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AI Tools in the Digital Transformation Programmes of Industrial Enterprises

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ABSTRACT

This article is devoted to the study of the prospects for the development and implementation of AI in industry in the context of digital transformation. Autonomous factories, integrated supply chains, and autonomous vehicles is a real proof of technological advances that AI brings to life. The article highlights a number of problems and challenges for Russian industry based on the results of applied research conducted in November-December 2023 at 18 medium and large industrial enterprises. The main conclusions include not only the identified systemic problems and risks (shortcomings in digitalisation methodology, ambiguity in calculating economic parameters, lack of technical expertise), but also the most promising areas for the development of AI technologies. The study finds significant potential for enhancing the technologies of the Industry 3.0 and Industry 4.0 paradigms using AI tools. Also, it describe the necessary changes in enterprise management and regulatory government activities aimed at realising the identified potential. In conclusion, the article emphasises the need to optimise parallel imports, develop human capital and adequately analyse the economic parameters of industrial enterprises' digital transformation project. The authors emphasise the relevance of studying the prospects for the development of AI in industry for Russian economic science in the period 2024–2026.

Keywords: industry 4.0; artificial intelligence; digital transformation; technology

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INTRODUCTION AND FORMULATION OF THE RESEARCH PROBLEM

The use of artificial intelligence (AI) represents a pivotal technological trajectory in the ongoing digital transformation of industry. The term artificial intelligence was introduced in the mid-20th century, coinciding with foundational research and experimental endeavors aimed at delineating the types of tasks AI could perform with greater speed, precision, and reliability than human counterparts. Distinct from robotics, AI was conceived to address specifically "human-centric" tasks — creative yet logically structured and amenable to algorithmic representation. The initial practical efforts of A. Newell and H. Simon in the late 1950s sought to develop software systems capable of emulating human cognitive processes, such as mathematical theorem proving or engaging in dialogues with other systems. This approach ensured the algorithmic functionality of AI but necessitated the integration of tens of thousands of dependencies and rules within the software architecture. Concurrently, from the mid-1960s, an alternative paradigm emerged, focusing on programming algorithms not for the direct operation of AI but for its ability to learn — a concept analogous to neural networks in the human brain. This line of inquiry culminated in the development of the first perceptrons, artificial neural networks capable of learning and performing tasks analogous to the functions of biological neurons. Contemporary AI tools employed across economic sectors, particularly in industrial applications, amalgamate these two approaches. For example, expert systems incorporate extensive rule-based dependencies within their codebase, while advanced AI methodologies in domains such as computer vision or digital twins undergo extensive training on large-scale datasets. By the close of the 20th century, AI tools had achieved significant specialization, both at the industry and niche levels, enabling them to solve distinct classes of problems with efficacy comparable to that of human experts [1]. This acceleration was facilitated by the resolution of a critical limitation — insufficient computational power. By the dawn of the 21st century, machine learning had evolved into a highly intricate discipline, equipped with a robust suite of automation tools, and emerged as an independent technological domain within the broader framework of artificial intelligence. Its efficacy has witnessed continuous enhancement over the past 25 years, marked by significant milestones such as the formulation of principles for self-learning neural networks, spanning from early deep learning methodologies in the 1980s to the current analysis of big data [2]. Among the most transformative developments in neural network research has been the realization of multilayered architectures. At present, multilayer neural network architectures constitute the most prominent and thoroughly researched approach. Such networks are capable of modeling complex processes and addressing a wide array of industrial challenges, with the number of layers and the neurons per layer directly influencing the complexity and adaptability of the system's functional capabilities [3].

The emergence and development of the "Industry 3.0" technological paradigm at the turn of the century coincided with the evolution of artificial intelligence (AI). Adherence to the "Industry 3.0" concept implies extensive use of electronics and automation, with the AI tools of that era classified primarily as expert systems. For instance, at the beginning of the 21st century, Volkswagen Group utilized machine learning technology to monitor product quality. By analyzing historical production process data, AI identified potential defects during manufacturing, thereby increasing the reliability of vehicles. Around the same time, advancements in robotics among industrial leaders and increased computational power enabled the application of AI in robot management. For example, Hyundai

Heavy Industries has successfully deployed AI-equipped robots for over a decade to service ships and ports. These robots, capable of autonomous movement in complex environments, perform a wide range of tasks, including loading, equipment installation, and maintenance. One of the earliest projects in Russia aligned with the "Industry 3.0" paradigm was the integration of AI into drilling rig management processes by Gazprom Neft. This implementation enhanced the safety and efficiency of drilling new wells.

The modern "Industry 4.0" paradigm represents the next stage in the technological evolution of industry, combining AI, the Internet of Things (IoT), and big data analytics to create fully automated and intelligent production systems such as "smart factories", "smart mines", and "smart warehouses". The accessibility of "Industry 4.0" technologies — including IoT, computer vision, industrial Wi-Fi, data warehouses, and non-relational databases — enables real-time processing of vast data volumes. This capability significantly enhances the mechanisms for AI learning and improvement [4]. Moreover, the "Industry 4.0" paradigm has already introduced new concepts that are transforming various sectors, including:

- Intelligent Internet of Things (IIoT);
- AI-driven engineering;
- Predictive systems based on big data.

AI systems are actively being developed today, with their economic efficiency serving as a key vector of competitiveness in the global economy. For instance, in Germany, so-called "smart factories" are being created. Siemens is developing control systems that automatically regulate production processes in real time based on data about demand and equipment status. This approach significantly enhances production efficiency and reduces costs. Similarly, Mercedes has constructed a fully autonomous automobile manufacturing plant where AI systems manage robotic vehicle production in real time. These systems process vast streams of data from all production lines, warehouses, raw material inventories, and even sales and logistics processes. Another notable example is autonomous vehicles, whose movement and operation are managed by AI systems capable of analyzing the surrounding environment and making safe navigation decisions. These technologies are central to the future of transportation. Companies such as Hyundai in South Korea, KAMAZ in Russia, and Tesla in the United States have already developed pilot models for use on public roads.

At the same time, the continuous reduction in the cost of training and operating AI tools will eventually make such solutions standard for enterprises operating within the "Industry 4.0" paradigm. Understanding the current state of affairs, objective barriers, and associated risks is critical for Russian economic science, emphasizing the relevance of the research goal: to assess the demand for and prospects of AI technology adoption in industrial enterprises under conditions of digital transformation. The development of AI tools involves not only simplifying and reducing the costs of these technologies but also designing optimal usage scenarios and creating conditions under which these tools will be most effective, given existing constraints. The economic factors outlined above enable an analysis of the prospects for the development of AI tools within the context of industrial digital transformation during 2024–2026.

APPLICATION OF AI TECHNOLOGIES IN THE DIGITAL TRANSFORMATION OF INDUSTRIAL ENTERPRISES

To address the outlined scientific objectives, an applied study was conducted in October–November 2023. The study involved 18 medium-sized (up to 1,000 employees) and large industrial enterprises from the following regions (listed in descending order of representation): Moscow, Moscow Region, Novgorod Region, Saint Petersburg, Udmurt Republic, Sakha Republic, and Krasnodar Territory. The goal was to identify key chal-

lenges in the practical implementation of AI technologies and elements into the production and business processes of industrial enterprises, focusing on insights from ongoing digital transformation projects.

The research employed a two-round expert panel method, synthesizing opinions and experiences from employees and managers of industrial enterprises: 1) Remote opinion collection via Google Forms 2) Feedback collection on structured findings from participating experts (including objections, comments, and additions). The general results revealed that:

1. AI tool adoption in industrial production remains fragmented, with various risks and challenges, such as:

• The digitalization methodology is underdeveloped, with unclear scenarios for calculating return on investment, insufficient understanding of the technical aspects of AI tools' operation and development, and poor integration of AI technologies into enterprises' broader IT landscapes.

• The average cost of AI implementation projects needs substantial reduction. This requires addressing hardware and software shortages, overcoming the isolation of Russia's technological sector, and reversing the brain drain of IT specialists.

2. Existing technologies from the "Industry 3.0" paradigm, such as automation, robotics, and expert systems (developed since the late 20th century), can be significantly enhanced by AI tools. However, for more than half of the enterprises studied, these advancements have not yet been implemented.

3. Technologies from the "Industry 4.0" paradigm face similar challenges. Despite isolated successes, particularly in implementing Artificial Intelligence of Things (AIoT) and AI-driven engineering concepts, the overall situation requires substantial investment in technological infrastructure and, specifically, AI tools for over two-thirds of the enterprises surveyed.

In this article, in line with the outlined scientific objectives, the focus is placed on expert forecasts regarding the short-term prospects for the development of AI technologies in industrial digital transformation projects. Two key success factors for such programs were identified:

• Understanding the real objectives of digitalization programs by participants — 47% of experts;

• Economic feasibility of digitalization projects — 42% of experts.

• Two primary barriers to implementing AI systems in industrial processes were also identified:

• High costs of AI-driven digitalization projects — around 60% of experts;

• Lack of personnel, knowledge, and adequate digitalization methodologies in industry — around 53% of experts.

The optimal balance between the speed of implementation (and associated costs) and potential economic benefits determines the most promising development paths for AI technologies in industry. Over the planning horizon of 2024–2026, these are:

• Data analysis (including telemetry) and decision-making support — 84% of experts;

• "Smart manufacturing", including AI-driven engineering — 58% of experts;

• Autonomous management (of workshops, machines, and equipment) — 42% of experts;

• Smart industrial safety systems (for personnel, equipment, and facilities) — 42% of experts.

Additionally, the most critical ideas and observations to improve the success of AI implementation practices in industry were agreed upon. For instance, there is a need to find optimal solutions to address increasing risks of various kinds. Some issues are being temporarily resolved (e.g., parallel imports enable the supply of hardware), while others cannot yet be addressed (e.g., replacing U.S.-developed AI solutions that lack equivalents in Russia or China). Regulatory pressures related to import

substitution have become an additional risk factor for some industrial enterprises, negatively affecting current business performance and reducing the likelihood of rapid digital transformation across industrial sectors. Furthermore, existing methodologies for calculating the profitability of AI implementation (and broader digital transformation projects) require improvement. Overall, the profitability of AI tools in industry remains a contentious issue, heavily influenced by unpredictable macroeconomic factors. This underscores the need for more reliable evaluation methodologies and risk mitigation strategies to unlock the full potential of AI in industrial applications.

Experts also noted a moderate increase in investment volumes (adjusted for inflation) in industrial digital transformation projects involving AI technologies. Approximately one-third of experts reported a significant rise in investments, surpassing the previous peak of 2019–2020. In the short term, around 80% of study participants associated the development of all AI tools with government investments in the sector, aimed at promoting hardware import substitution. According to roughly half of the experts, such substitution is essential for advancing AI technologies.

At the same time, the participants demonstrated a strong commitment to developing the most promising AI technologies in the industrial sector, including:

- AI-driven engineering;
- Big data processing and decision-making support.

Both technologies are considered the most promising applications of AI tools in the industry, offering substantial potential for enhancing operational efficiency and innovation.

PROSPECTIVE ANALYSIS OF AI TOOL DEVELOPMENT

The prospects for the development of AI tools for digital transformation projects in industrial enterprises are based on operational and tactical management of numerous risks, which have become even more relevant following the pandemic and the Ukrainian crisis. The pressure from these risks makes long-term strategic planning and goal-setting less effective but allows for the structuring of the following approaches to the development of AI tools in Russia's digital economy:

- Accelerated digitalization of the economy and overcoming the risks of an "AI winter";
- Transition from declared to actual import substitution;
- Creation of a significant HR capital[1] for the operation of digital technologies.

The accelerated digitalization of the economy, including the development of AI technologies, is regulated by a set of regulatory acts and federal development programs in Russia[2] [5]. However, goal-setting must be followed by theory, methodology, and financing for numerous projects in enterprises and industrial holdings. The economically unclear results demonstrated by leaders in domestic industry and pioneers of digitalization in the implementation of AI technologies highlight the need to improve the theory and methodology of AI use in the digital transformation of industry. The current development vector, which relies on foreign technologies, the experience of Western consulting companies, and difficult-to-recover investments, is unpromising in the context of the radical reduction in the availability of all the aforementioned resources.

The experience of European and American industrial corporations shows that AI technologies are profitable and represent the main pathway for the development of increasingly complex

[1] Hereinafter, the concept of "human capital" is used in a broad sense, as a productive factor in economic development, including a highly educated part of the labor force, knowledge, tools for intellectual and managerial work, living environment and work activity, allowing to reveal and use the personnel potential of enterprises or industries.

[2] URL: https://ai.gov.ru/strategy/federalnyy-proekt-ii/

concepts within the "Industry 4.0" paradigm. However, in addition to the factor of hardware and software availability, a crucial role is played by the clear economics of each project. For Western industrial corporations, the research and evaluation phase has been completed, and AI technology projects are successful and scalable across production sites, with a clear understanding of their role in the value-added chain. These are no longer pilot or research projects, but full-scale digitalization tools for enhancing competitive capabilities. It is quite evident that the developed methodology for implementing AI tools supports key economic parameters and allows for the amortization of innovations within a realistically predictable time frame. It can be assumed that a new trend in the Russian market in the coming years will be the emergence of domestic consulting companies that will actively participate in the digital transformation of industrial sectors, developing digitalization methodologies with economically understandable justifications and repeatable AI technology implementation results [6].

In the applied research, experts linked overcoming the current difficulties in the practical development of AI technologies to strengthening government support for fundamental research in this area. There is an objective risk of an "AI winter", when the already spent investments are insufficient to achieve the set goals, and large-scale investment programs and related research are completely halted. Retrospectively assessing the history of technology development, it should be noted that such "winters" — prolonged periods of sharp reductions in investment and interest (commercial, academic, etc.) in AI technologies — have already occurred. [7]. Overall, there has been a significant increase in the cost of projects involving any technological innovations within the framework of digitalizing industrial enterprises in Russia [5]. Therefore, experts rightly noted that the most significant factor in overcoming the risks of another "AI winter" in Russia is the increase in fundamental government investments in applied AI technologies. Another significant factor is the "elimination of hardware shortages", which has been addressed in recent years through parallel imports [8].

A significant influence on the prospects for the development of AI technologies is another trend of 2022–2023 — the shift from declared to real import substitution in the field of information technology. On the one hand, this direction has been chosen and is supported by industry regulators and state institutions. On the other hand, at the practical level, import substitution in certain areas of information technology not only worsens the competitive opportunities of Russian enterprises but also seems impossible for many years. For example, in another author's study conducted in October 2023 on the topic "Strategy and Tactics of Developing Corporate IT Landscape Amid Technological Embargo and Accelerated Import Substitution", presented at the "Kutafinsky Readings MGUA 2023" conference in the "Economics" section, the experience of the Russian IT industry was analyzed from the perspective of real and declared import substitution. Information was collected through interviews with managers of Russian IT companies and corporate clients, covering brands such as Yandex, Sber, VTB 24, Bank Saint Petersburg, Nestlé Russia, Coca-Cola Russia, Dom.RF, PSB Group, Lamoda, Aukso, Open Vision, Infosytems Jet, and others. The responses were then summarized, approaches and results were evaluated, and a roadmap was created to identify management opportunities, best practices, and lessons learned from active import substitution of hardware and software in 2022–2023.

The study showed that the processes of declared and real import substitution in the Russian economy are highly dependent on three factors:

- Regulatory pressure from government authorities;
- The efficiency of parallel imports[3];

[3] Hereinafter, the optimality of parallel import means a set of

• The capabilities of the corporation itself to create software and hardware, i.e., ready-made IT solutions.

Undoubtedly, the national IT industry demonstrates steady economic growth, but this process is largely related to the increase in service prices, the need for parallel imports, and government support, rather than the creation and sale of new software and hardware to replace the departed Western suppliers (despite the declarations and speeches at large professional IT industry conferences in the second half of 2023).

In the long term, up until 2030, it is difficult to assess whether the influence of regulatory pressure from government authorities in the area of IT import substitution will have a positive or negative impact on the Russian economy as a whole. Unlike sectoral and targeted support programs or federal projects, direct regulatory pressure is perceived negatively by many participants in the study mentioned above, and the management reaction from their leaders (both in private and state-owned corporations) tends to be focused on formal compliance with regulatory requirements — at the expense of the strategic interests of the business and its clients in the short term. For example, despite obvious challenges, for a class of corporations whose activities are defined by law as critical and infrastructural for the Russian economy, import substitution processes are mandatory. For such corporations, Presidential Decree No. 166[4] is the dominant motivation for the development of informatization and digitalization, which directly affects the choice of solutions and their implementation. The study analyzed all typical types of software and hardware: from communication tools to servers, from operating systems to peripheral devices. In this chapter, we are most interested in the set of technologies for creating AI solutions.

The *Table* highlights the elements and the dominant successful AI solution for real or declared import substitution, applied by most of the corporations whose representatives participated in the study. The last column specifies alternative approaches, conditionally successfully applicable to the Russian IT market, as well as scenarios for state-owned corporations that are required to fully replace imported software by 2025.

It should be noted that in the spring of 2023, there was no mass rejection of hardware. Even in the most problematic areas (telecommunications equipment from CISCO and servers from all global brands), Russian corporations were prepared for the corresponding risks. Although there was a surge in demand for any hardware from March 2022, by mid-2023, parallel import mechanisms (including "gray" and "black" schemes) were able to meet the minimal needs of the Russian economy. It is evident that the hardware elements of AI solutions in the short term will rely on parallel imports. Summarizing the prospects for the development of AI tools within the import substitution trend, the following should be noted:

1. The refusal of Western companies to cooperate with Russian partners, regulatory pressure from the state, and the general business turbulence have led to clear interest (and budgets) for real, not just declared, import substitution in the field of simpler information technologies. However, for more complex AI technologies, this is difficult, if not impossible.

2. The development (and cost reduction) of digital transformation projects with AI technologies critically depends on the effectiveness of parallel import development: the efforts of the Russian IT industry are directed toward other goals.

3. Despite a significant human capital base and proprietary IT technologies, only a few Russian corporations (such as Sber or Yandex) have

classical economic parameters: the final cost of ownership, quality guarantees and repairs, delivery time to the end consumer, the possibility of commissioning as part of an IT solution.

[4] URL: https://www.garant.ru/products/ipo/prime/doc/403684114/

Table

Import substitution options in AI solutions

AI Solution Element	Role of the Element	Recommended Solution	Implementation Features
High-Level Business Solution (End Information System)	Processing and storing information, finding the final solution via algorithm and delivering it to the required information system	Import substitution is only required for the database management system (DBMS), recommended solution — transition to open-source software PostgreSQL	It is recommended to develop in-house or outsource to system integrators for "turnkey" solutions
Neural Network Training	Creating a working target algorithm for decision-making	Solution from Sber — Kandinsky 2.1. Solution from Yandex — YaLM—	Corporations with strong internal development create their own solutions
System Software for Peripheral Devices (sensors, cameras, network nodes, etc.)	Collecting and transporting "raw" data (digital images, signal parameters, etc.)	No options for import substitution	Typically supplied together with the devices
Hardware — Peripherals	Receiving and transporting "raw" data (digital images, signal parameters, etc.)	There are no options for import substitution. Parallel import and search for suppliers from China	Certification of Chinese equipment under Russian brands
Basic Hardware	Information processing and storage	There are no options for import substitution. Parallel import	Certification of Chinese equipment under Russian brands

Source: compiled by the authors.

been able to continue developing AI technologies after 2022. Industrial corporations (with rare exceptions) have adopted a wait-and-see approach.

• уход западных технологических компаний и закрытие их центров обучения;

• массовый отъезд российских IT-специалистов за рубеж;

• кратное повышение цен на услуги российских IT-компаний, в том числе в области обучения специалистов.

A critically important factor for the operation of AI technologies remains human capital the ability of industrial enterprises to engage their employees in the practical implementation and daily use of digital technologies. Organizational efforts in this direction are widely recognized: the creation of specialized organizational structures, training and retraining programs, and dedicated budgeting to strengthen the company's human capital. However, since 2022, additional risks have emerged in this area:

• The departure of Western technology companies and the closure of their training centers;

• The mass emigration of Russian IT specialists abroad;

• A significant increase in the prices of services offered by Russian IT companies, including in the field of specialist training.

In the aforementioned applied research, experts from industrial enterprises pointed out these factors. Therefore, human capital should be considered one of the dominant factors in the development of digital technologies, including AI. It is the operation (rather than the design or implementation) of AI technologies

that ultimately determines their economic effectiveness, and thus impacts, at the tactical level, the continuity of funding for digitalization programs. The development of human capital remains a fundamental condition for the success of practical digitalization and AI programs.

CONCLUSION

Summarizing the results of this research, it is important to note that the field of AI is at the intersection of complex technological challenges, geopolitical uncertainty, and stringent economic requirements for the timely return on investments. Clearly, Russian industry cannot continue to implement digital technologies solely through subsidies or without recouping investments [9], which means the development of AI technologies has become a complex scientific and practical issue, as well as a subject of current research. Rapid changes in the surrounding economic reality leave little room for precise adherence to long-term plans; on the contrary, they require a flexible response to any significant changes and the adjustment of digital transformation programs to new constraints and opportunities[10]. The analysis of the main research results revealed several key aspects that serve as solutions to the scientific problem posed:

1. Limitations in the application of AI in industry

The use of artificial intelligence tools in industrial production remains fragmented. They are poorly integrated into the IT landscapes of industrial enterprises, and the results of their work are rarely processed automatically. These processes are heavily influenced by risks and difficulties related to the methodology of digitalization based on AI technologies, uncertainty in calculating the profitability and economic feasibility of innovations, as well as a shortage of technical expertise in operating AI tools.

2. Significant potential within the "Industry 3.0" and "Industry 4.0" paradigms

All digital technologies in both paradigms can be complemented by AI tools. However, many enterprises have not yet implemented the corresponding projects, which implies the need for significant investments in the development of AI technologies in the medium term.

3. Expert forecasts and prospects for AI development

In the 2024–2025 timeframe, experts identified several promising technological areas for AI implementation: big data analysis, "smart manufacturing", autonomous control of production systems, and industrial safety monitoring. The key success factors in implementing digital transformation programs for industrial enterprises include employee understanding of program goals and the economic profitability of innovations. Conversely, the main barriers to AI system implementation are high project costs, lack of knowledge among project participants, and insufficient expertise.

4. Import substitution and the role of parallel imports

Contrary to the market participants' expectations, real import substitution of AI technologies proves to be extremely challenging in the near future. The approaches used are often declarative in nature and do not constitute true import substitution, only increasing the budgets of digitalization programs for industrial enterprises. The actual development potential of the AI market in Russia largely depends on the success (optimality) of parallel imports.

5. Human capital as a key factor

Despite the complex and uncertain prospects for the development of AI technologies in Russia, human capital remains a dominant factor. The successful implementation and operation of AI technologies depend on the ability of enterprises to attract qualified and motivated employees to this field. After 2022, additional risks emerged, reducing the full utilization of

human capital, which is already having a noticeable negative impact.

Considering the above, it should be emphasized that the effective development and implementation of AI in industry require significant changes in enterprise management. The key areas in this regard are the optimality and continuity of parallel imports, the development of human capital, and the methodology for digital transformation, with an emphasis on evaluating the economic indicators of relevant innovations.

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S. S. Golubev — curator of the applied research "Strategy and tactics for the development of the corporate IT landscape in the context of technological embargo and accelerated import substitution" which results are partially presented in the article's chapter "Analysis of the prospects for the development of AI tools".
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A. G. Shcherbakov — elements' development for the applied research concept, sources' selection in both applied studies.

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Investment Priorities for Technological Breakthroughs Based on Scale Effect

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ABSTRACT

The article presents an analytical approach to calculating the value of technological scale effect in regional industry clusters using econometric models. This approach allows for the identification of production zones in Russia with the highest technological potential. The authors propose a method for calculating investments based on the traditional investment multiplier. This method enables rapid technological advancements in specific regional and sectoral clusters within the country. The methodology has been tested on two groups related to the agricultural sector: the main group and the control group, each consisting of seven territorial entities of the Russian Federation. The article also discusses the implementation of a selective investment policy to foster economic growth and enhance the performance of existing advanced industries.

Keywords: scale effect; investment; agriculture; Russian regions; ranking

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INTRODUCTION

Throughout its history, humanity has sought to achieve economies of scale. Over the centuries and millennia, this fundamental pursuit has remained unchanged. Today, Russia, facing sanctions and a severe shortage of investment resources, must leverage its natural advantages, which enable significant economies of scale across various sectors. It has already been proven that in certain industries of the Russian economy, this effect is particularly pronounced and can drive substantial technological breakthroughs and intensive economic growth [1, 2]. This serves as a starting point for further theoretical exploration.

At the same time, while economies of scale are a powerful driver of technological progress, they are not sufficient on their own to make effective investment decisions. Even with a relatively high technological level of production and a substantial reserve in terms of economies of scale, these factors alone are not enough to definitively prioritize a particular production segment. Such production may still be highly expensive (capital-intensive) for various reasons, including climatic, geographical, and logistical factors. Therefore, when aiming to achieve economies of scale, it is essential to account for the costliness of the production process. This task is far from straightforward and requires a step-by-step quantitative analysis of all aspects of production and investment. Moreover, this complexity applies not only to the establishment of new production facilities within the country but also to the expansion of existing clusters. This sets the objective of the article: to elucidate the entire logical framework of investment decision-making — from evaluating the technological level of production achieved through economies of scale to assessing the capital intensity of specific territorial and sectoral production segments. The theoretical approach will be tested using data from two samples, each comprising seven of the most promising and developing regions in the agricultural sector. If necessary, the proposed methodology can be applied to any sector of the economy.

PROBLEM STATEMENT AND LITERATURE REVIEW

In its canonical interpretation, economies of scale refer to a reduction in production costs as output increases [3]. Modern literature contains a significant number of studies examining the effects of economies of scale in specific industries [1, 4–8] and areas of societal activity [9–13], as well as its relationship with indicators such as economic growth [14], labor productivity, and capital intensity [15, 16].

For modern Russia, economies of scale hold particular importance, as they play a critical role in expanding existing production capacities and restoring technological sovereignty. However, relying solely on economies of scale is insufficient for determining investment priorities. Other factors must also be taken into account.

There is extensive academic research dedicated to substantiating and exploring the criteria and principles for selecting investment priorities. For instance, it is proposed to consider their impact on factors such as aggregate supply and demand, the state of the social and natural environment, budget revenue formation, the utilization of domestic resources, and the presence of a multiplier effect. Decision-making is recommended to adhere to principles of targeted focus, the specific importance of certain investments for the socio-economic development of a region, systematicity, comprehensiveness, rationality, efficiency, and manageability [17, 18].

In regional investment strategies, the selection of priorities is primarily guided by two criteria:

1. The existing structure and level of development of industries in the region.

2. The potential for achieving a systemic development effect in the industry, as reflected in its impact on the socio-economic indicators of the territory [19].

For example, the criteria for establishing sectoral priorities in the Investment Strategy of the Tula Region until 2030 include investment openness, the condition of fixed assets, workforce availability, resource base, scientific and technical infrastructure, and administrative and tax regimes.[1]

The Investment Strategy of the Voronezh Region for the period up to 2020, with key directions outlined until 2030, focuses on scalability, multiplicative and long-term effects, growth of added value, and innovation.[2] In conditions of federal, regional, and local budget deficits, as well as low solvent demand, the selection of sectoral priorities primarily aims to define the sectoral structure of investments and the significance of production for the region's vital functions [20].

