the large proportion of rural areas within it, which complements the theory of social cleavages with a neo-endogenous approach.

The term "neo-endogenous development" was first introduced in relation to rural areas by C. Ray. Its essence lay in the belief in the local potential of local areas for their future development [11, Kostyaev A.I., p. 968] while maintaining the influence of external environment factors. The scientist believed that "the core of neo-endogenous development is based on the assumption that currently disadvantaged rural areas can take action to improve their situation" [12, Ray C., p. 4]. The concept of neo-endogenous development focuses on the interactions of "local areas with the broader political, institutional, commercial and natural environment, as well as how these interactions are mediated" [11, Kostyaev A.I., p. 968].

The nature of the bordering Kalevalskiy District is understood by its residents, which is reflected, among other things, in electoral practices affected by the transformation of the international situation, especially near the Arctic northwestern European borders. "At the same time, the contribution of the neo-endogenous thesis was seen not in presenting a model of development, but in demonstrating a way of understanding the process of rural development and how everything works on the ground" [11, Kostyaev A.I., p. 969]. The neo-endogenous approach reveals the internal development potential of a territory by using socio-economic and human resources in the context of external environmental risk factors.

The predominantly rural nature of the northern territory allows for the application of a neo-endogenous approach to its development, as reflected in the "Strategy for the Socio-Economic Development of the Kalevalskiy National District Municipality until 2030", adopted in 2020 [9]. A study conducted by the Information and Analytical Centre of the State Commission for Arctic Development, jointly with the Institute of Regional Consulting, made it possible to classify the urban-type settlement of Kaleva as a key settlement for ensuring internal security of local significance, granting it the status of one of the new entities of spatial development in the Arctic[10].

It is also worth mentioning that the electoral process is quite diverse. This is especially true considering that the number of cases of electoral activity among voters in the Kalevalskiy District analyzed for the period from 2015 to 2024 includes election campaigns at the local, federal and regional levels, which are divided into "first" and "second" order elections.

The authors of the "second order elections" theory are K. Reif and H. Schmitt [13]. Analyzing the results of the 1979 European Parliament vote, they concluded that "'first order elections' in parliamentary systems are national parliamentary elections, and in presidential systems — national presidential elections. However, in addition to these, there are many "second-order elections": by-elections, municipal elections, various types of regional elections, elections to the "second chamber", etc. The specific significance of these elections lies in the particular arena in which public positions are filled" [13, Reif K., Schmitt H., p. 8].

Among Russian approaches, a comparative study conducted by R.F. Turovskiy, E.M. Korneeva, and O.S. Vaselenko is of interest, in which the authors identified patterns in local electoral voting, including those applicable to elections in Russia. They noted that voter turnout depends on the type of election; electoral activity in municipal elections is higher than in elections of representative authorities, provided that the elections are held separately, since "in municipal elections, voters tend to make strategic choices, expecting that the winner will have a greater influence on the decision-making process" [14, p. 121]; elections to local legislatures "are characterized by higher competition and expressive voting", since "in elections of representative authorities, voters express their political and ideological preferences to a greater extent" [14, p. 121].

In this work, the summary of statistical data from the Central Electoral Commission of the Russian Federation (CEC RF), correlation and factor analyses are presented in three research cases, which made it possible to compare the electoral practices of voters in the Kalevalskiy District with the behavior of the electorate of the Republic of Karelia and its Arctic territories, as well as to identify the specifics of voter preferences in the elections of the President of the Russian Federation,

[9] Strategy for the socio-economic development of the municipality "Kalevalskiy National District" for the period up to 2030. URL: https://visitkalevala.ru/ekonomika/strategija-social-no-ekonomicheskogo-razvitija-municipal-nogo-obrazovanija-kaleval-skij-nacional-nyj-rajon-na-period-do-2030-goda/ (accessed 27 December 2024).

[10] Key settlements are a new subject of spatial development in the Arctic // Investment portal of the Arctic zone of Russia. URL: https://arctic-russia.ru/article/opornye-naselennye-punkty-novyy-subekt-prostranstvennogo-razvitiya-arktiki/ (accessed 03 January 2025).

the Head of the Republic of Karelia, heads of settlements, and parliamentary elections at various levels in the Arctic national district of Karelia.

Each case includes the following comparative indicators:

- election level;
- electoral turnout values (calculated as average and median indicators);
- presence of "traditional" and "non-traditional" political players in the electoral district;
- alternativeness of elections (average value);
- specific preferences of voters for the winning candidate by subject of nomination, percentage of support and predictability of voting results;
- Pearson correlation coefficient (R_{xy}) as an indicator of the linear correlation between the number of invalid ballots and the number of votes for the candidate/party list that ranked last in the election race, determination of the level of connection on the Chaddock scale [15, Bavrina A.P., Borisov I.B., p. 71] and confirmation of the presence (or absence in the case of R_{xy}=0) of protest potential in the electoral behavior of voters in the Kalevalskiy National District.

Social cleavage structures in the Karelian Arctic

As mentioned previously, this study uses a theory of social cleavages adapted and supplemented by a neo-endogenous approach to the specifics of electoral behavior and voter preferences in the Karelian Arctic.

As part of this work, the author identified cleavage structures that served as the basis for creating a "socio-economic map" of the Arctic territories of the Republic of Karelia:

- *"center — periphery":* this indicator includes the geographical location of the territories relative to the central part of Russia;
- *"urban — rural":* this indicator demonstrates the ratio of urban and rural population to the total population as a percentage;
- *"districts with single-industry towns — districts without single-industry towns":* this parameter reflects the presence of single-industry entities within the territory — "single-industry towns", which both contribute to the industrial development of the region and are responsible for the presence of socio-economic risks in the area and the specific nature of demographic processes and changes;
- *"districts with specially protected natural areas (SPNA) — districts without SPNA (~~SPNA~~)"* [4, Kostyaev A.I., p. 103]: this demarcation structure defines cultural and recreational areas, promoting the development of the tourism sector and requiring investment in its prosperity (see Table 1).

Table 1

Socio-economic map of the territories of the Karelian Arctic [11]

Cleavages	Kalevalskiy District	Belomorskiy District	Loukhskiy District	Kemskiy District	Segezhskiy District	Kostomuksha Urban District
"center — periphery"	periphery	periphery	periphery	periphery	periphery	periphery
"urban — rural" (%) [12]	57.8–42.2	59.0–41.0	70.3–29.7	76.4–23.3	91.8–8.2	97.8–2.2
"districts with single-industry towns — districts without single-industry towns"	without single-industry towns	without single-industry towns	without single-industry towns	without single-industry towns	with single-industry towns	with single-industry towns
"districts with specially protected natural areas (SPNA) — (~~SPNA~~)"	SPNA (4)	~~SPNA~~	SPNA (3)	~~SPNA~~	~~SPNA~~	SPNA (3)

The resulting social cleavage structures in the Kalevalskiy District, compared with other areas of the Karelian Arctic, made it possible to identify a pattern for the Arctic national district, which is characterized by a lack of industrial facilities and high potential for the development of tourism due to the presence of specially protected natural areas. A competent regional investment policy for the development of northern national territories will make it possible to overcome the demographic risks of deterioration in the future, despite the large proportion of rural areas with low population density and natural population decline.

The peculiarities of the socio-economic pattern of the Arctic national region contribute to the modeling of the political behavior of its residents in elections and the specifics of their electoral preferences.

Electoral turnout

Voter activity analysis allows predicting and managing electoral processes. Changes in the socio-economic situation in a given region are reflected in electoral turnout dynamics and demonstrate the degree of voter interest in electing public officials.

Taking 100% as a baseline, the author has identified three levels of voter turnout: low (0%–33%), medium (34%–66%) and high (67%–100%).

We believe that the dynamics of electoral turnout in our country can be explained by a number of reasons.

Firstly, the level of the elections: federal, regional or local, which are classified as "first" and "second" order elections.

Secondly, their nature: parliamentary or presidential elections, elections of the highest official of a constituent entity of the Russian Federation, or elections of the head of a settlement.

[11] Source: compiled by the author.
[12] Republic of Karelia. Statistical yearbook 2024. URL: https://10.rosstat.gov.ru/storage/mediabank/02011_2024.pdf (accessed 30 December 2024).

Thirdly, the coincidence of election campaigns at different levels on a single voting day.

Fourthly, the high degree of predictability of the final election results under the influence of administrative resources, the image of the candidate/party, the traditional nature of electoral support among a significant portion of voters.

Fifthly, the alternative nature of elections, demonstrating the electorate's ability to vote for different candidates based on their preferences.

Sixthly, the participation of "traditional" and "non-traditional" political forces in election campaigns. "Traditional" political actors are parties that systematically nominate candidates/party lists for elective office and can secure sufficient support from the electorate to represent their interests, including winning elections. In the Russian Federation, these include United Russia (UR), the Communist Party of the Russian Federation (CPRF), the Liberal Democratic Party of Russia (LDPR), and A Just Russia / A Just Russia — For Truth (SR / SRZP). During the analyzed period, alongside UR, CPRF, LDPR, and SRPZP, the Yabloko party, which is represented in the Legislative Assembly of the Republic of Karelia, continues to be among the traditional players in Karelia. Since 2021, the New People (NL) party has become an important participant in the electoral process, having successfully debuted in both federal and regional elections. The status of this party is still difficult to determine due to its "youth" in the political arena. In the study, "non-traditional" actors were defined as parties whose candidates occasionally participate in elections and episodically get support from voters in the district [16, Rozhneva S.S.]. It should be noted that in the latter case, those "non-traditional" political forces that participated in federal and regional elections were excluded from the analysis of the electoral preferences of residents of the Kalevalskiy National District, since they were represented in all electoral districts where voting took place. Therefore, in this study, only those political parties that nominated their candidates/party lists for local elections were classified as "non-traditional" actors. During the study period, these were: the "Russian Party of Pensioners for Social Justice" (RPPSJ) and the Communist Party "Communists of Russia" (CPCR).

Seventhly, turnout may depend on the individual preferences of the electorate and their possible interest in socio-economic and political issues specific to their area of residence. It should be noted that this indicator is not unambiguous, since it affects not only the level of electoral activity, but also the degree of conflict potential in the electoral district, which is always present during elections. At the same time, according to some researchers, the Republic of Karelia is not a subject of the Russian Federation with a high level of protest potential [14, Sokolov A.V.], although the financial attractiveness of the Arctic territories for labor migrants, including foreign ones, on the contrary, indicates a high conflict index in the region [17, Pitukhina M.A., Tolstoguzov O.V., Belykh A.D.]. According to the decision of the State Duma of the Russian Federation dated June 12, 2006 [13], the column "against all" was excluded from the ballots [16, Rozhneva S.S., p. 272]. However, according

[13] Federal Law of July 12, 2006 No. 107-FZ "On amendments to certain legislative acts of the Russian Federation in terms of the abolition of the form of voting against all candidates (against all lists of candidates)". URL: https://base.garant.ru/12148261/ (accessed 02 January 2025).

to the election results, there are invalid ballots, the percentage of which may be linearly dependent on the smallest number of votes cast for a candidate/party list and thus determine the presence of protest potential in the electoral district, even despite the reasons for their invalidity, which cannot be identified from statistics. It was assumed that voters could spoil their ballots intentionally, because they were dissatisfied with all of the candidates/party lists, thereby expressing their protest in the election. At the same time, it would be wrong to completely exclude this indicator from the analysis, since, based on the calculation of the number of invalid ballots, it can reveal, albeit insignificantly, the configuration of electoral preferences in the district in a situation where none of the candidates/party lists were supported by the voters. Such a manifestation of protest activity can be considered as an individual conventional form of political protest [18, Kerimov A.A., Lugovtsov M.M. pp. 204–205] and, by and large, does not pose a threat to public authority. However, the indicator itself undoubtedly identifies electoral activity and determines the attention of residents to existing socio-economic problems in the district. Moreover, the existence of a variety of approaches in science to calculating index modelling of political protest [18, Sokolov A.V.] allows the use of the indicator of protest activity as a sufficiently important factor in determining the specifics of electoral behavior and voter preferences. In the presence of a correlation using the Pearson (R_{xy}) method, additional analysis of data from specific election campaigns was carried out. It was noted that if the difference between the number of votes cast for the candidate/party list that ranked last and the number of invalid ballots is negative, then protest potential is observed in voter behavior, and vice versa — with positive values, it is practically absent.

From 2015 to 2024, residents of the Kalevalskiy National District participated in 29 elections of various levels. The units of analysis included additional/by-elections for deputies of the Kalevala Urban Settlement (3), Yushkozerskiy (2), and Luusalmskiy (4) rural settlements (see Fig.1).

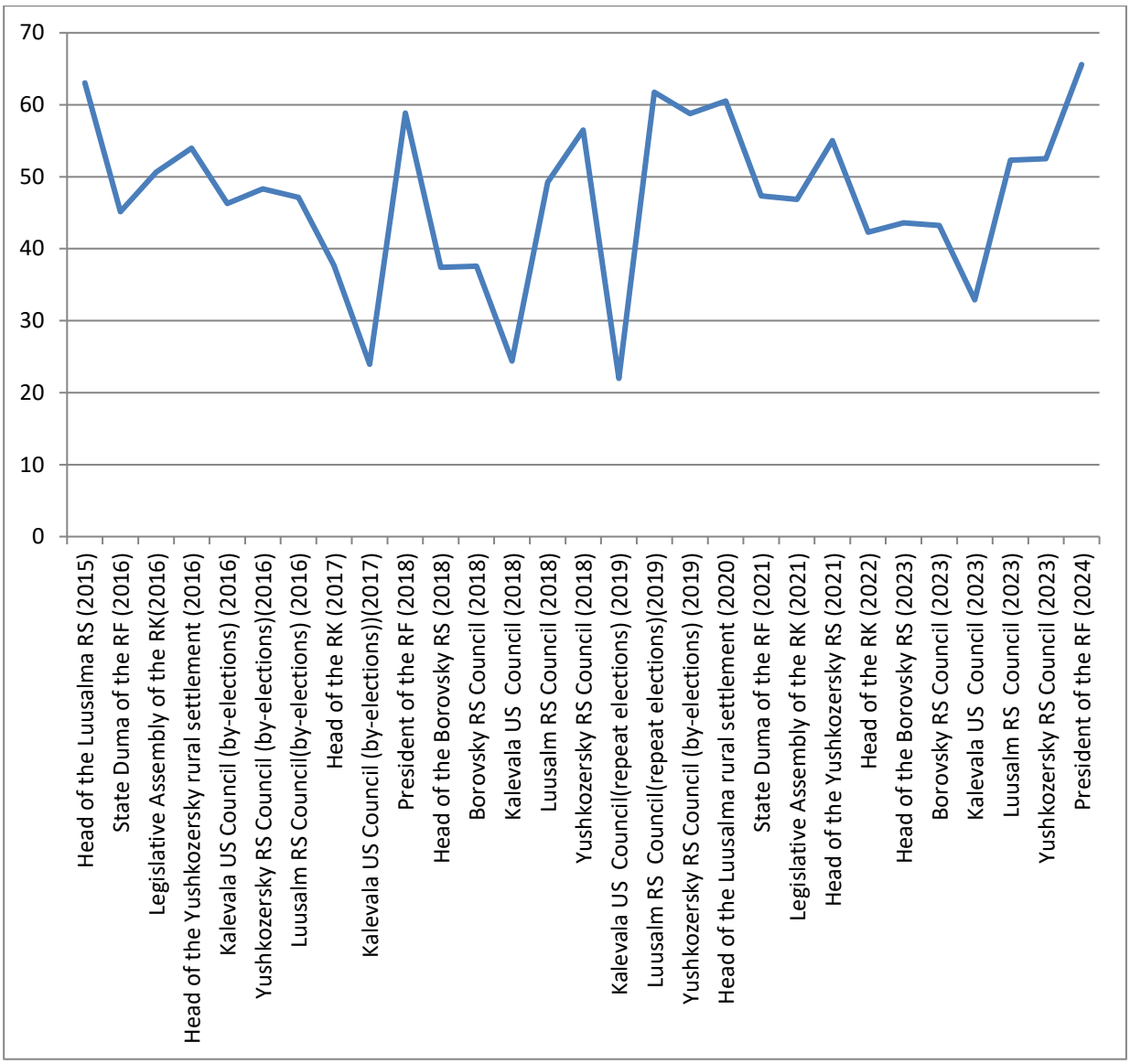

Fig. 1. Dynamics of electoral turnout in the Kalevalskiy District: 2015–2024 (in %) [14].

An analysis of the electoral turnout dynamics based on the data obtained reveals its instability, characterized by periods of both sharp declines and rises. It should be noted that in Figure 1, the values of voter activity in the district were distributed by year, and in the case of elections held on a single voting day, the data were ranked according to the level of authority. Peaks in voter turnout were observed during the presidential elections, while the lowest values were recorded in the elections for deputies to the Kalevala Urban Settlement Council.

Case 1. Federal elections

From 2015 to 2024, elections for deputies of the State Duma of the Russian Federation of the 7th (2016) and 8th (2021) convocations, as well as for the President of the Russian Federation (2018, 2024) were held.

Federal, “first-order” [13, Reif K., Schmitt H.; 14, Turovskiy R.F., Korneeva E.M., Vaselenko O.S.] elections are identified by voters as the most important, which increases both electoral

[14] Source: compiled by the author based on data from the CEC RF.

turnout and protest potential. However, it should be noted that since the head of state and the chamber of the Russian parliament are elected by nationwide vote at the national level, these election campaigns do not coincide with each other. This factor also influences voter turnout and voting results.

Comparing electoral turnout in national elections across all Arctic regions of Karelia, it can be seen that voters are more active in voting for the President of the Russian Federation than for deputies of the State Duma of the Russian Federation (see Fig. 2).

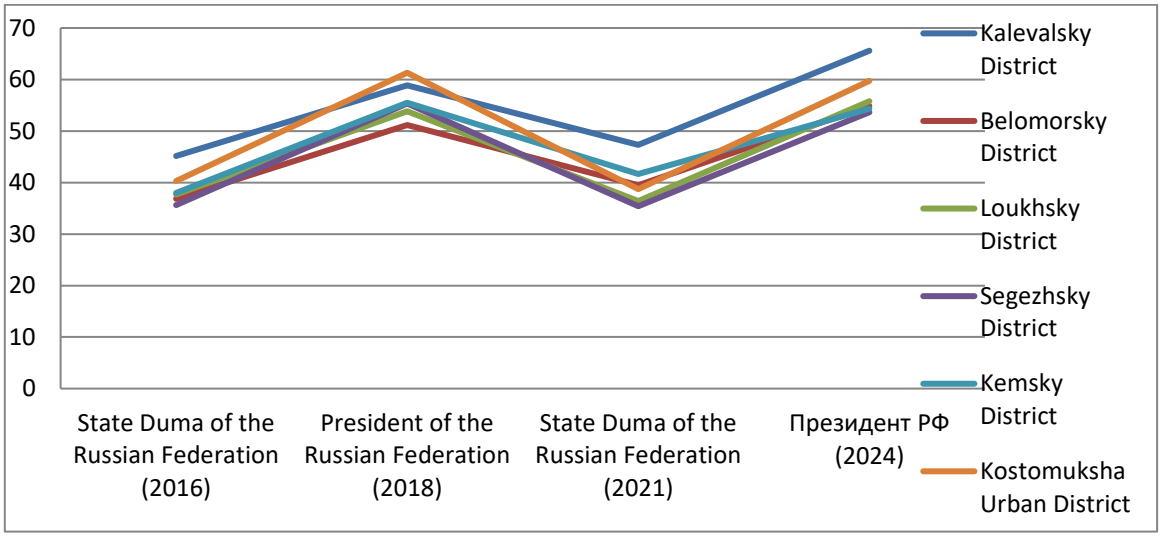

Fig. 2. Electoral turnout in federal elections in the Karelian Arctic regions: 2016–2024 (in %) [15].

One of the main reasons for this ranking of electoral turnout may be the fact that voters see the President of the Russian Federation as the person responsible for the country's policies, which increases their interest in participating in the vote. Moreover, this factor is influenced by external circumstances, which always affect the final election results, correlate with the personality of the candidate elected to the office of head of state, etc., which inevitably reflects in the consciousness of the electorate and resonates with their preferences.

As can be seen in the graph (Fig. 2), turnout rates for the presidential elections in all Arctic regions of the Republic of Karelia were distributed within the median range. In 2018, the highest electoral turnout was observed in the Kostomuksha Urban District, while in 2024, there was a significant gap in voter turnout for residents of the Kalevalskiy National District compared to other northern territories, with a median of 62.22 (see Table 2).

Table 2

Electoral turnout in presidential elections in Karelian Arctic regions: 2018, 2024 (median) [16]

Kalevalskiy District	Belomorskiy District	Kemskiy District	Loukhskiy District	Segezhskiy District	Kostomuksha Urban District
62.22	53.02	54.91	54.81	54.51	60.53

This distribution could be due to a number of factors. In 2024, voters participated in the presidential election over three days, from 15 to 17 March. This increased the potential for higher

[15] Source: compiled by the author based on data from the CEC RF.
[16] Source: compiled by the author.

voter turnout. It is also important to consider the specific preferences of voters in the Arctic national territory, which could be influenced not only by the migration outflow of the working-age population and demographic ageing trends, resulting in increased citizen participation in the election (it is well known that older age groups participate more actively in elections than younger voters and give their preference to political forces whose policies they are familiar with from the previous period), but also by the deterioration of the international situation in the border area, causing personal concern among its residents about the resolution of the situation, who see the President of the Russian Federation as an actor capable of dealing with it.

Moreover, by 2024, the alternatives in the election had decreased (from eight registered candidates in 2018 to four in 2024), but the voting results remained quite predictable. In this regard, the votes not in favor of V.V. Putin, who received high support in all regions of the Russian Federation, and the dynamics of the voting results were insignificant, but rather the votes for the candidate who came second in the region and actually demonstrated popular, possibly opposition ideas that resonated with a fairly large group of voters, are of particular interest.

Karelia became the leading region where, in the 2024 presidential race, V. Davankov, the candidate from the New People party, received the highest number of votes for second place, with 8.38% electoral support. It's important to note that V. Davankov also came second abroad, with 16.65% of the vote, and second "according to the results of the federal voting platform (6.28%)" [17]. However, while L.E. Slutskiy (LDPR) came third in the republic and N.M. Kharitonov (CPRF) came last, in the Kalevalskiy District the last two places were distributed in the reverse order. We believe that these presidential election results were caused, on the one hand, by the support of residents of the border region for the progressive ideas promoted by the candidate from the New People party and, on the other hand, by the preservation of traditional voting trends, as in the 2018 Russian presidential election, P.N. Grudinin (CPRF) surpassed V.V. Zhirinovskiy (LDPR) in terms of the number of votes in the Kalevalskiy District (see Table 3).

Table 3

Electoral support in the Russian presidential elections: 2018, 2024 [18]

Candidates [19]	*Russian Federation*	*Republic of Karelia*	*Kalevalskiy District*
Russian Presidential Elections (March 18, 2018)			
V.V. Putin (independent)	76.69%	73.04%	72.97%
P.N. Grudinin (CPRF)	11.77%	11.35%	10.52%
V.V. Zhirinovskiy (LDPR)	5.65%	7.83%	10.39%
…			
Russian Presidential Elections (March 17, 2024)			
V.V. Putin (independent)	87.28%	79.53%	80.80%
V.A. Davankov (New People)	3.85%	8.38%	6.00%
N.M. Kharitonov (CPRF)	4.31%	4.76%	5.89%
L.E. Slutskiy (LDPR)	3.20%	5.02%	4.85%

[17] Results of the 2024 Russian presidential election. Key figures. URL: https://www.kommersant.ru/doc/6579312 (accessed 25 January 2025).
[18] Source: compiled by the author.
[19] Ranking of voting results in the Kalevalskiy District of the Republic of Karelia.

Furthermore, we believe the "New People effect" [20] played a role in the 2024 presidential elections in the region. Their campaign was focused on the regions, emphasizing their socio-economic problems, which the "old" parties had so far been unable to address. This was reflected in the campaign slogan "Davankov. Time for New People". Sergey Usatenko, secretary of the Karelian regional branch of the party, commented on the success of the New People party: "Our team worked without populism. At the same time, we raised issues that concern people: economic growth, social support, education, and healthcare. Solving old problems with new approaches. This, along with people's demand for new solutions and ideas in politics, resulted in Vladislav Davankov's strong support in Karelia. It is important for us to build a country in which we want to live" [21].

At the same time, despite the predictability of the voting results, protest voting was observed in the presidential elections, with the Pearson correlation coefficient for all regions of the Karelian Arctic — $R_{xy} = 0.94$, indicating a "very high" linear dependence (according to the Chaddock scale [15, Bavrina A.P., Borisov I.B., p. 71]) between the number of invalid ballots and the number of votes cast for the candidate who took the last place in the election race. In the latter case, it was possible to observe the dynamics of protest potential in electoral behavior in the 2018 presidential election compared to the 2024 election campaign among residents of northern territories, including the Kalevalskiy National District. While in 2018, the difference between the number of votes for the candidate who came last and the number of invalid ballots was negative, in 2024, it was positive, indicating a clear voter preference for candidates in the 2024 elections.

This could also have been caused by both a decrease in the number of candidates competing in the elections (from 8 in 2018 to 4 in 2024) and an increase in electoral turnout in the Republic of Karelia (2018 — 57.14%, 2024 — 59.88%), and, consequently, a decrease in the level of absenteeism. In the Kalevalskiy District, voter turnout for the 2024 presidential election was the highest among Arctic territories, reaching 65.59%, with a maximum increase of 6.74% in electoral turnout in the national district compared to 2018 (see Table 4). We believe that this dynamic in the electoral behavior of residents of the republic's Arctic border territory is due not only to the demographic structure of voters, but also to the image of the candidates and the transformation of their political agenda.

Table 4

Dynamics of electoral turnout in the Russian presidential elections in the Karelian Arctic regions: 2018, 2024 [22]

District	*2018*	*2024*	*Dynamics*
Kalevalskiy District	58.85	65.59	6.74
Belomorskiy District	51.19	54.85	3.66
Kemskiy District	55.49	54.34	- 1.15
Loukhskiy District	53.85	55.78	1.93

[20] The party was registered on March 24, 2020 (according to the Russian Ministry of Justice). In September 2021, it won parliamentary representation in the State Duma and regional parliament elections (in 19 of 38), "breaking into big politics" — author's note.

[21] Karelia demonstrated the highest level of support in Russia for New People candidate Vladislav Davankov. URL: https://stolicaonego.ru/news/karelija-prodemonstrirovala-samyj-vysokij-v-rossii-uroven-podderzhki-kandidata-ot-novyh-ljudej-vladislava-davankova/ (accessed 13 August 2024).

[22] Source: compiled by the author.

Segezhskiy District	55.35	53.67	1.68
Kostomuksha Urban District	61.31	59.75	- 1.56

The situation in the State Duma elections was somewhat different, despite the fact that they are also considered to be "first-order" elections. In the minds of the Russian electorate, parliamentary elections are perceived as less important due to their collegial nature, which reduces the level of personal responsibility of deputies. This fact is reflected not only in the reduced voter turnout compared to presidential elections (see Fig. 2), but also in the level of alternativeness and the degree of protest potential.

The alternativeness of Duma elections is naturally always higher than that of presidential elections, and the mixed nature of the electoral system influences the modification of electoral preferences, since all candidates for elected office represent the Republic of Karelia and are, as a rule, known to the voters of the district. Therefore, the analysis of the electoral preferences of residents of the Kalevalskiy District was carried out in comparison not with the Arctic territories, but with the Republic of Karelia as a whole. A summary table was compiled ranking the political forces (based on the subject of nomination) that received more than 5% of the votes (see Table 5).

Table 5

Electoral support in the elections to the State Duma of the Russian Federation: 2016, 2021 [23]

Elections	State Duma of the RF (2016)		State Duma of the RF (2021)	
Mixed electoral system	Single-mandate constituency	Federal constituency	Single-mandate constituency	Federal constituency
Republic of Karelia	1. UR (36.56%) 2. SR (17.47%) 3. CPRF (11.47%) 4. LDPR (10.25%) 5. Yabloko (8.93%)	1. UR (37.30%) 2. LDPR (17.57%) 3. CPRF (13.05%) 4. SR (10.09%) 5.Yabloko (7.80%)	1. UR (27.68%) 2. Yabloko (14.79%) 3. CPRF (13.14%) 4. SRZP (12.85%) 5. RPPSJ (6.21%)	1. UR (31.69%) 2. CPRF (16.01%) 3. SRZP (11.73%) 4. LDPR (9.77%) 5.Yabloko (7.47%) 6. NP (7.00%)
Kalevalskiy National District	1. UR (44.87%) 2. SR (17.96%) 3. LDPR (10.29%) 4. CPRF (8.68%)	1. UR (41.16%) 2. LDPR (22.74%) 3. CPRF (10.87%) 4. SR (8.60%)	1. UR (30.16%) 2. SRZP (16.85%) 3. CPRF (10.25%) 4. RPPSJ (7.32%) 5. NP (6.74%) 6. LDPR (6.63%) 7. Yabloko (6.08%)	1. UR (33.20%) 2. SRZP (16.23%) 3. CPRF (9.82%) 4. NP (7.25%) 5. RPPSJ (5.39%)

As the data obtained shows, electoral preferences in the Arctic border region differed from those of voters in the Republic of Karelia in all four cases across the single-mandate and federal constituencies. The only exceptions were candidates/party lists nominated by United Russia, whose electoral support was slightly higher than in the republic. Otherwise, there were only differences.

While candidates/party lists from the Yabloko party secured sufficient electoral support at the regional level in 2016, in the Kalevalskiy District they received less than 5% of the vote. In 2021, the Yabloko candidate (E.E. Slabunova) in the single-mandate constituency received 6.08% of the vote, which was still insufficient for election to the 8th convocation of the State Duma.

It should be noted that the configuration of electoral preferences in the Arctic National District in the 2021 Duma elections was more diverse compared to the Republic of Karelia. In the single-mandate constituency, seven candidates received more than 5% of the votes: from both

[23] Source: compiled by the author.

"traditional" (United Russia, SRPZP, CPRF, NP [24], LDPR, Yabloko) and "non-traditional" (RPPSJ) political forces. At the regional level, only five candidates were represented. While the LDPR party list received 9.77% of the votes in the federal electoral district in Karelia, in the Kalevalskiy District, the party was represented only by a single-mandate candidate (A.M. Pakkuev). However, unlike in the Republic of Karelia, candidates/party lists from the Russian Party of Pensioners for Social Justice and New People gained more than 5% in both single-mandate and federal constituencies.

Federal parliamentary elections in Russia are the most alternative compared to all others, which is inevitably reflected in the increased level of conflict potential and the presence of protest potential in electoral preferences. With an average value of 12 for elections to the State Duma of the 7th and 8th convocations, the Pearson correlation coefficient $R_{xy} = 0.79$ for the Kalevalskiy electoral district. In the analyzed cases, the number of votes for the candidate or party list that ranked last in the elections was less than the number of invalid ballots. The negative values of the linear correlation indicate the presence of protest activity in the elections to the State Duma of the Russian Federation in both 2018 and 2021.

Case 2. Regional elections

According to the typology of K. Reif and H. Schmitt [13], regional elections are considered "second-order" elections, so voters may perceive them as secondary, which can reduce their desire to participate in them.

Between 2015 and 2024, residents of the Kalevalskiy National District participated in the elections of deputies of the Legislative Assembly of the Republic of Karelia (2016) and the 7th (2021) convocations and the Head of the Republic of Karelia (2017, 2022). However, they demonstrated electoral behavior that differed from other territories of the Karelian Arctic (see Fig. 3).

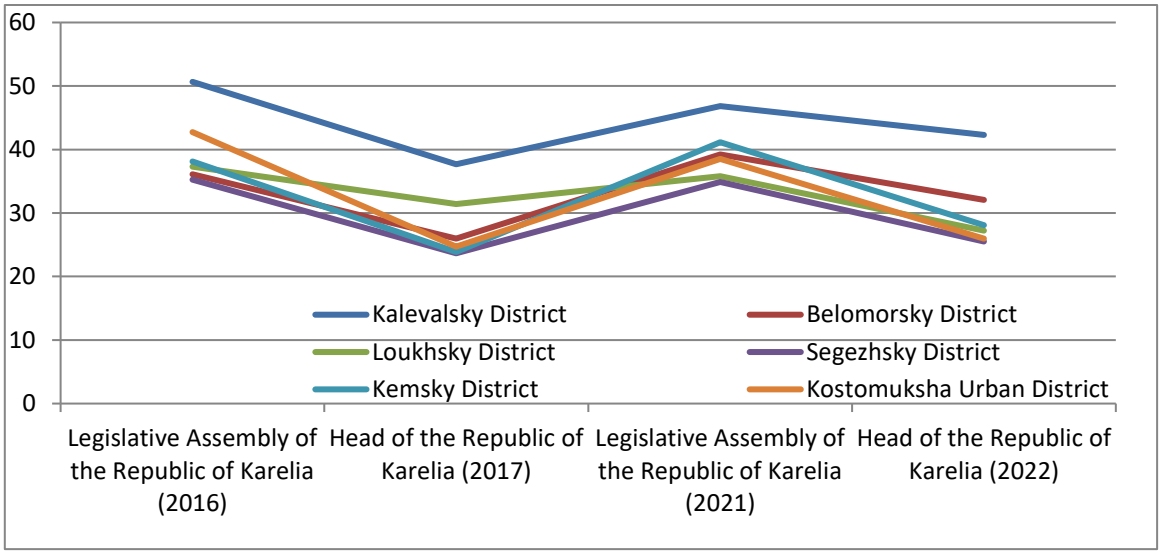

Fig. 3. Electoral turnout in regional elections in the Karelian Arctic: 2016–2022 (in %) [25].

[24] While the status of the NP party is difficult to determine, at the time of the study it was decided to classify it as a "traditional" political force – author's note.
[25] Source: compiled by the author based on data from the CEC RF.

The graph shows that voter turnout in the Arctic border region is higher than in other northern territories, both in elections to the Legislative Assembly of the Republic of Karelia and in elections for the Head of the Republic of Karelia. In addition, all regions show distinct peaks in activity during parliamentary elections and troughs during elections for the highest official of the constituent entity of the Russian Federation.

This pattern may be due to the fact that in the Republic of Karelia, federal and regional parliamentary elections are held on the same voting day, which has virtually no impact on the dynamics of electoral turnout during this period. Meanwhile, the election campaign for the Head of Karelia does not coincide with the primary elections, and electoral support depends on the image of a particular candidate.

Similar to the Duma elections, the electoral preferences of residents of the Kalevalskiy District were analyzed, and data on candidates/party lists (by subject of nomination) that received more than 5% of the votes were entered into a summary table (see Table 6).

Table 6

Electoral support in the elections of deputies to the Legislative Assembly of the Republic of Karelia: 2016, 2021 [26]

Elections	Legislative Assembly of the RK (2016)		Legislative Assembly of the RK (2021)	
Mixed electoral system	Single-mandate (multi-mandate) constituency	Single constituency	Single-mandate (multi-mandate) constituency	Single constituency
Kalevalskiy National District	1. UR (60.13%) 2. LDPR (10.98%) 3. SR (9.22%) 4. CPRF (9.11%)	1. UR (37.12%) 2. LDPR (23.79%) 3. SR (17.13%) 4. CPRF (10.76%)	1. UR (55.74%) 2. SR (24.08%) 3. LDPR (12.79%)	1. UR (29.68%) 2. SRZP (20.99%) 3. LDPR (13.18%) 4. CPRF (12.24%) 5. NP (6.12%) 6. RPPSJ (5.85%)

Based on the results, in 2016 it was observed that in both regional parliamentary and Duma elections in the single Kalevalskiy constituency, candidates from the Yabloko party did not overcome the 5% threshold, and in the single-mandate (multi-mandate) elections for deputies to the Legislative Assembly of the Republic of Karelia in 2021, there were no candidates from either the Yabloko party or even from the CPRF in the national district, in contrast to the 2016 elections, although they were represented in the region at the federal level (see Table 5). Thus, over the past five years, the positions of these political parties have weakened at the regional legislative level in the Arctic National District. This could be caused by both demographic decline and the outflow of the population supporting the ideas of the "traditional" regional political players, Yabloko and the CPRF, from the Kalevalskiy District.

Furthermore, based on the nature of electoral preferences, the Kalevalskiy National District cannot currently be classified as either a "red belt" (in the terminology of R. Turovskiy [20]) or a "Yabloko" constituency (by analogy). In the regional parliamentary elections, although the residents demonstrated a position that differed from that of the republic, this was fundamentally different only in relation to the Yabloko party. The electoral support of voters in the Arctic border region for

[26] Source: compiled by the author.

candidates/party lists nominated by United Russia was as stable in the elections to the Legislative Assembly of the Republic of Karelia as it was in the State Duma of the Russian Federation.

Despite the lower average alternativeness values for regional parliamentary elections (6.5) compared to federal elections (12), R_{xy} = 0.91 in the Kalevalskiy District. In three out of four cases, the negative values of the difference between the number of votes cast for the candidate/party list that ranked last in the election race and the number of invalid ballots indicate the presence of protest potential in the electoral preferences of residents of the Arctic border national territory.

A slightly different pattern of voter turnout in the Kalevalskiy District was observed during the elections for the Head of the Republic of Karelia, although it was still higher than in other parts of the Karelian Arctic (see Fig. 3). We believe that maintaining average voter turnout values for the elections for the republic's highest official depends on the demographic structure of the electorate in the district and the significant proportion of people of retirement age [27], who regularly participate in elections.

In their electoral preferences for candidates for the elected position of Head of the Republic of Karelia, voters of the Kalevalskiy National District demonstrated similarity with the final results of the vote in the Republic of Karelia, and the average values of the alternativeness of elections were equal to 4.5. The predictability of the voting results (that the winner of the elections for the Head of the Republic of Karelia in both 2017 and 2022 would be the candidate from the United Russia party, A.O. Parfenchikov) was also very high. When calculating the Pearson correlation coefficient for all regions of the Karelian Arctic, R_{xy} = 0.50, which is interpreted as "average" according to the Chaddock scale [15, Bavrina A.P., Borisov I.B., p. 71] depending on the number of invalid ballots and the candidate who received the fewest votes in the elections for the highest official of the subject.

However, in both federal and regional elections, the configuration of electoral preferences among residents of the Kalevalskiy National District of the Karelian Arctic is always influenced by external factors — those political forces that represent not the district, but Karelia or Russia. Therefore, only local elections can reveal the real picture and ranking of the electoral preferences of voters in the Arctic border region.

Case 3. Local elections

According to the theory of "second-order" elections by K. Reif and H. Schmitt [13], local elections are of secondary importance. "Voter turnout in local government elections is usually the lowest compared to presidential and parliamentary elections" [14, Turovskiy R.F., Korneeva E.M., Vaselenko O.S., p. 121]. However, the participation of residents of the Kalevalskiy District in local elections only partially confirms this statement, as an analysis of data for the period 2015–2023 showed

[27] Strategy for the socio-economic development of the municipality "Kalevalskiy National District" for the period up to 2030. Vol. 1. 2020 // Official website of the municipality "Kalevalskiy National District". URL: https://visitkalevala.ru/ekonomika/strategija-social-no-ekonomicheskogo-razvitija-municipal-nogo-obrazovanija-kaleval-skij-nacional-nyj-rajon-na-period-do-2030-goda/ (accessed 27 December 2024).

that voter turnout in the Borovskiy, Luusalmskiy, and Yushkozerskiy rural settlement council elections was distributed within the average range, with declines only in the Kalevala Urban Settlement Council elections [28] (see Figures 1 and 4) amid weak political competition (see Table 7).

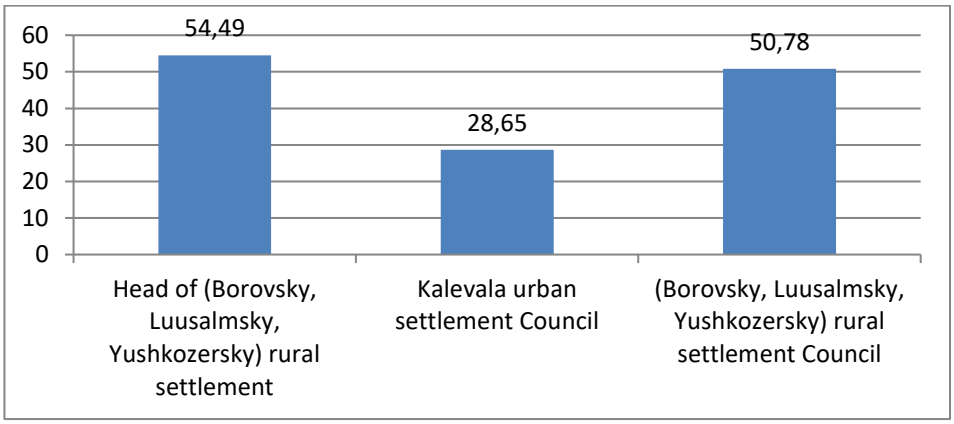

Fig. 4. Voter turnout in the Kalevalskiy District local elections: 2015–2023 (median) [29].

Table 7

Number of registered candidates: 2015–2023 (average) [30]

Borovskiy Rural Settlement Council	Luusalma Rural Settlement Council	Yushkozerskiy Rural Settlement Council	Kalevala Urban Settlement Council	Head of the Borovskiy rural settlement	Head of the Luusalma rural settlement	Head of the Yushkozerskiy rural settlement
1.15	1.11	1.72	2.04	2	2.5	2

It should be noted that local elections in the border Arctic national region of Karelia were held mainly separately, although there were cases when the elections of the head and deputies of a rural settlement were carried out on the same day (in the Borovskiy rural settlement (2018, 2023)). In 2016, in parallel with the election of deputies to the State Duma of the Russian Federation of the 7th convocation and the Legislative Assembly of the Republic of Karelia of the 6th convocation, by-elections were held for the deputy of the Council of the Kalevala Urban Settlement of the 3rd convocation in single-mandate electoral district No. 1 (turnout — 46.28%), the deputy of the Council of the Yushkozerskiy Rural Settlement of the 3rd convocation in single-mandate electoral district No. 7 (turnout — 48.33%) and the deputies of the Council of the Luusalmskiy Rural Settlement of the 3rd convocation in single-mandate electoral districts No. 1 (turnout — 59.25%) and No. 4 (turnout — 47.14%), as well as the election of the Head of the Yushkozerskiy Rural Settlement (turnout — 53.97%), which confirms the impact of holding elections at different levels on a single voting day on the growth of electoral activity indicators.

[28] The head of the Kalevala urban settlement is appointed, not elected – author's note.
[29] Source: compiled by the author based on data from the CEC RF.
[30] Source: compiled by the author.

In this regard, in order to identify the specifics of the electoral behavior of the residents of the Kalevalskiy District in local elections, all additional and by-elections of deputies to rural settlement councils in the district were excluded from the analysis.

It is worth noting that voters in rural settlements in the Kalevalskiy District actively participate in voting, and voter turnout in elections for both heads of local authorities and council deputies is practically identical and distributed within the average range (see Fig. 4). The rural areas of the Arctic border national district of Karelia are characterized by a low population density [31], with a predominance of residents above working age. This has an impact on voter activity and preferences because people may know candidates for elective office personally and may come to the polls and vote for someone they know, rather than for their political party affiliation. However, in rural areas of the district, the winning candidates were predominantly those nominated by United Russia.

In the 2023 elections for heads of settlements, only in the Borovskiy rural settlement, a candidate from the Russian Party of Pensioners for Social Justice competed with a candidate from United Russia; in all other cases, the opponents were independent candidates. The results of the voting for heads of rural settlements were also predictable, with the winners being exclusively candidates nominated by United Russia, with a low level of alternatives, averaging 2.16. This is also reflected in the weak correlation between the number of invalid ballots and the number of votes for the candidate ranked last in the election race (R_{xy} = 0.39) and the virtual absence of protest potential in the electoral behavior of rural residents.

Voter turnout differed slightly in the elections for rural council deputies. While voter turnout remained at average levels, the configuration of electoral preferences varied. The local legislative bodies included not only deputies from UR, but also from SR/SRPZP, CPRF and independent candidates, although the Borovskiy rural settlement councils of the 4th (2018) and 5th (2023) convocations and the Luusalmskiy rural settlement of the 5th (2023) convocation were represented only by UR deputies.

The urbanized nature of the Kalevala urban settlement, with more than 60% of the district's population located there [32], was reflected in the low values of electoral turnout in the district in the elections of deputies of the Council of the Kalevala urban settlement of the 4th (2018, turnout — 24.41%) and 5th (2023, turnout — 32.89%) convocations, and the calculation of the correlation coefficient of the dependence of the number of invalid ballots and the number of votes for the candidate who ranked last in local parliamentary elections is expressed in low values — R_{xy} = –0.11, which is of no interest for data analysis in a situation of low election alternatives.