In international literature, the methodology for evaluating sectoral investment priorities often employs the concept of key sectors, described by A. Hirschman in 1958. This concept is based on the hypothesis of reciprocal interconnections between key industries and the broader economy [21]. Today, modern modifications of this concept are also available [22, 23]. Widely used and further developed methodologies include those based on Saaty's Analytic Hierarchy Process, input-output balance models, and the coefficient of innovation induction [24], as well as algorithms focused on identifying the most profitable projects to maximize returns [25].

The Russian practice encompasses a wide range of approaches to determining sectoral investment priorities. In particular: I. Kovaleva's methodology focuses on evaluating indicators of investment potential, risk, and sectoral activity [26]. N. Sinyak suggests using the traditional method of discounting cash flows [27]. V. Moskovkin's approach involves comparing indicators such as the share of foreign investments, their volumes, and growth rates in the industry both regionally and nationwide [28].A. Panyagina's methodology assesses the alignment of sector development with the interests of key investors by analyzing growth rates of profits, production volumes, sales, investments in fixed assets, and prices. The proximity of these dynamics to normative values is determined using Spearman and Kendall coefficients, along with a composite coefficient [24, 29]. E. Popova's method provides an integral evaluation of sectoral investment priorities by first calculating the investment attractiveness of industries and then determining their priority using hierarchical analysis [30].

Thus, all existing methodologies for identifying sectoral investment priorities can be classified based on their primary focus [30]:

- investment attractiveness of the sector, where evaluations are conducted in the framework of "investment potential/investment risk," incorporating economic and risk parameters.
- multiplicative effect of the chosen priority on other industries.
- return on investment, emphasizing the efficiency of invested funds.
- actual investment activity, reflecting faster growth in sectoral investments at the regional level compared to national trends.
- alternatives close to the ideal (normative) solution, which involve analyzing large datasets to identify differences between indicator groups, calculating composite indicators, and ranking sectors accordingly.

In addition, there are integrated methodologies that combine all of the above approaches.

Investment priority selection approaches are also widely represented in intra-sectoral aspects. For example, to analyze investment priorities in transitioning to renewable energy in developing economies, the multi-criteria group decision-making methodology is applied. This method evaluates twelve criteria across four aspects: regulatory frameworks for

[1] URL: https://docs.cntd.ru/document/446100382

[2] URL: https://www.invest-in-voronezh.ru/ru/gosudarstvennaya-podderzhka/federalnyij-standart/investiczionnaya-strategiya

increasing renewable energy potential, supply of renewable materials, incentives for private sector investors in renewable energy, and awareness of renewable energy consumption [31]. For investment decision-making in the tourism sector, the method for impact assessment of programmes and projects is suggested. This approach helps determine the influence of investment activities on each development indicator of the territory [32]. Strategies for attracting investments in agricultural land use involve creating a system of eco-economic evaluation of investment quality, where, in addition to economic indicators, the environmental factor must be considered. Neglecting this factor can lead to errors regarding the eco-economic optimality of investment decisions [33].

Given the above, it is necessary to establish several key macroeconomic characteristics: first, we need to determine projected production growth in prioritized regional-territorial clusters. Secondly, we need to estimate potential labor productivity growth, driven by the anticipated production expansion and economies of scale. Thirdly, we need to calculate the investment volume required to achieve these outcomes. These characteristics must be assessed at macro-, meso-, and sectoral levels. The output should include a set of indicators for each selected (both priority and lagging) region within the agricultural sector, as well as for the Russian economy as a whole, incorporating the aggregated results from all evaluated regional clusters. The realization of these technological effects is expected in the medium term, spanning 2–3 years, and thus necessitates the implementation of a relatively prompt macroeconomic policy.

It is important to emphasize that the focus here is on existing agricultural complexes in the regions, as launching new enterprises from scratch requires entirely different analytical and regulatory frameworks, which fall outside the scope of this discussion [2].

ECONOMIES OF SCALE: METHODOLOGY AND EMPIRICAL ESTIMATES

The economies of scale can be understood, in general terms, as the phenomenon where an increase in production volume *(Y)* leads to a decrease in unit costs, equivalent to improved production efficiency. For the purposes of this analysis, production efficiency can be adequately represented by average labor productivity *(P),* defined as: $P = Y/L$, where L is the number of workers employed in production. Economies of scale are present when the following condition holds: $dP/dY > 0$; If this condition is not met, economies of scale are absent [2].

To provide clarity, we assume the relationship between labor productivity and production scale follows a power function, which is a traditional representation in economic analysis:

$$P_{ijt} = A_{ij} Y_{ijt}^{\theta_{ij}}, \quad (1)$$

where: P_{ijt} is labor productivity in the i-th industry, j-th region at time t (year), Y_{ijt} is the output volume in the i-th industry, j-th region at time t, A_{ij} and θ_{ij} are parameters of the function.

If $\theta > 0$, economies of scale are present. The larger the value of θ, the stronger the effect of economies of scale.

In addition to the economies of scale that determine the technological reserves of a group of enterprises in a region, it is also necessary to consider the technological level already achieved by the enterprises. These two factors of production should be analyzed together, which can be done by aggregating the two effects through simple multiplication [2]:

$$P_{ijT} / P_{M0} = (P_{ij0/} P_{M0})(1+ \lambda_{ij})^{\theta_{ij}}, \quad (2)$$

where P_{ij0}, P_{M0} and P_{ijT} are labor productivity of the i-th industry in the j-th region at the initial time $t = 0$, average labor productivity across the country at the initial time $t = 0$ and labor productivity of the i-th industry

in the *j*-th region after production expansion over *T* years; λ_{ij} is planned growth rate of the *i* -th industry's production in the *j* -th region as a result of investments in business expansion.

If the region's initial labor productivity is higher than the national average ($P_{ij0} > P_{M0}$), combined with a significant scale effect ($\theta_{ij} > 1$) and substantial investments to ensure a notable increase in production ($\lambda_{ij} > 0$), the economies of scale can drive a significant technological leap forward. When such results are achieved in multiple regions simultaneously, it can be said that the country has developed a cluster of high-tech enterprises comparable to leading international industries.

The structural effect will be denoted as $\Omega_{ij} = P_{ijT}/P_{M0}$. Based on this indicator, it is advisable to rank regions according to their technological prospects.

Table 1

Advanced agrarian regions of Russia, based on the criteria of scale effect and labour efficiency

No	Region	Model	Scale effect, θ_j	P_{j0}/P_{M0}
1	Kursk region	$lnP = -10.65 + 1.61\ lnY$ (−12.91) (19.79) $n = 22$. $R^2 = 0.951$. DW = 1.724. A = 2.48% Time series: 2001–2022	1.61	2.23
2	Oryol region	$lnP = -15.43 + 2.22\ lnY$ (−3.81) (5.28) $n = 14$. $R^2 = 0.699$. DW = 1.362. A = 6.23% Time series: 2009–2022	2.22	2.73
3	Tula region	$lnP = -6.39 + 2.22\ lnY$ (−11.93) (14.01) $n = 22$. $R^2 = 0.908$. DW = 2.273. A = 9.94% Time series: 2001–2022	2.22	1.46
4	Penza region	$lnP = -11.19 + 1.69\ lnY$ (−6.27) (9.10) $n = 22$. $R^2 = 0.805$. DW = 1.866. A = 5.49% Time series: 2001–2022	1.69	1.68
5	Saratov region	$lnP = -22.99 + 2.79\ lnY$ (−10.34) (12.65) $n = 23$. $R^2 = 0.884$. DW = 1.533. A = 2.71% Time series: 2000–2022	2.79	1.63
6	Sverdlovsk region	$lnP = -41.75 + 4.83\ lnY$ (−10.73) (12.05) $n = 23$. $R^2 = 0.874$. DW = 1.760. A = 2.33% Time series: 2000–2022	4.83	1.07
7	Amur region	$lnP = -5.60 + 1.23\ lnY$ (−3.10) (6.31) $n = 21$. $R^2 = 0.677$. DW = 1.425. A = 11.41% Time series: 2002–2022	1.23	2.10

Source: calculated by the authors.

Note: n — number of observations; R^2 — coefficient of determination; DW — Durbin–Watson coefficient; A — approximation error; *d* — dummy — variable that takes the values 0 and 1; values of their *t*-statistics are shown in parentheses under the regression coefficients.

To identify economies of scale, econometric dependencies were constructed for all regions of Russia based on a universal specification in the form of a logarithmic relationship (1):

$$\ln (P_{ijt}) = a_{ij} + \theta_{ij} \ln (Y_{ijt}), \quad (3)$$

where P and Y are, as before, labor productivity and the volume of output produced.

The agricultural sector is considered in an aggregated form, which includes not only agriculture but also fisheries and forestry. The retrospective calculations cover the period from the beginning of the 21st century to 2022, inclusive. Official data from Rosstat, presented in the Unified Interdepartmental Information and Statistical System (EMISS), as well as in the statistical yearbook "Regions of Russia. Socio-Economic Indicators", were used for the calculations.

In the study [2], a comprehensive econometric assessment of the relationship (3) was conducted for the agricultural sector across all regions of Russia. Based on these calculations, 7 regions with the most promising structural effects Ω were identified, assuming that the projected industry growth rate for each region is λ=0.5. Data for these most promising regions, including the econometric models, are presented in *Table 1*. (since all calculations were conducted for one industry, the index *i* will be omitted henceforth). All the models presented pass the basic statistical tests and can be used for applied and analytical calculations.

From the *table*, it is clear that the 7 selected regions not only have an acceptable initial level of labor productivity but also significant technological reserves related to economies of scale. These regions will henceforth be referred to as *leading*.

Although the selection of priority regional-industrial segments of the Russian agricultural sector represents a step forward in investment decision-making, it does not solve all the problems. First, questions remain about what growth rate of output (λ) is most preferable in these segments to achieve a visible technological breakthrough. Secondly, it remains to be determined what financial sacrifices are required to achieve these results. Both of these issues are closely interlinked and can be addressed within a corresponding methodological framework.

FACTOR OF INVESTMENT CAPACITY IN PRODUCTION

To address the task, we will use the concept of "capital return" or, more precisely, "output per unit of investment in fixed capital" — $k = Y/I$, where: Y is the output of the industry in the region for the corresponding year, I is the volume of investment in fixed capital for the corresponding year, k is the average return on investment in fixed capital. If we abstract from the differences between average and marginal values, the indicator k is essentially equivalent to the investment multiplier in Keynesian theory. Therefore, the projected increase in output for the i-th industry in the j-th region is related to the planned volume of investments in that industry through the elementary formula:

$$\Delta Y_{ij} = k_{ij} \Delta I_{ij}. \quad (4)$$

The expected rate of growth in output in formula (2) is determined as follows:

$$\lambda_{ij} = k_{ij} \Delta I_{ij} / Y_{ij0}, \quad (5)$$

where Y_{ij0} is the volume of output at the initial point in time.

Therefore, depending on the planned capital investments in the agricultural sector of the region, technological progress will be determined by the final formula:

$$\frac{P_{ijT}}{P_{M0}} = \frac{P_{ij0}}{P_{M0}} \left[1 + \left(\frac{k_{ij} \Delta I_{ij}}{Y_{ij0}} \right) \right]^{\theta_{ij}}. \quad (6)$$

Of course, using formula (5), the reverse problem can be solved to determine the required volume of investments for the projected rate of output growth λ. For simplicity in analysis and comparability of results, we will assume, as before, that the relative growth rate of output λ = 0.5 is the same across all regions. We are not

concerned with the time it will take to achieve this result; what matters is the result itself, with the possible caveat that it will be achieved in 1, 2, or 3 years. Substantively, this will not change the technological and investment preferences identified.

Since formula (6) allows us to determine not only the structural effect Ω but also the increase in production and investment, it is necessary to have an understanding of the final production and investment picture for the regions under consideration:

Table 2

The evolution of the agricultural investment multiplier (k_{jt}) in advanced Russian regions

Year	Sverdlovsk region	Oryol region	Saratov region	Kursk region	Tula region	Amur region	Penza region	RF
2000	19.9	12.5	29.2	36.5	19.8	80.6	20.1	23.6
2001	20.3	12.4	28.9	25.6	26.5	75.7	14.0	19.7
2002	17.3	13.9	29.7	23.2	19.3	50.7	15.5	12.5
2003	17.0	11.4	28.9	19.3	13.2	28.6	11.9	12.3
2004	17.5	9.1	26.0	12.7	11.9	44.4	13.1	11.5
2005	16.3	15.4	34.5	15.2	11.6	17.6	10.8	9.9
2006	11.4	5.4	28.6	7.6	9.5	12.1	10.3	7.0
2007	7.1	3.1	18.8	7.3	8.6	11.9	7.9	5.5
2008	7.1	4.4	19.2	14.0	10.4	16.8	6.9	6.1
2009	10.1	6.5	21.0	18.2	13.7	22.5	6.4	7.6
2010	14.8	11.7	29.0	6.9	14.7	19.8	5.8	8.0
2011	11.4	12.4	30.3	4.6	10.1	12.9	5.8	8.2
2012	8.3	9.2	20.7	5.3	10.2	16.4	7.6	6.7
2013	9.3	10.8	22.4	5.0	11.4	7.2	7.8	7.1
2014	13.6	13.4	27.4	13.4	25.7	24.6	6.3	8.0
2015	17.9	15.4	36.1	13.2	10.6	15.0	6.2	8.9
2016	15.2	12.1	32.5	6.7	9.6	15.8	11.4	8.4
2017	8.0	8.0	30.5	7.8	10.0	20.9	6.1	11.5
2018	13.6	6.5	27.5	8.5	6.2	13.1	5.0	11.0
2019	15.7	7.7	47.7	6.9	5.2	12.8	6.4	10.7
2020	13.0	7.5	28.3	10.4	8.8	13.9	11.0	11.7
2021	15.2	7.8	28.9	10.3	8.8	15.2	12.8	12.2
2022	14.4	7.9	37.8	12.5	6.4	14.2	14.3	12.5

Source: calculated by the authors.

$$\Delta Y_i^* = \sum_{j=1}^{m} \Delta Y_{ij}, \quad (7)$$

$$\Delta I_i^* = \sum_{j=1}^{m} \Delta I_{ij}, \quad (8)$$

where *m* is the number of regions in the considered production cluster.

The proposed method, despite its simplicity, allows for solving a wide range of tasks. For example, one can evaluate the dependence of the structural technological effect on targeted investment, economic growth based on the adopted investment program, or determine how much investment is required for the projected production volumes. Here and further, we will limit ourselves to the simplest and most natural formulation of the problem — determining the structural technological effect in the regions, as well as the required increases in production and capital investments for fixed economic growth.

ACCOUNTING FOR THE INVESTMENT FACTOR: ASSESSMENT OF THE ACTUAL SITUATION

For correct identification of investment multipliers, we will use the data from *Table 2* (as in *Table 1*, the industry index is omitted since only the agricultural sector is considered). The analysis of the provided figures allows for a number of key conclusions, which will form the basis for further exploration of the issue.

First, throughout the 21st century, the investment multiplier in Russia's agricultural sector has been decreasing. Overall, from 2000 to 2022, it halved. This unequivocally indicates that agricultural production has become increasingly capital-intensive and costly over time and indirectly suggests the saturation of agriculture with more complex and expensive technologies.

Second, the difference in regional multipliers is quite significant. For example, in 2022, the value of this indicator in the Saratov region exceeded that of the Tula region by 31.4 points; the relative advantage between the two regions was nearly 6 times. Such large-scale discrepancies require an explanation considering the production specifics of the Russian regions, but the highly differentiated return on investments still raises concerns and represents a separate issue that goes beyond the scope of the discussion.

Third, despite all the challenges, regional inequality in the return on investments is decreasing. In 2000, the absolute difference between the multipliers of the Amur and Oryol regions was 68.1 points, and the relative difference was

Table 3

The extent of investment required for technological leap in advanced regions

No	Region	Ω_j	k_j	ΔI, billion rubles	ΔY, billion rubles
1	Sverdlovsk region	7.58	14.4	4.0	57.7
2	Oryol region	6.72	7.5	8.9	67.0
3	Saratov region	5.05	34.0	3.8	130.8
4	Kursk region	4.28	9.7	12.2	118.9
5	Tula region	3.59	7.1	7.8	55.3
6	Amur region	3.46	13.8	3.1	43.0
7	Penza region	3.33	9.9	8.4	83.0
TOTAL		–	–	48.2	555.7

Source: calculated by the authors.

6.4 times. Thus, at the beginning of the century, technological disparities in the sector were even more pronounced than they are today. This circumstance indirectly indicates technological diffusion occurring in the agricultural sector.

Fourth, there was no clear trend in the dynamics of the investment multiplier. For the sector as a whole, 2012 was a year of decline, but for different regions, the downturns occurred in completely different periods. Importantly,

Table 4

The evolution of the agricultural investment multiplier (k_{jt}) in the context of catch-up development in Russian regions

Year	Kabardino_Balkarian_Republic	Republic of Degestan	Komi Republic	Altai Republic	Irkutsk region	Transbaikal territory	Primorsky Krai	RF
2000	94.8	22.8	21.4	16.6	30.8	104.8	36.1	23.6
2001	67.5	19.5	17.2	14.8	28.1	35.1	33.2	19.7
2002	42.5	38.0	11.3	19.4	25.3	68.4	10.3	12.5
2003	39.8	38.2	11.0	24.4	20.7	42.5	10.5	12.3
2004	113.5	31.4	17.9	25.0	22.7	43.5	12.5	11.5
2005	264.7	45.2	5.5	31.5	21.1	68.3	8.8	9.9
2006	158.7	83.2	2.3	29.9	12.5	40.2	9.0	7.0
2007	34.5	103.4	4.3	26.2	11.6	26.6	9.7	5.5
2008	147.5	146.2	5.0	33.3	7.7	56.7	11.4	6.1
2009	19.3	87.0	6.5	44.3	17.8	63.3	21.1	7.6
2010	37.6	186.5	6.8	68.1	21.1	61.5	26.8	8.0
2011	37.2	121.0	6.0	25.9	16.6	63.6	18.0	8.2
2012	120.3	240.6	7.7	37.3	12.6	107.4	17.8	6.7
2013	60.3	28.0	8.7	62.5	18.3	109.3	12.9	7.1
2014	11.9	189.9	8.0	55.2	20.1	65.1	11.3	8.0
2015	14.9	158.8	9.7	76.3	15.0	210.1	12.7	8.9
2016	31.8	179.7	7.4	40.2	13.3	271.0	13.9	8.4
2017	17.8	99.2	6.9	82.4	9.2	76.8	5.0	11.5
2018	25.6	61.1	6.8	62.3	9.3	66.2	3.8	11.0
2019	47.8	38.6	4.7	56.0	8.7	33.5	2.4	10.7
2020	71.2	41.6	7.2	79.9	12.0	75.4	2.0	11.7
2021	49.4	38.8	10.0	75.2	9.5	45.9	2.9	12.2
2022	67.8	56.8	9.6	70.7	10.0	104.4	2.0	12.5

Source: calculated by the authors.

both for the sector as a whole and for all regions (except for the Tula region), two phases were characteristic: a decline in the return on investments followed by a subsequent recovery. At present, there are grounds to hope that the sector has entered a growth trajectory for the multiplier.

Fifth, the dynamic instability of the return on investments within regions exceeds even the differentiation between them. For example, in the Amur region, the absolute gap in the size of the multiplier in 2000 and 2013 was 73.4 points, and the relative gap was 11.2 times. In the Saratov region, the absolute gap in 2007 and 2019 was 28.9 points, and the relative gap in the Penza region in 2000 and 2018 reached 4.0 times. These facts indicate that technological renewal in the agriculture of Russian regions was largely spontaneous and lacked a clear trend.

Despite the challenges mentioned, it is important to note that in the last five reporting years (2018–2022), there was, firstly, a clear stabilization in the dynamics of the multiplier, and secondly, a slight and still unstable improvement in the situation. As a result, in the further calculations, we will use the averaged regional investment multipliers for these five years. As stated earlier, for the sake of calculation unification, we will assume a projected regional production growth of 50% ($\lambda_j = 0{,}5$). The base year for us is 2022, relative to which all applied calculations are made (at comparable prices). The results are presented in *Table 3* (the multiplier and structural effect indicators have no units of measurement, reflecting the multiples of the respective ratios).

The analysis of the data in *Table 3* indicates that the total volume of investments in fixed capital in 7 regions will require an amount of $\Delta I^* = 48{,}2$ billion rubles. This will result in an increase in sectoral production $\Delta Y^* = 555$, billion rubles, which is equivalent to an overall sectoral growth rate of $\lambda = 6.5\%$. Thus, this investment sum, directed only to the 7 leading regions, will significantly boost sectoral production growth in the country and will create a regional-sectoral cluster of enterprises with an average labor productivity that exceeds the 2022 level by 4.9 times. It can be concluded that such a cluster will match the best global enterprises in its sector.

Let us ask the question: is such an "investment sacrifice" excessive? Calculations show that the required volume of investments μ will amount to only 7.1% of the total volume of investments in fixed capital in Russia's agricultural sector in 2022 (here and further, μ denotes the growth rate of investments in fixed capital). In other words, such an investment loss is clearly justified by the potential to create an advanced technological cluster in the country's agricultural sector.

The figures obtained are largely symbolic; however, for a better understanding of the situation, we will conduct additional calculations with a control group. For this, we will consider another 7 regions, which we will call *catching-up* regions — they are characterized by much more moderate values of the scale effect and relative labor productivity (*Table 4*).

Without going into excessive details, it can be stated that the catching-up regions have much more impressive investment multipliers than the leading ones. For example, in 2000, the average value of the multiplier in the catching-up regions was 1.5 times higher than in the leading regions, and by 2022, it was already 3 times higher. Thus, a paradoxical rule can be derived: *the less developed a region is, the higher its investment multiplier*. Moreover, as shown above, this effect does not weaken over time but strengthens, which rules out the randomness of the established pattern.

The explanation for the identified paradox should be sought in the regional-sectoral specifics of production complexes, but the main thesis is as follows. Catching-up regions are extremely passive in investing in technological innovations in agricultural production,

which leads to the conservation of their labor productivity at a low level. Accordingly, agricultural output is not so much driven by new technologies as by the natural potential of the region. For comparison, in 2000, the 7 leading regions invested 3.4 billion rubles in fixed capital, while the 7 catching-up regions invested 1.2 billion rubles; in 2022, these figures were 86.1 billion and 49.1 billion rubles, respectively. This shows that the leading regions focus on intensive development of agricultural production, while the catching-up regions rely on extensive growth.

Calculations for the catching-up regions are presented in *Table 5*. It shows that in the 7 regions, the total investment in fixed capital will need to be $\Delta I^* = 21{,}4$ billion rubles; this will ensure an increase in sectoral production of $\Delta Y^* = 241{,}1$ billion rubles, which corresponds to an overall sectoral economic growth rate of $\lambda = 2.8\%$. The required investment volume will constitute only $\mu = 3.1\%$ of the total investment in fixed capital in Russia's agricultural sector in 2022. All these figures are much more modest compared to the leading regions (assuming a 50% growth in agriculture across all Russian regions).

RESULTS AND DISCUSSION: EXPERIMENTATION AND REPLICATION

The results for the regional groups may be misleading since the first group performs better in some indicators, while the second group excels in others. For final conclusions, additional key macroeconomic characteristics are required for both regional groups (*Table 6*).

In the last column of *Table 6*, the indices of indicators for the corresponding regional groups are presented. For example, in terms of investment, leading regions are more costly than the lagging ones. However, stimulating their economic growth brings more significant results, slightly outweighing the high financial costs of such investments. The investment multiplier for lagging regions of the Russian Federation is much higher than that for leading regions, but this advantage is undermined by their enormous technological gap. This raises the key question: should we prefer effortless financial support for unpromising industries or costly support for leading production clusters?

Naturally, answers to this question may vary depending on initial political objectives and situational needs/opportunities. However, an objective consideration of all circumstances

Table 5

Scale of investment required for technological leap in catching-up regions

No	Region		Ω	k	Δ*I*, billion rubles	Δ*Y*, billion rubles
1	Kabardino-Balkarian Republic		0.73	52.4	0.8	42.2
2	Republic of Dagestan		0.69	47.4	2.0	96.5
3	Komi Republic		0.42	7.7	0.9	7.2
4	Altai Republic		0.60	68.8	0.1	6.3
5	Irkutsk region		0.71	9.9	4.1	40.2
6	Transbaikal Territory		0.64	65.1	0.2	13.9
7	Primorsky Krai		0.56	2.6	13.3	34.8
TOTAL			–	–	21.4	241.1

Source: calculated by the authors.

Table 6

Comparative macroeconomic features of two regional clusters

Aggregate figure	Group of regions		Ratio "leading/catching up"
	leading	catching-up	
Ω	4.86	0.62	7.84
k	13.8	36.3	0.38
λ, %	6.5	2.8	2.32
μ, %	7.1	3.1	2.29

Source: calculated by the authors.

leans the balance in favor of supporting advanced industries. Let us explain this position with reference to the data in *Table 6*.

In Russia, the issue of labor shortages is already being raised at the highest levels. In this situation, labor productivity growth is the main, if not the only, way to address the existing chronic shortage of workers. This is the first and very significant argument in favor of stimulating high-tech regional-industrial production clusters. Otherwise, outdated agricultural production will "consume" all the available labor in the country.

The second problem facing modern Russia is overcoming the technological lag behind Western competitors. Therefore, local technological breakthroughs are needed to level the playing field in the confrontation with the collective West. In this sense, supporting the cluster of leading regions will allow them to increase labor productivity nearly fivefold compared to the current national average. At the same time, supporting lagging regions will result in their technological stagnation at a level slightly above half of the average industry labor productivity. This scenario means outright technological degradation, albeit slow but inevitable. This is the second argument in favor of supporting the leading regions.

The third problem is historically a weak point for the country — the colossal inequality between regions in terms of labor productivity. For example, in 2022, productivity in the Oryol region was almost 23 times higher than in the Leningrad region. Such a situation can no longer be tolerated, as the country risks fragmenting into territorially incompatible regions. At first glance, this situation should not stimulate further technological divergence between the leading regions and the rest of the Russian Federation, but this is a very superficial opinion. The fact is that the existing regional disparity in agricultural labor productivity has evolved spontaneously over decades or even centuries, depending on the geographical conditions of the respective regions. Today, this situation must change radically through the formation of advanced production clusters and the subsequent organization of the transfer of their technological achievements to other regions. Without organizing widespread borrowing of advanced practices, the issue of inequality cannot be resolved, whereas the presence of advanced productions provides a real foundation for large-scale technological diffusion across the country. This is the third strong argument for supporting high-tech clusters.

The fourth strategic problem is ensuring the fastest possible technological transformations. In this sense, supporting leading regions with solid economies of scale means rapidly utilizing existing technological and organizational reserves within already functioning and well-

established productions. Any attempts to start from scratch by introducing advanced domestic or even foreign technologies are fraught with long timelines and unpredictable risks. This is the fourth argument in favor of selective investment policies supporting the best productions.