[31] Strategy for the socio-economic development of the municipality "Kalevalskiy National District" for the period up to 2030. Vol. 1. 2020 // Official website of the municipality "Kalevalskiy National District". URL: https://visitkalevala.ru/ekonomika/strategija-social-no-ekonomicheskogo-razvitija-municipal-nogo-obrazovanija-kaleval-skij-nacional-nyj-rajon-na-period-do-2030-goda/ (accessed 27 December 2024).

[32] Strategy for the socio-economic development of the municipality "Kalevalskiy National District" for the period up to 2030. Vol. 1. 2020 // Official website of the municipality "Kalevalskiy National District". URL: https://visitkalevala.ru/ekonomika/strategija-social-no-ekonomicheskogo-razvitija-municipal-nogo-obrazovanija-kaleval-skij-nacional-nyj-rajon-na-period-do-2030-goda/ (accessed 27 December 2024).

It should be noted that, overall, in the elections of deputies to local legislative councils in the Kalevalskiy District, R_{xy} = –0.47, and according to the Chaddock scale, the correlation is "weak" [15, Bavrina A.P., Borisov I.B., p. 71]. The alternativeness of all parliamentary elections held in the district is low (average values — 2.03), which demonstrates an insignificant degree of protest potential in the behavior and preferences of voters in the border Arctic national territory of the Republic of Karelia.

Conclusion

The comparative study of the electoral behavior and preferences of residents of the border Kalevalskiy National District of the Karelian Arctic in elections at different levels of public authority made it possible to identify their specific features and construct a pattern of the Arctic national district of the Russian Arctic as a possible unit for future comparative analysis of the national territories of the Arctic zone of the Russian Federation.

By comparing social cleavage patterns and electoral participation practices in "first" and "second" order elections between 2015 and 2024 with those in other Arctic regions of the Republic of Karelia, we identified seven patterns of voter behavior and preferences in the Kalevalskiy District (see Table 8).

Table 8

Patterns of electoral behavior and preferences in the Kalevalskiy National District of the Karelian Arctic: 2015–2024 [33]

Elections	Elections of the President of the RF, the Head of the RK, heads of rural settlements				Elections of deputies of the State Duma, the Legislative Assembly of the RK, councils of urban*/rural settlements			
	Turnout rate	Alternativeness of elections	Predictability of voting results	Protest potential	Turnout rate	Alternativeness of elections	Predictability of voting results	Protest potential
Federal	middle	+	yes	rather present	middle	+	yes	rather present
Regional	middle	+	yes	rather present	middle	+	yes	rather present
Local	middle	+	yes	rather absent or not clearly expressed	middle	+	yes	rather absent or not clearly expressed
					low*	+*	yes*	rather absent or not clearly expressed *

Like all Arctic regions of Karelia, this border national district is peripheral, but has the highest proportion of rural to urban residents. The Kalevalskiy District contains the largest number of areas with specially protected natural status, but it does not have a single settlement founded around a city-forming enterprise (single-industry town) to provide labor for production. This is characterized

[33] Source: compiled by the author.

by the risk of deterioration in the demographic situation of the district due to the outflow of the working-age population and an increase in the proportion of older residents, which reveals the specifics of voter participation in the district.

The predominantly active voting in elections at various levels of public authority is reflected in the average voter turnout figures, with the exception of the elections for deputies of the Kalevala Urban Settlement Council. Otherwise, the behavior of voters in the Arctic border national district correlates with federal and regional trends: despite the competitive nature of the elections, voting results are quite predictable, and the protest potential, although present, does not affect the configuration of electoral preferences in the district. Residents of the Kalevalskiy District, as in other Arctic regions of Karelia, prefer "traditional" political forces, and the positions of candidates/party lists nominated by the United Russia party are generally stable, and on this basis, they win elections.

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The End of Arctic Exceptionalism: A Review of the Monograph "Unfrozen: The Fight for the Future of the Arctic"

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Abstract. The monograph “Unfrozen: The Fight for the Future of the Arctic” attempts to analyze the current transformations in the Arctic region against the backdrop of climate change and escalating global geopolitics. However, from the Russian perspective, the work is significantly limited by its Western perspective, in which Russia is presented more as a source of tension and an object of sanctions pressure than as an equal participant in Arctic cooperation and sustainable development. The book does not pay sufficient attention to Russian national interests, strategic priorities, and comprehensive approach to Arctic development. The authors’ disregard for Russia’s role in ensuring environmental security, developing the Northern Sea Route and supporting the indigenous peoples of the region is critically important. Instead, the focus is on confrontation and the collapse of the Arctic Council’s institutional model, overlooking Russia’s efforts to maintain and advance cooperation mechanisms at the bilateral and multilateral levels. The monograph inadequately addresses Russian concepts of sustainable Arctic development as well as the consequences of unilateral sanctions and political pressure, undermining overall regional stability and security. Thus, while “Unfrozen” is valuable for understanding the Western perceptions of Arctic changes, it clearly lacks a comprehensive and balanced view that reflects the specifics and interests of Russia as a key Arctic state.
Keywords: *Arctic, geopolitics, Arctic Council, climate change, Arctic exceptionalism, international cooperation, regional governance, Greenland, Arctic militarization*

Introduction

An analysis of publication activity demonstrates a significant intensification of scientific interest in the collapse of “Arctic exceptionalism” between 2022 and 2025. Research shows that in 2024–2025, the number of publications on this topic increased by 2.5 times compared to the previous period. Leading academic publishers, including Oxford Academic, Cambridge University Press, and specialized Arctic journals, have published a series of comprehensive studies devoted to this phenomenon [1; 2; 3; 4; 5].

Thematic conferences on the Arctic, including the Arctic Circle Assembly (Reykjavik, October 2024) and the EGU General Assembly (Vienna, May 2025), have noted a record number of sections devoted to the breakdown of institutional ties and new formats for Arctic cooperation. The scientific

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aggregators Web of Science and Scopus have recorded over 80 new publications with the keywords “collapse of Arctic exceptionalism”, “Arctic governance crisis”, and “end of cooperation” in the past two years alone, whereas previously there were no more than 30 similar publications in the same two-year period.

Particularly indicative is the publication of the monograph “Unfrozen: The Fight for the Future of the Arctic” [6, Bennett M., Dodds K.] in September 2025, the authors of which state bluntly: “What we used to call Arctic exceptionalism has been absolutely blown out of the water”. Experts argue that “it is no longer possible to pretend that Gorbachev’s vision of the Arctic as a zone of peace, a Pole of Peace, is achievable” [1]. These assessments reflect the consensus in the Western expert community regarding the irreversibility of the ongoing changes. The book provides a comprehensive overview of the return to power politics in the Arctic region. The authors note a fundamental shift from cooperation to confrontation, with the great powers seeking to maximize their spheres of influence and consolidate resources.

It is clear that the Arctic region is undergoing a period of dramatic transformation, driven both by climate change and deterioration of international relations. Mia Bennett and Klaus Dodds’s monograph, “Unfrozen: The Fight for the Future of the Arctic”, published by Yale University Press, provides a timely and insightful analysis of these processes. The 352-page book addresses key issues in contemporary Arctic geopolitics and challenges established perceptions of the region as an area of exceptional international cooperation.

The authors — Mia Bennett [2], Associate Professor of Geography at the University of Washington, and Klaus Dodds [3], Senior Research Fellow at RAND Europe and Professor of Geopolitics at Royal Holloway, University of London — present their own vision of the processes in the Arctic region for expert consideration. This comprehensive study combines theoretical analysis with empirical data.

The book’s fundamental thesis is that the concept of “Arctic exceptionalism”, which allowed the region to remain a “zone of peace” outside global conflicts, has been completely destroyed. Dodds categorically states: “What’s happened over the last three years, is what we used to call Arctic exceptionalism has been absolutely blown out of the water” [4].

The authors believe the previous vision of the Arctic as a “Pole of Peace”, formulated in Mikhail Gorbachev’s famous speech in Murmansk in 1987, is no longer achievable. The events in

[1] Thorsson E. Unfrozen: The end of Arctic exceptionalism, cooperation and institutional rule // ArcticToday. 30.09.2025. URL: https://www.arctictoday.com/unfrozen-the-end-of-arctic-exceptionalism-cooperation-and-institutional-rule/ (accessed 01 October 2025).
[2] Mia Bennett / University of Washington. URL: https://geography.washington.edu/people/mia-bennett (accessed 01 October 2025).
[3] D. Klaus Dodds / Royal Holloway Research Portal. URL: https://pure.royalholloway.ac.uk/en/persons/klaus-dodds (accessed 01 October 2025).
[4] Thorsson E. Unfrozen: The end of Arctic exceptionalism, cooperation and institutional rule // ArcticToday. URL: https://www.arctictoday.com/unfrozen-the-end-of-arctic-exceptionalism-cooperation-and-institutional-rule/ (accessed 01 October 2025).

Ukraine in February 2022 became the catalyst for the final collapse of the system of circumpolar cooperation that had existed since the mid-1990s.

The authors note a fundamental shift from cooperation to confrontation, with the great powers seeking to maximize their spheres of influence and consolidate resources. This transition marks a return to power politics and classic geopolitical competition in the Arctic.

Institutional crisis of the Arctic Council

A significant part of the study is devoted to analyzing the crisis of the Arctic Council, the leading Arctic governance body established in 1996. Following the start of the special military operation in Ukraine, seven Western members of the Council announced a "pause" in cooperation with Russia, paralyzing the organization's work.

The suspension of 128 scientific and cooperation projects demonstrates the scale of destruction of institutional cooperation mechanisms. Dodds expresses concerns that the Arctic Council has ceased to function at the political and diplomatic levels [5].

The authors emphasize the paradoxical nature of the situation: what does the US get from the Arctic Council? The answer is: very little. Therefore, the US does not need the Arctic Council. This creates the preconditions for the final "dismantling" of the institutional architecture of Arctic cooperation.

The authors pay special attention to the transformation of American Arctic policy under President Donald Trump. His ambitions regarding Greenland are viewed not as political rhetoric, but as a serious intention requiring close attention.

Dodds says: "If I was the Kingdom of Denmark or Copenhagen, I would absolutely work on the assumption that Trump wants Greenland and don't treat it as a flippancy" [6]. These ambitions reflect a broader worldview that values territory, resources, and spheres of influence over institutional stability.

The authors interpret Trump's interest in Greenland through the prism of the concept of "planetary shrinkage" — a strategy of great powers to consolidate territory and resources in response to climate change. According to the researchers, similar logic explains statements about the possible annexation of Canada.

Climate change as a driver of geopolitical transformation

An innovative aspect of the study is its analysis of the relationship between climate change and geopolitical competition. The authors demonstrate how the rapid melting of sea ice is opening up new trade routes and making vast reserves of natural resources accessible.

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[5] Interview — Klaus Dodds // E-International Relations. URL: https://www.e-ir.info/2024/09/30/interview-klaus-dodds/ (accessed 03 October 2025).

[6] Thorsson E. Unfrozen: The end of Arctic exceptionalism, cooperation and institutional rule // ArcticToday. 30.09.2025. URL: https://www.arctictoday.com/unfrozen-the-end-of-arctic-exceptionalism-cooperation-and-institutional-rule/ (accessed 01 October 2025).

In the book, Bennett emphasizes that "climate change is catalyzing new opportunities and tensions in the region". The region is transforming from a "frozen desert" into an "international waterway" attracting global attention [6, Bennett M., Dodds K.].

The authors' understanding of Trump's approach to climate change is particularly important. Dodds notes: "Donald Trump understands climate change exceptionally well. He just doesn't understand it in the way that climate change scientists understand it." For the American president, climate change means "planetary shrinkage", requiring the strengthening of territorial positions and resource bases.

The role of non-regional actors and indigenous peoples

The authors analyze in detail the growing influence of China in the Arctic, which declared itself a "near-Arctic state" in 2018. Beijing is actively developing economic cooperation with Russia, including joint statements by the leaders of the two countries on strengthening the Arctic partnership [7].

The strengthening of Sino-Russian cooperation is creating a new geopolitical reality. This is forcing Western countries to review their Arctic strategies and seek new formats for regional interaction.

The monograph pays considerable attention to the situation of the indigenous peoples of the Arctic, who currently make up just over 10% of the region's population. The authors emphasize the uniqueness of their participation in governance through their status as permanent participants in the Arctic Council [8].

For this reason, the crisis in the Council has a particularly acute impact on indigenous peoples, since, according to the authors, if the Arctic Council does not survive, this unique structure will collapse. This assessment creates serious problems for Arctic indigenous peoples, who are unlikely to gain similar influence in other regional forums.

Methodological strengths and limitations of the study

Overall, the monograph "Unfrozen: The Fight for the Future of the Arctic" is a significant contribution to understanding Arctic issues. However, the work is not without a number of significant shortcomings and limitations that are important to consider in its scientific analysis. First of all, an attentive reader will immediately notice that the author's approach is shaped primarily by Western analytical frameworks and often ignores the point of view of Russia, which is one of the key actors in the region. This is evident in the selective interpretation of political and institutional processes: for example, Russia's behavior in the Arctic Council and its actions to expand its military presence

[7] Interview — Klaus Dodds // E-International Relations. 30.09.2024. URL: https://www.e-ir.info/2024/09/30/interview-klaus-dodds/ (accessed 03 October 2025).
[8] Rottem M.J., Svein Vigeland. The Arctic Council in the Shadow of Geopolitics / The Arctic Institute. URL: https://www.thearcticinstitute.org/arctic-council-shadow-geopolitics/ (accessed 03 October 2025).

are interpreted exclusively from the perspective of competition, while the internal logic of Russia's Arctic development and long-term national goals are ignored [9].

It should also be noted that, despite the stated interdisciplinary nature of the study, the authors largely give preference to geopolitical and institutional analysis with a focus on events of 2022–2025. As a result, economic, technological, and social aspects (including infrastructure development, demography, and Arctic economic development) are covered fragmentarily or not considered at all. The monograph is overloaded with factual material: readers may be confused by the abundance of details, acronyms, and references to little-known documents, which reduces the overall accessibility of the text for non-specialists and complicates the practical application of the study's results. This shortcoming has also been noted in a number of other reviews [10].

Another limitation of the work is the insufficient attention to long-term scenarios for the development of the situation in the region. The book details the process of the collapse of the mechanisms of "Arctic exceptionalism". However, specific strategies for overcoming the crisis, new institutional formats, and alternative vectors of cooperation (in particular, at the Eurasian, Asian, and bilateral levels) are either not proposed or only touched upon briefly. The problem of finding a balance between competition and sustainable development in the Arctic is hardly addressed, and the recommendations are limited to a statement of the unsatisfactory current state of affairs [11].

Finally, the authors clearly tend to exaggerate the scale of "Arctic disorder" and offer a pessimistic interpretation of the prospects for restoring any dialogue and cooperation, which does not fully reflect the sentiments and practices of a number of Arctic and non-Arctic countries that continue to seek opportunities for pragmatic interaction. Thus, the book leaves the impression of underestimating the potential for integration and existing positive examples of regional governance outside the framework of Western political models.

These shortcomings do not detract from the overall value of the monograph, but they highlight the need for a comprehensive, multifaceted assessment of Arctic transformations and the inclusion of all key regional actors in the analysis of national strategies. This is particularly relevant for the Russian academic community, which is interested in developing its own scenarios for sustainable development and integration of the Arctic into global processes, taking into account national interests.

Conclusion

In the current context of the transformation of the Arctic Council and the collapse of the previous model of cooperation in the region, it is necessary to review approaches to ensuring

[9] Hunter Tina Soliman. "The Consequences of Russia's Exclusion from the Arctic Council: Views of Member and Observer States" // IECCA. URL: https://www.iecca.ru/content/1851 (accessed 03 October 2025).
[10] To Kabul, Easter Island and the Arctic in the 'Literary Review' // Deskbound Traveller. URL: https://deskboundtraveller.com/to-kabul-easter-island-and-the-arctic-in-the-literary-review/ (accessed 03 October 2025).
[11] Interview — Klaus Dodds // E-International Relations. URL: https://www.e-ir.info/2024/09/30/interview-klaus-dodds/ (accessed 03 October 2025).

Russian national interests in the Arctic. The monograph "Unfrozen: The Fight for the Future of the Arctic" rightly notes the end of the era of Arctic exceptionalism. However, the authors assess this process primarily from a Western perspective, emphasizing disunity and a return to "politics of power".

For Russia, the Arctic is not just a platform for geopolitical competition, but a key territory for long-term sustainable development, strengthening national security, implementing major infrastructure and resource projects, and protecting the interests of the Arctic peoples. The practice of external isolation, boycotting Russia's initiatives in the Arctic Council and attempts to limit its participation lead to the loss of potential for stable development in the region and fail to take into account Russia's objective role as an Arctic power. Russia has proceeded — and continues to proceed — from the principle of the indivisibility of security and the need to resume constructive dialogue on key issues: ecology, ensuring the vitality of northern territories, developing the Northern Sea Route, and protecting the interests of residents and indigenous peoples.

It should be noted that the monograph does not fully reveal the specifics of Russia's approaches to Arctic policy, including the priorities set out in the "Basic Principles of the Russian Federation State Policy in the Arctic until 2035" and related strategies. Attempts by Western countries to transform the Arctic Council and other Arctic institutions into instruments of political pressure against Russia contradict the spirit of circumpolar cooperation and, in the long term, threaten the stability of the entire Arctic governance system.

It is obvious that Russia, based on its national interests, will continue to implement strategic projects, develop social and transport infrastructure, and support scientific research and environmental programs in the Arctic, relying both on internal resources and on bilateral and multilateral cooperation with those countries that are ready to engage in an equal dialogue. The revival of a full-fledged Arctic partnership is only possible with the recognition of Russia's legitimate interests, the abandonment of sanctions, and the return to the principles of equality and respect for the sovereignty of Arctic states.

The task for the Russian scientific and expert community is to develop new conceptual foundations for Arctic cooperation that take into account both global challenges and specific national interests. The future of the Arctic depends on the balance between geopolitical struggle and reasonable compromise, and the fate of the Arctic Council is a matter of willingness to abandon political prejudices in favor of pragmatic and inclusive dialogue.

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Sisters of Mercy and Peculiarities of Providing Medical Assistance to Fishermen in Murmansk in the Late 19th — Early 20th Centuries

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Abstract. The article examines the activities of the sisters of mercy of the Arkhangelsk Red Cross Community in the late 19th and early 20th centuries. The authors compare the forms of their work in peacetime and during wars. Based on the analysis of the annual "Reports of the Arkhangelsk Local Administration of the Russian Red Cross Society", the following main areas of activity are identified: caring for the sick and wounded (both in hospitals and medical centers in the Arkhangelsk province and at the front), fundraising for the Arkhangelsk institutions of the Russian Red Cross Society, organization of a surgical hospital for children under the Community, training and certification of junior medical personnel. Particular attention is paid to the provision of medical care to Russian fishermen on the Murmansk coast during the spring and summer fishing season. The quality and changes in the medical services provided in the Arctic climate in the early years of the 20th century are analyzed. Examples of the activities of the medical and sanitary detachment of the Arkhangelsk institution of the Russian Red Cross Society in Kiberg (Norway) are presented. The novelty of the study consists in a comprehensive analysis of the initial stage of the medical and sanitary detachments' activities and the specifics of training medical personnel to provide seasonal medical care to residents of the Arkhangelsk province going out to fish.
Keywords: *Murmansk coast, Arctic, sisters of mercy, medical and sanitary detachment, fishermen*

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Introduction

There are topics in Russian social history the study of which not only expresses respect for the past but also provides valuable historical experience for the present. In the context of the current rethinking of spiritual and moral values in Russian society, as well as the transformation of the social security system and the development of non-profit organizations, the study of centuries-old

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experience in charity work is becoming increasingly relevant.

Studying the history of charity and social support at the regional level contributes to a deeper understanding of the challenges faced by social institutions. Analysis of the activities of the Russian Red Cross Society allows for a detailed examination of both the socio-economic and cultural aspects of the past.

In the pre-revolutionary period, information about charitable initiatives of Arkhangelsk, published in central publications, was primarily informative, while more in-depth research could be found in local newspapers [1]. Currently, there are no comprehensive, generalizing studies devoted to the history of the formation of free medical care in the Arkhangelsk province. Medical and sanitary aspects of this topic were addressed in the work of A.A. Kirov and A.P. Tyukina, published during the Soviet period [1], as well as in modern scientific articles [2, Komissarova E.V., Petrova I.A.]. The works of local historians examine key issues related to the charity of Arkhangelsk merchants and women [2] [3, Ovsyankin E.I.]. It is also important to mention the authors who studied church charity and the social role of the Orthodox Church in the development of this phenomenon in Russia [4, Kolpakova O.V., Koblova N.A., Shigurova A.B.; 5, Leontyeva T.G.; 6, Syromyatnikov V.E.; et al.].

The topic of charity and social support in the North was covered in the works of E.Yu. Kolebakina [7; 8; 9], A.S. Kuzychenko [10], M.L. Golkova [11], and other researchers. The Pomor Encyclopedia also provides a brief description of social support in the Arkhangelsk province, citing the names of merchants involved in charity work [12, pp. 56, 78, 86, 213, 277, 308, 401, 425].

Despite this, the regional history of charity, including the activities of the Russian Red Cross Society, requires more detailed research.

The methodological basis of the current study is a synthesis of general scientific principles and specific historical methods. These methods imply a concrete historical approach to the analysis of the phenomena under study, their comprehensive assessment, and consideration of dynamics and inherent contradictions. A key element of the research methodology is the comprehensive use of a variety of documents and materials, which allows all factors to be taken into account for a more in-depth retrospective analysis of the processes.

The main objective of this article is to examine the specific activities of the Arkhangelsk branch of the Red Cross in providing medical assistance to Russian fishermen on the Murmansk coast during the pre-revolutionary period.

The work utilized a variety of sources, which can be divided into the following groups:

- Official reports, such as “Reports on the Funding and Activities of the Arkhangelsk Institutions of the Russian Red Cross Society” and “Protocols and Proceedings of the Arkhangelsk Medical Society”. These documents make it possible to track the dynamics of

[1] AEN — Arkhangelsk Eparchial News; ACN — Arkhangelsk City News; APN — Arkhangelsk Provincial News.
[2] Barashkov Yu. Yakov Efimovich Makarov. ATK Newspaper, 1996, March 9, p. 16; Zelenina T. Merchant’s Wife Plotnikova. Pravda Severa, 1995, January 11, p. 4; Ovsyankin E.I. Not Fear of Hell, but Compassion Forced the Rich to Charity. Pravda Severa, 1999, July 28, p. 11; Smirnova M.A. Do Good! Volna, 1996, No. 21, May 31, p. 8; Yakovlev S. First Guild Merchant. Pravda Severa, 1989, August 19, p. 3.

development, identify sources of funding and methods of charity.

- Periodicals: "Arkhangelsk Provincial Gazette" provides an opportunity to analyze the history of charity in the region and to describe the social practices implemented by various organizations and individuals. Since its founding in 1838, the newspaper regularly covered topics related to charitable events.

The establishment of the mercy sister training system in Arkhangelsk

The roots of public medical care for wounded and sick soldiers date back to the Crimean War (1854–1855), when the Russian Red Cross Society (RRCS) was founded.

The Russian Red Cross Society was officially established on 3 (15) May, 1867, with the approval of the Charter of the "Russian Society for the Care of Wounded and Sick Soldiers" by Emperor Alexander II. In 1879, the RRCS was renamed, and its honorary members included the Emperor, grand dukes and duchesses, as well as high-profile secular figures and members of the clergy.

One of the main tasks of the Russian Red Cross Society was the training of medical personnel. In 1877, with the active support of the director of the obstetric school, A.S. Stern, the Arkhangelsk local administration organized lectures on field surgery and the rules for caring for the wounded and sick [3]. Training was provided free of charge to anyone who wanted to become a sister of mercy and care for soldiers. Women of all Christian denominations and social classes, literate in Russian, aged 20 to 45, and free of chronic illnesses, were accepted into the ranks of sisters of mercy. Smallpox vaccination was also required; married women had to obtain their husbands' consent to participate in the program. In the event of military action, all trainees were required to work for the RRCS until the end of the war [4].

In 1877, with the outbreak of the Russo-Turkish War, the Society's leadership called on Arkhangelsk residents to actively raise funds and medical supplies to support the Russian army [5]. As a result, about 10,000 rubles were collected, which were used to purchase 17 beds, named "Arkhangelsk beds" [6]. This equipment was sent to the Red Cross hospital in Bucharest [7]. During the war, 12 sisters of mercy left the the Kholmogory Monastery for the front to provide assistance. After the peace treaty was signed, the Society did not cease its activities and continued to raise funds to help the wounded and sick.

Between the Russo-Turkish and Russo-Japanese Wars, the administration actively replenished its volunteer ranks and supported the victims, as well as trained sisters of mercy. Additionally,

[3] From the Arkhangelsk local administration of the Society for the Care of Wounded and Sick Soldiers // Arkhangelsk Provincial News, 1877, No. 38, May 23, p. 2.
[4] Ibid.
[5] From the Arkhangelsk local administration of the Society for the Care of Wounded and Sick Soldiers // Arkhangelsk Provincial News, 1877, No. 48, July 27, p. 3.
[6] From the Arkhangelsk local administration of the Society for the Care of Wounded and Sick Soldiers // Arkhangelsk Provincial News, 1877, No. 91, November 24, p. 3.
[7] From the Arkhangelsk local administration of the Society for the Care of Wounded and Sick Soldiers // Arkhangelsk Provincial News, 1878, No. 11, February 20, p. 3–4.

it provided medical equipment to fishermen on the Murmansk coast and collected the necessary resources for these purposes.

Organizing medical assistance for Russian fishermen on the Murmansk coast — the first medical and sanitary detachment

In the harsh Arctic climate and extremely difficult (mostly manual) work conditions, fishermen in Murmansk were always in need of medical care. Of particular interest for research is the work of doctors and sisters of mercy in organizing medical care for Russian fishermen on the Murmansk coast during the spring and summer fishing seasons.

The first detachment for this purpose was created in 1881 at the initiative of the Governor of Arkhangelsk, Prince N.D. Golitsyn. In order to provide medical care to sick fishermen on the Murmansk coast, a medical and sanitary team consisting of six sisters of mercy was formed annually in March. Until 1890, it consisted of nuns from the Kholmogory Monastery, but since March 2, 1890, after the establishment of the Red Cross community in Arkhangelsk, sisters of mercy from this new organization were sent to Murman [8, Kolebakina E.Yu., p. 65].

The dispatch of the Red Cross medical and sanitary detachment to Murman in 1881 was motivated by two key objectives: firstly, to provide medical assistance to sick fishermen, and secondly, to study the local living conditions of colonists and fishermen in order to determine what kind of assistance was most needed and when. This detachment was sent from Arkhangelsk on June 10, 1881, on its first voyage on the steamship “Arkhangelsk”. The detachment worked in two locations: in Teriberka, consultations were provided by doctor E.M. Dementyev and three sisters of mercy; and in the Sem-Ostrovov settlement, three sisters of mercy and volunteer doctor Vladislav Romualdovich Gulevich.

Vladislav Romualdovich Gulevich (abt 1848 – after 1892) was a doctor and nobleman. He graduated from the Faculty of Medicine at Kazan University in 1874. He was exiled to Arkhangelsk province in 1877, accused of exempting several peasants from military service while working as a zemstvo doctor in Kostroma province. When in 1881 the Arkhangelsk branch of the Red Cross Society assembled a medical detachment to provide assistance to Russian fishermen on the Murmansk coast, V.R. Gulevich volunteered to participate. Even after his amnesty, he continued his work in the North, leading a sanitary detachment in Murman and Kiberg in Norway in 1884–1885, 1887–1890. He authored two books on fishing, working conditions and life of industrialists in Murman, and a report at a meeting of the Arkhangelsk Medical Society in 1885, entitled “On the Etiology of Scurvy in Murman” [8]. Vladislav Romualdovich wrote that scurvy was more common among Russians than among Norwegians, as they set out on navigational voyages during Lent or immediately after it, when their bodies were weakened. Norwegians ate meat and dairy products, and therefore could withstand cold temperatures. In addition, patients with scurvy often visited the doctor when their

[8] Kola North: An Encyclopedic Lexicon from A to Z. URL: http://lexicon.dobrohot.org/index.php/ГУЛЕВИЧ_Владислав_Ромуальдович (accessed 16 November 2024).

condition was already very advanced, as they hid their illness because Russian industrialists believed that scurvy was not a disease but a simulation, and that only lazy people suffered from it [13, Gulevich V.R., pp. 24–39].

Due to the lack of necessary premises, during the first year of the mobile detachment's existence, patients were treated in tents, one of which was intended for patients requiring constant care, and the other — for the paramedic and hospital staff. The nurses and the hospital pharmacy were located in a government apartment [14, Gulevich V.R., p. 109].

In a report by doctor Leonard Petrovich Iskerskiy, who was in charge of the mobile hospital and Red Cross emergency rooms in Murman in 1882, it was noted that, despite the short duration of the medical and sanitary detachment's stay in Murman from June 15 to August 30, 1881, this experience showed that "during the Murmansk fishing season, medical assistance is not only absolutely necessary, but must also be strengthened so that it is permanent from year to year, rather than occasional" [9].

Over a month and a half, care was provided in the Teriberka emergency room and in the Sem-Ostrovov location to 136 sick and 88 diseased people [14, Gulevich V.R., p. 111–115].

However, the main result of the first detachment's work was the understanding that fishermen need medical care not only during the summer months, but throughout the entire fishing season, especially in early spring, when they arrive on the Murmansk coast. During this period, the number of sick fishermen is particularly high due to exhaustion from the long journey, Lent, and the cold spring weather.

Activities of the second medical and sanitary detachment on the Murmansk coast

The analysis of the first detachment's activities resulted in fundraising and the construction of special buildings for emergency rooms by the spring of 1882. By the summer of 1882, a camp in Sem-Ostrovov was purchased and adapted for emergency rooms; in the same summer, "a new building for the emergency room was built in Arkhangelsk and shipped disassembled along with the household equipment by steamship for installation in Tsyp-Navolok, which was later named after Her Majesty, the august patroness of the Red Cross Society, the Empress" [10].

It was also proposed to purchase the camp of colonist Kononov for use as an emergency room in Teriberka, and it was decided to renovate and adapt an unused government hospital building for emergency rooms in the Gavrilovo location.

Between the 1881 and 1882 navigation seasons, there was active correspondence between the chairman of the local Arkhangelsk Red Cross office and the director of the Department of Internal Relations of the Ministry of Foreign Affairs, Baron F.R. Osten-Sacken. A decision was made to organize an emergency center near Kiberg, Norway.

[9] Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1882. Arkhangelsk, Provincial Printing House, 1883, p. 6.
[10] Ibid, p. 7.

The need to develop this area of activity for the Red Cross sanitary detachment was driven by the following circumstances: “Before the start of the Murman fishing season, every April, our fishermen come to the eastern shores of Norway, especially to Kiberg, near Vardø, to engage in spring cod fishing. Following the general fish migration from west to east, they gradually move to the camps on the Murmansk coast. Fishing near Kiberg is carried out under much worse conditions than in Murman. Lacking camps on the foreign coast, our fishermen, wet from fishing, returning to the harbor, are forced to shelter from the cold, wind and bad weather in their boats, stretching out sails like tents and lighting small fires as space allows. Such conditions ... contribute to the spread of typhus, and meanwhile, there are no facilities for the sick in Kiberg” [11].

It was also noted that treatment in a Norwegian hospital was too expensive for Russian fishermen (one paper ruble per day), and no one agreed to transport the sick to the Vardø hospital and lose valuable fishing time.

The chairman of the local Arkhangelsk Red Cross, Prince Golitsyn, visited almost all the camps on the Murmansk coast in the summer of 1881 and got acquainted with the conditions of the fishing industry there, the living conditions of the fishermen and the climatic conditions. Following a statement by the Russian consul in Finnmarken, Bukharov, that “...during the Kiberg fishing season, it is the baiters and assistant workers who, suffering from injuries to their hands when baiting and untangling the nets, are most in need of medical assistance. Consequently, the charitable activities of the Red Cross should be directed to these people. Cases of serious illness are rare” [12], a decision was made to establish a medical station in Kiberg in 1882, equipped with bandages, with one sister of mercy and a paramedic, on the condition that a doctor would periodically visit the fishermen near Kiberg.

Thus, the activities of the second medical detachment on the Murmansk coast in 1882 were significantly expanded compared to the previous year: both in terms of the number of days (from March to August) and the number of mobile emergency rooms in the camps.

The medical team of the local Arkhangelsk Red Cross Comunity in 1882 consisted of two doctors, five sisters of mercy, one paramedic and three hospital staff. In addition, the Arkhangelsk Medical Department allocated five more paramedics [14, Gulevich V.R., p. 126].

In the official report by doctor Leonard Petrovich Iskerskiy, who was in charge of the mobile hospital and Red Cross emergency rooms in Murman in 1882, it was noted that at the time of the detachment’s arrival at Kiberg, there were between 50 and 70 shnyaks, or 250–350 fishermen and assistant workers.

[11] Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1882. Arkhangelsk, Provincial Printing House, 1883, pp. 11-12.
[12] Ibid, pp. 15-16.

The detachment's work at Kiberg was fraught with serious problems. Dr. Leonard Iskerskiy, paramedic Andrey Matveev, and sister of mercy Anfisa Mefodieva, who brought with them three beds, supplies and medicines, discovered that the local administration had not been notified, and that the local Norwegian doctor in Vardø protested against the Russians opening an emergency room. The issue was only resolved after the intervention of the Russian consul general in Christiania [13]. On April 18, 1882, after receiving official notification of the right to provide medical care to Russian fishermen and the right for a Russian doctor to provide medical services among them, the emergency room began operating under the banner of the Russian Red Cross Society.

In 1882, emergency rooms operated in five locations, but they were opened and closed not simultaneously, but rather according to the movement of fishermen following the fish (Table 1).

Table 1

Assistance to fishermen at the end of the 19th century in five locations

Location	Working periods	Staff	Activities
Kiberg	April 10 – June 5	Paramedic Matveev and sister of mercy Anfisa Mefodieva	The emergency room in Kiberg is equipped with both inventory and a full supply of medications and hospital supplies for the next year's activities.
Sem-Ostrovov	June 1 – August 30	Paramedic Matveev, sister of mercy Illaria and sister of mercy Anna Petkova	Construction is complete in Sem-Ostrovov
Tsyp-Navolok	April 7 – June 11	Doctor V.R. Gulevich, paramedic Stanislavov and two sisters of mercy Fekla and Illaria	The works on setting up the emergency room has been completed. The Mariinskiy Emergency Room in Tsyp-Navolok is equipped with both inventory and a full supply of medications and hospital supplies for the next year's activities.
Teriberka	June 13 – August 29	Doctor V.R. Gulevich, paramedic Shirman, sister of mercy Gorbatova paramedic Beltakov paramedic Stanislavov and two sisters of mercy, Anfisa and Illaria	Renovation of the industrialist Kononov's camp, purchased in 1881, to convert it into a hospital. An emergency room for five patients is ready for permanent use, as well as rooms for a pharmacy, a paramedic and nurses.
Gavrilovo	April 16 – August 30	Sister of mercy Illaria and sister of mercy Anna Petkova	Renovation of a hospital built in 1868 in Gavrilovo. Two rooms and a 16-bed emergency room were renovated.

Despite the fact that, in addition to medical problems, numerous repair and construction tasks had to be addressed during the 1882 navigation season, the detachment provided care to

[13] Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1882. Arkhangelsk, Provincial Printing House, 1883, p. 20.

1,076 patients across all locations, an average of 8 patients per day and 5 visits per patient. The highest number of patients was in Gavrilovo, where there were also a significant number of infectious diseases (typhoid fever and dysentery). Doctors explained this by the low-lying terrain, constant dampness and decaying fish entrails scattered on the shore and in the water, as the weak current carries nothing away, and if it were not for the cold, even in summer epidemics would be inevitable [14].

The 1882 report noted a shortage of bricks and other building materials, as well as difficulties in transporting doctors from one location to another. Traveling by steamship to Kiberg was particularly difficult and expensive. For moving between locations, they used a "state-owned yola (*a yola is a small, approximately 10-meter-long, wooden, sail-and-row vessel of Norwegian origin. In northern Russia, yolas were used primarily for fishing along the Murmansk coast. Before the Revolution, they were also used to transport mail, police officers, and visiting officials*), which, like its crew, was in a state of complete disrepair. The state-owned yola was leaky... during the journeys, water had to be pumped out constantly, and its crew consisted of two frail old men... they did not have the strength to row if it had not been for the favorable wind" [14, Gulevich V.R., p. 111].

Overall, the detachment's activities in Murman in 1882 were considered successful and extremely useful, and it was decided that the detachment should be sent annually [15]. It was also noted that the work of the sisters of mercy in Murman, who not only cared for the sick and assisted the paramedic with dressings, but also managed the entire emergency room, provided them with excellent training and practical experience.

Activities of the medical detachment on the Murmansk Coast in the early 20th century

By the early 20th century, the work of the medical detachment on the Murmansk coast had already become a traditional area of activity for the Arkhangelsk local branch of the Russian Red Cross Society. The terms of the detachment's stay at the fishing grounds from April to August were clearly defined, the places for providing assistance were arranged, and the practice of moving from west to east following the fishermen chasing fish was established.

The fact that the dispatch of the medical and sanitary detachment had become habitual and almost routine is evident even in the annual reports, which became more formal and brief.

From 1900 to 1913, the number of emergency rooms where doctors and sisters of mercy provided assistance to the Pomors gradually decreased, and this was due to the gradual decline in fishing in these waters, as well as some improvement in transportation and medical services in the area: "Fishermen begin to arrive in Murman in the second half of May, travelling by steamboat, while colonists in western and eastern Murman are provided with constant medical care thanks to

[14] Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1882. Arkhangelsk, Provincial Printing House, 1883, pp. 22–23.
[15] Red Cross Medical Assistance on the Murmansk Coast in 1883 // Arkhangelsk Provincial News, 1883, No. 95, November 26, pp. 2–3.

the winter and spring voyages organized by the Murmansk Steamship Company and the duty of paramedics to visit the colonies monthly to provide assistance to the sick" [16].

In the first decade of the 20th century, the medical and sanitary detachment operated during the fishing season in four locations: Teriberka, Gavrilovo, Rynda, and Kiberg (Norway). The number of patients who received care was published annually in reports [17] (Table 2).

Table 2

Number of patients who received medical care from the medical and sanitary detachment of the Arkhangelsk local branch of the Russian Red Cross Society in 1904–1909

Location	1904	1906	1908	1909
Teriberka	1 072	2 898	3 077	2 711
Gavrilovo	782	2 776	2 092	2 551
Rynda	300	908	1 071	1 134
Kiberg	313	516	374	405

Reports show that the highest number of cases is in Gavrilovo. This was noted by doctors from the first detachments, who noted that the main reasons were the low-lying terrain and weak currents, which did not carry away the fish entrails scattered on the shore and rotting in the water, contributing to the spread of infectious diseases [18].

The lowest number of requests for medical assistance was in Kiberg near Vardø. Nevertheless, the opening of this medical station on Norwegian territory was particularly important, as fishermen arrived there in the spring (April), during the coldest weather and often after Lent, which, according to doctor V.R. Gulevich, weakened their bodies and could provoke scurvy and other diseases [19]. Furthermore, seeking treatment from local Norwegian doctors in case of illness was too expensive for Russian fishermen; taking them to a doctor was far away and there was no one to transport them. Therefore, the establishment of a medical station in Kiberg in 1882, equipped with bandages, one sister of mercy and a paramedic, was an important breakthrough in medical care for Russian fishermen.

At the beginning of the 20th century, the doctor, paramedic and sisters of mercy did not stay in Kiberg all summer, but came and worked there until the end of the fishing season in Norwegian territory, after which they moved to Rynda, where in 1904 the Red Cross Society hospital building was moved from Tsyp-Navolok, which had not been in operation for the last few years due to the absence of fishermen there. For example, in 1909, the emergency room in Kiberg was opened on March 28. Its activities continued until the end of May, when fishing ceased in the

[16] Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1906. Arkhangelsk, Provincial Printing House, 1907, p. 7.
[17] Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1904, 1906, 1908, 1909. Arkhangelsk.
[18] Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1882. Arkhangelsk, Provincial Printing House, 1883, pp. 22–23.
[19] Gulevich V.R. Notes from observations during fisheries in Murman // Protocols and Proceedings of the Arkhangelsk Medical Society for 1889. Issue II. Arkhangelsk, Provincial Printing House, 1890, pp. 24–39.

area. After that, the detachment moved to the eastern shore of Murman, to the Rynada location, where it operated from 1 June to September [20].

At the beginning of the 20th century, a new trend emerged: medical students and medical apprentices were recruited to work in the detachments. In 1904, a junior medical apprentice working for the Onega district doctor Fokin joined the detachment [21]; in the summer of 1905, medical student Khoroshev worked in Gavrilovo [22]; in 1908, a fourth-grade medical student from Moscow University worked in Murman [23].

In 1905, public baths were built in the settlements of Teriberka and Gavrilovo by the Murmansk fishing expedition [24] to help fishermen to cope with skin diseases associated primarily with the working conditions of Pomors in cold salt water without waterproof clothing. However, the "Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1905" notes that the construction of baths could not solve existing medical problems, and that disease prevention primarily requires "decent housing for the arriving Pomors, and there is not enough of it" [25].

According to reports from the first medical and sanitary detachments, their activities in Norway were fraught with certain difficulties related to the rejection of their presence by the administration and a local Norwegian doctor in Vardø, who protested against the opening of a Russian emergency room [26]. However, the 1905 report on the activities of the emergency room in Kiberg, Norway, mentions for the first time that the services of the Russian doctor were used not only by Russian fishermen, but also by Norwegians, Lapps, and Finns [27].

The main illnesses for which fishermen sought treatment at the emergency room of the medical and sanitary detachment were ulcers, wounds, bruises, abscesses, frostbite, eye diseases, bronchitis, dental disease, rheumatism, and blisters [28]. Scurvy cases are difficult to count, as they were often concealed. Among Russians, there was a belief that scurvy was not a disease, but rather a sign of mooching and simulation. The percentage of patients with infectious diseases

[20] Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1909. Arkhangelsk, Provincial Printing House, 1910, p. 5.
[21] Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1904. Arkhangelsk, Provincial Printing House, 1905, p. 5.
[22] Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1905. Arkhangelsk, Provincial Printing House, 1906, p. 5.
[23] Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1909. Arkhangelsk, Provincial Printing House, 1910, p. 5.
[24] Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1905. Arkhangelsk, Provincial Printing House, 1906, p. 8.
[25] Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1905. Arkhangelsk, Provincial Printing House, 1906, p. 8.
[26] Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1882. Arkhangelsk, Provincial Printing House, 1883, p. 20.
[27] Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1905. Arkhangelsk, Provincial Printing House, 1906, p. 6.
[28] Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1882. Arkhangelsk, Provincial Printing House, 1883, p. 37.

increased in 1908 and 1909: from 24–30% in previous years, it rose to 44%. This increase can be explained by epidemics of smallpox and typhus in the Onega and Kemskiy districts, where most of the fishermen came from. Many of them got the disease at home and arrived in Murman already ill [29].

The Chairman of the Arkhangelsk Local Administration of the Russian Red Cross Society attributes the successful condition of the hospitals in the Murman settlements to the skilled work of specially trained hospital staff, namely, the sisters of mercy.

Before the establishment of the Red Cross sisters' community in Arkhangelsk in 1890, nuns from Orthodox monasteries in the Arkhangelsk province, primarily from the Kholmogory Monastery, worked in the mobile hospitals in Murman [8, Kolebakina E.Yu., p. 65].

The Arkhangelsk community not only began sending its sisters of mercy to Murman, but also provided their professional training and certification. Therefore, they were able not only to cook and clean, but also to assist the paramedic and doctor with dressings and even in surgeries. The professional training of sisters of mercy distinguished the medical care provided in the locations on the Murmansk coast from that of the northernmost hospital of the Arkhangelsk Public Welfare Office in Alexandrovsk, where the management of inexperienced village servants led to its decline.

The Russo-Japanese War, which began in 1904, inevitably affected the activities of both the Red Cross Society and the Arkhangelsk Community of Sisters of Mercy. The sisters continued to work in Murman, caring for the sick at the Arkhangelsk Hospital of the Public Welfare Office and in private homes in the provincial capital. Despite the war, one of the community's sisters was sent annually to enhance medical care (especially during epidemics) at the district hospitals, most often in Shenkursk, Kem, and Mezen.

A new trend during wartime was the training and dispatch of sisters of mercy to the Far East. According to the order of the Executive Committee of the Main Administration of the Red Cross Society dated March 14, 1904, five sisters of mercy from the Arkhangelsk community (Vera Chekaevskaya, Anna Kozmina, Anfusa Kekina, Evpraksiya Efremova and Anna Fedorova) left for Samara on April 8 to continue on to the Far East [30].

Then, at the suggestion of the Commission, the local Administration began to form a Red Cross medical detachment with 50 beds. On August 24, 1904, a detachment consisting of a doctor, eight sisters of mercy (who passed the test at the preparatory courses), and seven orderlies departed from Arkhangelsk for the Far East. On October 2, 1904, the Arkhangelsk sanitary detachment arrived in Harbin and began its work. "The detachment included: doctor G.M. Leibson; sisters of mercy: Agniya Shuryndina, Evpraksia Taratina, Alexandra Bravanova, Anastasia

[29] Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1909. Arkhangelsk, Provincial Printing House, 1910, p. 6.
[30] Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1904. Arkhangelsk, Provincial Printing House, 1905, p. 9.