The nearly 8-fold gap in structural effects between the two regional groups (*Table 6*) speaks to the potential for technological stimulation in both investment programs. In the first case, Russia is forming a highly efficient production segment capable of transferring positive experiences, knowledge, and technologies to other regions. In the second case, the country effectively maintains the *status quo*, characterized as systemic technological lag. Strategically, the first case means building a two-level economy, where the higher-level sector conducts technological experiments and achieves high labor productivity as a result, while the lower-level sector borrows its experience. The first sector is more costly but strategically defining, while the second, with government support, should be provided the opportunity to widely benefit from others' achievements.

Thus, the task of restoring the country's technological sovereignty gives rise to investment strategies that were simply impossible in previous decades.

CONCLUSION

Modern Russia is going through difficult times. In such an environment, the country needs new or at least significantly modified investment strategies. The old doctrine, aimed at leveling the technological level of production across regions, has become outdated due to its inefficiency in extraordinary circumstances. In this regard, the article proposes an alternative strategy for determining investment priorities for Russia's agricultural sector, one that takes into account the effect of initial conditions (the achieved relative technological level) and production technological reserves (economies of scale). Regions with the most impressive indicators in these areas should be classified as priorities for state and private investments.

The applied calculations conducted showed that there are seven leading regions in Russia's agricultural sector (Sverdlovsk, Oryol, Saratov, Kursk, Tula, Amur, and Penza regions) that, with increased funding, can act as a high-tech cluster for the industry and reach the highest international standards. In the future, the progressive experience of enterprises in this cluster can be replicated to other regions, thus achieving cross-sector technology diffusion more efficiently. Otherwise, if investments are distributed relatively evenly, the technological leap in the leading regions will be delayed, and the rest of the industries will maintain their unacceptably low technological levels. Such a strategy would lead to technological stagnation in the sector, which is why it is necessary to abandon it in favor of a differentiated investment system.

For the successful implementation of the proposed analytical framework, it is necessary to examine subindustries in more detail. For example, the agricultural sector can be divided into crop farming, fisheries, and forestry. In these segments, the effect of scale may be highly differentiated, while practical proposals will be much more specific and productive. However, the most interesting area for application is replicating the proposed analytical approach for high-tech subindustries of manufacturing, where technological progress is particularly pronounced.

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Business Ecosystems: Specific Features of Organising Interactions and Communications

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ABSTRACT

The article is devoted to the creation and evolution of ecosystems, the peculiarities of their functioning, the control and communications management. The main characteristics of ecosystems are considered as: modularity, network structure, different types of partnership and competition, complementarity, interdependence, self-regulation, joint value creation, coevolution, etc. Integrated communications create the most optimal conditions for ecosystems' functioning, ensure the consistency of participants' interactions, introduce a common culture, rules, basic values, ethics and communication style, which increases motivation and favourably affects the overall image. According to the authors, in the context of decentralised management, the role of compliance control for assessing and preventing compliance risks, as well as the requirements for the organisation of monitoring, is increasing. **The relevance** of the study is related to the rapid evolution of ecosystems and their importance for the economy, as well as difficulties in understanding the process of their creation and functioning on the background of the lack of scientific research on the organisation of integrated communications. **The purpose** of the article is to study the modern ecosystem management using the analysis of scientific papers, comparison, generalization, analogies, systematic and logical analysis. **The scientific novelty** is in the author's interpretation of the peculiarities of ecosystem functioning. **The practical significance** of the work is in the possibility of its use in the creation and improvement of ecosystems within the framework of sustainable innovative development.
Keywords: ecosystems; ecosystem approach; competitive partnership; innovation; platforms; compliance control; integrated communications; stakeholders; sustainable innovation management; sustainable development

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INTRODUCTION

The term "ecosystem" was first used by prominent British botanist and ecologist Arthur Tansley, who challenged the existing concepts of "complex organism", "biome", and "biotic community". In his 1935 article, he noted that in an ecosystem, both living organisms and inorganic factors "are components that exist in a relatively stable dynamic equilibrium" [1, p. 306].

In addition to energy exchange, the circulation and processing of substances, and species diversity, the following properties of natural ecosystems can be identified: the interconnection and interaction of components; food chains and food webs; stability and vulnerability. All of these influence one another, ensuring the stability and functioning of the ecosystem as a whole.[1] It should also be added that ecosystems have integrity, self-regulation, succession (progressive changes, self-development, self-reproduction), and emergent properties.[2]

According to Robert Metcalfe's law, the value/utility of communication networks increases in proportion to the number of users. However, in practice, not all participants establish connections and interact with one another.[3]

Many evolving components of ecosystems are characterized by both autonomy and interconnection. The most encompassing type of relationship in nature is recognized as intra- and interspecies competition. Other forms of interaction include predation, parasitism, amensalism, and neutralism, although the latter is difficult to define through observations and experiments in natural conditions.[4]

American economist Michael Rothschild was one of the first to propose, in 1990, that the economy be viewed as an ecosystem within the framework of a new science — bionomics [2].

In 1992, M. Rothschild, in his book Bionomics: Economics as an Ecosystem, emphasized that, just like in an ecosystem, information and innovation play a decisive role in the economy. Similar to an ecosystem, the economy is self-organizing and does not require central management or control [3]. However, the term "bionomics" was perceived as too abstract and academic, and it did not receive further development.

In 1993, American researcher James Arthur Moore published an article titled Predators and Prey: The New Ecology of Competition, in which he proposed the application of an ecological approach to analyzing business processes. He wrote: "To expand the systemic approach to strategy, I suggest considering a company not just as a member of an industry, but as part of a business ecosystem that spans several industries. In a business ecosystem, companies jointly develop opportunities for new innovations: they work together based on cooperation and competition to create new products, meet customer needs, and, ultimately, implement the next phase of innovation… A business ecosystem, like its biological counterpart, gradually transitions from a random set of elements to a more structured community" [4, p. 76].

The term "business ecosystem" (BES) introduced by Moore has remained relevant in both theory and practice of management. The first ecosystems appeared in the IT business based on innovation clusters. Moore's concept is a direct transfer of biological ideas about competitive struggle into the field of innovation technology and value creation. Today, the interdisciplinary concept of ecosystems is considered the foundation of new economic relationships.

Given the infinite variety of ecosystems, in this article the authors use the term "business ecosystem" (BES) when distinguishing specific characteristics of platform, innovation, or other

[1] URL: https://nauchniestati.ru/spravka/vvedenie-termina-ekosistema-a-tensli-v-1935-godu

[2] URL: https://portal-slovo.ru/impressionism/36222.php?ELEMENT_ID=36222&SHOWALL_1=0

[3] URL: https://habr.com/ru/articles/4387/

[4] URL: https://ecoportal.su/public/other/view/965.html

alliances and collaborations of independent companies and organizations is not necessary.

International and Russian practices show that cooperation can take various forms: proto-cooperation, cooperation, collaboration, partnership, equity investment in venture capital, and other non-conflict ways of interaction with competitors.

Experts at Sberbank note that partnerships are typically based on the principle of complementarity or mutual supplementation, where it is more beneficial to jointly produce a product or service. At the same time, to expand demand, partners can create complementary products (demand complementarity), where the consumer receives several products or services almost simultaneously. Partnerships within ecosystems differ from traditional forms of inter-firm interactions.[5]

In turn, competition, as a multi-level process, can also have various manifestations: rivalry, mergers and acquisitions, coexistence, collaboration, up to integration of a particular type. That is, competition is not eliminated or weakened, but takes on new forms. Moreover, the determining factor is not aggressive rivalry between individual companies, but the competition existing within the collaboration/partnership of the BES, which generates new business models and changes the relationships between market participants.

ECOSYSTEMS AS A NEW MODEL OF VALUE CREATION

American scholars Douglas Hanna and Kathleen Eisenhardt note that firms in ecosystems balance between cooperation for value creation and competition for profit: "For example, while Universal Music and Apple cooperated to increase revenues, they competed for the share of this revenue and the associated profit. Cooperation and competition can also develop simultaneously and differently at multiple levels of the ecosystem: within components; between firms in the focal (main,— Authors' note) ecosystem; and among competing ecosystems. These characteristics complicate the balance between cooperation and competition among firms within ecosystems" [5, p. 10].

European researchers Michael Jacobides, Carmelo Cennamo, and Annabelle Gawer emphasize the importance of the modular architecture of business ecosystems (BES) (autonomy of participants,— Authors' note), which "facilitates the emergence of an ecosystem as it allows a multitude of separate but interdependent organizations to coordinate their actions without complete hierarchical subordination". According to them, "an ecosystem is a set of actors with varying degrees of multilateral, non-patented complementarities that are not fully hierarchically controlled" [6, p. 10].

In addition to decentralization of management and flexibility in development strategies, critical for the survival of BES are abilities borrowed from living nature, such as self-organization, self-regulation, and self-development, as well as properties like heterogeneity, adaptability, complementarity, emergence, co-evolution, and others.

Modular architecture allows the construction of BES in a variety of configurations. The multiplicity of options for combining modules that perform a wide range of previously incompatible functions complicates the process of classifying ecosystems.

It is practically impossible to provide an exact and comprehensive definition of "ecosystem management" against the background of the already existing dozens of variations, since BES have long been the subject of research in a range of disciplines: philosophy, ecology, economics, sociology, cybernetics, linguistics, psychology, political science, cultural studies, and other humanities, natural, and applied sciences.

The Bank of Russia, which regulates ecosystems in the Russian market, understands them as "a set of services, including platform solu-

[5] URL: https://sberuniversity.ru/sber-knowledge/about

tions, united by common resources, including customer data, and enabling users to receive a wide range of products and services within a unified process". It also notes: "At the same time, we do not plan to strictly adhere to this definition for regulatory purposes, as we believe it cannot be exhaustive, which, in turn, potentially creates risks of regulatory arbitrage". A platform, according to the Bank of Russia, is an information system that allows participants to interact, create, and exchange value.[6]

American scholars S.L. Vargo and R.F. Lusch argue that an ecosystem is a relatively autonomous, self-regulating system of participants who integrate resources, bound by common institutional mechanisms, and mutually create value through service exchanges [7].

Professor R. Kapoor from the University of Pennsylvania points out that a business ecosystem (BES) includes a set of entities that contribute to the value proposition for the user of the primary offering. At the same time, ecosystems possess the properties of "complementarity" and "interdependence" among participants [8, p. 9].

However, it is important to remember that each participant in a BES has its own goals. Professor R. Adner from Dartmouth College notes that as they gradually develop their capabilities and clarify their roles, they tend to align with the benchmarks set by the parent company, thus undergoing an alignment process. According to him, "an ecosystem is an alignment structure of a multilateral set of partners who must interact to realize the primary value proposition" [9, p. 40].

In a later article, J. Moore writes that a BES is "a key public good, which, like the concept of the business ecosystem itself and the definition of space, is both intangible and effective means of aligning the actions of entrepreneurs. The definition of a business ecosystem is essentially a plan for how contributions to the proposed system will be modularly distributed, and which firms will provide each element" [10, p. 36].

In the opinion of the authors of this article, ecosystem management is the distributed regulation of the process of mutually beneficial resource exchange among autonomous participants, including technologies, explicit and tacit knowledge, competencies and innovations, human resources, for the continuous creation of new values for consumers and added value for the BES.

Despite the vast diversity of business ecosystems, experts from the BCG Henderson Institute have highlighted several characteristics that distinguish them from other management models: modularity, customization, multilateralism, and coordination [11].

Analogies with biological ecosystems might help broaden the view of competition in the economic sphere and identify new models for multi-contour interfirm relationships. However, these analogies have limitations due to the inherent differences between natural and socio-economic ecosystems.

The main difference lies in the fact that business ecosystems are managed by people who do not always act rationally and are guided by logic and common sense. Often, intuition kicks in, leading to insights, inspirations, delusions, revelations, unusual analogies and associations, unconventional solutions, tacit knowledge, premonitions, foresight, confidence, and other unpredictable factors. The peculiarities of human thinking and behavior partially explain why a universally accepted understanding of the essence of BES, how they form, are coordinated, and managed, has not yet emerged.

PROBLEMS OF MANAGING RESOURCE AND INNOVATION EXCHANGE

Theorists and practitioners unanimously agree that the key feature of Business Ecosystems (BES) lies in their modular structure, in which autonomous/independent and functionally heterogeneous legal entities/actors constantly

[6] URL: https://cbr.ru/content/document/file/123688/consultation_paper_23062021.pdf

and non-linearly interact with each other. No two BES are alike; they are all self-organizing, self-regulating, and self-developing networked structures, which imply the presence of:

- a multitude of independent partners;
- a unified resource and technological base that significantly reduces participants' costs;
- a shared knowledge base for experience exchange;
- risk distribution among participants;
- an integrated communication system;
- compliance with agreed-upon rules, norms, and standards.

Each BES consists of several network substructures, which also form various groups of organizations, and the interrelationships between them can be both formalized and informal. According to the founders of BES theories, they are "intangible", "invisible", and inaccessible to holistic perception.

The participants/actors of BES, each with different corporate cultures, influence each other in unpredictable ways, continuously changing the configuration of interactions, which requires flexibility and rapid adaptation. The number of participants also changes, as they can alternate their roles at different stages: leader, active or passive participant, complementor, innovator, etc.

If risks of fragmentation by activity type, competency levels, culture, etc., hinder smooth operation within a BES, they are mitigated by strengthening the overall motivation through the implementation of unifying goals, visions for further development, and shared values, culture, and ethical codes of relations. Participants/actors who are unable or unwilling to engage in this process may be excluded or penalized.

Ecosystems based on new principles of less aggressive competitive interactions and relationships constantly reproduce a state of uncertainty. However, flexible and adaptive business models quickly respond to changes due to the mobility of the structural elements, the ability to eliminate the "weak link", the capacity to attract additional resources, and so on.

The emergence of diverse ecosystems — multiconnected, flexible, and dynamic — required the development and implementation of new management principles and models, which serve as an overlay, without eliminating existing regulatory levers but, in some cases, pushing them into the background.

All BES share common management principles, but the practices are completely different. For example, openness is crucial to the success of some BES but poses significant risks for others.

Vertical management models have become flat and polycentric, and the development of horizontal and diagonal links promotes innovation and self-organization among BES participants.

Network Relations in BES are coordinated not only through contractual agreements but also through standards, norms, monetization rules, behavioral protocols, data ownership rights, etc.

The company that organizes the BES (also called the parent, core, key company, central hub, orchestrator, etc.) makes and implements management decisions and performs various functions: strategic, delegating, informational, competence-based, motivational, social, providing, distributing, and team-building.[7]

Orchestrators must create an effective management model — a set of explicit or implicit structures, rules, and practices that define and manage the behavior and interaction of BES participants [12].

One of the main goals of managing a platform ecosystem is to balance the trade-offs related to controlling the core technology — a key problem in organizational design [6].

The popularity of BES is growing despite numerous failures that occur during their

[7] URL: https://www.itweek.ru/digitalization/article/detail.php?ID=206814

creation and development. Researchers from the BCG Henderson Institute analyzed the effectiveness of 57 ecosystems across 11 sectors in various geographic markets and found that fewer than 15% of them are sustainable in the long term.

The most common cause of failure (34%) was the incorrect choice of management model [13].

Another article from the BCG Henderson Institute states: "Business ecosystems tend to make various types of management errors. Many ecosystems struggle because they choose too open a management model… Others fail due to a management model that is too closed… Some business ecosystems experience difficulties because they cannot control bad behavior on their platforms…"

Table

Ecosystem Management Framework

Elements	Aspects	Key Questions
Mission	Goal	What is the overall goal that aligns/connects all ecosystem stakeholders?
	Culture	What common set of values guide the ecosystem's stakeholders?
Access	Entry Commitments	Who can participate in the ecosystem and under what conditions? What level of exclusivity or specific co-investments is required?
Participation	Decision-making Rights	How are decision-making rights distributed among the ecosystem stakeholders?
	Transparency	How transparent are the governance model and strategic roadmap?
	Conflict Management	How are conflicts between ecosystem stakeholders resolved?
Management	Entry Control	What requirements govern the contributions of stakeholders?
	Process Management	How are behavior and interactions of stakeholders regulated?
	Exit Control	How are the products/services created by the ecosystem regulated?
Sharing	Data/Information Rights	What rules govern ownership, access, and use of data?
	Ownership Rights	Who owns the tangible and intangible assets created by the ecosystem?
	Value Distribution	How is the value created by the ecosystem distributed among stakeholders?

Source: BCG Henderson Institute. URL: https://www.bcg.com/publications/2021/how-to-manage-business-ecosystem

Another type of failure in management includes conflicts between ecosystem partners, particularly between the orchestrator and its complementors (additional participants — Authors' note). Early warning signs include complaints from complementors that the orchestrator is using its dominant position to impose unfair conditions on the ecosystem… Some BES receive negative reactions from consumers or regulatory bodies, indicating flaws in the current management that may jeopardize their operational license…

The success or failure of ecosystems in the market mainly depends on the rules of interaction, the nature of standards, and the quality of interfaces.

Based on the analysis of over 80 business ecosystems from various sectors of the economy, experts from the BCG Henderson Institute developed a comprehensive management framework for them (see *the Table*).

The innovative component is present at various scales in almost all types of business ecosystems, which is why ecosystems combine two different types of activities: research (innovative) and commercial (operational). In the "Sber" ecosystem, they went even further and, in the second half of the 2010s, introduced the concept of a trimodal organization. In early 2023, Sber's president and chairman, Herman Gref, noted: "In any organization, there are three ways to carry out activities — we call them run, change, and disrupt. Run refers to process management, where the same operation is repeated every day. Change refers to project management. The third component is disrupt, which is innovative activity".[8] These modalities are characterized by different corporate cultures: intolerance to mistakes, a desire to experiment, creativity, tolerance for errors, and a willingness to lose money.

It is important to emphasize that conventional control methods are insufficient or do not work for ecosystems. Since BES combine independent actors, individual participants do not have access to control the entire ecosystem. BES cannot be fully managed and controlled hierarchically due to their modularity, variability, and boundlessness, as it is impossible to identify the entire ecosystem space at once, and it is difficult to fully cover the numerous network interactions of an unlimited and changing number of participants.

Therefore, compliance control (from English compliance — conformity, observance, obedience) is most effective in ecosystems. It evaluates and prevents compliance risks that arise from non-compliance with laws, rules, standards, and ethical norms, including internal ones. This is achieved through regular monitoring of all possible interactions and performance indicators of BES, followed by analysis and management actions, such as restricting access to certain resources (it is important to document the key data from monitoring). However, if control becomes excessively rigid and is exclusively the prerogative of the BES organizer, it may turn into a supply chain and lose all of its advantages.

MAIN TRENDS IN THE DEVELOPMENT OF SUBSTRUCTURAL COMMUNICATION ECOSYSTEMS

Any organism, like an organization, exists due to its ability to receive, use, store, and transmit information. However, the term "communication" is rarely found in scientific publications on the organization and management of business ecosystems, both in Russian and English, except in a few studies on the promotion of innovative BES. The goals and tasks of communication management are mainly discussed in the context of natural ecosystems, particularly regarding the involvement of different stakeholder groups in environmental protection activities.

At the same time, the term "interaction" is traditionally used in the description of ecosys-

[8] URL: https://stimul.online/articles/interview/gref-innovatsiy

tems, with the word "communication" being one of its main synonyms, playing a key role in ecosystem management.

One reason for the narrow use of the term "communication" is related to the fact that over a hundred years ago, German scientist Max Weber introduced the concept of "social action", which later evolved into "social interaction" and became dominant in English-language socio-economic studies.

In turn, communication, as the process of exchanging information and knowledge, involves interaction between its participants. Therefore, everything mentioned above justifies the occasional use of the terms "interaction" and "communication" as synonyms.

With the development of information technology, the concept of "communication" has expanded significantly, and its role in socio-economic reality has grown exponentially compared to interaction. However, researchers still prefer the latter, following established traditions.

In Russia, the lack of proper attention to communication and its undervaluation in management may be explained by the fact that when translating from English, people tend to choose the first translation option offered by dictionaries rather than one that more closely aligns with the meaning of the word. Additionally, many still perceive communications as a supplementary resource without productive value or a financial dimension.

Nevertheless, we have found no scientific research containing principles and recommendations for creating adaptive systems for the organization of integrated communications within ecosystems. A number of works contain general principles and rules for interacting with partners and stakeholders, some of which are provided above. We will attempt to fill the gap in understanding the role of communications in ecosystem management.

At the very end of the 20th century, several American authors proposed, in addition to the ecological approach, the stakeholder approach [the term "stakeholder" is translated in Russian scientific and managerial literature as "interested party" or "influencing group"]. Through its use, ecosystem management combines ecological, socio-economic, and institutional knowledge and priorities through the participation of various stakeholders. Shareholders and stakeholders determine the architecture of the business ecosystem, partnership conditions, rules of interaction, and communication.

It is also important to note that the stakeholder approach unites ecosystem management and the concept of integrated communications (IC), in which interaction with stakeholders plays a key role. The participation of stakeholders has become even more relevant in the formation of BES, with an emphasis on long-term relationships with all stakeholder groups.

Nelly Bachurina, an associate professor at the Department of Integrated Communications at the National Research University Higher School of Economics, defines IC as follows: "It is a multidisciplinary strategy of variable media and structural coordination of communications with stakeholders, affecting their perception of all information about the organization as a whole". IC includes advertising, marketing, public relations, corporate culture, corporate design, etc. [14, p. 32].

One of the main innovations of Integrated Communications (IC) is that while communication used to focus on consumers and partners, now interaction and communication occur with all groups of stakeholders whose interests are, to some extent, affected or could be affected by the activities of companies and organizations.

In other aspects, IC also most closely aligns with the ecosystem management model. Furthermore, the self-producing and continuous flow of information in companies and organizations is, in itself, an ecosystem of communication.

Similar to an ecosystem, integrated communications unite and coordinate various modular structural elements that autonomously perform

functions such as advertising, marketing, public relations, product promotion, reputation management, branding, and more, in interaction with all stakeholders (target audiences — TAs). IC implies an equal approach to all TAs: shareholders, staff, consumers and clients, partners, investors, and other stakeholders.

Modern technologies enable omnichannel communication (from Latin "omni" — all, every). Unlike multichannel communication, omnichannel is a unified system of continuous, seamless interactions through different channels, preserving the history of communication, which becomes one of the main areas of development for platform-based and other BES.

Such unified communications (UC) allow business processes between partners to be linked within a single digital space, both for coordinating work teams and for communication with clients.[9]

We propose viewing IC as a localized communication ecosystem, a component of BES, in which all stakeholder groups are participants. In other words, IC acts as an ecosystem substructure within BES.

Another key task of the unified communication organizer in BES is to create key messaging (KSM). After decomposing the target audiences by functions, interests, goals, and expectations, considering factors like education, competencies, etc., a personalized KSM is prepared for each of them in a language understandable to the recipient and written in the appropriate style, sent through individually selected channels.

The main task of KSM is to convince the recipient to change their behavior, obtain information, influence activity, decision-making, etc. The result of communication is mutual understanding or its absence, which determines the prospects for possible interactions and affects the efficiency of the communication system and the entire BES as a whole. The communication strategy should include the values and meanings underlying the activities of enterprises and organizations.

The primary method for ensuring understanding of the messages transmitted to the recipient is to create an effective decision-making system based on well-established communications, with a dense network of corrective feedbacks, telling the sender how accurately the message has been perceived by the recipient [15, p. 46].

Equally important is to establish a system and define the procedure for establishing horizontal and diagonal communications (including informal ones) to exchange not only the necessary information for interaction but also knowledge, experience, innovations, and new ideas between BES participants and their departments. This will increase productivity, create more favorable conditions for innovation, and improve the overall atmosphere of partnership within the BES.

In an era of information abundance and oversupply, competition between BES in Russia for consumers' attention to products and services has significantly intensified, aiming to attract new users and retain existing ones. To capture this monetizable resource, various forms of entertainment, sensational headlines that do not reflect the content, etc., are used.

In the 2017 study "The Future of Communications" by the Russian Association for Public Relations (RASO), it is stated: "Competition for human attention will require companies not only to provide omnichannel communication but also a deeper integration into people's lives: offering them not just goods and services, but care, help with everyday tasks, while paying close attention to their emotional responses to each interaction".[10]

The properly organized exchange of information between participants in, for example, a

[9] URL: https://www.tadviser.ru/index.php/

[10] URL: https://raso.ru/research_raso/about_the_future_of_communications.

platform-based BES, forms its main asset — a large database of products and their consumers, which remembers the history of their interactions. Analyzing customer behavior enables forecasting their needs in order to offer products, services, and content that meet their demands. At the same time, populating the database of partner interactions allows for the adjustment of ecosystem standards and rules, improving management decision-making procedures.

Integrated communications (IC) are particularly effective in solving the problem of information asymmetry, where participants in BES have different levels of knowledge. Such uneven transparency breeds distrust among them, reducing the effectiveness of partnerships, increasing transaction costs, harming competition, and increasing the risks of unethical behavior and abuse. This is a serious issue, as K. Sarkar and F. Kotler emphasize, "trust is the currency of ecosystems".[11]

In the process of information exchange, it is crucial to minimize traditional management methods, such as concealing or limiting information under the pretext of protecting commercial secrets or the risk of losing data and confidentiality.

The process of transitioning from one management model to another, as practice shows, occurs gradually over the years in different countries. In a 2018 study commissioned by the Association of Independent Directors (AID) and conducted by the Center for Social Design "Platform", the question was asked: what management style do you think will dominate in Russian companies in the next few years? Over 100 AID members — independent directors, heads of Russian companies, and independent experts — answered as follows: 75% — directive management; 13% — entrepreneurial management; 11% — collegial management; 1% — other.[12]

Thus, managers accustomed to directive methods of control will likely continue as they are, as they fear change or are unwilling to complicate their work with coordination procedures and approvals, or to delegate authority to lower levels even for the sake of increased efficiency.

The integration of communications is hindered by the undervaluation of the role of information systems in management, the team-oriented behavior of leadership, the desire of long-established marketing, advertising, and public relations departments to preserve their autonomy and budgets (which reduces motivation for change), underdeveloped corporate culture, etc.

Therefore, the fundamental transformation in the form of communication integration is perceived by most department heads as a threat to their existence. Additionally, any changes are often viewed as situations of uncertainty, where people tend to make irrational judgments, decisions, and actions. Thus, it is necessary to highlight the discussed issues, show the advantages and possibilities of new management models, and the practical application of integrated communications.

The study by D. Hanna and C. Eisenhardt mentioned above showed that firms in ecosystems regulate the levels of interaction and competition during value creation to achieve profit [5].

Companies participating in BES, being autonomous, have their own communication systems that ensure internal interactions, public relations, media relations, and functions such as advertising, marketing, etc. They form substructural communication ecosystems within the BES, which compete with each other to varying degrees of honesty and integrity. Conflicts of interest may also arise if companies are part of two or more competing ecosystems.