Zaruchevskaya, Sarra Eisenberg, Natalia Golovanova, Anna Vasilyeva, and Lidiya Ilyina, and seven orderlies sent by the Executive Commission of the Main Directorate of the Red Cross from St. Petersburg" [31].

In 1904, at the initiative of its patron, K.G. Martsinovskaya, and D.V. Pets, together with the community's head sister of mercy, T.F. Znamenskaya, a free workshop was organized to produce linen and other supplies for Red Cross hospitals at the front at the Arkhangelsk Community of Sisters of Mercy. Thanks to this, a full set of linen for 50 beds was produced in early 1905 [32].

After the end of the war, the sisters of mercy of the Arkhangelsk Red Cross Community, who were sent to the Far East in 1908, were awarded gold and silver medals for their excellent service: Vera Chekaevskaya, Anna Kozmina, Anna Fedorova and Anfusa Kekina with gold medals, and Evpraksiya Efremova with a silver medal on the Anninskaya and Stanislavskaya ribbons [33].

In October 1908, the Arkhangelsk community of Red Cross Sisters of Mercy significantly expanded its activities. A surgical hospital for children was established within the community. At the time of its opening, the hospital had five beds and treated children of both sexes up to 12 years of age, excluding infants [34]. The chief doctor of the hospital was collegiate counsellor F.V. Grenkov, and doctors-teachers of the Community of Sisters of Mercy F.E. Sharin and A.G. Popov also worked there. In the first year of its opening, three girls and one boy received treatment at the surgical hospital; by 1909, there were already ten patients. The sisters of mercy assisted with dressings after amputations and fractures and with caring for children. These were all peasant children of poor parents, so in 1908–1909, care for children of poor parents was provided free of charge.

The hospital's Economic Committee established the titles of honorary members with a mandatory annual contribution of 100 rubles, and members-beneficiaries, who could maintain a hospital bed bearing their names, paid 250 rubles per year. In 1909, the hospital's honorary members included Dmitriy Ivanovich Maslennikov, Agrippina Petrovna Popova, and Ekaterina Kirillovna Plotnikova, who donated 100 rubles annually to the hospital. D.I. Maslennikov also donated 250 rubles for the maintenance of an additional hospital bed named after him [35].

In September–November 1908 and July–September 1909, cholera epidemics occurred in Arkhangelsk. Due to a shortage of junior medical personnel, sisters of mercy worked in two cholera hospitals in the provincial capital. As necessary, they were sent to district towns to provide

[31] Ibid. p. 8.
[32] Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1905. Arkhangelsk, Provincial Printing House, 1906, p. 5.
[33] Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1908. Arkhangelsk, Provincial Printing House, 1909, p. 8.
[34] Ibid, p. 7.
[35] Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1908. Arkhangelsk, Provincial Printing House, 1909, p. 7.

on-site assistance during epidemics. For example, in 1908, “two sisters of mercy were sent to the Kholmogory and Onega districts to deal with an epidemic of typhus and scarlet fever” [36].

In peacetime, the Arkhangelsk local branch of the Red Cross Society collected donations for those affected by crop failures and epidemics [37].

A shortage of junior medical personnel challenged the Arkhangelsk community of Red Cross Sisters of Mercy to train their own personnel. The sisters were trained free of charge, and the following individuals were involved: “The Law of God was taught by the priest of the hospital church, I.A. Popov; Russian language and arithmetic — by V.I. Levakovskaya; and other subjects from the curriculum approved by the Main Branch of the Red Cross Society were taught by doctors N.V. Georgievskiy, F.E. Sharin, and pharmacist K.A. Lorenz” [38]. Upon completion of their training, the candidates took an examination for the title of sister of mercy, received a certificate, and were accepted into the staff of the Arkhangelsk community.

The Arkhangelsk community tried to support the health of its sisters of mercy in cases of illness acquired in the line of duty. Reports from 1908 indicate that those suffering from tuberculosis were sent to a sanatorium for treatment at the community’s expense. In September 1908, Vera Frolova, a sister of mercy suffering from pulmonary tuberculosis, was sent to the Emperor Alexander III Sanatorium in Yalta for treatment [39].

Conclusion

At the end of the 19th and beginning of the 20th centuries, the Russian Red Cross Society was formed in the Arkhangelsk province and became involved in providing social and medical assistance to the population. One of its tasks was the training of junior medical personnel. After the Red Cross Sisters’ community was established in Arkhangelsk in 1890, the sisters of mercy from this organization began to provide assistance to Russian fishermen in mobile hospitals in Murman. Red Cross medical detachments were sent to the Kola Peninsula during 30 years, and each year five sisters of mercy took part in them. In challenging climate and living conditions, they assisted doctors and paramedics in receiving and caring for patients, dressing wounds, and took on all housekeeping duties in the emergency rooms of the locations. The doctors of the detachment not only provided assistance to fishermen, but also studied the climatic features of the region, the conditions of the Pomors’ fishing industry, and gave recommendations on the prevention of diseases and epidemics among colonists and fishermen in the region.

[36] Ibid, p. 8.
[37] From the Arkhangelsk local administration of the Society for the Care of Wounded and Sick Soldiers // Arkhangelsk Provincial News, 1906, No. 1, January 4, p. 1.
[38] Report on the funds and activities of the Arkhangelsk institutions of the Russian Red Cross Society for 1908. Arkhangelsk, Provincial Printing House, 1909, p. 9.
[39] Ibid, p. 8.

In peacetime, the sisters of the Arkhangelsk Red Cross Community cared for the sick both in private homes and in hospitals of the Arkhangelsk Public Welfare Office in Arkhangelsk and other district towns of the province, participated in fundraising for Arkhangelsk institutions of the Russian Red Cross Society, organized a surgical hospital for children within the community, and launched a program for the training and certification of sisters of mercy. During the war, they not only raised funds and manufactured hospital linens for the wounded, but also traveled to the Far East to work in military hospitals. This experience was later actively used by sisters of mercy during the First World War.

The activities of the Arkhangelsk Community of Red Cross Sisters of Mercy were primarily aimed at providing medical care to those categories of the population for whom it was inaccessible due to financial or geographical reasons. The community provided low-income women with the opportunity to obtain professional education, official certification as a sister of mercy, and subsequently find paid employment, thereby fulfilling a social assistance function. These pages of our history can be seen as the precursor and source of experience for the revival of Orthodox sisterhoods in the 21st century.

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Arkhangelsk Seaweed Factory: One Hundred Years of Import Substitution

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Abstract. The article is devoted to a retrospective analysis of the century-long history of the Arkhangelsk Seaweed Factory (ASF), the oldest enterprise in Russia with a full resource cycle of seaweed processing. The study is relevant in the context of modern challenges of import substitution and greening of industrial production. The subject of the study is the patterns and features of the evolution of an enterprise based on renewable natural resources. The object is the ASF, whose activities cover the full cycle, from seaweed harvesting to product release. The purpose of the study is to explain the long-term economic dynamics of the factory through the concept of of Kondratiev-Perez-Glazyev technological structures. For this purpose, the tasks of periodization of technological history, analysis of enterprise sustainability factors in times of crisis and identification of the specifics of its technological evolution were solved. The information base of the study includes documents of the State Archive of the Arkhangelsk Oblast, ASF reports, scientific publications and digital resources. The methodology is based on time series analysis, comparative and biographical analysis. The main results of the study are as follows: a periodization of the century-long economic history of ASF has been developed on the basis of the concept of technological formations; the evolution of the enterprise from handicraft to modern post-industrial production has been demonstrated; the factors of ASF sustainability in crisis periods, including the 1990s, due to the specificity of assets and innovative approaches have been identified; the contradictions between the production and resource base, which determined the need for technological transformation, have been revealed. During the discussion, the authors emphasize the importance of the transition to environmentally friendly technologies (plantation cultivation of seaweed) and the greening of production. The conclusions emphasize the unique role of ASF as an example of successful import substitution, transformation of technological structures and adaptation to the challenges of sustainable development.
Keywords: *Arkhangelsk Seaweed Factory, technological structures, evolution, renewable resources, mining and processing subsystems, import substitution*

Introduction

Decree No. 529 of the President of the Russian Federation of June 18, 2024, “On Approval of Priority Areas of Scientific and Technological Development and the List of Key Science-Intensive Technologies”, defined the transition to a highly productive and environmentally friendly agro-

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industrial and water management complex, as well as the development and implementation of rational nature management systems, as one of these key areas [1]. This is fully consistent with the revolution in global biotechnology and life sciences that we are witnessing.

Meanwhile, we still know very little about the patterns and characteristics of the long-term economic dynamics (birth, formation and transformation) of economic structures that rely on the use of renewable natural resources and are currently the backbone of the agro-industrial, forestry and fishing sectors in Russian regions. The lack of such knowledge is particularly noticeable when compared to the numerous works of economists, historians and geographers on the long-term economic dynamics of regional enterprises in the oil, mining and coal industries.

In this regard, a retrospective analysis of the century-long history of the Arkhangelsk Seaweed Factory (ASF) is of exceptional interest. It is the oldest and the only Russian enterprise with a full resource cycle — from harvesting seaweed in the White Sea to its deep and diversified processing with the production and sale of hundreds of types of commercial products to consumers. The uniqueness of the enterprise has ensured the availability of long-term series of natural indicators of seaweed harvesting and processing, an extensive archive and an informative museum, which determine the possibility of systematic scientific research into the economic history of the factory.

The enterprise was originated by the challenges of import substitution, which our country faced at the beginning of the 20th century no less acutely than today. Therefore, looking back at the history of ASF is extremely relevant and instructive for us. Moreover, both the enterprise and the industry as a whole are on the threshold of significant changes, the course of which will be easier to predict and understand in the context of the factory's century-long evolution.

The subject of our research is the patterns and characteristics of the development of the enterprise based on the use of renewable natural resources over a century, from the 1910s to the 2010s. The object of the research is the Arkhangelsk Seaweed Factory (ASF).

The purpose of the study is to explain the long-term economic dynamics of the ASF using the Kondratiev-Perez-Glazyev concept of technological structures, which necessitated the solution of several tasks:

- defining the boundaries and characteristics of the main periods in the factory's technological history on the basis of graphs of the enterprise's natural resource use dynamics (seaweed harvesting and production);
- identifying the reasons for the ASF's survival during the crisis of the 1990s as a result of the significant specificity of all the enterprise's assets (natural, labor, capital);
- generalizing the specifics of the enterprise's technological evolution as a local-level entity compared to regional and interregional entities (e.g., aquaterritorial or mining area, province).

[1] Decree of the President of the Russian Federation of June 18, 2024, No. 529. URL: http://www.kremlin.ru/acts/bank/50755 (accessed 21 February 2025).

The novelty of this study lies in the fact that the Arkhangelsk Seaweed Factory (ASF) has never previously been the subject of a comprehensive analysis covering the entire period of its economic activity (for example, studies by K.P. Gemp [1] have covered specific periods). This analysis of the economic history of the factory is the first to be conducted in the context of the evolution of technological structures, constant technical innovations in seaweed harvesting and drying, methods for extracting useful biological substances from them, and the import substitution challenges faced by the country.

The information base for this work is Collection 1457 of the State Archive of the Arkhangelsk Oblast (SAAO), dedicated to the ASF: annual reports of the factory on its main activities, explanatory notes to it, reference materials, prefaces to collection inventories; scientific literature; materials from websites devoted to the activities of the ASF.

Research methodology and methods

The research methodology is based on the works of N. Kondratiev, K. Perez, S. Glazyev [2; 3; 4], as well as our own research on regional aspects of the evolution of technological structures in resource-rich areas of Magadan and Murmansk Oblasts, the Nenets Autonomous Okrug, and the Arctic zone of the Russian Federation as a whole [5, Pilyasov A.N.; 6, Pilyasov A.N., Kotov A.V.; 7, Pilyasov A.N., Tsukerman V.A.; 8, Pilyasov A.N., Tsukerman V.A.].

Research methods include analysis of time series of natural resource use, periodization method for identifying key stages of the factory's activity, comparative analysis of the technological dynamics of enterprises with different resource profiles, individual enterprises and resource provinces as a whole, analysis of the biographies of the factory's managers, etc.

Main results

1. The century-long economic history of the factory can be represented as a consistent technological evolution from the second to the fourth Kondratiev wave

Kondratiev's long waves, lasting approximately half a century, reflect the economic realities and socio-cultural values of a particular technological and economic system. Their change, which is primarily associated with a radical shift in the dominant "anchor" technology used by industries that create the main added value in the economy, is always accompanied by the replacement of the previous production structure of society, scientific and technological paradigms, and socio-cultural concepts with new structures, paradigms, and values.

The second Kondratiev wave (…–1934)

In the Russian North, the beginning of the 20th century was marked by the emergence of the first "factory" industries, which inherited the characteristics of traditional, life-sustaining handicrafts of the 18th and 19th centuries. In our periodization, we will refer to this emerging technological structure as the second Kondratiev wave (K2).

During this time, the first seaweed “manufactory” appeared in Arkhangelsk — an iodine factory — a proto-industrial enterprise that operated de facto from 1914–1915, officially since January 1918. The technological process was relatively primitive and involved collecting washed-up laminaria along the shores and islands of the White Sea, hand-drying it on stands, burning the ash, and extracting iodine from it using manganese peroxide and sulfuric acid. “To obtain ash, seaweed is transported to the shore by horses, dried like hay, burned in piles, and stored in bags. From 100 poods of raw seaweed, 5–7 poods of ash are obtained” [9, Shurupova E.P., p. 167]. The emergence of the factory was directly linked to the imperatives of import substitution: iodine was needed for the wounded, and obtaining it from Germany, as before, was naturally impossible during the war with it [10, Stasenkov V.A., Studenov I.I., Novoselov A.P., p. 134].

The artisanal under-industrialization, difficulties of expensive delivery of seaweed resources from distant fields to Arkhangelsk [9, Shurupova E.P., p. 107; 11, Chirtsova M.G.], and high losses of iodine during transportation explain the instructive failure with the mothballing of the Arkhangelsk Iodine Factory in 1923 [10, Stasenkov V.A., Studenov I.I., Novoselov A.P., p. 236] and the partial relocation of its equipment to Zhizhgin Island [9, Shurupova E.P., p. 152], closer to the sources of iodine raw materials in the form of storm-driven luminaria drains, which this island was famous for due to its numerous bays.

This dichotomy — “closer to transport and trade routes to markets or closer to direct sources of raw materials?” — or, as it is commonly said in regional economics, location according to Losch-Christaller, i.e. based on demand and consumer market factors, or according to Weber, i.e. based on supply factors, unique resources — is uniquely characteristic of the second, artisanal Kondratiev period. Let us recall similar discussions on the “golden Kolyma” — where to build the city, the capital of the Kolyma region, nearby, directly at the gold mines in the Upper Kolyma basin, or as a seaport and transport hub in Nagaevo Bay on the Sea of Okhotsk?

For small, individual, artisanal production volumes, location directly at the sources of resource extraction is absolutely logical. In this regard, the relocation of the factory from Arkhangelsk to Zhizhgin Island precisely reinforced the artisanal, small-scale nature of the new seaweed production. On the other hand, as soon as there is a need for larger-scale, mass production aimed at a large external market, the advantages of proximity to the source of raw materials lose their former significance, and location in a large industrial and transport center, conveniently connected by transport routes to external consumers in the form of enterprises, exchanges, and companies, becomes the unconditional alternative.

Therefore, the failure of Arkhangelsk and then again, after the “Zhizhgin hesitations” (in 1923, on the instructions of the Arkhangelsk Provincial Council of National Economy, V.K. Nizovkin, I.V. Martsinovskiy, M.F. Smirnov, P.V. Ivanovskiy, I.A. Pavlov organized the industrial cooperative partnership “Belomorskoe iodine production” in Zhizhgin [9, Shurupova E.P., p. 152]), its acquisition of the functions of the location of an agar factory in 1933 should be considered not in the accepted interpretation of profitable/unprofitable (see, for example, the article by I.V. Martsinovskiy [12]),

but as a reflection of the different patterns of location of small-scale artisanal production in the second Kondratiev wave and mass large-scale production in the industrial third Kondratiev wave. It was impossible to expand the scale of resource-super-productive Zhizhgin Island's industry due to the objective new laws of industrial enterprise placement in the third Kondratiev wave. What mattered for this was not Zhizhgin's proximity to other islands with massive storm-driven seaweed drains, but Arkhangelsk's proximity to the large consumer markets, which demanded new, massive production volumes (and not the availability of firewood for drying seaweed with heat from a boiler house near Arkhangelsk and its absence on the industrial islands).

It is instructive to analyze the disruptions in the iodine industry: in 1929, the factory on Zhizhgin was re-equipped to expand iodine production [13, Vinogradov V.A., p. 3]. In the following year, 1930, the Arkhangelsk Iodine Factory restarts, but in 1931–1932, it is mothballed again due to a lack of raw materials. Finally, in 1934, after a year of experimental work, it was re-launched as an agar factory, designed to substitute raw materials imported from Japan [10, p. 242]. This event marked the transition of the White Sea seaweed industry to the third technological stage, which increased the volumes from the first tons of iodine production at the Arkhangelsk and Zhizhgin iodine factories in the early 1930s to tens and hundreds of tons of agar, alginate, and mannitol production at the Arkhangelsk Seaweed Factory in the 1930s–1980s.

The third Kondratiev wave (1934–1996)

In our periodization, the third industrial Kondratiev cycle in the ASF lasted from 1934 to 1996, i.e. it stretched over 62 years (the standard duration is half a century). On the other hand, the second "artisanal" cycle, which was based on the extraction of iodine from laminaria, was compressed to approximately 20 years (1914–1933). Iodine production was interrupted by the discovery in the 1920s of more cost-effective methods of extracting it from mineral waters rather than from seaweed [10, p. 241]. These patterns were characteristic of many regions of the North and the Arctic, where the transition to mass industrialization in the 1930s led to the rapid displacement of artisanal production of the second Kondratiev wave that had just begun in the last years of Tsarist Russia (in Kolyma — gold mining from placers, in the White Sea region — iodine extraction from laminaria). The third industrial "conveyor-belt" techno-economic order, on the contrary, was significantly delayed, even as the preconditions for the transition to the fourth and fifth Kondratiev waves, based on pipeline and air transport, and then on digital and biotechnology, telecommunications, and total computerization, were already developing worldwide.

It is essential to distinguish between the second and third Kondratiev waves precisely in terms of resource specialization. The second wave was based on artisanal (manual extraction and processing), i.e. small-scale iodine production, which in the late 1920s began to take on new mechanized forms (mechanical dredging of seaweed, rather than manual, as before [13, Vinogradov V.A., p. 3]). The third wave was based on mass (large-scale) mechanized production of agar at a new agar facility.

The type of seaweed used, the resource extracted from it (i.e., the enterprise's resource specialization), the technology applied, and the territorial structure of the seaweed industry changed. After experiments in the early 1930s, from 1935 onwards, instead of laminaria, the new main resource for the factory became ahnfeltia, which was intended to replace the imported Japanese agar extracted from it (used as a natural thickener for the production of jam, soufflé, pastille, marmalade, and other confectionery products, which is why the factory was part of the State Trust for the Glue and Gelatin Industry). Instead of relying primarily on storm seaweed drains, there was an emphasis on harvesting (first manually, then mechanically) growing/cut seaweed. The possibilities for mechanizing all production processes and transporting harvested seaweed raw materials to the factory for processing arose and gradually expanded. Innovative technologies for processing seaweed and producing new types of products were developed. The technology for obtaining agar from ahnfeltia was the result of the work of a specially created Seaweed Laboratory in the late 1920s [1, Gemp K.P., p. 8].

The factory, which later became a combine, began generating its own innovations in harvesting, drying, storage, and processing — a process of innovation localization took place (in the second Kondratiev wave, the first knowledge of seaweed resources obtained from scientific expeditions from St. Petersburg was used in production). The third Kondratiev wave at the factory was not associated with just one resource specialization: foreign market conditions and demand for seaweed products, import substitution imperatives, and the available reserves of seaweed resources in the White Sea determined multiple changes in the dominant specialization: first, agar from ahnfeltia, then middlings from fucus, then alginate from laminaria, then various pharmaceutical products from laminaria.

The pioneering stage of launching a new resource frontier, as always happens and as subsequent events showed, was a very fragile stage with several restarts of the enterprise: the first launch of the new resource frontier took place in the 1934–1940s, then, after a de facto shutdown during the war years, the restart took place in 1945–1954. At the same time, until 1943 [1, Gemp K.P., p. 8], along with the production of new agar, the production of the old iodine, inherited from the second Kondratiev wave, continued by inertia. This is very similar to the preservation of placer gold mining in Kolyma until the 1940s, when mechanized industrial equipment had already been introduced at most of the Dalstroy mining departments.

The pioneering stage of economic development is usually characterized by extraordinary personalities who manage it and therefore remain in the historical annals of the enterprise, industrial region, or province for a long time. For the Arkhangelsk Agar Factory, such a legendary figure was its first director (1933–1937), N.D. Grigoryev, who established the new production with the help of a small team (about 75 people), consisting mainly of women [2].

[2] State Archives of the Arkhangelsk Oblast (SAAO). F. 1457. Inv. 1. File 16. Sh. 3.

Despite the objective difficulties always associated with the pioneering stage of enterprise development [3] and the high annual amplitude of production, the factory quickly moved from the production of first tons of agar to tens of tons (53 tons in 1939), thereby exceeding substantially the volume of iodine production from laminaria in the 1910s and 1920s in the second Kondratiev wave. Although the creation of the agar factory initiated a long era of agar production at the enterprise, in the mid-1940s (Fig. 1), the first diversification of production occurred through the manufacturing of alginate from laminaria, which was used in the textile, paint, and rubber industries. Even for the vertical take-off of a new frontier resource production, it is always characteristic to simultaneously improve other, non-core types of industry, which over time can become a new frontier and replace the previous one.