While research on communications in natural BES addresses general communication issues,

[11] URL: https://www.marketingjournal.org/ecosystem-marketing-the-future-of-competition-christian-sarkar-and-philip-kotler/

[12] URL: https://pltf.ru/2018/12/19/korporativnoe-upravlenie-v-rossii-krizis-zhanra-i-nadezhdy-na-budushhee/?print=print

the authors found no studies on the application of integrated communications in business ecosystems, except for a few applied and descriptive publications. Given the above, we can conclude that communication systems within BES interact directly or indirectly with each other and may collaborate or compete to varying degrees — from unified communication policies to information wars.

The nature of interactions between substructural communication ecosystems primarily depends on the relationship between specific firms participating in BES, which currently defines the goals and objectives of communication systems (CS) and may change along with market conditions. Factors such as mutual understanding of coordinated actions, varying levels of competencies, mismatched corporate values, ethics, and culture also influence the possibility of integrating CS within BES.

Hybrid options are also possible, where companies compete on some issues or topics and cooperate on others in the information space. In relations between ecosystems, competition predominates over cooperation in the communication field.

In a networked, "invisible" organization, BES's functionally heterogeneous autonomous elements continuously interact with each other in a nonlinear and unpredictable way. Each partner/collaborator in BES has their own goals, knowledge, experience, technologies, etc. According to Oliver Williamson, Nobel laureate in economics in 2009, such a diverse array of social communications significantly increases the speed and variety of interactions and exchanges. This provides companies and organizations with much broader opportunities, such as increased flexibility and maneuverability, as well as the ability to self-organize and self-regulate to quickly adapt in the face of growing uncertainty [16, p. 87].

The integration of communications in companies and organizations is not limited to the unification of communication channels but encompasses all interactions coordinated by a central management system. Essentially, it involves creating a substructural communication ecosystem that aligns the functions of departments (press services, public relations, marketing, advertising, etc.) regarding interactions with departments, stakeholders, investors, partners, suppliers, consumers, etc.

The core of this system can be a committee, commission, responsible person, or group of managers coordinating in an ad hoc manner. The primary task is to organize the effective exchange of information and knowledge, during which the embedded meanings that serve the interests of business and society are accurately transmitted and perceived. To achieve this, strategies, norms, rules, standards/templates, key messaging, communication channels, and style specifics for each stakeholder group are developed.

These actions ensure the synergy of all departments and management bodies in the development and implementation of strategies and business plans, as well as in the processes of control, automation, risk assessment, and so on.

All of the above indicates that researchers should take an interest in the organization of communication interactions within ecosystems and between them, as well as study the potential for their integration for sustainable innovative development. This creates the most optimal conditions for BES's multitasking operations, significantly reducing many contradictions between individual information exchange directions and tools, forming them into a single unified message for target audiences, ensuring consistency of interactions, a common culture, communication rules and style, and improving the effectiveness of ecosystems in conditions of constantly reproduced uncertainty.

CONCLUSION

In conditions of growing uncertainty, the key priorities are maximum decentralization of

management, rapid adaptability, and flexibility in the face of continuous changes.

Instead of linear value chains, BES coordinate interactions between autonomous businesses that create value propositions or solutions. They form the most favorable environment for innovation and sustainable development, playing an important role in the growth of the Russian economy.

The authors have studied certain features of ecosystem management processes in detail and offer their own definition of it.

Ecosystems create unconventional content and forms of competition, adding to the long-standing battle for market share by introducing different types of competitive partnerships aimed at creating new value propositions through innovation, including in virtual space, driven by the digital economy.

The strategy of ecosystem leaders — organizers — sets the trajectory for the entire multi-agent community in the face of a dynamic and uncertain external environment, as well as unstable market leadership by both traditional and modern platform companies.

The limitless diversity of BES types, a variety of strategies, the characteristics of networked inter-firm and inter-industry interactions, the involvement of the same modules (companies and organizations) in different ecosystems, etc., indicate that the same rules and management decisions can lead to opposite results in ecosystems that are unlike each other.

A vertical control system is replaced by coordinating the activities of all BES participants through the establishment of adaptive rules, norms, and standards. The specifics of BES are reflected in the organization of compliance control, based on monitoring the maximum possible number of interactions and performance indicators of BES, which should ideally be carried out in a 24/7 mode due to the increased volatility of ecosystems.

The main task of ecosystem management is to reconcile the interests of stakeholders and coordinate the actions of diverse and varying partners from all industries. The effectiveness of this task is largely dependent on the implementation of an integrated communication system, which is optimal for the ecosystem management model, as it unites stakeholders through an approach that allows for aligning interests and coordinating actions among all partners. The authors view integrated communications (IC) as an ecosystem substructure within the framework of business ecosystems (BES).

The integration of communications creates a unified information space for interactions (including knowledge exchange), which ensures more effective cooperation and coevolution of BES. This plays a key role in realizing the competitive advantages of ecosystems in the process of creating and monetizing new values. Data banks have become an important resource and valuable asset for BES.

The underestimation of the role of integrated communications in Russia is related to the persistent adherence of many owners and managers to the administrative-command management model, their resistance to change, short-term planning horizons, rigid thinking, and a narrow worldview.

In our country, certain aspects of ecosystems, such as their ability to self-regulate, remain underexplored. Moreover, only general approaches to ecosystem management are described, without concrete methods for coordination, management, integration mechanisms, etc. This hinders the development of the ecosystem approach that meets current demands.

The authors have not found any scientific works dedicated to the organization of integrated communications in BES, so this article can be valuable for creators, participants, and clients of ecosystems, as well as for their researchers.

As the ecosystem approach spreads throughout the economy, the number of individuals with the corresponding mindset and shared values will increase. This means we can talk

about the emergence and evolutionary development of a new type of individual — the ecosystemic person (homo ecosystemus), one who has internalized certain laws of nature and sees themselves not only as a competitor in the markets of knowledge, innovation, goods, and services, but also as part of a collective effort. This individual replaces the "networked person" (network man), the "paradoxical person" (man of paradox), and the "confused person" (man of confusion) as a response to the increasing riskiness of society.

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E.A. Plaksenkov — the practice of managing business ecosystems, the formulation of goals and objectives of the study.
S.N. Silvestrov — a new model of value creation, concept development and general guidance of writing an article.

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Creating Industrial Ecosystems as a Tool for Anti-Crisis Management

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ABSTRACT

In the current economic climate, the Russian industrial sector needs significant structural reform to facilitate its transition to a new, more advanced technological level. To achieve this goal, it is recommended to introduce new management tools, one of which is the establishment of industrial ecosystems. **The purpose of the article** is to prove that industrial ecosystems have a positive effect on the sustainable development of the Russian economy, especially during economic crises. **The subject of the study** includes industrial ecosystems as a crucial tool for managing economic crises. It also explores the historical context of industrial collaboration and the formation of clusters during economic downturns. This paper explores two industries that have been significantly affected by recent economic crises: pharmaceutical and automobile manufacturing. It is shown that during times of crisis, some industries develop characteristics similar to ecosystems. The authors propose a method for analysing and evaluating the performance of industrial ecosystems. **The theoretical and practical significance of the study** of this study lies in identifying the key factors that contribute to the development of effective industrial ecosystems. Furthermore, it aims to develop a trustworthy tool for evaluating their influence on socio-economic processes. The establishment of industrial symbioses is seen not only as a way to overcome economic crises but also as the foundation for the strategic long-term development of the Russian economy.

Keywords: industrial economics; industrial cluster; industrial ecosystem; industrial symbiosis; economic crisis; crisis management

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INTRODUCTION

In the context of modern economic realities, the industrial sector in Russia requires a radical structural overhaul to ensure a transition to a qualitatively new technological level. To achieve this, it is advisable to seek new management tools, one of which is the formation of industrial ecosystems.

An industrial ecosystem is a system of interacting actors (including companies, government structures, research and educational institutions, as well as other stakeholders) who collectively contribute to innovation, economic development, and sustainable growth in the industrial sector. Such associations are created independently by their members, have a high level of independence from the governing bodies at various levels, and adopt a decentralized approach when making decisions [1]. The interaction of participants in industrial ecosystems is based on socio-economic and scientific-technological links that form sustainable cooperation even in the absence of legally binding relationships. The effect of participating in an ecosystem includes expanding the opportunities and competencies of participants through the joint use of resources.

Industrial ecosystems have emerged as a result of the evolution of industrial clusters, with a primary focus on symbiotic relationships between companies that not only coexist but actively exchange resources and waste, creating closed production cycles [2]. Industrial ecosystems and industrial clusters can be combined under the common term «industrial symbiosis,» which highlights the mutually beneficial relationships between different enterprises and organizations working together by exchanging resources and knowledge to achieve the common goal of sustainable development and increased efficiency.

World practice has shown that the ecosystem approach significantly contributes to the reindustrialization of the economy [3, 4]. On the international stage, there are several examples of successful industrial ecosystems that can serve as models for study (Silicon Valley in the USA, the Baden-Württemberg industrial cluster in Germany, etc.). Their effective functioning enables the achievement of a synergistic effect [5].

Particular attention is drawn to discussions about the development of the ecosystem business model, which, in its generalized form, represents "building a complex non-hierarchical cooperative chain of various business directions and individual companies, united by a set of common rules, methods, and technological tools, and functioning as a single entity in relation to the consumer." [6]

A modern industrial ecosystem is formed from several key elements [7], which interact and create common value (digital platforms, industry and cooperation chains, key actors, eco-resource potential, digitized business processes, etc.). This leads to an increase in the efficiency and transparency of collaboration between participants.

Despite numerous studies in the field of the ecosystem approach, the hypothesis that the creation of industrial ecosystems is an effective management tool in an unstable economy remains insufficiently substantiated. The study of existing ecosystems is complicated by the fact that existing economic indicators (sectoral, regional, and data on the economic performance of individual organizations) do not allow for a full analysis of this object of activity [8].

Thus, the aim of this article is to substantiate the hypothesis of the positive impact of industry ecosystems on the sustainable development of the economy, including in times of crisis.

INDUSTRIAL SYMBIOSIS AS A TOOL FOR OVERCOMING ECONOMIC CRISES: A HISTORICAL OVERVIEW

During times of economic crises, the industrial sector in many countries underwent sig-

nificant changes. Industrial associations were created to ensure coordination and interconnectedness between enterprises. For example, during the Great Depression in the United States, government intervention actively shaped economic processes, creating conditions for the formation of clusters. Industrial policy also took into account social and environmental effects, ensuring employment and social stability [9].

There is a study that analyzes how technological changes and crises lead to the formation of new organizational structures and interactions, including industrial clusters [10]. The authors explore how radically new technologies create advantages for new market participants. They ask questions such as: under what conditions does this occur? To what extent are the shortcomings of existing companies related to their inability to adapt to new opportunities and strategies in a timely manner? The concept of "value networks" is introduced in this context.

In recent history, Russia has also experienced significant government interventions and initiatives aimed at stabilizing and developing the economy during crises. For example, the financial crisis of 1998 caused deep economic and social shocks. The public administration sector was forced to actively search for ways to stabilize and restore the economy, including the use of cluster approaches [11]. Thus, in 1999, one of the first IT clusters was created in St. Petersburg, focusing on software development for IT systems management across various industries, as well as the installation and maintenance of information systems [12].

One study examines the concept of the virtual economy as a system of informal rent distribution that emerged in post-Soviet Russia in the 1990s [13]. The authors describe how unviable manufacturing sectors from the Soviet era sought to protect themselves from market discipline. Enterprise leadership and their allies in the economy, including officials, conspired to use non-market prices and various forms of non-monetary exchange, including barter, to transfer value from the raw materials sectors to manufacturing industries. According to the authors, these informal mechanisms helped preserve certain sectors of the economy during the crisis.

The global financial crisis of 2008–2009 caused significant changes in economic systems worldwide, prompting many countries to take measures to create and support industrial clusters and ecosystems. A study analyzes how cluster approaches can contribute to economic revival and sustainable development, emphasizing the importance of aligning state policy with new economic realities regarding competition [14]. It is believed that government support should focus on creating favorable conditions for the self-organization of cluster participants, rather than managing them entirely [15].

The crisis related to the coronavirus pandemic in April 2020 led to a significant decline in most socio-economic development indicators in Russia. Subsequently, during 2020–2021, the government took vigorous measures to coordinate anti-pandemic and anti-crisis policies, including the development of an antivirus vaccine and vaccination of the population, which allowed, to some extent, to mitigate the most acute manifestations of the "corona-crisis" [16, p. 25]. At the beginning of the pandemic, many countries implemented restrictive measures, including border closures. In this context, the creation of clusters that utilized the advantages of sectoral and geographical proximity in forming new production chains, as well as the potential of small and medium-sized enterprises (SMEs), seemed preferable to relying solely on large businesses [17].

The 2022 crisis, associated with the beginning of the Special Military Operation (SMO) and unprecedented sanctions against Russia, led to the need for the introduction of a mobilization economy model [18]. The formation of

this model fully incorporated the experience of the anti-crisis and anti-pandemic policies of 2020–2021.

In all the economic crises discussed above, the role of the state can be highlighted, as it took an active stance in the management process by creating institutional conditions for the formation of clusters and ecosystems, including tax incentives, subsidies, investments in infrastructure, and educational programs. No less important was the self-organization of enterprises, and their active participation in the creation of effective industrial clusters and ecosystems ensured coordination and proper interaction among employees. Such industrial symbioses can be used not only as a tool for crisis management but also as a mechanism for long-term economic development.

Thus, it is proposed to use new structures, called metaverses, which represent the next stage in the development of industrial ecosystems and allow for the mobilization of resources in the relevant area without harming other sectors of the economy [19]. "An industrial metaverse is understood as a virtual space combined with real production processes, complementing them, and organized by leading technological companies based on network interaction principles to increase the efficiency of operations" [19, p. 379].

METHODOLOGY FOR ANALYZING AND EVALUATING THE EFFECTIVENESS OF INDUSTRIAL ECOSYSTEMS

Next, we will describe the author's methodology that we recommend for analyzing and evaluating the effectiveness of industrial ecosystems as a tool for crisis management. It includes several key stages.

1. **Problem Analysis**: The initial stage involves a detailed study of current and potential economic crises, their causes, and consequences. This is done to identify problem areas and needs that can be addressed and satisfied using the ecosystem approach.

2. **Development of an Indicator System**: The system includes three levels. First Level is *Leading Indicators*: These help determine the potential timeframes and scales of crisis phenomena. These indicators can include business confidence indices (BCI) in large sectors of the economy, measured in percentage terms and calculated based on surveys of industrial enterprise managers, as the difference between positive and negative responses. Additionally, stock market indicators, such as the monthly average index of the Russian Trading System (RTS), can be used. Leading indicators can signal the onset of an economic crisis in advance.

The Second Level is *Industry Indicators (Indices)*: These show how industrial ecosystems are created in some sectors during a crisis, which are essentially mechanisms of crisis management. The dynamics of such indicators allow for the assessment of the onset, depth, and end of crisis phenomena in each sector, as well as the potential for import substitution and economic growth.

The Third Level is *Performance Indicators*: These assess the impact of the created ecosystems on socio-economic processes. Such indicators can include the dynamics of GDP, adjusted for seasonality, GDP growth rates, real disposable income index, and others.

3. Dynamic Analysis of Three Groups of Indicators: This stage involves monitoring and evaluating leading and industry-specific indicators, as well as performance indicators. It examines the various effects related to the impact of crisis phenomena on industry-specific indicators (such as the onset of a downturn, depth of the decline, and the duration of the crisis until recovery). A conclusion is drawn about the signs of a crisis, the involvement of various sectors, and their impact on performance indicators.

4. Analysis of Fine Structure: Dynamics of Specific Industry Indicators: At this stage, a particular sector (or sub-sector) is selected for study, and the dynamics of industrial indi-

ces and specific types of products are analyzed in real terms.

5. Evaluation of the Effectiveness of Industrial Ecosystems: The final stage of the methodology includes a comprehensive assessment of the effectiveness of the functioning of industrial ecosystems within individual sectors. This evaluation is based on the analysis of results from previous stages of the methodology. The assessment determines how ecosystems impact production processes, the environment, and the social sphere, as well as how justified their use is as a tool for crisis management.

PRACTICAL EVALUATION OF THE METHODOLOGY

1. Problem Analysis: In our opinion, during crisis phenomena, certain sectors of industry acquire ecosystem traits for the following reasons:

- Companies begin to collaborate more closely to reduce costs and improve efficiency.
- Companies strive to diversify their services and products to be less dependent on a single market or direction, leading to the formation of ecosystems where different products and services complement each other.
- Crises accelerate digital transformation, and companies adopt new technologies to enhance the efficiency of their business activities.

For example, during economic crises, banks and financial companies often develop digital ecosystems, including online banking, mobile applications, and fintech services, to offer customers more convenient and diverse financial products [20].

2. **Development of an Indicator System**: *Table* 1 presents the system of indicators used by the authors.

3. Dynamic Analysis of Indicators. Let's consider the dynamics of the indicators in accordance with *Table* 1.

Leading Indicators (*Figures 1–2*).

Examples of Industry Indicators (*Figures 3–5*).

Performance Indicators (*Figures 6–7)*.

Table 2 contains the dynamic parameters of the response of the crises of 2020 and 2022 to the indicators presented in *Figures 1–7*.

From *Table 2*, it can be seen that among the leading indicators, the RTS index most adequately reflects the situation, with its decline typically being recorded a month before the onset of crisis events in the economy. The analysis of the dynamics of various sectors of the economy revealed the non-homogeneity of the time frames for entering crisis conditions, the depth of crisis manifestations, and the periods of post-crisis recovery. A differentiation in the indicators of economic performance is observed: during the first crisis, GDP fell within two months, whereas during the second crisis, it took five months. In contrast to GDP, disposable income showed a longer decline during the first crisis. This fact highlights the differences in the responses of various economic indicators to crisis phenomena.

4. Analysis of fine structure: dynamics of sectoral indicators. This study examines two characteristic examples of empirical analysis of industries that were significantly impacted by the recent economic crises. The pharmaceutical sector effectively adapted to changing conditions, successfully implementing anti-crisis measures. In contrast, the automotive industry was less resilient in the face of severe economic turbulence.

Pharmaceutical sector analysis. The pharmaceutical sector became one of the key industries in the fight against the pandemic. Investments in the development of vaccines and medical drugs contributed to the growth of the healthcare sector, having a positive impact on the economy during the crisis. The increase in vaccine production and medical equipment positively influenced GDP dynamics. Empirical data illustrating the dynamics of this sector's indicators are presented in *Figures 8–10*.

According to *Figure 8*, at the beginning of 2020, the pharmaceutical production index showed a slight decline. However, in the fol-

Table 1

A system of indicators for assessing the effectiveness of industrial ecosystems as a tool for crisis management

Indicator	Calculation Method	Period	Source
Leading Indicators			
Business Confidence Index (BCI) in the extraction of minerals; manufacturing industries; electricity, gas, and steam supply; air conditioning, %	Calculated as the arithmetic average of the balance of demand levels (order portfolio), finished goods inventory (with the opposite sign), and expected production output (according to the Official Statistical Methodology approved by Rosstat Order No. 643, dated 14.09.2022). The balance is determined by the difference between the shares of respondents who reported "increase" and "decrease" in the respective parameters	Monthly	https://rosstat.gov.ru/leading_indicators
Russian Trading System (RTS) Index, USD	A price-weighted composite index of the Russian stock market, including the most liquid stocks of the largest and dynamically growing Russian issuers in sectors related to the main sectors of the economy represented on the Moscow Exchange	Daily, averaged monthly	https://www.moex.com/ru/index/RTSI
Industry Indicators			
Production indices for specific types of economic activities in Russia, %	The ratio of the current value of the parameter to its value in the corresponding month of the previous year * 100	Monthly	https://rosstat.gov.ru/enterprise_industrial
Production of key types of products in physical terms	Direct operational monthly data since 2017 according to OKPD 2	Monthly	https://rosstat.gov.ru/enterprise_industrial https://www.fedstat.ru/indicator/57783
Performance Indicators			
GDP at 2021 prices, billion rubles, excluding the seasonal factor.	The evaluation of GDP production data, excluding seasonal and calendar factors, is carried out using the software product "JDEMETRA +".	Quarterly	https://rosstat.gov.ru/statistics/accounts
Physical volume index of GDP, %.	The ratio of the current value of GDP to its value in the corresponding quarter of the previous year * 100	Quarterly	https://rosstat.gov.ru/statistics/accounts
Index of real disposable monetary income of the population, %.	The ratio of the current value of real disposable income to its value in the corresponding quarter of the previous year * 100	Quarterly	https://rosstat.gov.ru/folder/13397

Source: compiled by the authors.

lowing years, the sector significantly strengthened its position, as evidenced by the sharp growth in the production of pharmaceuticals from 2021 to 2023. An important factor contributing to this was the government preferences provided during the pandemic, as well as the import substitution strategy. In contrast to pharmaceutical production, the vaccine development process is characterized by greater stochasticity. A pronounced seasonal factor can be observed here, as well as the wave-like nature of the population's vaccination process.

Automobile production analysis. It turned out that the industry is highly influenced by economic conditions (*Figures 11–13*). This was especially evident at the beginning of 2022, when there was a sharp decline in production volumes. The greatest losses were recorded in the passenger car segment, indicating the high sensitivity of this sector to changes in economic conditions and structural crises.