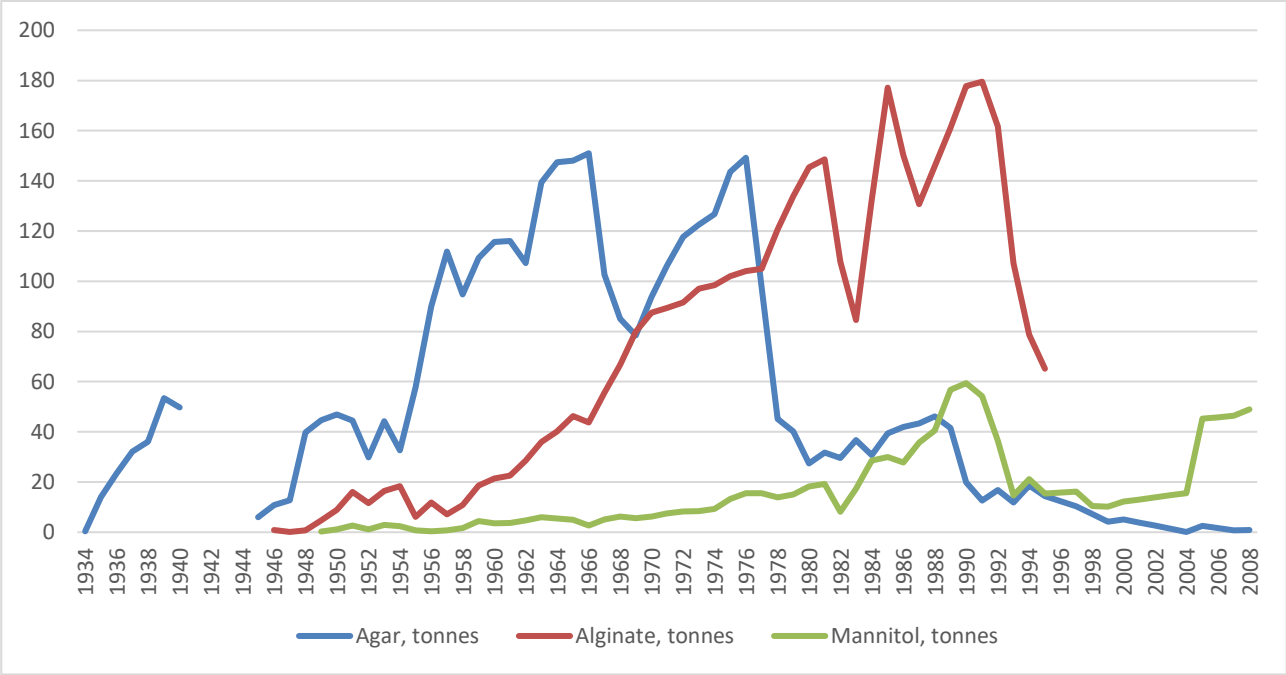

Fig. 1. Dynamics of agar, alginate, and mannitol production at the Arkhangelsk Seaweed Factory, t [4].

During the war years, the factory changed its focus, temporarily switching to the production of laminaria powder for making seaweed soup stock for residents of besieged Leningrad and the Arkhangelsk Oblast [10, p. 242]. Therefore, in 1945, the first frontier phase of the enterprise's re-start essentially began again. However, it would be incorrect to assume that this was a simple re-launch of pre-war agar production.

In fact, pre-war and post-war productions were two different frontier eras. The pre-war factory was managed by the exotic state trust "Kleizheprom". After the war, it was transferred to the

[3] Violations of production discipline by suppliers of chemical reagents — caustic soda, bleaching powder, filter cloth (and therefore the need to purchase them on the market), shortages of special clothing, special footwear, fuel, raw materials — White Sea ahnfeltia, competition for ahnfeltia harvesting with the Leningrad marmalade factory and the Moscow factory "Udarnitsa", which harvested it on the Kemskiy coast of the White Sea, downtime of processing equipment, etc. Sources: SAAO. F. 1457. Inv. 1. File 66. Sh. 17-19, 38; SAAO. F. 1457. Inv. 1. File 16. Sh. 5; SAAO. F. 1457. Inv. 1. File 26. Sh. 3.

[4] Source: Fund 1457 SAAO, annual reports on the main activities of the Arkhangelsk Seaweed Factory.

state trust “Rosglavkonditer”, and in 1947 — to the fishing industry trust “Sevryba” [5], which emphasized the commonality of seaweed and fish harvesting in the post-war period of active mechanization of all major production processes.

Indirect, but very important confirmation of our correctness in identifying the 1945–1954 period as a new (industrial) start of a long technological wave in the graphs of nature use dynamics (primarily basic and agar) is the fact that F.A. Bryzgunov was the factory’s director during these years (1938–1941 and 1946–1953). On the one hand, he ensured the continuity of the factory’s first pre-war and second post-war agar production. He quickly restored production after the Great Patriotic War. On the other hand, he strengthened a new (pharmaceutical and technical) direction for the factory — the production of sodium alginate and mannitol (the former mannitol factory was destroyed during the war) from laminaria, which eventually became the mainstay of the factory. It began producing technical sodium alginate in 1946 (food-grade alginate in 1955) and mannitol in 1949 (pure mannitol for analysis in 1959). By that time, the factory employed over one hundred people, making it a medium-sized enterprise.

After the initial phase of establishing the new agar frontier, which was specifically launched twice at the factory — before and after the war, there was a phase of aggressive investment and extensive experiments to develop methods for mechanizing the extraction and processing. This stage lasted for more than two decades, from 1954 to 1977, and ensured a significant increase in indicators across the entire range of production. It should be noted that this phase may proceed differently depending on the state of the resource base. For example, in the Kolyma gold-bearing regions, after quickly reaching its peak in the first phase, aggressive investment in the second phase was unable to break the trend of decline of the new province, despite various efforts. As a result, the decline in gold production continued throughout the entire period against the backdrop of experiments to expand the resource base at the expense of adding other metals, using new technologies such as new models of industrial equipment, etc.

On the other hand, at the Arkhangelsk factory, which essentially monopolized the White Sea seaweed resource base, aggressive investment in the second phase ensured an increase in seaweed harvesting volumes and the production of agar, sodium alginate, and mannitol.

The phase of aggressive investment was marked by the mass mechanization of all production processes. In harvesting, this meant concentrating on the most productive section of the Solovetsky Islands and expanding the enterprise’s self-propelled fleet to a hundred units [6]. A single area of mechanized dredging for laminaria from barges/boats with winches accounted for up to 35% of its total harvest [7]. A self-propelled mechanical dredger of the “Nepreryvka” type was used to extract

[5] SAAO. F. 1457. Inv. 1. Preface to the inventory for the years 1930-1983. Sh. 2.
[6] SAAO. F. 1457. Inv. 1. File 382 Sh. 117.
[7] SAAO. F. 1457. Inv. 1. File 523. Sh. 126.

laminaria at depths of up to 12 m [8]. Mechanical dredgers of the "Pauk" type were used in areas with gravel and rocky soil.

The preparation stage included mechanized pressing of harvested seaweed into bales, previously into nets. New drying principles and dryers were introduced for drying seaweed [9]: a workshop for artificial drying of fucus and laminaria was built, and a double-drum steam dryer was purchased in Estonia. A new continuously operating KALEV-type apparatus was used for boiling seaweed. As a result of the reconstruction of the mannitol department in 1973 [10], crystallizers, heat exchangers, evaporative bowls, cartridge filters, centrifuges and other necessary equipment appeared here, which doubled the annual production volume [11]. The total mechanization of production processes reduced dependence on manual labor, and for the first time, the factory experienced a reduction in the number of workers.

During the phase of aggressive investment (no later than 1958), an experimental group was created at the factory, which for a long time served as its local innovation system: it developed special dredger models for the enterprise, taking into account the characteristics of the White Sea seabed, an underwater industrial installation for cutting seaweed, carried out the adjustment of equipment received from suppliers, and collected rationalization proposals from the plant's employees.

The beginning of the aggressive investment phase marked a period of centralization of the factory's functions as the sole, monopolistic entity for seaweed economic activity in the White Sea. In 1955, the Zhizhgin Agar Factory became part of the Arkhangelsk Agar Factory as a workshop [12]. In 1960, a workshop was launched on the Solovetsky Islands for processing seaweed into agar and producing seaweed powder [13]. In 1964, the Arkhangelsk Seaweed Factory was established on the basis of the Arkhangelsk Agar Factory. The new name emphasized the resource diversity of the main products (agar, sodium alginate, mannitol).

In the context of the enterprise's growth based on the mechanization of key production processes and the already apparent depletion of ahnfeltia resources [10, p. 243], on which the production of agar as the main, absolutely dominant type of product was based (i.e. it was impossible to achieve economies of scale in agar production), the decision to combine several resource chains was entirely justified. By the end of the 1950s, the formerly single-profile factory had become a diversified enterprise with two internal workshops — an agar workshop and an alginate workshop (with boiling, alginate, and mannitol sections) [14], serving several consumer groups: agar for the confectionery and microbiological industries; mannitol for the pharmaceutical industry; sodium alginate and laminaria powder for the textile industry.

[8] SAAO. F. 1457. Inv. 1. File 506. Sh. 117.
[9] SAAO. F. 1457. Inv. 1. File 506. Sh. 129.
[10] SAAO. F. 1457. Inv. 1. File 579. Sh. 145.
[11] History of the Arkhangelsk Seaweed Factory. URL: https://snowsea.ru/o-nas/history/ (accessed 18 February 2025).
[12] SAAO. F. 1457. Inv. 1. Preface to the inventory for the years 1930-1983. Sh. 2.
[13] SAAO. F. 1457. Inv. 1. Preface to the inventory for the years 1930-1983. Sh. 3.
[14] SAAO. F. 1457. Inv. 1. File 257a.

The dynamics of the annual amount of seaweed received for processing (Fig. 2) clearly distinguish two periods in the factory's operation: 1) exponential growth in 1954–1965, reaching a peak of 3,754 tons in 1965; and 2) a sharp decline in 1965–1977, followed by stabilization at approximately 1,200–1,300 tons by the end of the period in 1977. The graph of consumption of all types of seaweed shows a similar pattern, with the peak value of 2,574 in 1966 (Fig. 3).

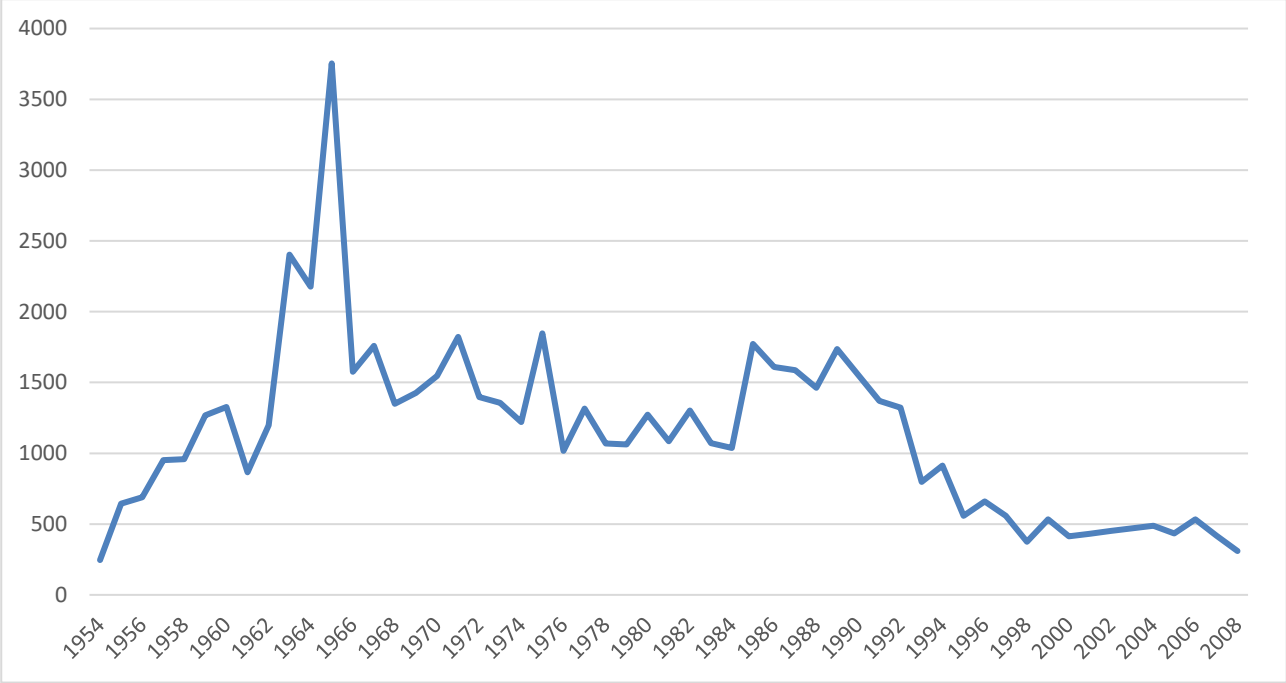

Fig. 2. Dynamics of total seaweed harvesting volumes (own and purchased under contracts), t.

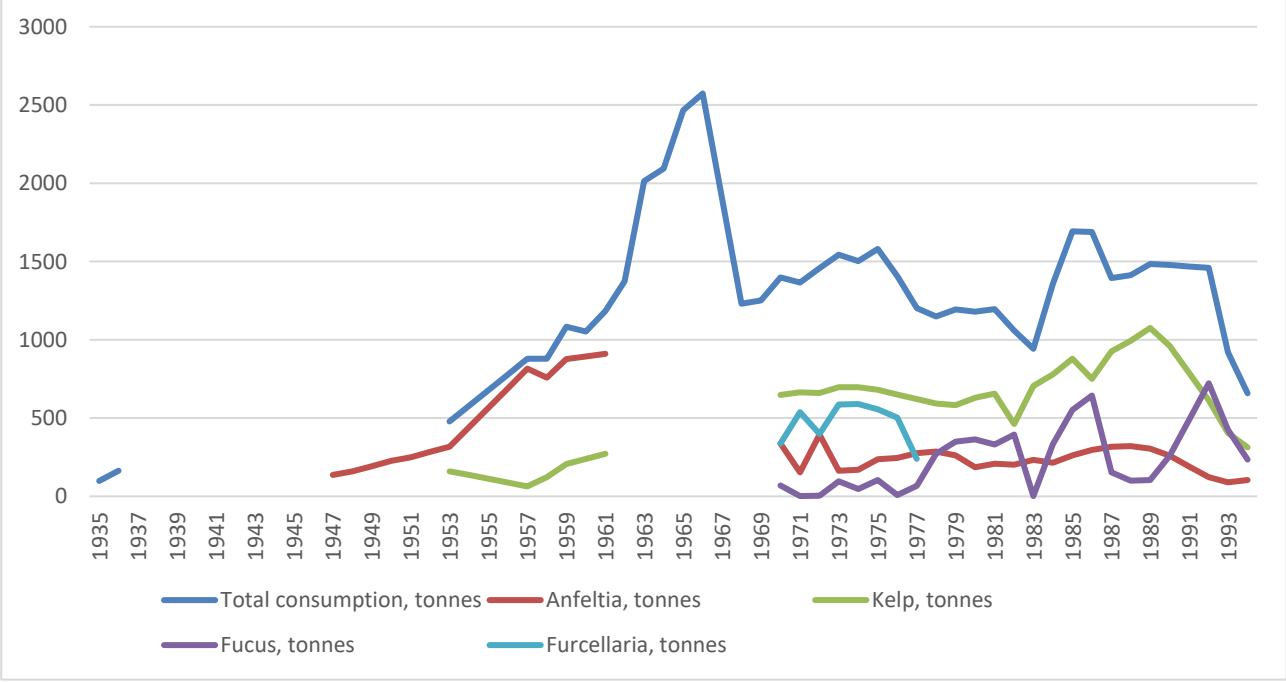

Fig. 3. Consumption of all types of seaweed for production, t.

What happened between 1963 and 1967, when the volume of received and consumed seaweed increased sharply? At that time, massive production of seaweed powder and seaweed middlings was carried out. Seaweed powder was produced in the powder workshop on Solovki from laminaria (dry laminaria is crushed, dried, then crushed again into middlings and ground into

powder in a vibratory mill) [15] and was used in the textile industry in the Ivanovo Oblast. Middlings were produced from fucus and supplied to mixed feed factories.

This short-term experiment in mass production of low-value end products was similar to the experiment with mass planting of corn in risky farming zones, which was launched in the country at the same time and was just as quickly abandoned. After a short period of frontier expansion, the production of middlings and powder was significantly reduced by the end of the period, and only fucus middlings continued to be produced.

However, this short experiment with the production of a new mass product, which accounted for about two-thirds of the factory's total output, reflected a general search for a new sustainable specialization that was responsive to the new possibilities of total mechanization of all production processes. It was no coincidence that it affected laminaria and fucus, rather than ahnfeltia: the characteristics of both laminaria and fucus allowed them to be easily involved in mass harvesting and processing. On the other hand, the scattered growth of ahnfeltia [10, p. 247–249], with the constant threat of depletion, made it difficult to take advantage of the possibilities of mass mechanization of harvesting, for example, by mowing from self-propelled barges. Different types of seaweed in the White Sea were not equal in terms of their readiness to be mechanized.

In the 1960s, K.P. Gemp first wrote about the apparent depletion of ahnfeltia stocks in the White Sea [14, p. 191]. This was facilitated by many years of active exploitation of nearby shallow areas by hand dredging, more remote areas — by mechanical "Pauk" dredges, and the deepest areas, where dredges cannot operate, — by divers. The search for a solution to the emerging local environmental crisis involved switching to storm-driven ahnfeltia drains collection, limiting the harvesting of ahnfeltia to hand dredging [16], cultivating ahnfeltia artificially in collaboration with SevPINRO [15, Gemp K.P., p. 232] (the experiments were deemed unsuccessful), and purchasing Baltic furcellaria (a technology for producing agar from furcellin was developed in 1968). At the end of the third industrial wave, the restrictions imposed were intensified: in 1987, according to the conclusion of the Northern Branch of PINRO, the seaweed industry had reached the limits of its development, exhausting the permissible limit for the extraction of resources from the White Sea. Even on the factory's new frontier near the Solovetsky Islands, a limit on laminaria harvesting was set at 950 tons instead of the previous 2,400 tons [17].

This raises the question of the nature of the first and second peaks in agar production in 1966 and 1976 (Fig. 1). While the first peak reflected the monopoly dominance of agar in the factory's final output —sodium alginate production from laminaria was still insignificant (44 tons) — the second peak occurred when alginate production had already reached 104 tons, significantly less than agar production in terms of volume. At the first peak, the agar produced was intended for the microbiological industry, and at the second peak, due to its production from Baltic furcellaria of

[15] SAAO. F. 1457. Inv. 1. File 345. Sh. 97.
[16] SAAO. F. 1457. Inv. 1. File 506. Sh. 117.
[17] SAAO. F. 1457. Inv. 1. File 869. Sh. 21.

poorer quality (purchases were made in the short period from 1969 to 1977 and ensured growth in production), it was intended for the food industry. At the beginning of the next phase of the "golden age synergy", sodium alginate production from laminaria (with the potential for a mass resource base) surpassed the rapidly declining production of agar.

This successful period for the enterprise during the second phase of the third Kondratiev industrial cycle ended with the loss of its legal and financial independence due to its entry into the Arkhangelskrybprom production association in 1976 [18]. At the same time, the factory's director, A.I. Potrokhova, left for a promotion. The most important outcome of this phase was that the reliance on mass production, characteristic of the period of total industrialization, made a shift in the enterprise's resource focus inevitable. This mass production could now be ensured by laminaria, not ahnfeltia. The era of agar dominance came to an end, and the era of laminaria product dominance began at the factory.

The next phase of the third Kondratiev cycle at the factory was in the period from 1977 to 1990. Some experts call it the factory's "golden age", "the best years of exploration and implementation" [16, Bokova E.M., Titov V.M.]. During this period, the country's demand for seaweed products increased by several times [17, Semenova R.P., p. 38], and the factory strengthened its position through the mass production of technical and then food-grade sodium alginate from laminaria and fucus, mannitol, agar, dietary supplements, and other products for light, food, and pharmaceutical industries.

In 1979, the plant was renamed the Arkhangelsk Experimental Seaweed Factory [19], since the share of experimental and testing work in the total gross output amounted to more than 90%. The only full-cycle industrial seaweed enterprise in the country became an experimental base for extensive innovative research by chemists, technologists, and engineers not only from the factory itself, but from across the country. Broad scientific partnerships were established between the factory's specialists and technologists from the Plekhanov Institute in Moscow, the All-Union Scientific Research Institute of Medical Polymers, the Leningrad Scientific and Production Association Fitolon, the All-Union Scientific Research Institute of Chemical Technology of Medicines, and other chemical, technological, pharmaceutical, and biotechnological enterprises [17, p. 39].

There was a clear shift in focus away from engineering and mechanical innovations towards innovations in chemical reactions and processes, which are becoming primary, with technical modernization of equipment being carried out to support them. For example, more advanced extraction systems for increasing product output, which entail the modernization of the equipment.

The accident at the Chernobyl Nuclear Power Plant in 1986 gave a powerful impetus to research work at the factory and a significant expansion in the production of "by-products". Unexpected anti-radiation properties of alginates were discovered, which "ensure a 75% reduction in the level of cesium and strontium in body tissues and specifically affect the vital systems of the body

[18] SAAO. F. 1457. Inv. 1. Preface to the inventory for the years 1930-1983. Sh. 6.
[19] SAAO. F. 1457. Inv. 1. Preface to the inventory for the years 1930-1983. Sh. 6.

most affected by radiation" [20]. This became the impetus for the start of production of the first dietary supplements: radioprotective preparations "Algigel", "Canalgat", as well as "Inhibitor", "Laminaria Extract", "Laminaria Concentrate", "Laminit", etc. [18, Varfolomeev Yu.A., Bogdanovich N.I., Bokova E.M., p. 158]. The director of the factory (1984–1990), A.M. Kostomarov, initiated the production of new products for the perfume, soap and cosmetics industries from mannitol production waste.

During this period, two lines coexisted in the enterprise's activities: a new, "capillary" line for expanded production of small-batch, high-value new products for medical, pharmaceutical, and perfumery purposes, reinforced by the factory's new pilot status; and, simultaneously, a traditional line for mass, large-scale production of technical alginate, mannitol, and agar for the needs of other industrial enterprises in the country, which was accentuated by the completion of the new factory in 1982 [19, Polovnikov S.Ya., p. 91].

The initiative to build it was put forward back in the late 1960s [19, Polovnikov S.Ya., p. 90], that is, in a completely different economic era — at the stage of aggressive investment during the third Kondratiev wave. This gives rise to a dramatic contradiction of this period: the largest production facility, commissioned during the "golden age of the factory", was actually timed to appear much earlier, in the early 1970s, during a period of quantitative expansion and total mechanization of production processes. Instead, it emerged at a time when the focus was not on mechanical expansion, but rather on the chemical "deepening" (intensification) of technological and production processes.