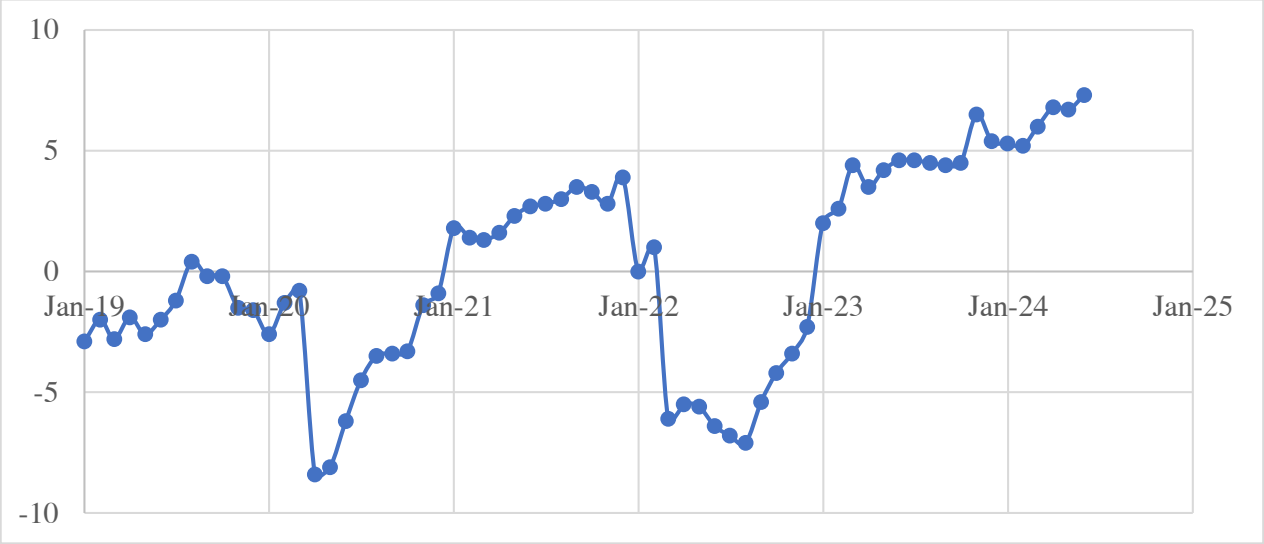

Fig. 1. **Dynamics of business confidence index in manufacturing, %**

Source: URL: https://rosstat.gov.ru/leading_indicators

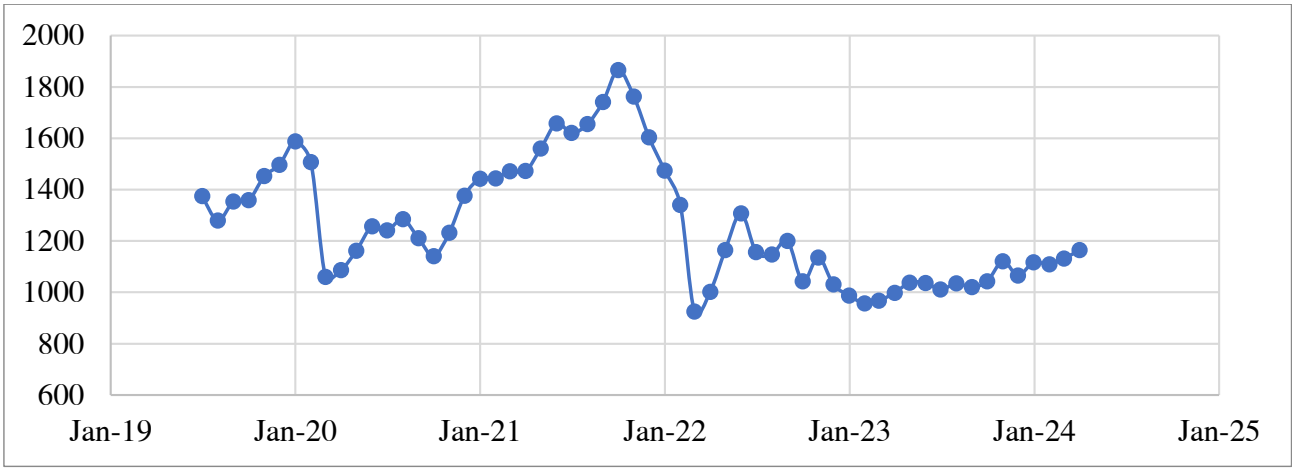

Fig. 2. **Dynamics of RTS index, USD**

Source: URL: https://www.moex.com/ru/index/RTSI

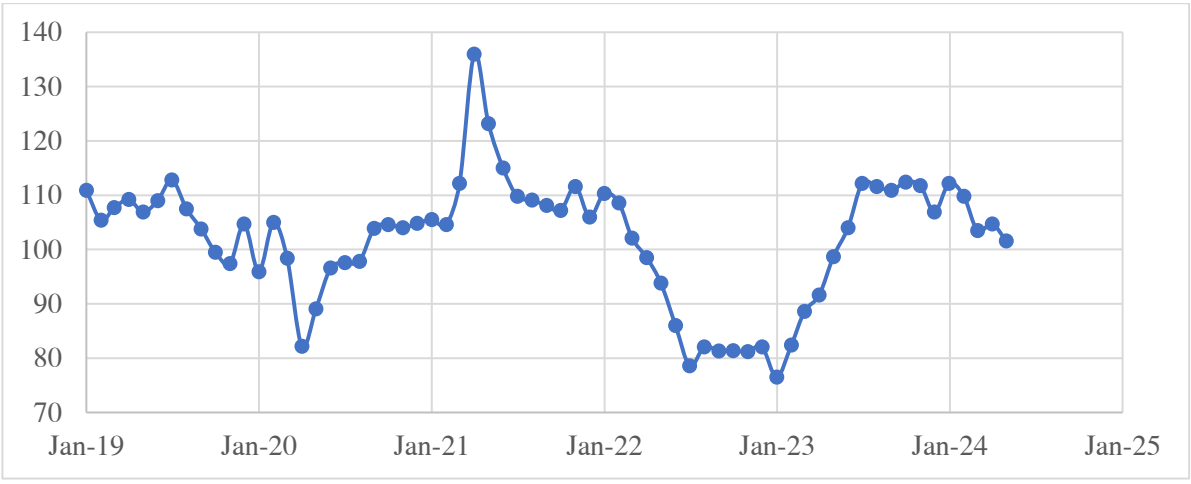

Fig. 3. **Dynamics of timber production index, %**

Source: URL: https://rosstat.gov.ru/enterprise_industrial

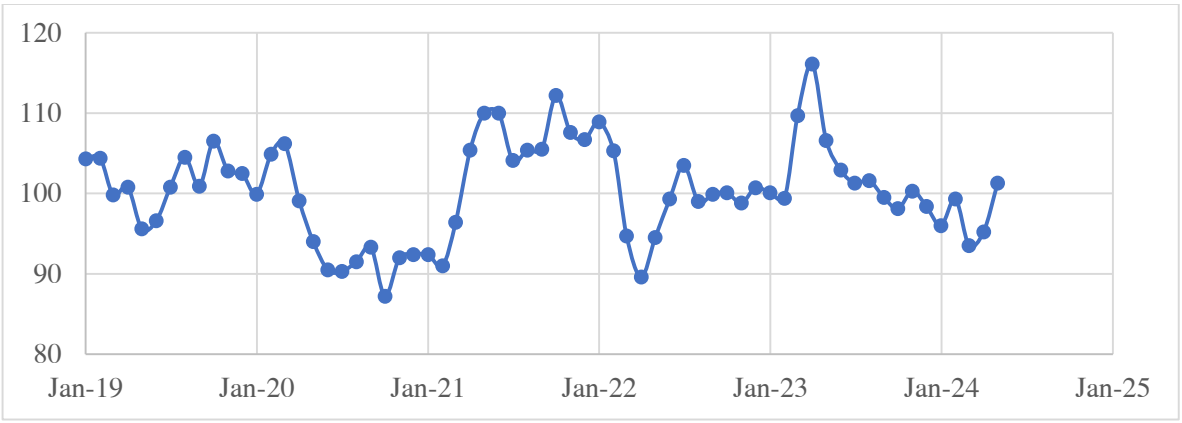

Fig. 4. **Dynamics of petroleum products production index, %**

Source: URL: https://rosstat.gov.ru/enterprise_industrial

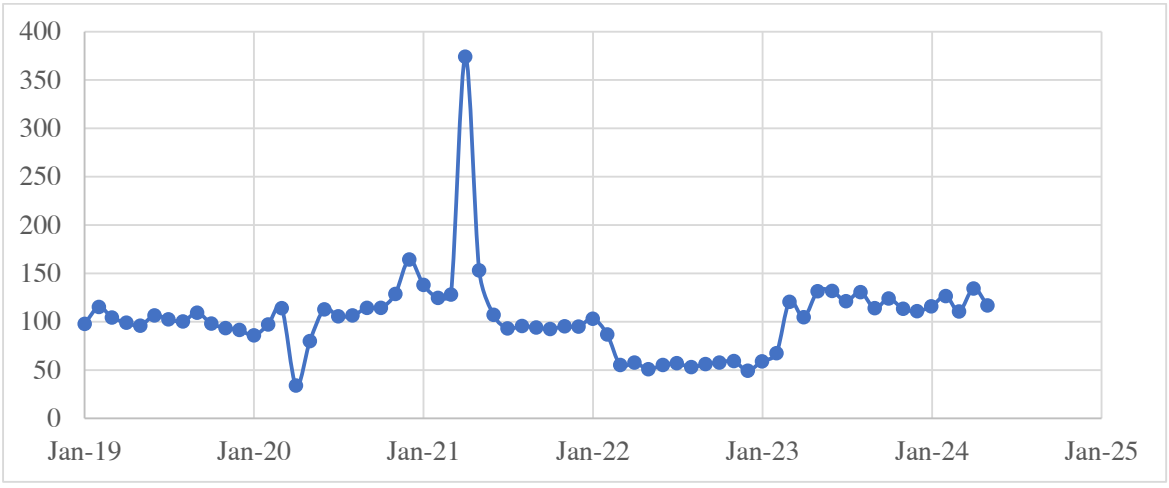

Fig. 5. **Dynamics of the household appliance production index, %**

Source: URL: https://rosstat.gov.ru/enterprise_industrial

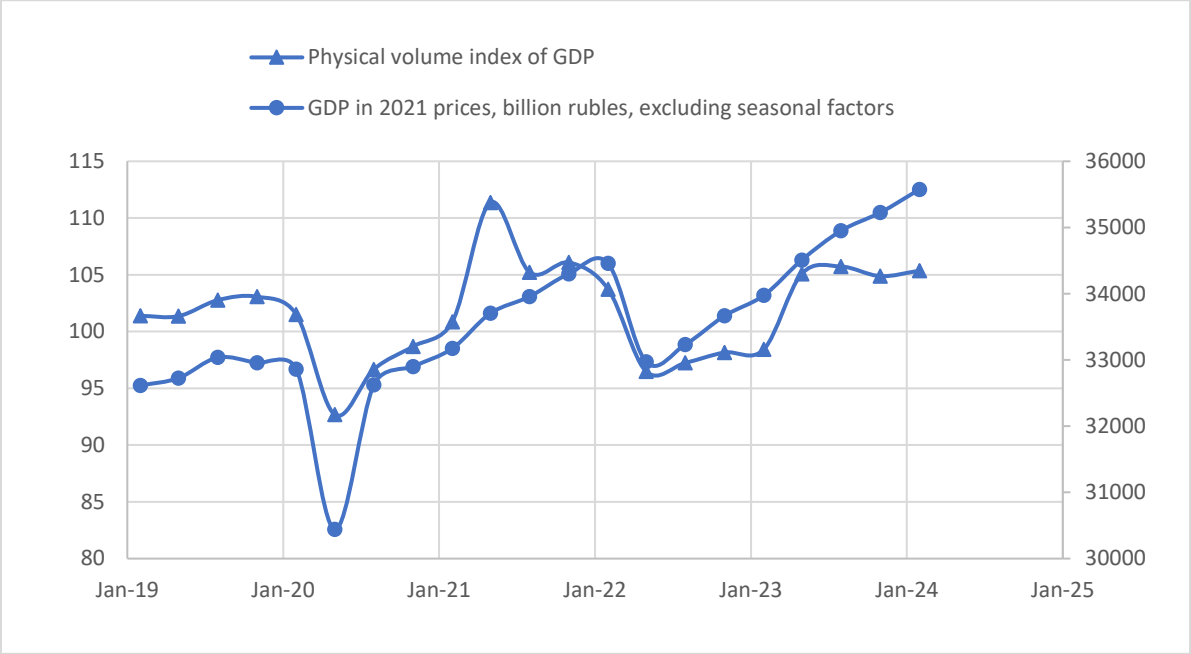

Fig. 6. **Dynamics of physical volume index of GDP,% (left axis) and GDP in 2021 prices, billion rubles (right axis)**

Source: URL: https://rosstat.gov.ru/statistics/accounts

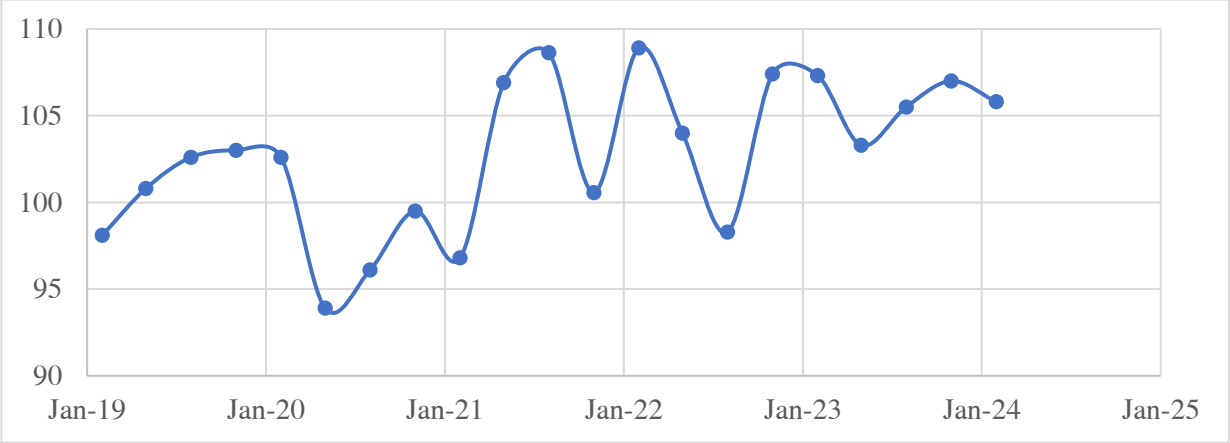

Fig. 7. **Dynamics of index of real disposable income, %**

Source: https://rosstat.gov.ru/statistics/accounts

5. Evaluation of Industrial Ecosystems Effectiveness. In conclusion, we present an analysis of several sectors of the economy in terms of the creation of industrial ecosystems and their potential as an effective tool for crisis management.

The defense-industrial complex (DIC) played a significant role in maintaining economic stability during the 2022 crisis. The increase in government orders for defense and related sector products contributed to the preservation of economic activity in the country. Despite the limited availability of empirical data, indirect evidence points to a growth in DIC product volumes over the last two years. DIC enterprises act as a driving force for domestic

Table 2

Dynamic Parameters of the Response of the Crises of 2020 and 2022 to the Indicators

No	Indicator	Crises 2020			Crises 2022		
		Start Date	Decline Depth	Recovery Period	Start Date	Decline Depth	Recovery Period
1	Business Confidence Index (BCI) in Manufacturing	04.20	10%	7 months	04.22	2%	8 months
2	RTS Index	03.20	30%	11 months	03.22	27%	7 months
3	Timber Production Index	04.20	20%	6 months	05.22	20%	6 months
4	Refined Petroleum Products Production Index	04.20	10%	12 months	04.22	8%	13 months
5	Household Appliances Production Index	04.20	20%	9 months	03.22	20%	8 months
6	GDP	05.20	8%	2 months	05.22	5%	5 months
7	Real Disposable Income Index	05.20	9%	5 months	08.22	10%	3 months

Source: compiled by the authors.

industry, stimulating reindustrialization and import substitution processes in the context of a mobilization economy.

After February 2022, DIC enterprises began to integrate more closely with various sectors of the economy to ensure a stable supply of necessary materials and components [21]. One study suggests using entrepreneurial ecosystems as a new form of interaction between DIC enterprises, SMEs, and other participants under changed conditions [22]. In another study, the authors justify the need for interaction between DIC enterprises and SMEs but highlight the emerging issue of technology transfer from small businesses to large ones [23]. The paper proposes a model for technology transfer, describing the interaction mechanism between small innovative enterprises and large regional businesses to create new innovative products. Another article presents a technology for managing the development of an enterprise's innovation ecosystem and demonstrates its testing at a large DIC enterprise. The research confirmed the methodological and practical value of the considered ecosystem technology [24].

Thus, it can be concluded that the hypothesis regarding the effectiveness of crisis management at defense-industrial complex (DIC) enterprises using the ecosystem methodology is well-founded.

A completely different situation is observed in the *automotive industry*. The empirical data presented in *Figures 11–13* show that in early 2022, when most foreign car manufacturers left the Russian market, it collapsed, particularly in the passenger car segment. The low level of production localization and slow import

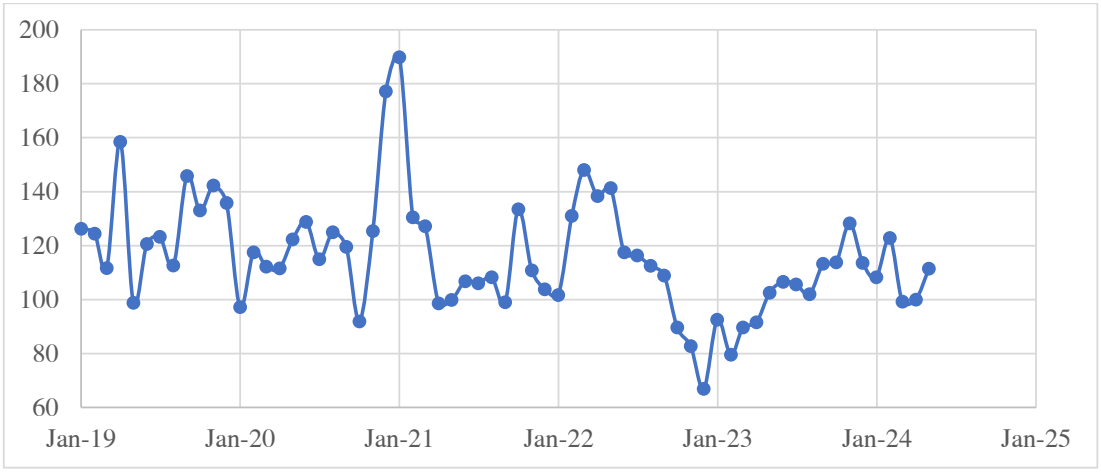

Fig. 8. **Dynamics of industrial production of medicines, %**

Source: URL: https://rosstat.gov.ru/enterprise_industrial

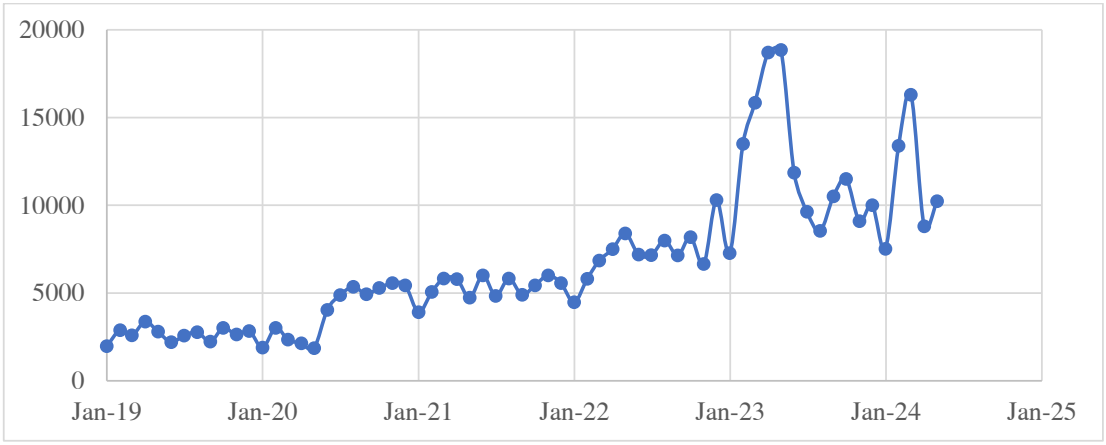

Fig. 9. **Dynamics of pharmaceutical production, thousand packages**

Source: URL: https://www.fedstat.ru/indicator/57783

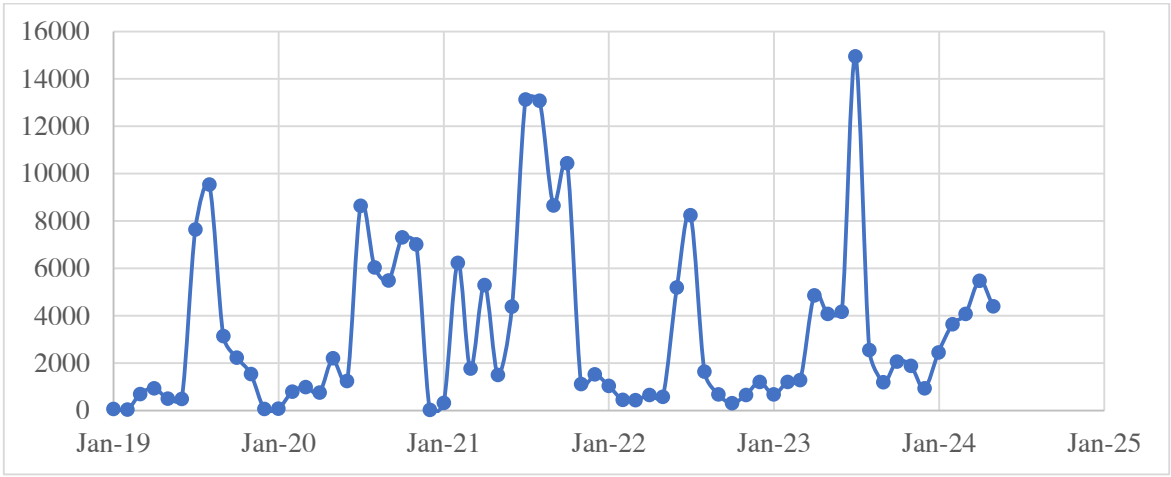

Fig. 10. **Dynamics of vaccine production, thousand doses**

Source: URL: https://www.fedstat.ru/indicator/57783

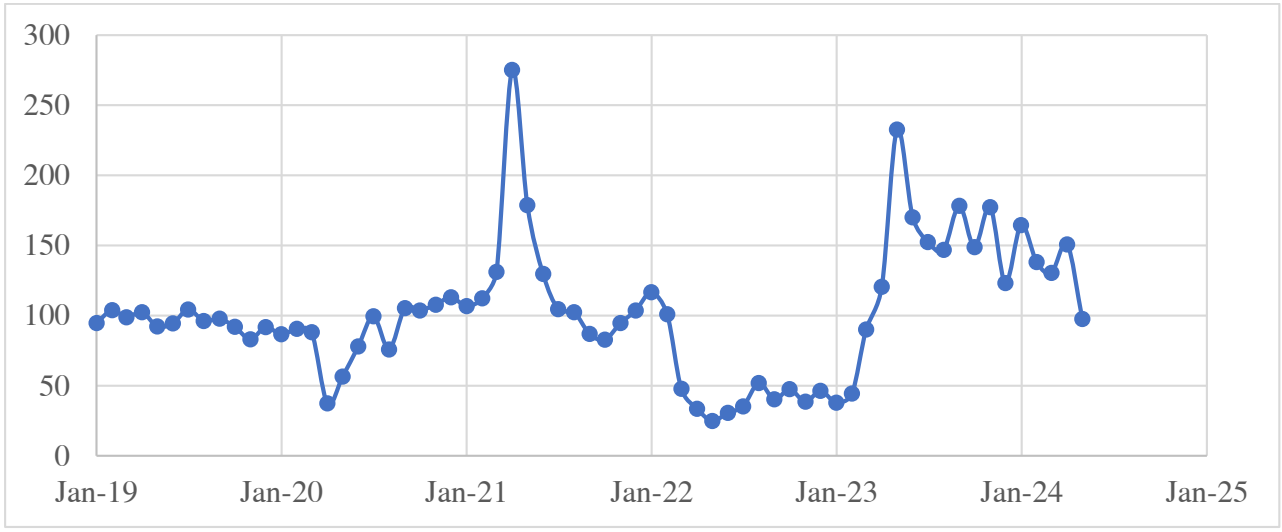

Fig. 11. **Dynamics of the motor vehicle production index, %**

Source: URL: https://rosstat.gov.ru/enterprise_industrial

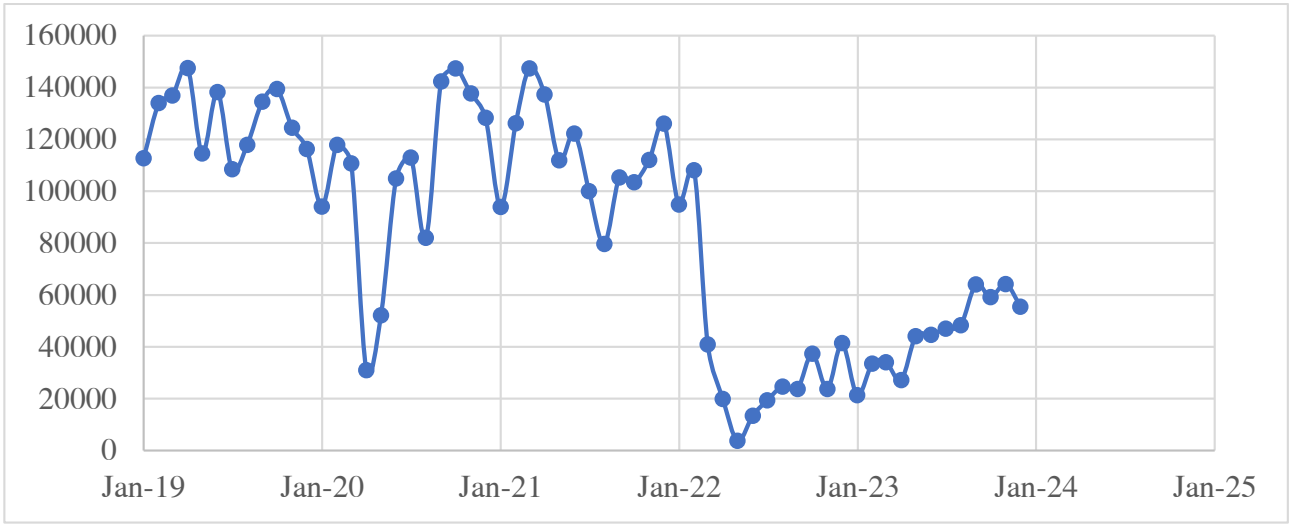

Fig. 12. **Dynamics of the passenger car production index, pcs.**

Source: URL: https://www.fedstat.ru/indicator/57783

substitution rates are, among other things, due to domestic manufacturers' reluctance to switch to network interaction.

A model of the automotive sector's innovative ecosystem, covering various technological innovations, is presented in a paper by Brazilian scientists [25]. The authors link the level of integration of ecosystem participants to car manufacturers' responsiveness to open innovations (OI). They believe that adapting participants to a platform ecosystem requires the implementation of digitalization and the shift toward OI practices. Furthermore, to create an effective ecosystem, a new level of cooperation and an "eco-friendly" type of competition between players is necessary. Interaction between the government and business is required to develop policies for integrating enterprises into the ecosystem.

Such systems are functioning in leading car-producing countries. In contrast, the domestic automotive industry is currently facing difficult

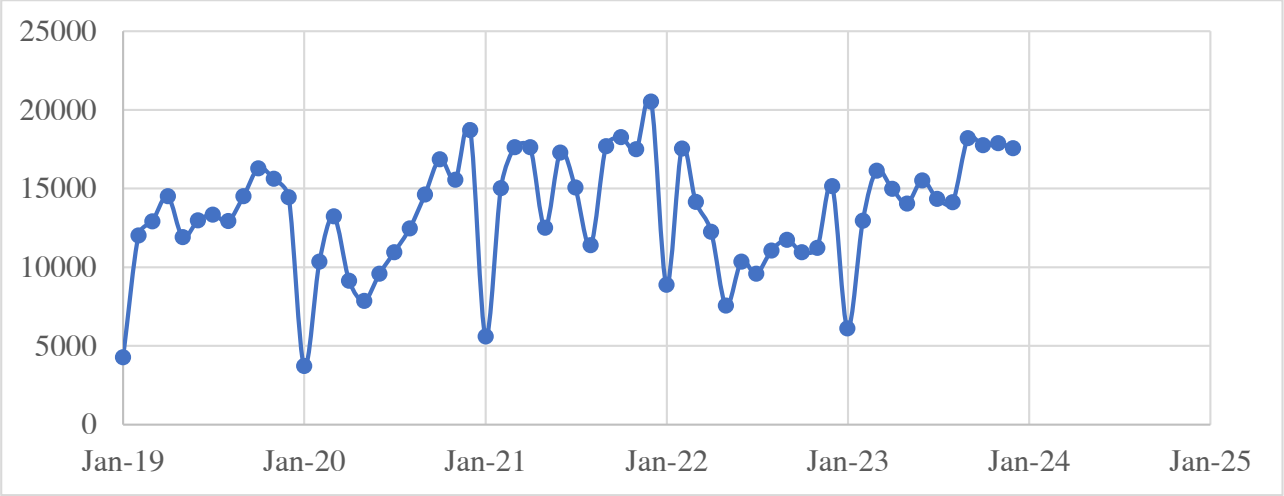

Fig. 13. **Dynamics of the truck production index, pcs.**

Source: URL: https://www.fedstat.ru/indicator/57783

times. The main barrier to ecosystem creation is the insufficient innovation culture among participants. To improve the situation, models of integration within automotive clusters and ecosystems developed by leading scientists can be applied.

As for the *pharmaceutical sector*, cooperation between enterprises within the ecosystem approach is not only possible but also entirely feasible. The COVID-19 pandemic became a vivid example when medical companies actively collaborated, creating ecosystems for the development, production, and distribution of vaccines. Additionally, telemedicine and digital platforms for remote medical services were developed [26].

In Moscow, an ecosystem has been formed for the rapid conduct of clinical trials of pharmaceutical products, aimed at improving the performance of the pharmaceutical industry under the pressure of sanctions, with the active implementation of import substitution mechanisms. One of the prominent examples of its effective functioning was the clinical trial of the COVID-19 vaccine «Sputnik V.» Thanks to the creation of this ecosystem, a significant increase in pharmaceutical production was achieved in 2023 (see *Fig. 9*).

Therefore, the ecosystem approach is beginning to be implemented in the pharmaceutical sector, leading to improved crisis management efficiency.

CONCLUSION

The empirical analysis of the crises of 2020 and 2022 demonstrated that industrial ecosystems play an important role in crisis management and economic recovery. Based on both crises, timely government support measures, investments in key sectors, and adaptation of production processes help accelerate economic recovery and mitigate the negative effects of crises.

The study results showed significant industry differentiation, with varying elasticity of sectors to crisis phenomena. This is confirmed by the parameters of the start, depth, and duration of the crises of 2020 and 2022 for different sectors of the economy.

At the same time, the high degree of integration of participants in the production process, characteristic of industrial ecosystems, is not supported by all sectors of the economy. This is due to their competitiveness level, the impact of sanctions, and historical development features that have influenced

the acceptance or rejection of the open innovation ideology.

Overall, it can be stated that the author's hypothesis about the possibility (and, in some cases, the advisability) of applying the ecosystem approach as a mechanism for crisis management in certain sectors of the national economy has been fully confirmed.

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Paradigm Shift: Will "Productivism" Replace the Washington Consensus?

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ABSTRACT

The article examines the reasons for the emergence and theoretical content of a new political-economic concept "productivism", which claims to be doctrinal, replacing the neoliberalism and the "Washington Consensus". The article explains how productivism differs from previous economic theories. It also highlights some internal contradictions within productivism and explains why some people criticize it. Despite the fact that some authors consider productivism as a "New Supply-Side Economics", we propose to treat this concept not in the context of economic theories, as it does not have the relevant paradigmatic characteristics, but within the family of political-economic doctrines aimed at the direct justification of economic policy. In this case, productivism joins the American collection of "national developmentalism" doctrines, which has a long history and acute demand in the present period.