The launch of the first and second phases of the new factory (construction began in 1978 and was completed in 1982, with the first phase commissioned at the end of 1981 and the second one — at the end of 1983) [19, Polovnikov S.Ya., pp. 90–92] raised the planned output to 300 tons of sodium alginate from laminaria, 200 tons of sodium alginate from fucus, 50 tons of mannitol, and 39 tons of agar from ahnfeltia per year [19, Polovnikov S. Ya., pp. 91–92]. However, the factory was unable to actually produce these volumes.

Total sodium alginate production at the factory in the 1977–1990s (technical and food grade) never exceeded 180 tons, which was almost three times lower than the capacity of the first and second phase alginate workshops. However, the graph showing the 40-year dynamics of alginate production at the factory from 1946 to 1986–1988 looks very impressive, demonstrating almost continuous growth.

The new factory's mannitol production capacity was calculated at 50 tons [19, Polovnikov S.Ya., p. 91], and demand for it in the country in the 1980s was stable in the pharmaceutical and medical industries (used as an osmotic diuretic, in the process of blood preservation, as a cryoprotectant when freezing erythrocytes, for the production of mannitol solution, which is indispensable in heart surgery and for cerebral edema), as well as in the food industry (used as a sweetener and

[20] A hundred years of benefits: how arctic seaweed became a true treasure for Russia. URL: https://foodika.ru/sto-let-polzy-kak-arkticheskie-vodorosli-stali-nastoyashhim-bogatstvom-rossii/ (accessed 18 February 2025).

stabilizer in the production of dietary products and sugar substitutes). Therefore, the requirements to meet the planned targets were very strict, and the factory wrote annual explanations of the reasons for chronic failure to fulfill planned targets: during the entire available observation period, it only "reached" this target three times (1989–1991, Fig. 5).

As for the production of agar from ahnfeltia, the capacity of the new factory was more realistically estimated at 39 tons [19, Polovnikov S.Ya., p. 92], which was achieved for almost the entire period up to 1990 (Fig. 1).

The golden age of the factory ended with its granting legal entity status with financial independence in 1989, which marked the beginning of a new period of "freewheeling". Apparently, there is a certain pattern in the fact that in the first and last phases of the Kondratiev cycle, the enterprise has the rights of legal and financial independence (autonomy): in the first frontier stage — because the future is uncertain, and the risks are entirely on the enterprise; in the final crisis stage — because the future is problematic, and the enterprise has to cope on its own, without relying on higher authorities. Only in the prosperous second and third phases, the enterprise has the high-level supervision of central administrations, state trusts, and agencies that "extort money" from it.

The final phase of the third Kondratiev wave, which can be called the "crisis twilight", began in 1990–1996 against the backdrop of a nationwide economic and political crisis. During this period, the most important task was to preserve this unique enterprise.

Obviously, such a radical transformation was accompanied by a significant reduction in the output of the enterprise's traditional products, for which, on the one hand, there was a shortage of raw materials, and on the other, there were no longer traditional consumers. For example, the volume of seaweed harvested by the end of the period had fallen threefold, from 1,500+ tons in the early 1990s to 500 tons in 1995–1996, fourfold for fucus, twofold for ahnfeltia, and one and a half times for laminaria. Such radical reductions were naturally accompanied by mass layoffs.

Pressure from cheap Chinese competitors [21] (for example, synthetic sodium alginate substitutes from China) forced the factory to stop production of traditional varieties and switch to new ones. Agar production was reduced by half, sodium alginate — by three times, and mannitol — by four times. The factory developed a special program for the production of consumer goods: medical products, dietary supplements, cosmetics, confectionery, and pharmaceuticals, for which the technological equipment was retooled.

The fourth Kondratiev wave (1996–nowadays)

An analysis of the development of the Arkhangelsk Seaweed Factory during the third industrial wave allows us to formulate a fundamental contradiction between the available resource base

[21] Malysheva E. Arkhangelsk seaweed factory: the only, unique, almost century-old. URL: https://bclass.ru/region/promyshlennost/arkhangelskiy_vodoroslevyy_kombinat_edinstvennyy_unikalnyy_pochti_vekovoy/ (accessed 18 February 2025).

and the enterprise's production capabilities. The factory began its operations as a new, small entity on the seaweed resource frontier (agar from ahnfeltia) and initially had no resource constraints on its growth. However, as it inevitably expanded (in terms of personnel, production, harvesting areas), it began to encounter limitations in the availability of easily accessible and profitable resource base. The peak indicators of seaweed harvesting, ensured by the transition from manual harvesting of laminaria and ahnfeltia and the collection of storm-driven fucus and ahnfeltia drains to dredging (including) mechanized harvesting, subsequently led to a collapse in production due to the destruction of bottom ecosystems. The rate of growth in production exceeded the rate of natural recovery. It is impossible to resolve the described contradiction within the natural-production system of the third Kondratiev wave. A way out is required in order to start all over again, but within the new technological framework of the fourth Kondratiev wave, based on the ideology of environmentally friendly technologies and solutions (for example, the transition to controlled plantation seaweed farming).

The crisis of the first half of the 1990s accelerated the long-awaited but constantly postponed transition of the country, its enterprises and regions to a new post-industrial technological structure, the basic features of which are environmentally friendly technologies, human-centered production, and ecological priorities in economic activity. As early as the 1980s, it was obvious to enterprise management that the new main path of development was linked to the production of "by-products" oriented not towards the economy of legal and economic entities, but towards the economy of individuals, i.e. the demand of individual consumers for high-quality natural cosmetics, diabetic products, medicinal raw materials, food supplements, etc. Radical market reforms in the country facilitated the transition to this trend by dismantling the rigid planning system that had been reproducing outdated technological solutions for decades. This created conditions for searching for alternative non-governmental financing for the implementation of new technological schemes for seaweed processing, first through own funds and then through borrowed ones (credit and investment).

It can be said that for the Arkhangelsk Seaweed Factory, this meant a return to the artisanal values of a century ago, but at a new level of modern production capabilities. In economic terms, the effect of economies of scale and volume of operations was replaced by the effect of small-volume commodity groups, i.e. the effect of diversification characteristic of a medium-sized seaweed business, which is what the ASF is today.

The first phase of the new cycle was unfolding over 20 years (1996–2016) and was characterized by a long launch of the frontier on new technology/resources, although its initial prerequisites were already outlined in the final stages of the previous wave. Within this phase, two periods can be distinguished: 1) disjointed organizational and technological transformations in the early years — as the priority to ensure the survival of a unique enterprise in aggressive external environment remained; 2) systematic work to modernize the factory to meet the requirements of the new order — in the 2000s and 2010s, under the leadership of E.M. Bokova.

In 1996, the factory received the status of a state unitary enterprise. From the three types of intermediate products (agar, alginate, mannitol) that were canonical for the third Kondratiev wave and were intended to meet the demand of other economic enterprises, it moved on to the production of end products for individual consumers. The factory's new products included the food supplement "Laminal", "Dessertnoe" jelly, "Laminaria" cream [22], "Laminaria" shampoo, the food supplement "Fucus", diabetic products, dietary supplements, and medications [23].

In 2002, the plant was transformed into the Federal State Unitary Enterprise "Arkhangelsk Experimental Seaweed Factory" (FSUE "AESF") [24], which meant that it bypassed the first wave of privatization and retained its original state status, under which it operated until the mid-2010s. During this period, it was possible to stabilize the production of its core products (significant growth was achieved for mannitol), to expand the range of products (to over 50 items) for perfumery, cosmetics, medicine, healthcare, food and agriculture, to establish a new confectionery production facility and to implement successful marketing of the factory's new products.

The environmental agenda became a new frontier for the enterprise: the factory focused on eco-products and environmentally friendly technologies. The relaunch of the factory was facilitated by E.M. Bokova, who had worked for a long time as a process engineer at the plant, including at the remote Solovetsky site, and therefore had a very good understanding of the potential of the enterprise's resources, production and personnel capabilities in the context of a radical transformation of its specialization (a new frontier in biopharmaceutical products from seaweed). At the end of the period, in 2016, the enterprise became a private joint-stock company, OJSC "AESF", due to the sale of 100% of the state-owned stake to a new owner [25].

Summing up the results of the first phase of Kondratiev's post-industrial cycle, it should be noted that its traditional main objective — entering a new development trajectory by creating new seaweed processing lines — was achieved. At the same time, it is regrettable that this process took too long (two decades). This was undoubtedly due to delays in the privatization process, protracted transition of the enterprise from one form of state ownership to another (SUE–FSUE–OJSC with 100% state participation and the Russian Federation as its state founder). However, we cannot imagine all the risks posed to the enterprise by rapid privatization: despite its monopoly status as the only seaweed factory, the small plant (as of 2024, it employs 76 people [26]), could simply disappear (in the 1990s, numerous larger enterprises were subdivided, disintegrated, became targets of raider attacks and endless reorganizations).

[22] SAAO. F. 1457. Inv. 1. File 1016. Sh. 42.
[23] SAAO. F. 1457. Inv. 1. File 1016. Sh. 42.
[24] SAAO. F. 1457. Inv. 1. Prefaces to inventories for 2000–2006. Sh. 177.
[25] The Arkhangelsk seaweed factory will be able to fill the country's shortage of iodine-containing dietary supplements. URL: https://madeinrussia.ru/ru/news/17326 (accessed 18 February 2025).
[26] JSC "AESF". URL: https://www.list-org.com/company/21578 (accessed 18 February 2025).

The second phase of the fourth Kondratiev wave, characterized by aggressive investment in previously discovered new resource / commodity frontiers, achieving mass production volumes, and vigorous diversification of the product range, began in 2016 and continues to these days.

According to the SPARK database, "in 2016, the factory underwent privatization, and in 2017, it was acquired by a group of Moscow investors". These changes led to an updated development strategy for the enterprise and the attraction of additional investments, which contributed to a threefold increase in its revenue over the next two years. The new owner's priorities were to maintain the factory's traditional production methods while modernizing its technology and making it more environmentally friendly: gasification, technical re-equipment, modernization of old equipment and purchase of new one, environmentally friendly seaweed harvesting, and creation of a wide range of new products. These priorities were clearly outlined in 2022 in an interview with the ASF Director Artem Ivanov [27].

The new systemic investment project for the factory's modernization was estimated at half a billion rubles, with an emphasis on budget financing (federal and regional). The enterprise began promoting its products on major online platforms such as Ozon, Wildberries, and Yandex.Market, through its official online store, and in offline stores in Moscow, St. Petersburg, Arkhangelsk, Severodvinsk, Kotlas, Kaluga, Ryazan, and Petrozavodsk [28].

At the same time, and somewhat unexpectedly from the perspective of the factory's traditional activities, in 2019, a small investment project was implemented on behalf of the ASF to build a mini fish-processing plant for cod, haddock, and other types of fish, "which made it possible to expand the product range and increase processing volumes" [29].

In 2022, control over the factory was acquired by a new owner, PJSC Inarktika [30]. Since Inarktika is the Russia's largest commercial fish farming (aquaculture) company, it can be assumed that the strategy of radically transforming the factory's activities into aquaculture will become the company's main investment priority, while strengthening and expanding the modern biotechnological profile of its products.

It should be remembered that PINRO's first attempts at plantation cultivation of ahnfeltia and laminaria were made back in the 1960s, but they were unsuccessful at the time because they contradicted the main direction of the third Kondratiev industrial cycle: mechanization of production processes, increased production of technical alginates and food-grade agar at any cost, deliberately ignoring the resulting environmental limitations.

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[27] Business from the seabed: How Arkhangelsk is making money from White Sea seaweed. An interview with Artem Ivanov, director of the Arkhangelsk Seaweed Factory. URL: https://biz360.ru/materials/biznes-so-dna-morskogo-kak-v-arkhangelske-zarabatyvayut-na-vodoroslyakh-belogo-morya/ (accessed 18 February 2025).

[28] Ibid.

[29] The Arkhangelsk Seaweed Factory plans to build a fish processing plant. URL: https://tass.ru/ekonomika/4883321 (accessed 21 February 2025).

[30] Buy INARCTIC (AQUA) shares: today's price, price forecast, chart quotes, and online price dynamics. URL: https://www.tbank.ru/invest/stocks/AQUA/ (accessed 21 February 2025).

In the spirit of the environmentally friendly solutions of the fourth Kondratiev wave, the aquaculture investment priority [20, Stasenkov V.A., Zelenkov V.M., Antonova V.P. et al., p. 52] of the new owner of the ASF seems appropriate and more convincing than the ecologically beautiful romanticization of the archaic Pomor activities (manual harvesting, natural drying, etc.) of the previous owner. Aquaculture and seaweed cultivation are considered by the leading countries in the industry as a global strategic development trend for the coming decades [21, Albrecht M.A.; 22, Stévant P., Rebours C.; 23, Veenhof R.J., Burrows M.T., Hughes A.D. et al.; 24, Duarte C.M., Bruhn A., Krause-Jensen D.; 25, Orbeta M.L.G., Digal L.N., Astronomo I.J.T. et al.; 26, Chopin T., Tacon A.G.J.; 27, Chung I.K., Sondak C.F.A., Beardall J.; 28, Kim J., Stekoll M., Yarish C.]. This means that the new owner will have to find pioneering and cost-effective technical solutions for plantation cultivation of seaweed in the specific conditions of the White Sea, effective "environmentally friendly" mass drying of seaweed, and preserving a reasonable share of traditional harvesting of wild seaweed in new nature-compatible forms. After all, for example, plantation cultivation of cranberries and blueberries does not negate the value and necessity of traditional harvesting of wild berries.

It can be expected that the fourth Kondratiev cycle for the ASF will be completed in the middle of the 21st century, and a required radical paradigm shift in the White Sea seaweed farming industry will occur in the near future. This will reflect not the superficial environmental imperatives of the existing industrial production, but rather its complete reformatting in line with new, environmentally friendly requirements. As the experience of the factory's century-long development shows, solving the environmental problems of seaweed resource depletion within the industrial economic model is impossible; its complete technological transformation is required, in line with the values and technical capabilities of the new economic philosophy of the fourth Kondratiev wave. During all these years, the main imperative in the enterprise's activities will remain the idea of import substitution with its own high-quality products that are in demand on the Russian market.

Summarizing the retrospective dynamics of the development of the factory's production system in the third industrial wave and the beginning of the fourth Kondratiev wave, we can understand the role of innovations as an attempt to balance the dynamics of the extractive and manufacturing subsystems. At each phase of the Kondratiev wave, an imbalance arises between the extractive and processing subsystems. The extractive subsystem initially takes the lead, and this is the frontier stage; the manufacturing subsystem cannot keep up with it and becomes a "brake" on the growth of the new frontier. During this period, the innovation process intensifies in the processing subsystem.

Then, as signs of initial depletion appear and pioneer development resources (frontier) enter a stage of stabilization without sharp growth, the resource base begins to slow down the development of the enterprise, while the processing system has already gained momentum. This is the stage of investment expansion. There is a demand for a sharp enlargement of the harvesting area. Here, again, the innovation process succors — a cascade of innovations in resource harvesting methods appears.

The third phase signifies a certain harmony between the volumes of seaweed harvested and the volumes of various types of end products extracted from it. Then, in the fourth stage, this balance is disrupted again, and the rapid depletion of the resource base becomes an obstacle to maintaining the same production level. This raises the question of a change in the production structure, which, in essence, acts as a change in the entire previous industrial paradigm. Innovations created during this crisis period become the "fuel" for the development of the enterprise in the new long wave of the fourth Kondratiev cycle.

2. The reason for the factory's survival in the 1990s as a result of the positive effect of the specificity of its assets

The reasons for the resilience of this medium-sized seaweed processing factory (while much larger ones were disintegrated and disappeared) during the crisis of the 1990s are rooted, among other things, in the history of its creation. The location of the plant during the dramatic years of wars and revolutions at the end of the second decade of the 20th century in Arkhangelsk, rather than in neighboring Murmansk and Petrozavodsk, is both natural and paradoxical. The availability of seaweed resources — laminaria, ahnfeltia, and focus — was by no means the decisive factor. The resource base itself did not give Arkhangelsk a clear advantage, since Murmansk and Karelian fishing collective farms supplied the Arkhangelsk factory with scarce ahnfeltia for agar production for many years afterwards. Apparently, both Karelia and the Murmansk Oblast had their own resources of iodine-rich laminaria.

A more important factor was the successful and rare combination of, on the one hand, already established industrial innovations and culture and, on the other hand, preserved maritime traditions of fishing vessel construction and repair. Neither Murmansk nor Petrozavodsk had such a combination of innovations and traditions. These circumstances explain the emergence in Arkhangelsk of the first in the White Sea region iodine factory, based on laminaria resources.

The factory could disappear during the crisis of the 1990s, like hundreds of other, including larger, industrial enterprises in Russia. However, this did not happen, as we believe, due to the highly specific nature of its resource, production, and labor assets, which determined the strong integration of the extraction and processing sectors, the commitment of the remaining employees to the plant, and the close ties of all links in the production system (extraction, processing, and marketing) with local "seaweed" science. The monopoly position of the factory in the country and in the White Sea basin as the only enterprise carrying out the full cycle of seaweed processing, from extraction to deep processing and the release of the final product, was also of great importance. Another significant factor was the reliance on its own resources, which was strengthened during the crisis years: harvesting of seaweed raw materials with its own small fleet, and the historically established processing along three main lines: agar from ahnfeltia, mannitol and sodium alginate from laminaria. In the 1990s, the factory began building its own fishing boats [31], purchased a dry cargo

[31] SAAO. F. 1457. Inv. 1. File 1005. Sh.46.

ship to supply the harvesting areas with all necessary equipment [17, Semenova R.P., p. 39], and built its own boiler house to ensure a constant supply of process steam [32]. The sustainability of the factory's autonomous production system only strengthened in the 1990s.

Specific seaweed assets required specialized technological equipment for harvesting and processing, which the factory needed as the only enterprise in the country consolidating all stages of the production process — from harvesting seaweed to selling it to consumers. This meant that such equipment had to be unique in many cases, i.e. to be produced in a single copy or a "single-piece". So, constant close interaction between the factory's employees and the suppliers of such equipment was required. This suggests that much of this equipment was produced by the factory itself (for example, in 2020, the factory, together with colleagues from PINRO, developed a special mower for the mechanized harvesting of seaweed in the conditions of the White Sea [33]), or was obtained from geographically close industrial enterprises in Arkhangelsk and Leningrad. Only continuous personal communication, with a constant exchange of tacit knowledge between consumers (represented by the factory's employees) and suppliers (represented by employees of supplier companies), could ensure the alignment of the factory's requirements and suppliers' proposals with the necessary "subtle" parameters.

However, a similarly close relationship existed between the factory's consumers and its technologists, ensuring the precise "fine-tuning" of the chemical engineering process in the interests of the consumer enterprises (the largest of which were the textile enterprises in Ivanovo). There was also close cooperation through regular business trips between the factory's research and experimental departments and the research institutes in the light, pharmaceutical and food industries.

3. Features of the local level of a resource enterprise when applying the technological wave concept

Previous experience in conducting deep retrospective "technological wave" studies for Russia's resource territories (the Arctic zone, its individual regions, and the Magadan Oblast) allows us to highlight the features of the local level discussed in this article — the production system of an individual enterprise —the Arkhangelsk Seaweed Factory.

Firstly, the atomic level turns out to be less "regular" in terms of technological wave dynamics, containing a greater number of anomalies and exceptions (for example, a significantly more compressed or extended phase), as well as amplitude "shaking", than the aggregate level of a resource province, region, or zone. An enterprise always "breathes" more rapidly, nervously, with frequent arrhythmia. Therefore, the rhythm of changing phases and the boundaries between them are more difficult to identify here than for aggregate objects. That is why we are not confident in the correctness of the boundaries we have identified between the industrial and post-industrial long

[32] SAAO. F. 1457. Inv. 1. File 1029, Sh. 63.

[33] Arkhangelsk scientists have developed a "mower" for harvesting seaweed in the White Sea. URL: https://av1918.ru/ru/smionas/arkhangelskie-uchenye-razrabotali-kosilku-dlya-dobychi-vodorosley-v-belom-more-/ (accessed 21 February 2025).

waves of the ASF, within the third wave, between its four phases (for example, the delimitation of the first two frontier phases, interrupted by the war, is controversial; it might have been possible to shorten the duration of the aggressive investment phase to 1966, rather than 1976 — in this case, all subsequent phases of the third and fourth Kondratiev waves would have shifted leftward; perhaps, in that case, the currently too short final twilight phase, having shifted leftward, would have turned out to be longer; the first frontier phase of the post-industrial wave, stretched over 20 years, is not entirely convincing — it would have been possible to identify a transitional moment between the end of the third and the beginning of the fourth Kondratiev wave due to the national economic crisis that lasted for more than 10 years). The overall duration of the industrial wave we identified, 62 years instead of the usual 50 years, is also debatable.

Secondly, at the local level, the connection between the rhythm of the enterprise and the rhythm of the country, which is determined by political events and changes in central government leadership, is much weaker or even absent. The graphs of the ASF's natural resource use dynamics (Figs. 1–3) do not allow us to see either 1953 or the period of the economic council experiment as separate, demarcated boundaries. However, analogies to national "campaigns", such as the expansion of corn beyond its natural latitudinal zone, can be seen at the enterprise level in the form of a short "fascination" with mass-produced but low-value products such as seaweed powder and fucus middlings.

Thirdly, at the local level, the role of the enterprise manager as a regulator of the duration and boundaries of individual phases of long waves of technological renewal of the enterprise is more visible. Therefore, in cases where we were uncertain about the clarity of the boundaries and could not see them in the graphs of natural resource use dynamics, we relied on the dates of the directorship of key managers of the factory and adjusted the boundaries of the phases to these milestones.

In general, it can be argued that the emergence of a new economic philosophy is more evident in structures exploiting biological resources than in mineral resource or fuel and energy industries. They are closer to nature and more vividly manifest the values of the new economic era.

Conclusion

The economic history of the Arkhangelsk Seaweed Factory demonstrates the remarkable flexibility of the enterprise's production system, which over the course of a century has repeatedly shifted its core specialization to meet the emerging challenges of import substitution. The enterprise was originally created in response to the challenges of import substitution as an iodine factory, then, in response to new challenges, it successively became an agar factory, an experimental factory, a state unitary enterprise, a joint-stock company, and now it is a limited liability company. Clearly, the future history of the factory will be inextricably linked to the country's need for import substitution of seaweed products. According to the FAO, between 2010 and 2017, agar imports to Russia amounted to 1,136 tons [29, Podkorytova A.V., Roshchina A.N., Burova N.V.].

Russia's demand for food alginates is also only partially met. The ASF has good potential for future growth based on import substitution. However, the effects of resource depletion could pose a serious threat to the company's sustainable growth, as demonstrated by the lessons of its development during the third Kondratiev wave. Therefore, the transition to plantation cultivation of certain seaweed types, to aquaculture, seems to be the only option for the ASF.

Within the Kondratiev wave, the first phase of "opening" a new frontier, which initiates the launch of a new cycle, plays a special role in a resource-based enterprise. Its basic feature is a "candle-shaped" increase in the volume of new resource production over a very short period. New harvesting and vertical take-off are the basic features of the frontier phase. Subsequent growth may be just as dynamic, but it is no longer a frontier because the features of novelty have been lost: staples become simply resources.

Our work on the century-long economic history of the Arkhangelsk Seaweed Factory inevitably raises a broader question: what should be the optimal organizational structure of the seaweed business in the White Sea in the future — a single monopoly enterprise or several medium- and large-scale enterprises like the ASF? It is advisable to consider several development scenarios for the entire White Sea basin as a whole: many harvesters — one ASF (the situation of the 1970s and 1980s, the "golden era"); many harvesters — many ASFs; one ASF that is also the main harvester of seaweed raw materials (the current situation). We were unable to answer this question in this article due to a lack of information and knowledge of the situation in our neighboring White Sea region — in the Republic of Karelia and in the Murmansk Oblast. It would be advisable to direct future research efforts towards further exploration of this topic.

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Legal Ecological Protection of the Lena River

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Abstract. The aim of the work is to study the legislative framework for the protection of the Lena River. The article discusses actual problems related to the ecology of the Lena River. A brief analysis of the current ecological state of the Lena River basin is made. Mining, industrial development of deposits, operation of oil storage facilities and settlements located in coastal areas lead to pollution of the river with various harmful impurities. The unique natural conditions and wealth of natural resources of the northern territories require the adoption of all possible methods of protecting the unique ecosystem. Legal protection should be a priority measure in preserving the ecology of the Lena River basin. An overview of federal regulatory and legislative documents on the protection of water bodies is provided. It is shown that the legislative framework for the protection of the Lena River has not been formed and is in the process of formation. The paper proposes the creation of comprehensive environmental legislation to preserve the nature of the Lena River basin. The basis for the legislative protection of the Lena River is the strategic provisions of federal laws on water bodies. The article outlines the main measures to preserve the ecological state of the river for future generations. The need to increase humanity's responsibility for preserving the environment is noted. The above circumstance makes it relevant to attract public attention to the development of programs to preserve the ecological state of the Lena River.
Keywords: *north, environment, environmental safety, Lena River, environmental legislation*

Introduction

The Lena River is one of the few rivers in the world that has preserved its pristine, unique ecosystem. Currently, the Lena River faces a serious threat from anthropogenic pollution and requires careful preservation of its natural beauty and wealth [1]. Technogenic factors that create environmental risks are associated with human industrial activities. The development of northern territories leads to an increase in anthropogenic impact on nature. Every technical system containing energy reserves and active chemical or biological substances is a potential source of danger. The main sources of river pollution are extractive industries, public utilities, oil product storage and transportation facilities, as well as wastewater generated in cities and towns [1; 2; 3; 4; 5, etc.]. Data on the ecological condition of the Lena River are presented in the State Report "On the State and Protection of the Environment of the Republic of Sakha (Yakutia) in 2022". According to this document, the Lena River is classified as a third-category polluted water body, and in some places — as highly polluted [2]. An analysis of pollution and water quality according to standard RD 52.24.643–

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20021 shows that most sections of the Lena River exceed the maximum permissible concentrations for iron, copper, organic substances and phenols by several times [3].

Let us provide several examples of man-made pollution of the Lena River. The location of nine large oil depots, fuel and lubricant storage facilities with a total capacity of over 900,000 m³ on the riverbank poses a significant environmental problem [4]. During springs, the oil storage facilities are sometimes flooded, which increases the risk of contamination of water bodies with petroleum products. In 1996, there was an emergency drainage of petroleum products in the area of the oil depot in the city of Lensk. An oil spill covering 3,150 m² was discovered on the river's icy surface. As a result of the accident, 49.3 tons of petroleum products were collected, and 96 m³ of contaminated snow and ice were removed. The incident was caused by defects in the bottom of the storage tank. In the spring of 2001, the city of Lensk was severely affected by a devastating flood in Yakutia, and the Lensk oil depot area was flooded. As a result, 89 out of 148 vertical storage tanks containing petroleum products were damaged by ice, which led to a leak of 9,390 tons of petroleum products into the river [5; 6]. In total, 12,814 tons of petroleum products spilled into the Lena River during the flood, and the damage to water resources amounted to approximately 2.5 billion rubles. On 12 June 2023, in the Irkutsk Oblast, the TR-900 tanker "Erofey Khabarov", carrying 832 tons of petrol, collided with the TR-901 vessel, resulting in up to 90 tons of oil spilling into the river. One of the main causes of pollution of the Lena River is domestic wastewater from populated areas. Currently, in Yakutia, contaminated wastewater accounts for 39% of the total volume of discharges into water bodies, while in Russia as a whole, this figure is 34%. Besides, 32 settlements located on the banks of the Lena River [1] have no sewage or wastewater treatment systems. For example, large settlements such as Tiksi and Mokhsogollokh have only mechanical treatment facilities. The quality of human life depends on the quality of drinking water. Currently, 59.8% of the population, primarily urban residents, is provided with high-quality drinking water from centralized systems. In the Republic of Sakha (Yakutia), 16.3% of settlements have water intake structures, while water treatment facilities are available in only 10% of municipalities. So, people are forced to drink water without prior purification and disinfection. The low level of clean water supply through centralized systems in Yakutia is explained by several factors, including low population density, remoteness of settlements, and complex transportation infrastructure. This increases the cost of constructing water supply and treatment facilities, and reduces the investment attractiveness of these projects. Pollution levels are higher in areas with large settlements. For example, in Yakutsk, total emissions into the atmosphere reach 35,100 tons per year [7]. The high incidence of acute intestinal infections (1,000 cases per 100,000 people) and diphyllobothriasis (900 cases per 100,000 people) [8] among the Yakutsk population indicates severe pollution of the river by municipal waste and insufficient treatment measures.

Research object

It is worth noting that the Lena River basin landscape is an important natural resource for the livelihood of the population of the Russian Federation. The importance of studying the legislative framework for the protection of the Lena River is justified by the fact that it is one of the ten greatest rivers in the world, the largest river in Russia with a basin located within its territory, and the only river entirely located in the permafrost zone [9]. Its basin area is 2.49 million km², and the average long-term runoff is 530.225 km³ per year. The river's surrounding area is rich in mineral deposits, including iron ore, coking coal, natural gas, and gold. Its banks are home to unique, pristine landscapes, such as the Lena Pillars, a UNESCO World Heritage Site, the Tukulan sandstone mountain, unique in the world for its size, the Diring Yuryakh ancient settlement, and layered ice masses that do not melt in summer.

Legislative protection of the Lena River

The Lena River is less polluted by industrial waste than other major rivers in the country, which makes its environmental protection an important task in Russia in the interests of future generations. Despite the measures taken to improve the safety of technical facilities, accidental pollution is not decreasing and poses a potential danger to the population and the surrounding natural environment. Pollution of the river will continue due to a variety of possible reasons, including environmental terrorism. Currently, the environmental safety of the Lena River is not adequately ensured. In this regard, work to protect the Lena River should be carried out under the constant supervision of the public and the entire population. Ensuring the environmental safety of the Lena River involves preventing the harmful impact of economic activity on the environment, preserving biodiversity for the long term, and providing clean drinking water to urban and rural communities. The solution to this problem largely depends on legislation regulating the protection of the Lena River.

Let us consider the laws of the Russian Federation that relate to environmental protection policy applicable to the Lena River. Article 72 of the Constitution of the Russian Federation states that "the joint jurisdiction of the Russian Federation and the constituent entities of the Russian Federation shall include: c) issues of ownership, use, and disposal of land, subsoil, water, and other natural resources; d) nature management; environmental protection and ensuring ecological safety..." [1]. It is worth noting that the distribution of powers between the center and the regions is not specified in the Constitution of the Russian Federation, although it should probably be reflected in subordinate legislation in accordance with the country's fundamental law.

[1] The Constitution of the Russian Federation (adopted by popular vote on December 12, 1993, with amendments approved during the all-Russian vote on July 1, 2020). URL: http://pravo.gov.ru/proxy/ips/?docbody=&nd=102027595 (accessed 12 November 2024).

One important document on this issue is the "Environmental Doctrine of the Russian Federation" [2], approved by Government Order No. 1225-r of August 31, 2002, which defines the strategic goal of state environmental policy as "preserving natural systems and ensuring the ecological security of the country". In 2017, the "Strategy for Environmental Security of Russia until 2025" was adopted by Decree of the President of the Russian Federation [3]. The basis of the strategy is that "high quality of life and health of the population, as well as national security, can only be ensured by preserving natural systems and maintaining adequate environmental quality". There is also a provision of importance for the republic's population regarding "the participation of civil society, local government bodies, and business community in the preparation, discussion, adoption, and implementation of decisions on environmental protection and sustainable natural resource management". The health of the population and life expectancy directly depend on the quality of the water consumed. Drinking water is the source of life, determining its quality and duration. Article 56.1 of the Water Code [4] of the Russian Federation stipulates that "the discharge into water bodies and the burial therein of production and consumption waste, including decommissioned ships and other floating vessels (their parts and mechanisms), is prohibited". In accordance with sanitary and epidemiological requirements (Federal Law "On Water Supply and Disposal") [5], drinking water must be safe in epidemiological and radiation terms and harmless in terms of its chemical composition. It is worth noting the practical significance of Federal Law No. 199 of 29.12.2005 "On the Transfer of Powers in the Sphere of Natural Resource Use and Environmental Protection to the Executive Authorities of the Constituent Entities of the Federation" [6] in terms of the opportunities for regions to introduce effective measures to improve the ecological state of water bodies. An extensive analysis of regulatory and legal documents relating to the Arctic zone is presented in the work of A.A. Solovyanov [10]. This work emphasizes that the provisions defining strategies for ensuring environmental safety are not reflected in specific regulatory acts in practice, and also notes the insufficient effectiveness of the environmental protection management system in the Arctic regions. In addition, the issue of "transferring maximum powers to the subjects of the Federation in all aspects of environmental protection" is considered, which is in line with Article 72 of the Constitution of the Russian Federation. The document "Fundamentals of the State Policy of the Russian Federation in

[2] Environmental Doctrine of the Russian Federation. Approved by Decree of the Government of the Russian Federation of August 31, 2002, No. 1225-r. URL: http://pravo.gov.ru/proxy/ips/?docbody=&prevDoc=102149626&backlink=1&&nd=102077597 (accessed 12 November 2024).
[3] Decree of the President of the Russian Federation of April 19, 2017 No. 176 "On the Strategy for Environmental Security of the Russian Federation until 2025". URL: http://pravo.gov.ru/proxy/ips/?docbody=&firstDoc=1&lastDoc=1&nd=102430636 (accessed 12 November 2024).
[4] Water Code of the Russian Federation of June 3, 2006 N 74-FZ. URL: http://pravo.gov.ru/proxy/ips/ (accessed 12 November 2024).
[5] Federal Law of 07.12.2011 N 416-FZ "On Water Supply and Disposal". http://pravo.gov. URL: ru/proxy/ips/?docbody=&nd=102152700 (accessed 12 November 2024).
[6] Federal Law No. 199 of December 29, 2005 "On the Transfer of Powers in the Sphere of Natural Resource Use and Environmental Protection to the Executive Authorities of the Constituent Entities of the Federation". URL: http://pravo.gov.ru/proxy/ips/?docbody=&vkart=card&link_id=0&nd=102104210&bpa=cd00000&bpas=cd00000&intelsearch=31.12.2005+%E3%EE%E4%E0+%B9+199-%D4%C7++&firstDoc=1 (accessed 12 November 2024).

the Arctic until 2020 and Beyond" [7] states that one of the key measures for implementing state policy in the field of environmental safety in the Arctic zone is the requirement that any industrial activity must provide for the elimination of accumulated environmental damage and the restoration of degraded ecosystems. However, these declared provisions are not being implemented by extractive companies, but the restoration of the damaged natural environment should become their urgent task, which needs to be under the strict control of environmental protection authorities. Summarizing this review, it should be noted that at the federal level, strategic environmental protection provisions are declaratively outlined in laws and can be referred to when developing regional documents; the only issue that remains is the desire and willingness to implement these provisions in practice.

Various federal legislative acts on the protection of water bodies have been adopted in relation to Lake Baikal and the Volga River. The paper [11], providing an overview of legislative documents on the protection of Lake Baikal, states that their basic principle is the balanced approach to socio-economic objectives and tasks related to the protection of the lake. As shown by the analysis of the regulatory legal acts of the Russian Federation [8] in the field of ensuring the preservation of the Volga, a legislative framework for the protection of the river has been created [12], and it is proposed to develop regulations on mechanisms for identifying and assessing accumulated damage to water bodies. The work notes that the Volga River restoration project was planned to reduce the volume of polluted wastewater discharged into the river by three times by the end of 2024. Approximately 128 billion rubles were allocated from the federal budget for the project's implementation.

At the regional level, the main strategic document for environmental protection is the "Concept of Environmental Safety of the Republic of Sakha (Yakutia)" [9], adopted in 2002. A review of this document reveals the following conceptual provisions relevant to the topic of this article:

- prioritizing the preservation of the biosphere over the direct use of its resources;
- identifying and minimizing environmental risks to the natural environment and public health;
- preventing the possibility of chemical pollution of the territory during the implementation of new industries and technologies.

As can be seen, the provisions of the concept are consistent with federal fundamental documents, reflect the entire range of possible actions to preserve the natural environment in the republic, and constitute the basic doctrine for ensuring the environmental safety of the Lena River.

[7] "The Fundamentals of the State Policy of the Russian Federation in the Arctic until 2020 and Beyond" were approved by the President of the Russian Federation on September 18, 2008 (Decree No. Pr-1969). URL: http://static.government.ru/media/files/A4qP6brLNJ175I40U0K46x4SsKRHGfUO.pdf (accessed 12 November 2024).

[8] "The Fundamentals of the State Policy of the Russian Federation in the Arctic until 2020 and Beyond" were approved by the President of the Russian Federation on September 18, 2008 (Decree No. Pr-1969). URL: http://static.government.ru/media/files/A4qP6brLNJ175I40U0K46x4SsKRHGfUO.pdf (accessed 12 November 2024).

[9] Resolution of the Government of the Republic of Sakha (Yakutia) dated December 26, 2002 No. 651 "Concept of Environmental Security of the Republic of Sakha (Yakutia)". URL: https://docs.cntd.ru/document/815000367 (accessed 12 November 2024).

The protection of the Lena River is governed by the Law of the Republic of Sakha (Yakutia) dated 25 December 2003 No. 103-3 No. 209-III "On Drinking Water and Drinking Water Supply" [10], according to which "the right of citizens to an uninterrupted supply of drinking water that meets hygienic standards is guaranteed". Planned environmental measures to preserve the natural environment of northern ecosystems in the republic until 2024 are outlined in the Decree of the Head of the Republic of Sakha (Yakutia) "On the Environmental Well-Being of the Republic of Sakha (Yakutia)" [11]. The Decree includes provisions on the creation of an ecologically safe environment in the territories of populated areas of the Republic of Sakha (Yakutia) "with the share of the population provided with good-quality drinking water reaching 55%, an increase in the share of processed solid municipal waste to 60%, and the share of recycled solid municipal waste in the total volume of solid municipal waste generated reaching 36%; construction and reconstruction of water intake and water treatment facilities to provide high-quality drinking water to more than 520,000 people, construction and reconstruction of wastewater treatment facilities in at least 15 settlements, development of environmentally friendly production facilities, and implementation of environmentally friendly technologies".

The Lena River is federal property and flows through two regions, so its management is regulated by the Water Code of the Russian Federation. This circumstance deprives the republic of the ability to legislatively intervene in its development. The parliaments of the Irkutsk Oblast and the Republic of Sakha (Yakutia) have raised the issue of including the Lena River basin in the national "Ecology" project aimed at preserving unique water bodies, but a positive decision has not yet been reached. These regions are raising the pressing issue of protecting the ecology of the Lena River, and it is hoped that the measures taken will receive support from the public and the population of the republic, which will allow progress to be made in resolving this issue. As mentioned earlier, the legal protection of the environment of Lake Baikal and the Volga River has a well-developed legislative framework.

The next important aspect of protecting the Lena River is the practical application and compliance of the established norms enshrined in legislation. Any construction project should conduct an environmental impact assessment. The results of the assessment and information on the planned economic activity should be publicly available. Any intervention in the unique natural environment of the Lena River basin should be strictly regulated and undergo comprehensive state and public review. It is also necessary to develop more rigid provisions specific to the Lena River on mechanisms for identifying and assessing cumulative damage.

Latypova V.Z. [13] proposes measures for the improvement of the Volga River. Some of these proposals are interesting and applicable to the Lena River, which leads to additional

[10] Law of the Republic of Sakha (Yakutia) dated 25.12.2003 No. 103-Z No. 209-III "On drinking water and drinking water supply". URL: https://docs.cntd.ru/document/802007458 (accessed 12 November 2024).
[11] Decree of the Head of the Republic of Sakha (Yakutia) dated September 27, 2018 No. 2 "On the environmental well-being of the Republic of Sakha (Yakutia). URL: https://docs.cntd.ru/document/802007458 (accessed 12 November 2024).

opportunities for improving its condition. The work raises the issue of creating a comprehensive system of state environmental control and monitoring along the entire length of the river in a single system “natural environment — source of pollution”, an inventory of pollution sources, a system of environmental standards for water quality, the introduction of automated wastewater control systems, the modernization of storm water treatment facilities, which are also relevant for the Lena River. The given examples of legislative support for the ecology of large water bodies can serve as a basis for the creation of similar legislation for the Lena River: both in content and quantity. First of all, it is necessary to ensure 100% availability of drinking water for settlements at risk of oil pollution in case of accidents on the ESPO oil pipeline crossing the Lena River, as well as to organize wastewater treatment in all settlements along the river. This task is quite ambitious and should be addressed in the near future, given the global importance of preserving the natural environment of the Lena River basin. Researching the ecology of the Lena River, developing a strategy for its preservation, and preparing specialized regulations on acceptable pollution levels and the limits of its economic use are the most important tasks for the republic’s scientific community. It is also worth noting the importance of active public participation in matters of environmental protection of the river.

In today’s world, human impact on natural ecosystems has become more widespread and diverse, negatively impacting living organisms on the planet. The growing arms race and existing stockpiles of nuclear and biological weapons pose a serious threat to life on Earth. Environmental issues may take a backseat in these times of global conflict, but humanity's survival is entirely dependent on the ecological state of planet Earth. A number of studies discuss the relationship between the development of human society and the environment in the context of the ideas of V.I. Vernadskiy [14; 15; 16, etc.]. In his opinion, humanity should fundamentally transform its way of life and shift to a noosphere — a sphere of rational life. Noospheric development implies human coexistence in harmony with natural processes and a careful attitude toward the environment with the aim of preserving its structural diversity. The current environmental crisis is viewed as the result of humanity’s spiritual and moral degradation. The main reason for this is the loss of moral compass and traditional systems of economic management, as well as the prevalence of a consumerist approach in shaping people’s lives.

The foundation of noospheric development should be a physically, morally, and mentally healthy person. Our ancestors treated nature with great respect, not destroying it without serious need, taking only what was necessary for life, and treating natural objects as living beings. In the culture of the Sakha people, there was a deep respect for celestial phenomena, as the state of nature directly influenced human life in the harsh conditions of the North. The negative impact of changes in natural phenomena is vividly reflected in the epic work “Kudangsa the Great” by the writer Platon Alekseevich Oyunskiy, in which the main character decides to split the star Cholbon — the cause of the severe cold — for the prosperity of his people. A shaman, however, warns him of the cruel retaliation of natural forces. Even if the intentions seem noble, large-scale man-made

changes to the environment can lead to unforeseen consequences, even threatening the survival of humanity. The essence of the work is to warn people about this. Numerous examples confirm the Earth's response to large-scale changes, including the COVID-19 pandemic, which has affected all of humanity and resulted in numerous casualties. It is necessary to accept the idea that human existence is possible only with the adoption of a noospheric model of development, ensuring a balanced interaction between humans, the technosphere, and the biosphere. A striking example of progress in this direction is the Altai Republic, where the President of the Russian Federation approved the country's first project, "Altai — Territory of Noospheric Development" [16]. Similar projects, based on the idea of peaceful coexistence of peoples, with an emphasis on preserving the biosphere through rational use of its resources, could also be developed for the Lena River basin.

Conclusion

The analysis of the current ecological state of the Lena River basin reveals a lack of a systematic approach to solving its environmental problems. The primary measure for preserving the ecology of the Lena River basin should be its legal protection, which should be based on the key provisions discussed above that are relevant for the Lena River:

- the framework for the legislative protection of the Lena River, given its global significance and in the interests of future generations, should be based on the strategic provisions of federal laws on environmental protection, such as: "the joint jurisdiction of the Russian Federation and the constituent entities of the Russian Federation shall include issues of ownership, use, and disposal of land, subsoil, water, and other natural resources", "prioritizing the preservation of the biosphere over the direct use of its resources", "high quality of life and health of the population can only be ensured by preserving natural systems" [12], "the transfer of powers in the sphere of natural resource use and environmental protection to the executive authorities of the constituent entities of the Federation", "the participation of civil society, local government bodies, and business community in the preparation, discussion, adoption, and implementation of decisions on environmental protection and sustainable natural resource management" [13], "identifying and minimizing environmental risks to the natural environment and public health";
- the principle of balancing solutions to socio-economic and environmental protection challenges in the Lena River basin should be based on conducting a comprehensive state and public environmental assessment of the impact on the social and natural environment for all industrial and economic activity projects;

[12] Order of the Government of the Russian Federation of August 31, 2002 No. 1225-r "On Approval of the Environmental Doctrine of the Russian Federation". URL: https://ivo.garant.ru/#/document/2158906 (accessed 12 November 2024).
[13] Ibid.

- indicators and their permissible values of anthropogenic impact on the Lena River ecosystem, as well as provisions on mechanisms for identifying and assessing accumulated damage, should be developed and defined, which will allow for establishing justified requirements for the activities of economic entities and monitoring their implementation;
- any industrial activity should include the elimination of accumulated environmental damage and the restoration of degraded ecosystems; access for environmental authorities to their operating territories for environmental control should be ensured;
- "creating a comprehensive system of state environmental control and monitoring along the entire river within a single system "natural environment — source of pollution", determining pollution sources, establishing a system of water quality environmental standards, implementing automated wastewater control systems, and modernizing storm water treatment facilities" [13].

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