Keywords: political-economic doctrine; neoliberalism; economic development; bidenomics; industrial policy; productivity; protectionism

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INTRODUCTION

The economic and social dynamics of any nation, or even stable coalitions of nations, invariably necessitate a form of scientific "legitimation" aimed at convincing economic agents — ranging from ordinary wage earners to the presidents of major corporations and financial institutions — of the theoretical validity and necessity of the prevailing economic model. The greater the perceived significance of a given concept, as encapsulated in doctrinal economic principles, the more assured and stable the population's confidence in the system becomes. For instance, the economic policies pursued in the United States between the 1940s and 1970s derived legitimacy from the mutually reinforcing effects of robust economic growth and Keynesian economic theory, which provided a coherent explanation of its underlying principles and mechanisms. However, with the subsequent crisis of Keynesianism and the neoliberal revolution of the 1980s, a constellation of economic ideas rooted in neoconservative thought — monetarism, supply-side economics, and the rational expectations school — crystallized into the principles of the "Washington Consensus" in 1989, fulfilling a comparable legitimizing function.

In the contemporary context, neoliberalism, as a politico-economic doctrine that once underpinned the globalized order, is undergoing a rapid decline alongside the obsolescence of the globalization model it supported. The resulting intellectual void, characterized by the absence of a new organizing framework for the economic systems of the Western world, is increasingly being filled by emergent ideas and conceptual frameworks. These new paradigms are fundamentally antithetical to the principles of neoliberalism, emphasizing a departure from free trade and a reorientation toward production-oriented policies and industrial strategies. Among the multitude of competing proposals, many of which remain underdeveloped in terms of logical coherence, one concept stands out for its theoretical sophistication: the doctrine of productivism, or "productive economics", introduced in 2022 by

the prominent American scholar Dani Rodrik. This doctrine or "paradigm", as Rodrik himself prefers to describe it, has elicited significant attention and sparked substantive debate within American political economy discourse. The emergence of an anti-neoliberal consensus in the West, epitomized in part by the concept of productivism, is supported by compelling intellectual arguments. Notably, Rodrik's critique of globalization policies, articulated as early as 1997, presciently challenged the dominance of a model then at the zenith of its influence.

THE DECLINE OF THE NEOLIBERAL ERA

In 2000, U.S. President Bill Clinton proclaimed globalization to be "the economic equivalent of natural forces, such as wind or water," rather than "a machine that can be stopped or turned off.[1]" However, just over two decades later, the crisis of globalization has emerged as a recurring manifestation of the broader fragility of the neoliberal doctrine. The decline of neoliberalism as a dominant intellectual paradigm, not only within economics but across the broader spectrum of Western social sciences, has been evident for at least the past fifteen years. This shift has been closely associated with the onset of the global financial crisis and the "Great Recession" of 2008–2009, events frequently identified in academic literature as both triggers and turning points in this historical trajectory [3].

For instance, in their 2011 monograph, Duménil and Lévy [4] argued that the demise of neoliberalism as an economic model parallels historical developments at the turn of the 20th century. They draw an analogy to the period following the prolonged economic depression that began in 1873 and ended in the 1890s. The recovery from this period necessitated a managerial revolution and the intensification of financialization, which, while contributing to the exuberance of the 1920s, ultimately culminated in the Great Depression of 1929–1933. According to Duménil and Lévy, the structural similarities between the late 19th and early 20th centuries and the period spanning the 1990s to the early 2000s are striking. While the authors refrained from predicting a crisis on the scale of the Great Depression in 2011, they anticipated a profound restructuring of the prevailing economic model. They left unresolved the critical question of whether this would mark a new phase of neoliberalism or the establishment of an entirely new social order.

Western socio-political discourse is now replete with extensive analyses and reflections on this transformation. For instance, Louis Menand's "The Rise and Fall of Neoliberalism" provides a comprehensive assessment of the life cycle of this once-dominant paradigm [5].

The neoliberal economic model, characterized by the liberalization of financial markets and the prioritization of financialization over industrial production, resulted in an unprecedented surge in profitability from the low levels of the early 1980s. However, this model also facilitated extensive speculative activity and allowed financial institutions to appropriate an increasingly disproportionate share of national income, thereby exacerbating economic inequality. Despite the highly favorable conditions for capital accumulation fostered by neoliberalism, investment rates in core economies have decelerated over several decades. Furthermore, between 2007 and 2020, Western economies experienced the weakest post-crisis recovery in modern history. This phenomenon reflects what could be described as the "economic paradox of neoliberalism". As Saad-Filho observes, the exceptionally favorable conditions for capital accumulation have coincided with declining productivity and a heightened propensity for deeper and more protracted economic crises [6].

It is important to emphasize that the actual implementation of neoliberal economic policies has consistently been marked by a degree of cynicism and duplicity, as these policies have rarely aligned with the principles of neoclassical market purism. As early as 2005, D. Altman, a prominent advocate of neoliberalism, which posits that freer markets result in greater prosperity for all, was compelled to acknowledge: "The problem is that genuine neoliberals appear not to exist. The U.S. government,

[1] URL: https://www.wsj.com/articles/globalization-isnt-unraveling-its-changing-11650015032

like its principal economic competitors, does not seek open markets universally. If it did, the poorer nations so fervently defended by anti-neoliberals might be in significantly better condition.[2]"

J. Stiglitz saw this inconsistency, saying: "The neoliberal agenda has always been partially a farce, serving as a fig leaf for power politics. While financial deregulation was pursued, it was accompanied by substantial government subsidies. While 'free trade' was advocated, it coexisted with significant subsidies for large-scale agriculture and the fossil fuel industry.[3]"

This critique is echoed by Robert Reich, a prominent proponent of industrial policy. Despite his opposition to neoliberalism, Reich wryly remarked in 1985 that the Reagan administration had implemented "a more ambitious industrial policy than Democrats had ever dreamed of proposing." Decades later, Reich reaffirmed this position: "During the 1980s, significant debates arose concerning the transition to a 'new economy.' <…> Increasingly, there was recognition that government intervention was necessary to facilitate the economic shift from traditional industries <…> to high-tech sectors. <…> Without a well-defined industrial policy, the one that encouraged the downsizing of obsolete capacities in legacy industries, adoption of new technologies, investment in research and development for emerging sectors, and support for worker retraining, this transition would have been slower and more disruptive. <…> This is precisely what Reagan's administration pursued, actively promoting both advanced technologies and the defense industry. The U.S.'s emerging sectors, including advanced computing, lasers, fiber optics, new materials, and biotechnology, reaped substantial benefits as a result." [7].

The renowned Keynesian economist and Nobel laureate Joseph Stiglitz, a steadfast advocate of traditional liberal principles as evidenced by his recent publication, "The Road to Freedom: Economics and a Good Society" [8], has issued a definitive critique of neoliberalism. In his article, "Neoliberalism Must Be Recognized as Dead and Buried," Stiglitz asserts that "The neoliberal experiment, characterized by lower taxes for the wealthy, deregulation of labor and product markets, financialization, and globalization, has proven to be a spectacular failure.[4]"

The economic policies pursued by the last two U.S. presidents signify a clear departure from neoliberal paradigms. From its outset, "Bidenomics" symbolized a decisive break with neoliberal doctrines. The administration's four landmark legislative initiatives, particularly the Inflation Reduction Act (IRA), embodied a substantial shift toward government intervention through extensive public funding, incentives, and subsidies. This development marked the reemergence of industrial policy as a central economic strategy [9]. Moreover, the Biden administration's explicit rejection of free trade policies[5] signaled a fundamental departure from the neoliberal economic framework championed by his Democratic predecessors, Bill Clinton and Barack Obama.[6] Robert Reich,[7] a prominent advocate of industrial policy, welcomed this shift, recalling that free trade had previously cost the United States millions of high-paying industrial jobs.

Biden's divergence from neoliberalism during his first term is particularly striking given his historical alignment with the neoliberal order.[8] Throughout his extensive political career, Biden was a prominent figure within the Washington establishment, which advanced economic globalization and embraced the tenets of free trade and fiscal responsibility.[9] However, his recent policy trajectory reflects a broader

[2] URL: https://www.nytimes.com/2005/07/16/business/worldbusiness/neoliberalism-it-doesnt-exist.html?searchResultPosition=14.

[3] URL: https://www.project-syndicate.org/onpoint/what-comes-after-neoliberalism

[4] URL: https://www.theguardian.com/business/2019/may/30/neoliberalism-must-be-pronouced-dead-and-buried-where-next

[5] URL: https://prospect.org/blogs-and-newsletters/tap/2024–05–24-biden-vs-free-trade-blob/

[6] URL: https://www.washingtonpost.com/business/2023/08/27/biden-trade-trump/

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[8] URL: https://jacobin.com/2018/08/joe-biden-neoliberal-democrat-conservative-lobbying

[9] URL: https://www.washingtonpost.com/world/2021/04/05/biden-infrastructure-plan-neoliberalism/.

repudiation of neoliberal orthodoxy and a deliberate reduction in the influence of academic economists on policymaking. The Biden administration has distanced itself from the cohort of economists that rose to prominence during the Clinton and Obama administrations. Rooted in the neoclassical "efficient markets" orthodoxy, these economists have struggled to address novel and unprecedented challenges, such as global climate change. Consequently, Biden's administration lacks the centralized economic advisory axis that defined previous administrations, such as Larry Summers, Tim Geithner, and Peter Orszag under Obama, or Robert Rubin and Summers under Clinton.[10]

Jake Sullivan, the U.S. National Security Advisor and a principal strategist behind Bidenomics, officially declared the "death" of neoliberalism in April 2023. Sullivan argued that the neoliberal economic paradigm had led the country into a state of stagnation, rendering it incapable of addressing four critical challenges currently confronting the United States: the degradation of its industrial base; the need to adapt to a new geopolitical environment defined by competition; the intensifying climate crisis and the imperative of transitioning to sustainable energy; and the growing levels of inequality. In declaring the demise of the neoliberal "Washington Consensus", Sullivan called for the construction of a new economic consensus, positioning President Biden's "new course" as a contemporary manifestation of Franklin D. Roosevelt's New Deal, which had been instrumental in rescuing America from the Great Depression.[11]

Similarly, in the United Kingdom, the Conservative Party, once closely aligned with Margaret Thatcher and her archetypal neoliberal "Thatcherism", has explicitly distanced itself from the values associated with neoliberalism in its official policy documents. The Conservative Party's 2017 election manifesto, under Theresa May's leadership, proclaimed: "We do not believe in untrammeled free markets. We reject the cult of selfish individualism. We abhor social division, injustice, dishonesty, and inequality." Such rhetoric, more commonly associated with socialist ideologies, symbolized a fundamental departure from the neoliberal orthodoxy. May's radical left-leaning stance on inequality and social division signified the conclusion of the Anglo-American revolution of the 1980s, which had advocated for reduced governmental intervention and free-market primacy. Observers have noted that policymakers are now striving to formulate a new economic consensus, often revising or abandoning their historical positions.[12]

Consequently, Western socio-political thought, having lost confidence in the once-dominant neoliberal economic framework and its doctrinal foundations encapsulated in the Washington Consensus, finds itself in a state of intellectual disarray or in search of a new trajectory for future development. At present, fragmented and disordered conceptual frameworks are colliding in unpredictable ways, awaiting the emergence of a new intellectual focal point. Among the competing ideas is the concept of "productivism", introduced in 2022 by Harvard University professor Dani Rodrik.

WHAT IS PRODUCTIVISM?

Dani Rodrik aptly observes that "economic policy must be based on a unifying and inspiring vision", which implies adhering to an authoritative consensus recognized by key economic elites. In the past, this consensus was represented by Keynesianism, followed by neoliberalism, but due to the discrediting of the latter, Rodrik proposes a new "candidate" — productivism. "This approach prioritizes the spread of productive economic opportunities across all sectors of the economy and segments of the workforce. It differs from the neoliberalism that preceded it in that it assigns a significant role to governments (and civil society) in achieving this goal. Furthermore, it places less

[10] URL: https://www.nytimes.com/2021/04/08/opinion/biden-jobs-infrastructure-economy.html.

[11] URL: https://www.whitehouse.gov/briefing-room/speeches-remarks/2023/04/27/remarks-by-national-security-advisor-jake-sullivan-on-renewing-american-economic-leadership-at-the-brookings-institution/.

[12] URL: https://www.nytimes.com/2017/06/20/magazine/the-rise-of-jeremy-corbyn-and-the-death-throes-of-neoliberalism.html?searchResultPosition=8

trust in markets and is suspicious of large corporations — for productivism, the focus is not on finance, but on production, investment, and the revitalization of local communities" [10]. Rodrik has formulated a new "value triangle" of productivism — production, work, localization — which he proposes should replace the "triangle" of neoliberalism — finance, consumerism, and globalization [1].

Productivism also differs from the Keynesian paradigm or the Keynesian-Rooseveltian consensus that preceded neoliberalism. Keynesianism, especially at its peak, relied on the potential to build a welfare state through aggregate demand management, income redistribution, social transfers, and so on. Productivism, however, is a "supply-side" theory aimed at creating productive jobs for all. Moreover, the new concept distinguishes itself from its predecessors by following Rodrik's earlier idea about the exaggerated dangers of populism in the economic sphere [11].

Rodrik argues that the major economic problems of the developed Western countries — poverty, inequality, alienation (exclusivity), and insecurity — have multiple causes, but they are daily reproduced and exacerbated within the framework of the current business model, which is focused on short-term profit success. This model continuously generates externalities. Positive externalities (such as learning and innovation effects from R&D) justify tax breaks and other government subsidies, while negative externalities, such as environmental pollution, justify regulatory interventions.

Rodrik suggests considering the external effects of "good jobs" as positive externalities, as they provide a pathway to the middle class, and firms creating such jobs contribute to the viability of their communities. Conversely, a lack of good jobs leads to social (manifesting as alienation, family breakdown, drug addiction, dependency, and crime), political, and economic costs.

The shortage of "good jobs" results from the gradual leveling of production conditions between developed and developing countries due to the mass offshoring from the former to the latter during globalization. Consequently, the "dualism effect" in production, formulated by Nobel laureate W.A. Lewis in 1979 for developing countries, has recently become relevant for developed nations as well. The essence of the effect is the existence of two economic sectors: a small industrial one utilizing high-productivity technologies and a large "traditional" one characterized by low productivity and low wages. However, Lewis's 1954 model assumed that the development of underdeveloped countries would occur through the absorption of labor from the traditional sector by the advanced industrial sector. Yet, advances in automation over the past 70 years have altered this dynamic: the industrial sector has been shrinking, not only in newly industrialized countries like China and India but also in exemplary industrial nations such as Japan and Germany.

Production dualism has become typical in developed countries due to deindustrialization and globalization, creating a pressing issue in the West of a disappearing middle class [13]. Today, Western politicians and officials are tackling the same challenges that were traditionally outlined in development economics for underdeveloped countries: how to attract investment, create jobs, improve skills, stimulate entrepreneurship, expand access to credit and technology — in other words, how to reduce the gap with more developed and productive parts of the national economy. Rodrik's proposed productivism aims to enhance the productive potential across all layers and regions of society. "This economic policy should directly contribute to increasing the quantity and quality of jobs available to less educated and less skilled members of the workforce, where they prefer (or can afford) to live" [10]. Of course, productivism is not feasible without industrial policy, which must take on new characteristics. Rodrik does not believe that the old principles of industrial policy — selecting "winners and losers" with their accompanying inefficiencies and corruption — are adequate for productivism. In his view, the most effective industrial policy is one that entails close cooperation between public authorities and private companies, where the latter

receive essential public resources — financial support, skilled workers, or technological assistance — in exchange for achieving "soft" and evolving goals in the areas of investment and employment.

Rodrik does not believe that new "good jobs" will necessarily be created within the industrial sector. He does not support the views of those who argue that only manufacturing can generate well-paid and promising jobs. For instance, Jeff Ferry, the chief economist of the "Coalition for a Prosperous America", maintains that industrial production will remain the key to economic growth in the 21st century due to two unique characteristics: "scalability and reach". Scalability means that the expanding manufacturing sector benefits from economies of scale. … Manufacturing also has "reach"[13]…" It can provide employment to a significant portion of the population, employing millions of workers[14]". Ferry strongly endorsed Rodrik's concept in an article titled "Productivism — The Key to National Prosperity" [14], seeing it as focused on creating productive opportunities within the country.

Rodrik argues that within the framework of productivism, as with any other economic policy narrative, the favorite neoliberal argument against government intervention — namely that the state lacks the information and capacity necessary to achieve positive structural changes in the economy — must be rejected. Productivism should shift economic thinking and make the "state-market" dichotomy irrelevant, as both are complementary rather than substitutive. The standard "top-down" model of economic regulation based on "principal-agent" frameworks becomes obsolete.

Finally, Rodrik warns about the entrenched institutions that universalized economic principles during the dominance of previous paradigms: "By the time a certain set of ideas becomes accepted wisdom, it is filled with universal generalizations and truisms that inevitably prove to be useless and misleading. Productivism may be the right approach to solving current challenges. However, the more successful it becomes, the less relevant it will be for future challenges" [10].

INTERPRETATION OF PRODUCTIVISM

Productivism, as a novel economic paradigm, has elicited a range of responses within Western political-economic circles, reflecting a significant degree of ambivalence. One of its most consistent proponents is Jeff Ferry, who underscores the industrial and production-focused ethos of productivism, positioning it as a counterpoint to neoliberal globalization, which has led to the loss of millions of jobs in the United States. Conversely, numerous economists and political commentators, particularly from the academic sphere, identify substantial conceptual contradictions and ambiguities inherent in the productivist framework.

Felix Salmon, a commentator for the financial analytical outlet "Axios", when evaluating productivism's effort to establish a new political consensus, observes that it is sufficiently broad to encompass political figures such as Donald Trump, Joe Biden, and Boris Johnson. However, Salmon argues that while Keynesianism and neoliberalism had solid academic foundations, productivism is merely a collection of populist intuitions, lacking a comprehensive or coherent theoretical structure. He posits that productivism's core essence lies in its critique of large corporations that, particularly during inflationary periods, profit at the expense of consumers, and argues that the proposed new consensus, which spans the political spectrum, "rejects globalism and liberal capitalism in favor of something more localized and state-managed".[15]

Professor James K. Galbraith, drawing on his distinguished father John K. Galbraith's work, identifies internal contradictions within Rodrik's conception of productivism. Galbraith argues that "productivity"

[13] The author takes the term. The author uses the term "reach" in quotation marks, emphasizing the ability of industrial production to reach (the main meaning of the term reach) significant distances in physical space through supply chains.

[14] URL: https://www.industryweek.com/the-economy/competitiveness/article/21272198/the-idea-of-a-manufacturing-delusion-is-delusional-itself

[15] URL: https://www.axios.com/2022/07/10/productivism-policy-consensus necessary

is conventionally defined as the ratio of output to labor (Y/L), where Y represents output in physical units, and L denotes labor time. According to this definition, productivity increases as the labor component decreases, typically through the elimination of jobs and their replacement by machines. This dynamic, Galbraith suggests, explains why, in capitalist economies, firms strive to reduce "good jobs", while governments and unions seek to resist such trends. At the same time, government and non-profit sectors play a crucial role in creating additional employment opportunities to offset reductions in the private sector. In this context, Galbraith contends that to achieve the goal of "good jobs with decent wages", there is no alternative to laws, institutions, unions, wage standards, and countervailing power. The challenge is not to align firms with this goal through market incentives, but rather to regulate and counteract the market in the interests of a stable and prosperous society. Consequently, he asserts that defending this position requires rejecting the current mainstream economic paradigm [15].

It is worth noting, however, that Rodrik, first, does not view industrial production with its significant potential for labor substitution as the principal source of good jobs, and second, he fully supports an active role for the state in replacing market forces to generate employment. In this regard, his brand of productivism seeks to establish an alternative paradigm to the mainstream economic model.

A second critique raised by Galbraith concerns Rodrik's skepticism toward large corporations, which seems puzzling given the son of the author of "The New Industrial State" and the term "technostructure". Galbraith questions whether Rodrik truly advocates for manufacturing automobiles in small workshops or producing steel in backyard furnaces[15]. Furthermore, Galbraith contends that productivism does not appear to belong to any recognizable unorthodox tradition within economic thought.

Indeed, productivism does not represent a fully developed and refined theoretical framework, but rather a loosely coordinated set of doctrinal propositions aimed at addressing the challenges posed by contemporary "tectonic processes of global transformation".[16] As such, it has yet to secure a definitive position either within mainstream economic thought or among established heterodox economic schools.

Productivism has found some unexpected allies, including Daron Acemoglu and James A. Robinson, authors of globally recognized bestsellers, who paradoxically argue that neoliberal and democratic forces in the West should be more attentive to well-functioning economies under authoritarian regimes, such as China, as economic prosperity over time provides a pathway to democratic values. The example of Taiwan [16], they contend, supports this argument. In light of this, D. Mamun suggests that productivism represents the missing theoretical foundation in economic literature, emphasizing progress as a result of economic growth capable of addressing long-standing issues such as unemployment and inflation. If businesses can create "good jobs" through innovation, this will not only increase wages but also reduce production costs (thereby reducing inflation) and partially alleviate the outsourcing needs of enterprises, thereby reducing unemployment [17].

Finally, productivism has found support in the United Kingdom, where leaders of the revitalized Labour Party have adopted the term "securonomics" as a central tenet of their economic platform. Rachel Reeves, the new leader of the Labour Party, defines "securonomics" as the "practical restoration of the balance between market forces and state control, shifting greater power to the latter". She views "securonomics" as fundamentally rooted in the belief that economic security must take precedence over foreign initiatives. Reeves has frequently referred to the "modern supply-side economy", though George Dibbs of the left-wing analytical center IPPR asserts that "productivism"[17] is a more apt description of her economic approach.

Political philosophers argue that "securonomics" represents a response to contemporary political maneuvering, reflecting the Labour Party's

[16] URL: https://iz.ru/news/511884

[17] URL: https://theweek.com/business/economy/securonomics-what-is-rachel-reeves-economic-plan-and-will-it-work

efforts to address the changing political and economic landscape. By emphasizing economic security, "securonomics" highlights the analysis of the economic consequences of the geopolitical divide emerging between two competing blocs: one centered around the United States and Europe, and the other around China and Russia.[18]

CONCLUSION

In conclusion, it is evident that Dani Rodrik's concept of productivism, as an attempt to establish an alternative paradigm in economic theory, remains significantly distant from its intended goal. Productivism lacks the requisite model constructs and a comprehensive set of new categories needed to adequately describe its subject matter in theoretical terms. Proponents of productivism highlight its focus on expanding productive capabilities, drawing parallels with the supply-side economic theory that gained prominence during the Reagan era. In this context, they attempt to position productivism as a "new supply-side economy". However, this endeavor is likely to encounter limitations, as an inherent contradiction arises between the "old" and "new" economic paradigms. The former regards the state as the primary impediment to growth, while the latter identifies it as a key driver of progress in contemporary economic contexts.

Moreover, productivism faces difficulty in finding a comparable theoretical kin within non-mainstream economic schools. Post-Keynesianism remains deeply embedded in the monetary paradigm, a framework that productivism does not endorse. Similarly, contemporary neo-institutionalism operates within a distinct theoretical framework, governed by alternative categories and dynamics. Left-wing radical and neo-Marxist theories, which emphasize the critique of capitalism, would likely find productivism at odds with its aim of stabilizing and improving what they perceive as an exploitative system.

Nevertheless, when examined from a broader methodological perspective, particularly through the lens of the traditional political-economic approach rooted in mercantilist thought [18]—where national economic development is considered the paramount objective — productivism reveals its alignment with a longstanding American intellectual tradition. This tradition is encapsulated in the concept of "national developmentalism", as articulated by R. Atkinson and M. Lind [19]. They identify five distinct schools of thought, each presenting a different vision of how the United States should engage with the global economy and govern its own: global libertarianism, progressive localism, national protectionism, global neoliberalism, and national developmentalism. Each of these schools articulates its vision of a just society, expressed through its own preferred mix of policies regarding businesses, trade, and immigration.

"Unlike global neoliberals, libertarians, and progressive localists, but akin to national protectionists, national developmentalists perceive national economies as directly competing with one another for high value-added production and the well-paid employment it facilitates" [19]. National developmentalism embraces large corporations as key drivers of innovation. The government, in this framework, is envisioned as a "coach", assisting American firms in competing on the global stage, fostering innovation, and enhancing productivity, while concurrently attracting high value-added foreign production. The ideological origins of developmentalism lie in the works of F. List, T. Veblen, J. Commons, and J. Schumpeter, and align with a tradition that, in the late 20th century, underwent a renaissance under the term "evolutionary economics" (Richard Nelson).

In a subsequent work, R. Atkinson, while critiquing the "Neo-New Dealism" (the Biden administration's efforts to implement economic policies reminiscent of Franklin D. Roosevelt's New Deal), articulates five core principles of national developmentalism that define its identity and distinguish it from other schools of thought [20]:

[18] URL: https://renewal.org.uk/bringing-securonomics-down-to-earth/

1. The primary focus is on growth, particularly productivity, innovation, and competitiveness.

2. The development of strong, dynamic opportunities for firms of all sizes, particularly large corporations, is central to achieving growth.

3. A carefully devised and implemented state policy is of paramount importance.

4. National development is more oriented toward goals than processes (in contrast to neoliberals and neo-progressives, who prioritize processes).

5. National developmentalism rejects the neoliberal and Marxist dialectic of capital and labor ("Neo-New Dealism"): capital and labor are not in a zero-sum competition, where the success of one necessarily detracts from the other.

The conceptual frameworks of Atkinson and Rodrik exhibit notable similarities, as both offer not an abstract, logically refined, and overly simplified theoretical model of economics, but rather a set of economic principles addressing the pressing challenges currently confronting the United States and the West. Both frameworks emerge from a fundamentally different (in contrast to the prevailing economic orthodoxy) competitive, rather than equilibrium-based, ontological worldview. Atkinson's work consistently emphasizes that national developmentalism does not adhere to the foundational notion of neoliberalism (and, by extension, the broader contemporary mainstream) of market equilibrium, and similarly, Rodrik's productivism does not conform to this ontological premise, but instead seeks an alternative.

Therefore, the search for a new doctrinal-type political-economic framework capable of guiding economic policy in the evolving global landscape has become an increasingly critical pursuit in Western political discourse. The ideological collapse of neoliberalism as the dominant derivative of neoclassical orthodoxy in the era of liberalization, which has failed to function as an adequate theoretical foundation for economic policy during periods of deglobalization and escalating inter-state competition, has catalyzed the need for alternative conceptual paradigms. The central criteria for the relevance and urgency of these new concepts are the challenges associated with preserving and rebuilding the national industrial base, particularly in the context of competition with China. Questions surrounding domestic production and employment — often at the expense of comparative advantage in costs and international specialization — now dominate discussions surrounding the emergence of new economic doctrines.

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Information Basis to Assess Russian Technological Security: Problems and Solutions

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ABSTRACT

In this study we continue the research on the main indicators of Russia's technological security assessment. In previous study we identified and outlined the main vulnerabilities in the information base for assessing technological development. In this article we will consider the ways to address the problems identified earlier in order to improve the information base and minimise threats to technological security. The methodological basis of the study comprises the normative documents defining the technological development of the Russian Federation, as well as the information base of its indicators. The authors analysed the main strategic documents to determine whether there is a methodological basis for calculating the indicators contained in them, the relevance of their target values and the consistency of planned values with the nature of their dynamics at the present time — to identify the possibility of achieving them. The authors assess the relationship between the level of depreciation of fixed assets in the regions of Russia and the degree of reconstruction and modernization of fixed assets. The article suggests directions of improvement of the information base of indicators, necessary for their improvement and updating.

Keywords: technological sovereignty; technological development; information base; indicators of technological development

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INTRODUCTION

At the current stage, Russia faces challenges and threats to economic security, which necessitate the identification of directions for establishing technological sovereignty based on the development of high-tech industries and innovation-driven economic growth. The primary strategic documents on technological development outline goals for achieving independence in this critical area for the country and indicators for each goal. However, assessing the effectiveness of state policy measures and monitoring the achievement of these goals require an informational foundation. Much scientific research today is dedicated to the quality of indicators for technological independence.

The issue of selecting indicators that can assess the achievement of sovereignty is actively discussed: scientists emphasize the need for their development and for "measuring achieved results and comparing them with costs and potential alternatives" [1]. It is also noted that analyzing the dynamics of key indicators of technological security will help determine its state and identify strengths and vulnerabilities [2]. In publications by foreign authors, it is suggested that the system of technological sovereignty indicators should include qualitative indicators in addition to quantitative ones, allowing for an understanding of when a country can rely on its own resources and when it depends on others [3]. Some researchers propose combining quantitative indicators with expert surveys to assess the level of technological sovereignty, while also utilizing not only statistical data but also patent and bibliometric indicators [4]. Many researchers stress the need to consider limitations when selecting indicators. One of the studies describes difficulties encountered with official statistical data when assessing technological sovereignty: the data is not always available, its reliability is questioned, and the lack of a unified methodology complicates international comparisons [5].

There are also shortcomings in the domestic information base for assessing technological security: it is noted that there is no continuity between the indicators established by key regulatory documents [6]; some indicators are still under development [7]; and threshold values for key technological development indicators are absent [8–10]. In a previous article, the authors examined the main indicators for assessing technological security in Russia [11]. This study proposes solutions to the identified problems to improve the informational foundation and minimize threats to technological security.

RESEARCH RESULTS

In developing proposals to improve the information base of the technological security indicator system, it was taken into account that this system is part of economic security, which, in turn, is an element of national security. It was also considered that security cannot be absolute, and the domestic technological development sphere is not isolated but interconnected with other countries worldwide.

One of the shortcomings of the current information base for indicators is the partial connection between them and their incomplete alignment with the indicators established in key documents regulating technological development. Therefore, this system requires an update and improvement to enable effective monitoring of proposed measures.

In our view, to assess Russia's technological development, it is essential to evaluate the state of the technological sphere to promptly identify challenges and threats. For instance, the Economic Security Strategy[1] identifies creating economic conditions for the development and implementation of modern technologies as one of the measures to ensure security (Section III, Clause 15.3). This means that the conditions established in the economy for technological development are an element of technological

[1] URL: https://www.garant.ru/products/ipo/prime/doc/71572608/

Table

Compliance of indicators of the state of the technological sphere recommended by the Ministry of Economic Development and the Economic Security Strategy

Methodological Recommendations by the Ministry of Economic Development	Economic Security Strategy
Share of investments in fixed assets in GDP	Share of investments in fixed assets in GDP
Physical volume index of investments in fixed assets, % year-on-year	–
Renewal rate of fixed assets by economic sectors, for commercial and non-commercial organizations	–
Share of machinery and equipment in the total volume of fixed assets by economic sectors, for commercial and non-commercial organizations	Share of investments in machinery and equipment in the total volume of investments in fixed assets Share of machinery, equipment, and vehicles in total imports
Share of information, computer, and telecommunication equipment, as well as intellectual property objects and intellectual activity products, in the total volume of fixed assets	–
Degree of depreciation of fixed assets	Degree of depreciation of fixed assets

Source: compiled by the authors.

security in the narrow sense and economic security in the broader sense. Unfortunately, none of the strategic documents defining Russia's technological development include indicators of the state of the material base for creating and implementing technologies. This omission prevents the identification and mitigation of potential threats.

One of directions for improving the information base for technological security assessment is the inclusion of indicators reflecting the state of the material base. These indicators would serve as markers of potential threats in creating economic conditions for developing and implementing modern technologies.

As early as 2020, Russia's Ministry of Economic Development recommended assessing the state of the technological sphere. It approved methodological guidelines[2] containing twenty-three indicators grouped into five categories. The Economic Security Strategy proposes forty indicators for monitoring threats to Russia's economy. A comparison of the two documents shows that three indicators overlap, and three additional indicators proposed by the Ministry of Economic Development aim to expand the set of metrics characterizing the intensity of economic asset modernization (see *Table*).

One of the indicators of technological security is the share of investments in fixed assets as a percentage of GDP.

Additionally, in our view, the physical volume index of investments in fixed assets is an important metric, as it is sensitive to both domestic crises and external shocks. As shown in *Figure 1*, the physical volume index of investments in fixed assets significantly declined during the 2008 financial crisis (by 13.5%), the imposition of sanctions in 2014 (by 10.1%), and the COVID-19 pandemic (by 0.1%).

The depreciation of fixed assets, which reflects the state of economic sectors for technol-

[2] URL: https://ivo.garant.ru/#/document/73685552/paragraph/7:0

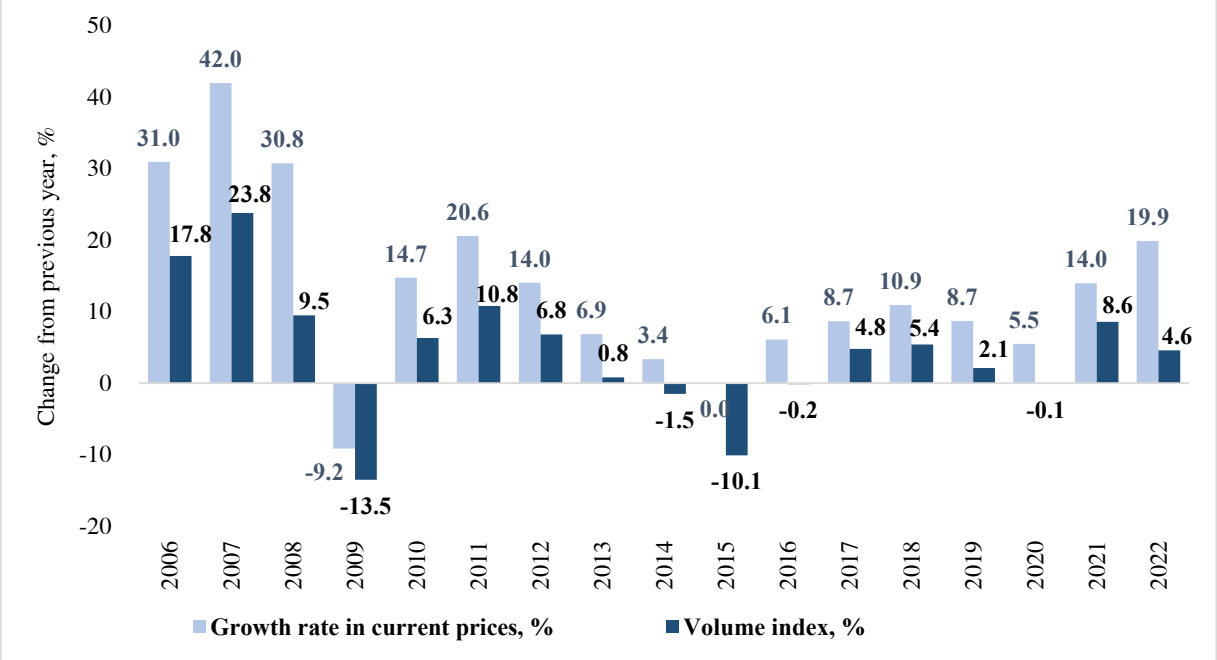

Fig. 1. **Percentage growth of investments in fixed assets in current and comparable prices**

Source: compiled by the authors.

ogy creation, also poses a threat to technological security. As of 2022, Russia's fixed assets were 41% depreciated: machinery and equipment were the most depreciated at 64%, followed by buildings at 54% and vehicles at 49%. This highlights the need for modernization and reconstruction. However, in 2022, with investments in fixed assets totaling 28 trillion rubles, only 14% was directed toward technological development of economic sectors, i.e., reconstruction and modernization. A statistical analysis was conducted to assess the correlation between the level of fixed asset depreciation and the level of reconstruction and modernization of fixed capital. The data used for this analysis was provided by the Federal State Statistics Service.[3] The analysis was carried out across 85 regions of the Russian Federation using the Spearman non-parametric test. The relationship was considered statistically significant at $p < 0.05$. The results showed no statistically significant correlation between the indicators (*Spearman's coefficient* = 0.061; $p = 0.578$), indicating an imbalance between the technological state of the economy and the measures taken to improve it. To monitor the level of modernization and reconstruction of fixed assets, it is advisable to consider the indicator for the share of investments directed toward this in the total volume of investments in fixed assets. Additionally, it is necessary to track the level of the physical volume index of investments in fixed assets and the degree of fixed asset depreciation.

It seems necessary to give uniform names to the indicators established in strategic documents on technological development.

Given that in 2022 the government[4] introduced a moratorium on accounting for scientific publications in journals indexed in international databases, it would be appropriate to remove the indicator reflecting Russia's position in these journals.

[3] URL: https://rosstat.gov.ru/folder/14304; https://rosstat.gov.ru/folder/11189

[4] URL: https://base.garant.ru/403731094/ (дата обращения: 22.09.2024).

The indicator demonstrating the dynamics of internal costs for research and development in the 2024 Strategy[5] is called "growth in the volume of internal expenditures for research and development", while in the 2023 Concept,[6] it is referred to as "growth rate of internal expenditures on research and development at comparable prices to 2022". The latter definition, in our view, more accurately reflects the dynamics of the indicator and is more suitable as an indicator of technological development.

For the indicator characterizing the sufficiency of young researchers, there are also two different formulations: in the 2016 Strategy,[7] it is "the share of researchers under 39 years old in the total number of Russian researchers," while in the 2024 Strategy, it is "the share of young scientists in the total number of scientists." Since data on researchers under 39 has been collected and published for a long time, it is advisable to stick with the first formulation.

Bringing the information base of indicators into uniformity and selecting those that will serve as indicators of technological security will allow for monitoring, timely identification of threats, and finding ways to eliminate them. In our opinion, given the tight deadlines for achieving technological security set by the 2024 Strategy, it is necessary to refine the existing information base of indicators, excluding outdated ones and clarifying the formulations of the relevant ones, selecting those that can already serve as the foundation for assessing technological security, with subsequent improvements.

To modernize the information base, it is essential to intensify efforts in developing methodologies for calculating technological security indicators. The analysis of key strategic documents revealed that, currently, there is no calculation methodology for six indicators out of the sixteen outlined in the 2023 Concept. These include: (1) the achieved level of technological sovereignty, (2) the achieved level of development of critical and cross-cutting technologies, (3) the growth rate of innovative products, works, and services by small technology companies, (4) the number of small technology companies, (5) the growth rate of investments in small technology companies, (6) the share of high-tech industrial products produced in Russia in the total consumption of such products in the country.

There is so far no calculation methodology for two of the five indicators outlined in the 2024 Strategy: (1) the volume of tax revenues to the budget from the sale of products manufactured using domestic technologies, (2) the ratio of sales of domestic science-intensive products to the volume of purchases of similar foreign products.

The calculation methodology for the indicator of the share of organizations engaged in technological innovation within the total number of organizations needs clarification. In December 2019, it was amended, and the value of the indicator since 2017 was recalculated, resulting in a sharp increase from 7.5% to 20.8%. The Accounts Chamber of Russia established that, during statistical monitoring, ambiguous criteria were used to select organizations,[8] and it also pointed out the low coverage (only 50,000 organizations were included in the sample, while the total number was 284,000).

For some indicators of technological development, target values are either missing or have become outdated. Currently, there is a need to determine threshold values for indicators that characterize the technological security of the country.

For monitoring the implementation of the 2016 Strategy, the set of indicators was approved by a government decree,[9] and the planned values were set by the State Program "Scientific

[5] URL: https://www.garant.ru/products/ipo/prime/doc/408518353/

[6] URL: https://www.consultant.ru/document/cons_doc_LAW_447895/

[7] URL: https://base.garant.ru/71551998/

[8] Accounts Chamber of the Russian Federation. Perchyan A.V. Technological development is not subject to statistical observation: the monitoring methodology needs to be improved. July 14, 2020 URL: https://ach.gov.ru/checks/12198

[9] URL: https://legalacts.ru/doc/postanovlenie-pravitelstva-rf-ot-07042018-n-421-ob-utverzhdenii/#

and Technological Development of the Russian Federation,[10]" which has undergone six revisions. Currently, the established planned values have lost their relevance, even though eleven indicators for assessing Russia's scientific and technological development have not been canceled. For monitoring the indicators of the 2024 Strategy, target values have not yet been established, while in the 2023 Concept, target values have been developed for fourteen out of sixteen indicators, six of which are in the form of growth rates at comparable prices to 2022.

This creates a problem, as indicators without developed target values (and in the case of security diagnostics, it is better to speak of threshold values) cannot fully reflect the state of technological security. The target values presented in the 2023 Concept reflect the level of technological development that is planned to be achieved by a certain year, and they should not be considered as indicators of technological security threats, since they have a different nature and do not address the set task.

We agree with researchers of economic and technological security monitoring systems that the foundation of assessment should be indicators for which threshold values have been developed, allowing the differentiation of various states of technological security. This is the so-called indicative approach to monitoring, which provides the opportunity to assess the current level of technological security and reflect the threats outlined in the main strategic documents of technological development. Indicators of the material base for the creation and implementation of technologies should increase as it improves; they should be correlated with the costs that contribute to technological development and the results achieved. Moreover, it is desirable for them to be aligned with the indicators of industrial policy effectiveness, as industrial policy is the main mechanism ensuring technological security.

Let us analyze the target values of some indicators that can be considered as indicators of technological security.

The development of the technology sector is determined by the volume of internal expenditures on research and development. This indicator appears in all three strategic documents: in the 2016 Strategy, expenditures are

[10] URL: https://ivo.garant.ru/#/document/77317971/paragraph/2:5

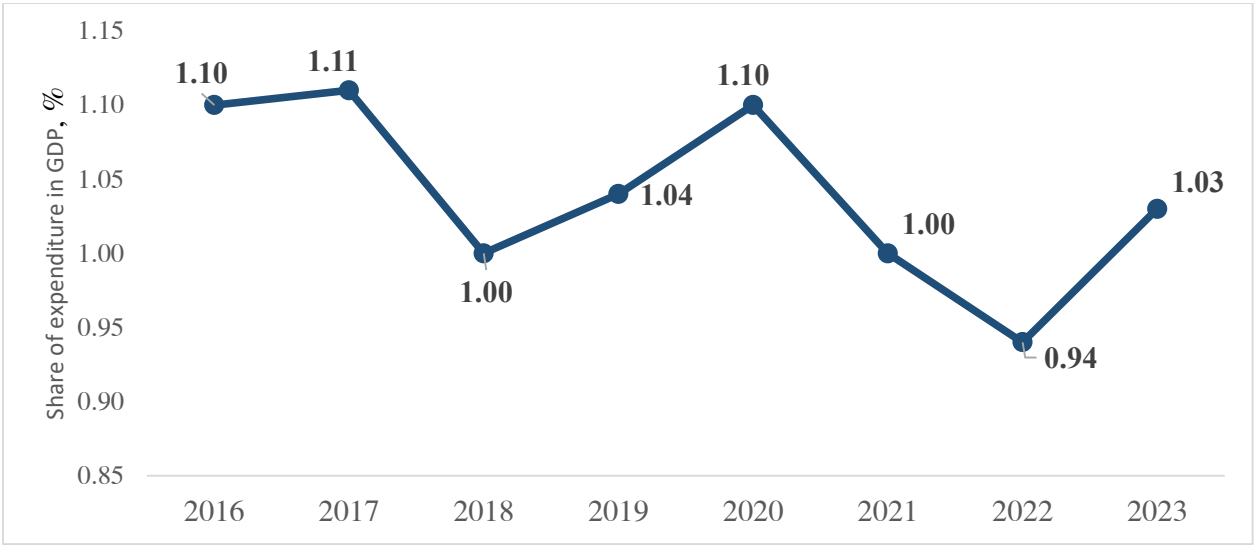

Fig. 2. **Dynamics of the share of domestic R&D expenditures in GDP for the period 2016–2023**

Source: compiled by the authors on the basis of: URL: https://rosstat.gov.ru/statistics/science /

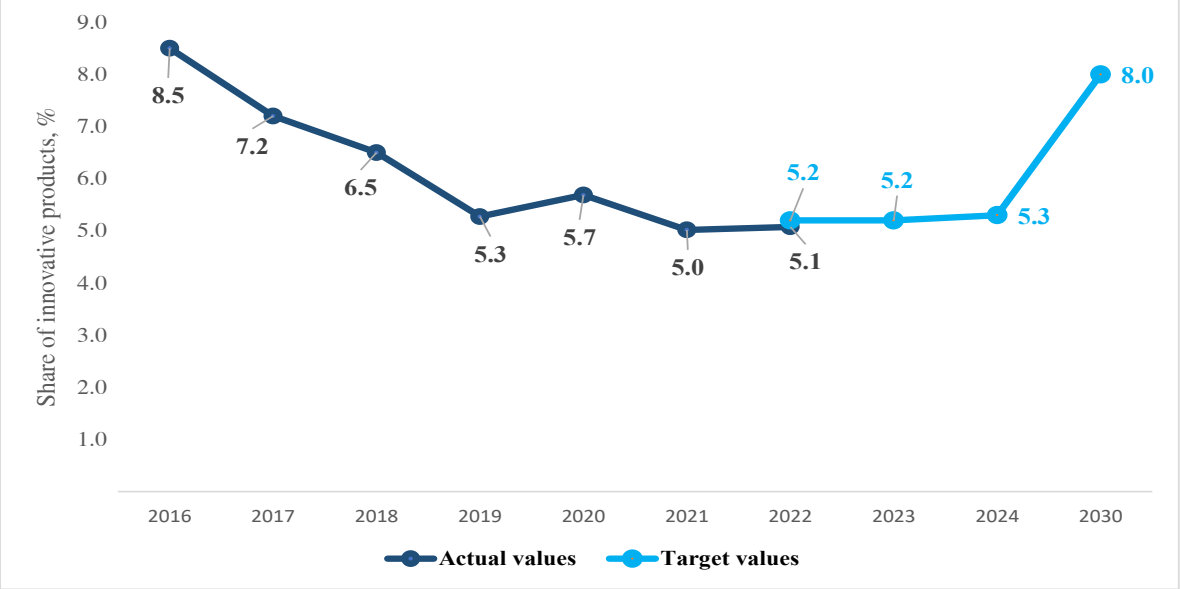

Fig. 3. **The share dynamics of innovative goods, works, and services in the total volume of goods shipped, works completed and services provided**

Source: compiled by the authors on the basis of: URL: https://rosstat.gov.ru/statistics/science

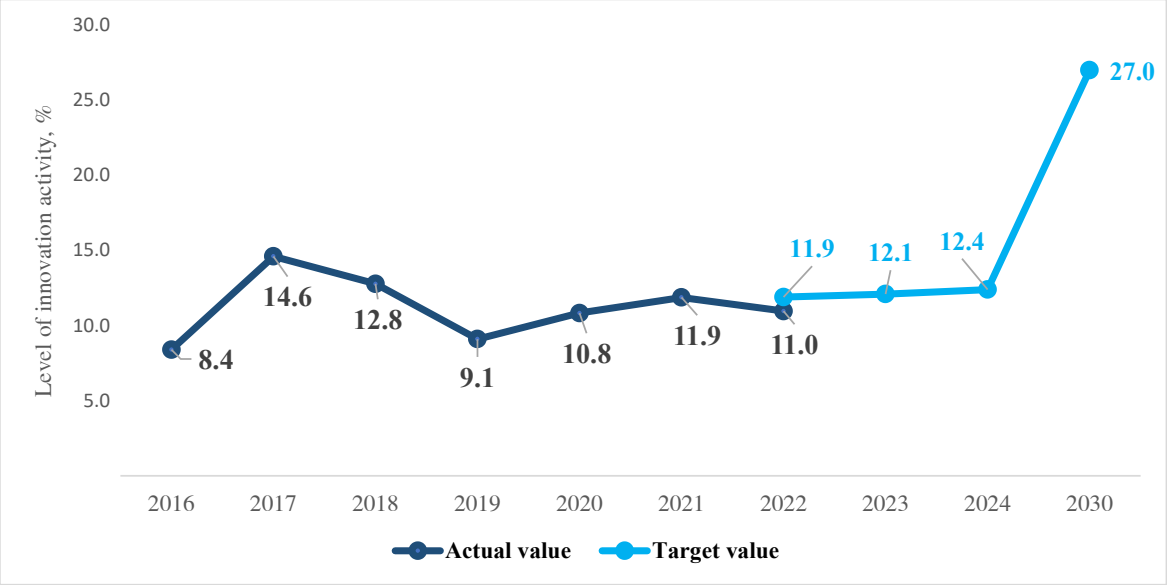

Fig. 4. **Innovation activity dynamics**

Source: compiled by the authors on the basis of: URL: https://rosstat.gov.ru/statistics/science

taken at current prices and compared with GDP; in the 2024 Strategy, it is recommended to calculate the growth of expenditures; and in the 2023 Concept, the growth rate is calculated at comparable prices to 2022. The 2016 Strategy assumed that by 2035, internal expenditures on research and development, as a percentage of GDP, should be at least 2%. From 2016 to 2023, the share of internal expenditures in GDP changed irregularly (see *Figure 2*) — it not only reached the target value but also did not approach it.

In order for the target value to be achieved, the share of internal expenditures in GDP should have increased by an average of 3% annually. However, significant fluctuations in the indicator resulted in an average growth rate of 99.1% over the period under consideration, which can be interpreted as an annual decrease of 0.9% on average. Even assuming that the target value of 2% was reached, it is still significantly lower than the levels of leading countries: the share of internal expenditures on research and development as a percentage of GDP is 6.0% in Israel, 5.2% in South Korea, 4.0% in Taiwan, 3.6% in the USA, and 3.4%[11] in Sweden.

The 2023 Concept includes a growth rate for internal expenditures on research and development at comparable prices to 2022: 146.3% by 2030. Intermediate values are also provided: 107.5% in 2023 and 109.2% in 2024. Since data for 2023 has not yet been published, it is not possible to assess how closely the actual growth rate matches the planned one.

Another important indicator of technological development is the share of innovative products in GDP. A retrospective analysis shows that from 2016 to 2022, this value decreased from 8.5% to 5.1% (see *Figure 3*). However, the 2023 Concept envisions growth to 8.0% by 2030, i.e., back to the 2016 level. To achieve this, the share of innovative products must grow by an average of 5.8% annually. Therefore, it is necessary to assess the validity of the planned indicators, considering that in 2022, the actual value was already below the target.

An important indicator for assessing technological security is the number of organizations engaged in innovation. From 2016 to 2022, there was an increase in innovation activity, partly due to changes in the methodology used by Rosstat to calculate this indicator in 2019. The values starting from 2017 were recalculated, which explains the sharp rise in the indicator in 2017 from 8.4% to 14.6% — the highest point in its actual dynamics (see *Figure 4*). After that, innovation activity decreased on average by 5.5% annually. However, the 2023 Concept envisages more than a twofold increase in growth by 2030, to 27%. To achieve this, the indicator should grow by an average of 11.9% annually, which does not align with the dynamics observed in the previous period.

An informative indicator for monitoring technological security is the technological dependence ratio, the calculation methodology of which needs clarification. However, if it is considered as the ratio of patent applications from foreign and Russian applicants, it is evident that technological dependence, fluctuating unevenly and abruptly between 2016 and 2022, overall decreased from 55.2% to 41.9%. This occurred against the backdrop of a 1.5-fold decrease in patent activity. Moreover, the rate of decline in Russian applications was higher than that of foreign ones, with an average annual decrease of 6.1% and 5.1%, respectively. The exception was 2022, when sanctions were imposed on Russia, and the rate of decline in foreign applications (30.3%) was ten times higher than the Russian rate (3.1%), which led to a reduction in technological dependence in the domestic intellectual property market.

The 2023 Concept provides for a reduction in Russia's technological dependence ratio to 27.3% by 2030. Considering that it was 41.9% in 2022, this suggests a 1.5-fold decrease, which is only achievable through significant structural changes in the domestic patent activity market and is not supported by the dynamics of the indicator in the preceding periods.

A similar situation is observed with the indicator that characterizes the share of manufacturing industry organizations engaged in technological innovations: between 2017 and 2022, its values fluctuated between 27% and 29%, but by 2030, a growth to 45% is planned.

Thus, the target values of some indicators do not align with their dynamics over the preceding period and can be considered inflated. For six of

[11] URL: https://www.oecd.org/

the sixteen indicators established by the 2023 Concept, target values are given in the form of growth rates in comparable prices to 2022. This significantly complicates their monitoring because the target is set not as a specific value but as the intensity of growth, for which the current values must first be recalculated into comparable prices. Therefore, a multi-step calculation process based on data from various sources is necessary.

Currently, Rosstat conducts statistical observations only for advanced technologies. The 2023 Concept includes a preliminary list of cross-cutting technologies, but a list for critical technologies has not yet been provided, even though it has been developed since 2002 and periodically updated. This creates a need for the development of lists for both types of technologies, as well as a methodology for statistical monitoring, taking into account the existing experience, to calculate technological security indicators based on them.

There are also difficulties in assessing the activities of small technological companies, the status of which is established by the Federal Law,[12] with criteria for classifying organizations into this group approved by the Government Resolution.[13] These criteria include revenue (up to 4 billion rubles) and activities in priority sectors of Russia's economy (more than 90 types of activities). A registry of small technological companies is planned, but it has not yet been formed, which complicates the determination of their number and other indicators. Since the 2023 Concept provides for three indicators related to the activities of small technological companies, there is an urgent need to create their registry.

An important area for improving the information base of technological security indicators could be the development of a system for assessing its achievement, which is necessary for monitoring the current state, identifying threats, and assessing the intensity of the development of Russia's technological sector in accordance with the goals and objectives set in the main strategic documents.

One of the options for assessing technological development is described by the Ministry of Economic Development of Russia in its Methodological Recommendations.[14] The proposed approach is based on an integrated indicator calculated for each type of economic activity, allowing for comparisons between them and providing an overall assessment of the technological development of the economy. Another approach to monitoring is outlined in the Regulations on the organization of monitoring of economic security.[15] Although the recommendations in this document are focused on economic security, this approach can also be used for assessing technological security. The methodology involves observing and analyzing the dynamics of economic security indicators and comparing their actual values with projected or permissible limits. The level of goal achievement is assessed in points, based on how close the actual indicator value is to the boundaries of one of five intervals that characterize five possible security states: favorable, stable, unstable, negative, and critical. Both approaches described above have undeniable advantages and could form the basis for creating a system for evaluating technological security, but for this to happen, threshold and target values must be developed.

Unfortunately, strategic documents lack an indicator for monitoring one of the technological security challenges — the concentration of scientific, technological, and educational potential in specific regions of the country — something that needs to be addressed.

Our experience shows that the information base for assessing technological security is based on quantitative indicators. This is correct, as target and threshold values can be de-

[12] URL: http://publication.pravo.gov.ru/document/00001202308040087

[13] URL: http://government.ru/news/50032/ (дата обращения: 22.09.2024).

[14] URL: https://ivo.garant.ru/#/document/73685552/paragraph/7:0

[15] URL: https://ivo.garant.ru/#/document/72272840/paragraph/7:0

veloped for them, and there are many tools for their analysis. However, it is also important to consider survey results, which provide feedback from the business community — information that cannot be obtained through indicators developed in the main strategic documents.

CONCLUSION

In conclusion, the following directions for improving the information base of the technological security indicator system can be identified:

1. Consider indicators of the state of the material base that will serve as indicators of the presence of threats in the area of creating economic conditions for the development and implementation of modern technologies.

2. Standardize the terminology of indicators established in the strategic documents on technological development.

3. Intensify efforts to develop methodologies for calculating technological security indicators that are not yet defined.

4. Develop threshold values for indicators that characterize the technological security of the country.

5. Clarify the target values of technological security indicators established by the main strategic documents.

6. Compile a list of cross-cutting and critical technologies, as well as methodologies for statistical monitoring of them, based on existing experience monitoring advanced technologies.

7. Create a registry of small technological companies to assess their quantity and activities.

8. Develop a system for assessing technological security based on threshold and target values.

9. Add an indicator to the technological security system to monitor the degree of concentration of scientific, technological, and educational potential in specific regions of the country.

10. Supplement the information base for assessing technological security in Russia with survey results from the business community on the introduction of new technologies into the production process and the obstacles to doing so.

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The New Paradigm of Russia's International Financial Relations

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ABSTRACT

The objective of this study is to explore the fundamental features of the emerging international financial framework in Russia, to pinpoint potential risks and central issues in its development. The distinctive characteristics of Russian companies' international trade activities are explored through a comparative and economic-statistical analysis. The identification of risks was done by creating checklists using logical and analytical methods to organize information about the research topic. The risk analysis was based on the Ishikawa method ("fish bone"). The framework of Russia's international financial interactions from 1991 to 2014 was centred on the goal of swiftly integrating the country into the global monetary and financial framework, fully embracing the standards set by the global power, while also acknowledging the increasing reliance on the collective West, which could potentially compromise national interests. The New Paradigm envisions a balanced integration of diverse subsystems and individual components — nations and groups of nations — within a cohesive geographical context. This framework envisions the enhancement of mutually beneficial international collaboration with allied nations and the development of novel settlement and payment systems, which are based on the utilization of national currencies and/or cutting-edge digital instruments.

Keywords: Russia; international financial relations; external sanctions; foreign trade; global monetary and financial system; international settlements and payments; national currencies; financial market; digitalisation of financial infrastructure; fragmentation of the global economy; deglobalisation

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INTRODUCTION

After the global financial and economic crisis of 2008–2009, the previously dominant process of globalization slowed down (slowbalization) [1]. The outbreak of the coronavirus pandemic in early 2020 further fueled protectionism and the emergence of autarkic tendencies. The United States, as the world's leading economic, financial, and military power, continued its unilateral efforts to dictate the rules of international relations, which clashed with the desire of several developing countries to achieve greater independence. Their dissatisfaction with their subordinate role in the modern international financial architecture has become one of the primary causes of rising geopolitical tensions worldwide [2, p. 168]. As a result of this growing conflict, the world economy and global finance[1] have experienced increased regionalization [3, 4] and fragmentation [5–7]. Trends leading to economic deglobalization have gained momentum globally. Governance has become more politicized, and "deglobalization has transitioned from a stage of possibility and virtuality to a stage of reality; subsequently, it quickly moved from being a reality to becoming a central reality" [8].

In its pursuit of financial-economic independence and national sovereignty, Russia has become one of the nations actively opposing the dominance of the United States and its allies [9]. According to the Concept of the Foreign Policy of the Russian Federation, approved by Presidential Decree No. 229[2] on March 31, 2023, Russia's primary strategic partners are now China and India. Additionally, the country's foreign economic activities have shifted focus toward its near-abroad, as well as the East (both Far and Middle East), Africa, and Latin America. This reorientation of foreign economic activity has necessitated a change in Russia's previous paradigm[3] of international financial relations.[4] Therefore, analyzing the new paradigm of international financial relations — defining its main characteristics, identifying risk factors, and addressing key challenges in its formation — has become a pressing issue.

FEATURES OF THE POST-SOVIET PARADIGM OF RUSSIA'S INTERNATIONAL FINANCIAL RELATIONS

After the dissolution of the USSR in December 1991, Russia began taking steps necessary for swift integration into the global monetary and financial system (GMFS). According to the country's leadership, this integration, in contrast to the economic autarky of the bipolar world, was to serve as a new strategic goal for international financial and economic relations. Between 1992 and 1996, Russia joined major international financial and credit organizations and liberalized its currency regulation, as this was one of the prerequisites for receiving international loans — a critical need for the country at the time. At the end of 1992, restrictions on the current account of the balance of payments were lifted in Russia, and by the summer of 2007, restrictions on capital account transactions were also removed.

In the second half of the 1990s, the process of Russia's integration into the GMFS accelerated with the entry of Russian borrowers into the international financial market. Simultaneously, foreign investors were granted the right to purchase Russian government debt securities

[1] URL: https://www.imf.org/en/Publications/GFSR/Issues/2023/04/11/global-financial-stability-report-april-2023

[2] URL: http://www.kremlin.ru/acts/bank/49090

[3] In the context of this article, the term "paradigm" is used as a synonym for the words "model", "sample" (from the Greek Paradeigma).

[4] According to the definition of the Department of International Financial Relations of the Ministry of Finance of the Russian Federation, "International financial relations are state policy and legal regulation in the sphere of financial relations of the Russian Federation with foreign countries, their associations, forums, groups, international financial institutions, international organizations, as well as in the sphere of participation of the Russian Federation in promoting international development." URL: https://minfin.gov.ru/ru/perfomance/international/

in the domestic financial market. From 1998 onward, Russia regularly participated in the G7, temporarily transforming it into the G8.

Following the global financial and economic crisis of 2008–2009, Russia, as part of the G20, joined other nations in reforming the existing GMFS, particularly as a member of the Financial Stability Board. In 2012, Russia became a member of the World Trade Organization, which was a natural outcome of its integration into the global economy and GMFS.

Thus, the paradigm of Russia's international financial relations from 1991 to 2014 was based on full acceptance of the rules set by the global hegemon — the United States. This paradigm could be conditionally termed the "Champagne Tower" Integration Paradigm" [10]. The growing dependency on the collective West at the expense of national interests, as well as the significant socio-political and financial-economic costs incurred from consistently fulfilling the requirements of international financial and credit organizations, were considered an unavoidable price for the opportunity to cooperate on equal terms with the leading countries of a unipolar world.

REASONS FOR THE FORMATION AND KEY CHARACTERISTICS OF RUSSIA'S NEW PARADIGM OF INTERNATIONAL FINANCIAL RELATIONS

The formation of a new paradigm in Russia's international financial relations began in 2014, following the introduction of sanctions by the United States and its allies. Initially, these sanctions led to a decline in GDP, an increase in inflation, and a reduction in foreign trade volumes [11, p. 14]. The measures taken by the Russian leadership during this period aimed to stabilize the country's financial system by developing an independent domestic payment infrastructure.

In 2022, Russia faced extensive geopolitical risks. The Russian government and the Central Bank of Russia had to take urgent steps to adapt the economy and financial system to the unprecedented sanctions pressure from the collective West.[5] The main goals of the sanctions policy included halting foreign investments entirely, freezing the foreign assets of Russian state-owned companies, encouraging "brain drain", and exerting active pressure on Russian oligarchs [12]. The freezing of Russian assets abroad, the refusal of counterparties in unfriendly countries to process payments, and fears of secondary sanctions by foreign trade partners of Russian banks and companies had a profoundly negative impact on Russia's financial and economic situation.

To stabilize the financial system in 2022, the Central Bank of Russia implemented a series of measures, including easing regulations for financial market participants, increasing banking liquidity, imposing capital controls, and limiting stock market activities [13]. As a result, experts from the Bruegel thinktank, established in 2005 by EU countries, acknowledged that the Russian budget was not severely affected by the sanctions and that the effective actions of the Central Bank of Russia prevented financial instability and safeguarded the national economy [14]. Adaptation to the sanctions was achieved not only through prudent regulatory measures but also by enhancing the state's role as an investor, buyer, and producer of goods and services [15, p. 58].

The national payment infrastructure, developed since 2014, played a critical role in financial stabilization. It allowed regular payments and transactions to continue, including those involving cards of international payment systems that had ceased operations in Russia.

In December 2022, during a meeting of the Council for Strategic Development and National Projects, President Vladimir Putin identified one of the six key tasks for 2023 as "elevating inter-

[5] According to the Castellum.AI platform, as of 04.06.2024, the number of current restrictions against Russia amounted to 21,167. URL: https://www.castellum.ai/russia-sanctions-dashboard

actions with our key partners to a new level.[6]" This goal entails strengthening traditional ties with friendly nations and seeking new international partners. Russia's foreign economic focus has shifted towards Asia, the Middle East, Latin America, and Africa. In the current environment, it has become increasingly vital to explore new forms of collaboration, establish supply and distribution channels, and develop alternative economic partnerships [16, p. 110].

Foreign trade turnover between Russia and friendly countries is gradually increasing. According to the acting head of the Federal Customs Service of Russia, R. Davydov, in 2023, about 75%[7] of Russian imports came from these countries. China leads by a significant margin, followed by Turkey in second place. The share of imports from the countries of the Eurasian Economic Union (EAEU) is also growing. Conversely, the share of Europe in Russian imports has significantly decreased, with European goods being replaced by products from China, Turkey, the UAE, Iran, Azerbaijan, and the EAEU countries.

In the structure of Russian exports in 2023, the share of friendly Asian countries increased substantially (from 46% to 71%), while the share of Europe fell sharply (from 48% to 20%[8]). Alongside China, India has become one of the main importers of Russian products in Asia. The volume of exports to African countries increased significantly — by 54% — although their share in the total structure of Russian exports remains

[6] URL: https://ria.ru/20221215/council-1838930361.html

[7] URL: https://iz.ru/1572451/irina-tcyruleva-roman-babenkov/import-v-tcelom-vyros-na-10

[8] URL: https://iz.ru/1605180/sofia-smirnova/tramplin-v-aziiu-raskryt-obem-rossiiskoi-vneshnei-torgovli-za-2023-god

Table 1

Currency composition of transfers for imports of goods and services by the Russian Federation by geographical zones, %

Region	Transfers	January 2022	December 2023
Asia	In Russian rubles	19.8	24.0
	In currencies of unfriendly countries	68.0	20.5
	In other currencies	12.2	55.5
America	In Russian rubles	16.9	35.1
	In currencies of unfriendly countries	83.1	56.1
	In other currencies	0.0	8.8
Africa	In Russian rubles	2.8	48.1
	In currencies of unfriendly countries	91.6	33.1
	In other currencies	5.6	18.8
Europe	In Russian rubles	35.3	49.0
	In currencies of unfriendly countries	64.5	47.1
	In other currencies	0.2	3.9

Source: compiled by the authors according to data of Bank of Russia. URL: https://www.cbr.ru/statistics/macro_itm/svs/#highlight

below 5%. African countries account for about 1% of Russian imports.

A notable feature of Russia's foreign trade under the pressure of external sanctions is the increase in barter transactions. Additionally, national currencies have been more actively used in intergovernmental settlements with friendly countries (see *Table 1*).

As shown in *Table 1*, during the specified period, the share of currencies from unfriendly countries in Russia's payment structure for imports of goods and services decreased on average by 2.4 times (from 76.8% to 31.7%). Conversely, the share of the Russian ruble increased on average by 2.1 times (from 18.7% to 39.0%).

Significant changes also occurred in the currency structure of revenues from the export of Russian goods and services between January 2022 and December 2023 (see *Table 2*).

As shown in *Table* 2, during the specified period, the share of currencies from unfriendly countries decreased on average by 2.5 times (from 82.5% to 32.6%). Europe moved from third to first place in terms of payments made in Russian rubles for goods and services imported from Russia. The significant increase in the share of the ruble was primarily driven by the requirement for unfriendly countries to pay for gas in Russian currency[9] starting April 1, 2022.

According to Russian Prime Minister Mikhail Mishustin, by the end of 2023, the share of national currencies in Russia's foreign trade settlements was expected to reach about 65%, and around 70% with key partner countries (according to Russian Finance Minister Anton Siluanov, by September 2023, the share of national currencies in trade between China and Russia exceeded 90%[10]). By 2030, it is anticipated that the share of national currencies in settlements with foreign countries will reach 80% or more.

In 2023, the trading volume of the Chinese yuan on the Moscow Exchange nearly tripled, with its share of the total spot foreign exchange trading volume reaching almost 42%, surpassing the U.S. dollar. The trading volume of the Turkish lira increased 17-fold (0.6%), the Kazakhstani tenge nearly six-fold (0.47%), and the Hong Kong dollar and Belarusian ruble almost doubled (0.09% and 0.06%, respectively[11]). New currency pairs, such as the Armenian dram, Kyrgyz som, Tajik somoni, Uzbek sum, and South African rand,[12] are being introduced. Over-the-counter trading volumes of the Indian rupee and UAE dirham have also increased.

According to Mishustin, entering new promising markets will require accelerated development of new infrastructure, logistics, and the simplification of customs procedures.[13] The country's leadership opposes isolationist policies, emphasizing that Russia remains open to investors and participants in global trade.

Under the new paradigm of international financial relations, Russian energy resources have been more actively supplied to China, India, African countries, and the Asia-Pacific region. New logistics connections have also been established. For example, Russian oil producers are directly negotiating with buyers from friendly countries, with prices calculated based on physical deliveries to the buyers' ports [17, p. 127].

In December 2022, the Strategy for the Development of the Financial Market of the Russian Federation Until 2030[14] was adopted. This strategy outlines key elements of the new paradigm of Russia's international financial relations and measures to enhance the com-

[9] URL: http://www.kremlin.ru/acts/bank/47699

[10] URL: https://www.vedomosti.ru/economics/news/2023/12/12/1010657-dolya-natsvalyut-torgovle-virastet

[11] URL: https://www.vedomosti.ru/finance/news/2024/01/16/1015228-smi-dolya-torgov-yuanem.

[12] URL: https://www.moex.com/s10

[13] URL: https://minfin.gov.ru/ru/press-center/?id_4=38448-stenogramma_vystupleniya_predsedatelya_pravitelstva_rf_mikhaila_mishustina_na_sovmestnom_rasshirennom_zasedanii_kollegii_minfina_rossii_i_minekonomrazvitiya_rossii

[14] URL: https://www.consultant.ru/document/cons_doc_LAW_436693/

Table 2

Currency structure of revenues from export of goods and services of the Russian Federation by geographical zones, %

Region	Receipts	January 2022	December 2023
Asia	In Russian rubles	15.6	33.1
	In currencies of unfriendly countries	82.3	23.5
	In other currencies	2.1	43.4
America	In Russian rubles	12.4	35.2
	In currencies of unfriendly countries	87.6	62.4
	In other currencies	0.0	2.4
Africa	In Russian rubles	1.7	26.6
	In currencies of unfriendly countries	70.8	3.2
	In other currencies	27.5	70.2
Europe	In Russian rubles	10.7	49.0
	In currencies of unfriendly countries	89.3	41.5
	In other currencies	0.0	9.5

Source: compiled by the authors according to data provided by The Central Bank of the Russian Federation. URL: https://www.cbr.ru/statistics/macro_itm/svs/#highlight

petitiveness of the Russian financial market. For instance, it proposes preferential tax regimes for non-residents who operate through Russian financial intermediaries and is developing a mechanism for their remote identification.

As part of further digitalization of financial and economic operations, the introduction and use of the digital ruble plays a significant role. This innovation enables cross-border payments outside the traditional currency settlement systems, bypassing the U.S.-controlled SWIFT. In March 2024, legislation was passed permitting the use of digital financial assets[15] (DFAs) in international settlements. DFAs include "digital rights, encompassing monetary claims, rights under equity securities, participation rights in the capital of non-public joint-stock companies, and the right to demand the transfer of equity securities.[16]" This legislation aims to simplify foreign trade settlements between Russian companies and friendly countries under the sanctions regime. Thus, the new paradigm is shaping a payment and settlement mechanism immune to economic sanctions imposed by the U.S. and its allies.

The development of an independent national payment infrastructure will continue.

[15] URL: http://www.kremlin.ru/acts/bank/50395

[16] URL: http://www.kremlin.ru/acts/bank/45766

One of the priority areas is the expansion of cross-border operations and the enhancement of the financial information transmission system as an alternative to Western systems. For example, the project to integrate the Faster Payments System (FPS) with analogous systems in other countries (primarily within the EAEU) will proceed. Additionally, new countries and non-resident participants are expected to join the Russian financial messaging system. Plans are also underway to expand the use of the Mir payment cards beyond Russian borders.

Under the new paradigm of international financial relations, significant emphasis is placed on strengthening cooperation not only with friendly countries but also with international (regional) unions and institutions.

Despite increasing sanctions pressure, necessary measures are being taken to further integrate the Russian financial market with international markets and with the domestic financial markets of friendly countries. This includes conducting transactions using national currencies, developing long-term correspondent banking relationships, and fostering cooperation between respective exchange infrastructures. Special attention is being given to creating new payment and settlement mechanisms, ensuring the efficiency and reliability of investor rights accounting for securities issued and traded in the financial market, simplifying mutual access for investors and issuers to national financial markets, and mutually recognizing insurance and reinsurance coverage (including insurance support for commercial transactions[17]).

Thus, the new paradigm of Russia's international financial relations is based on ensuring financial and technological sovereignty, prioritizing national interests, increasing the attractiveness of the Russian financial market for foreign investors, and developing comprehensive international cooperation with friendly countries. It can be conditionally termed the "paradigm of a high-tech polycentric sociosphere[18]", which envisions the harmonious coexistence of various subsystems and individual elements (countries and groups of countries) within a unified geographical framework.[19]

KEY ISSUES AND RISKS ASSOCIATED WITH THE FORMATION OF RUSSIA'S NEW PARADIGM OF INTERNATIONAL FINANCIAL RELATIONS

It should be noted that the use of national currencies in bilateral international settlements and payments has certain objective limitations [18, p. 50]. One of these limitations is related to the mandatory maintenance of a foreign trade balance between two countries [19]. If one of the countries accumulates a low-liquidity currency that is rarely used for international payments and settlements and is difficult to spend in the country that issued it, an imbalance will inevitably arise, hindering the development of bilateral trade and economic cooperation.

For example, Russia has accumulated a significant volume of Indian rupees as a result of selling Russian oil. Strict foreign exchange control and regulation rules in the Indian financial market significantly limit the opportunities for potential foreign investors. In this situation, the joint search by partner countries for possible alternatives for using the national currency in the domestic financial market becomes crucial. To address the issue, the Reserve Bank of India, acting as the country's central bank, partially liberalized the rules for investing funds from accounts opened by foreign

[17] URL: https://www.consultant.ru/document/cons_doc_LAW_436693/f62ee45faefd8e2a11d6d88941ac66824f848bc2/

[18] The sociosphere (from Latin societas — society and Greek σφαῖρα — sphere) is a part of the Earth's geosphere that includes humanity with its inherent social (including production) relations, as well as the part of the natural environment that has been mastered by humanity. URL: https://old.bigenc.ru/geography/text/4245453

[19] The geographical framework refers to the natural conditions of human existence on Earth that are involved in the sphere of human activity. URL: https://bigenc.ru/c/geograficheskaia-sreda-ad68ca

banks in Indian banks [20]. This allowed Russian investors to purchase corporate bonds (which had previously only been available in government bonds and treasury bills).

The formation of Russia's new paradigm of international financial relations is a profound transformational process that affects not only the fundamental foundations of the national economy but also the global system of governance, as these relations are inherently international and arise only through the process of international division of labor. It is important to emphasize that this transformation occurs under conditions of high uncertainty, as it is associated with the transformation of complex spatial systems whose functioning depends on a large number of factors.

When analyzing the risks associated with the formation of Russia's new paradigm of international financial relations, the primary criterion for assessing the significance of the risk was the achievement of the goal — transitioning from the "Champagne Tower" Integration Paradigm to the Paradigm of a High-tech Polycentric Sociosphere. This transition implies not only internal changes but also a transformation of the global system of governance (moving from a unipolar world to a multipolar one). Given the presence of several types of uncertainty (including that which acknowledges the internal variability of phenomena and cannot be reduced through further research), qualitative research methods were chosen for the risk assessment process. Risk identification was carried out through the creation of checklists using logical and analytical methods for systematizing the results of information analysis on the topic of the research. Risk analysis was conducted using the Ishikawa method ("fishbone diagram") with the application of brainstorming techniques. The results of the analysis are presented graphically in the *figure*.

We have identified six groups of risk factors: political, economic, managerial, social, technological, and external. The external factors include unpredictable and uncontrollable natural and socio-economic phenomena and processes (natural and technological disasters, global financial-economic crises, etc.). The factors identified in each group are divided into levels based on their impact and the nature of their consequences (admissible, acceptable, and critical risks).

The analysis showed that, from the perspective of the potential realization of Russia's new paradigm of international financial relations, the most critical risks at present are political, economic, and technological, which should be given special attention during the development of strategic planning documents. It must be taken into account that the new paradigm of Russia's international financial relations will be shaped under the conditions of ongoing sanctions pressure and numerous restrictions from the collective West.

CONCLUSION

The current state of the Russian economy (with a 3.6% GDP growth in 2023) has led even experts from unfriendly countries to acknowledge the ability of the Russian economy to continue functioning under sanctions [21]. Russia, with the largest territory and rich, diverse natural and climatic resources, should rely on its own vast reserves in its further development. It should maximize the potential of its national financial market while simultaneously seeking and creating alternative channels and mechanisms for international payments and settlements [22]. This will help minimize the risk of secondary sanctions for partners from friendly countries and accelerate the creation of a new international financial architecture that takes into account the interests of most countries in a multipolar world, in contrast to the current system focused solely on meeting the needs of the United States, which no longer corresponds to its status as the world hegemon but is striving at all costs to maintain its influence.

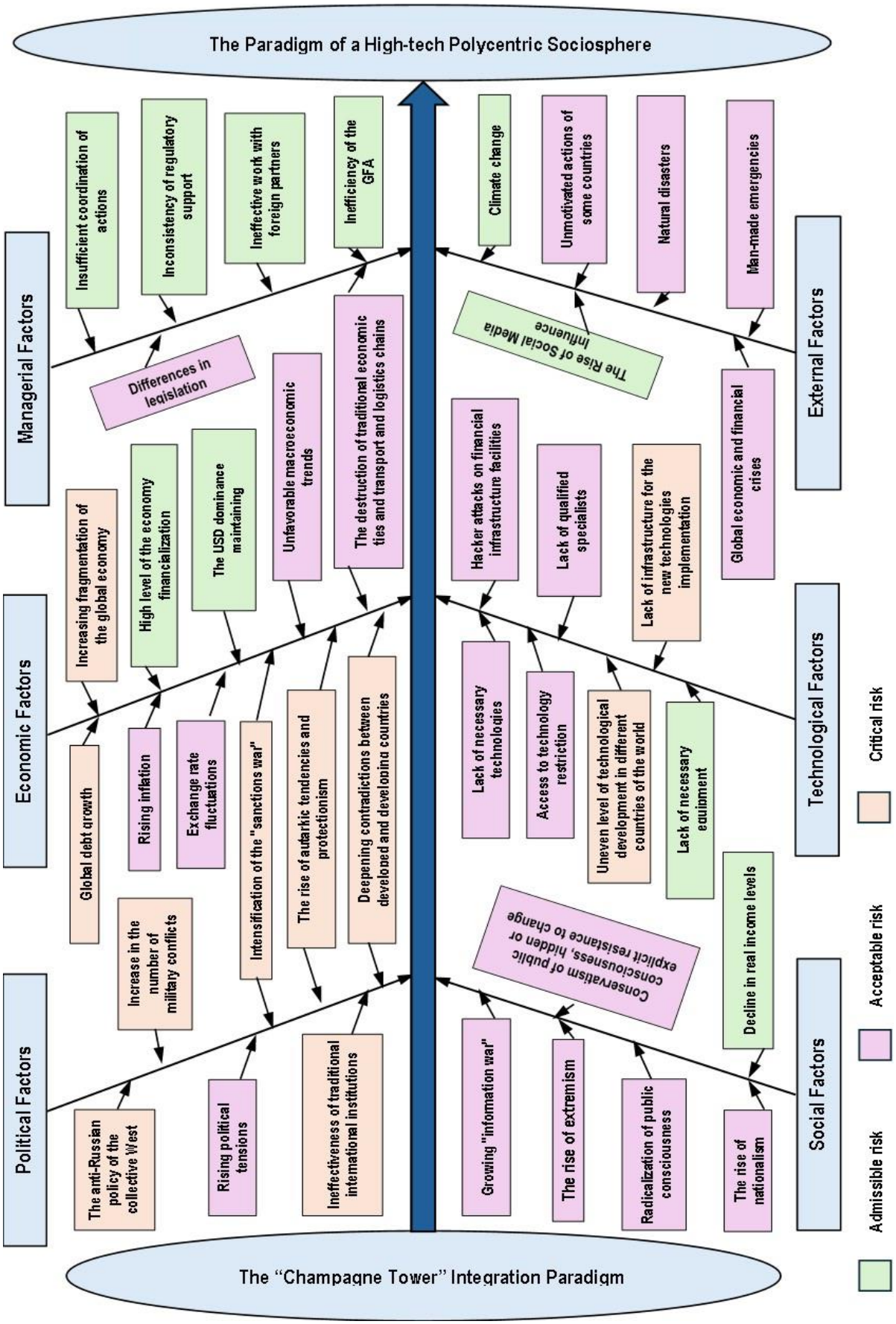

Fig. **Risk factors' analysis in the formation of a new paradigm of Russia's international financial relations**

Source: compiled by the authors.

The IMF structure, likened to a "champagne tower" filled with liquidity by the "chief bartender" in the form of the U.S. Federal Reserve, has proven to be an unreliable and unjust system, drawing numerous complaints from most members of the global community. The role of these countries in the global economic system is steadily increasing, providing them with the basis to actively assert their national interests. The United States' attempt to retain its influence through the further tightening of sanctions and increased pressure paradoxically leads to the weakening, rather than strengthening, of the dollar as the primary global currency, which forms the foundation of U.S. global dominance.

The new paradigm of international financial relations being formed by Russia is primarily aimed at achieving the country's financial and technological sovereignty, protecting its national interests, increasing the attractiveness of the Russian financial market for foreign investors, and ensuring balanced growth and sustainable development of the Russian economy. Although the active restructuring of Russia's international financial relations paradigm may be seen as a necessary measure to minimize the negative consequences of external sanctions and prevent attempts at total isolation and autarkic development, in our opinion, the events of recent years have merely acted as a catalyst for transformation processes that first became apparent after the global financial and economic crisis of 2008–2009, triggered by the collapse of the U.S. real estate market.

The Paradigm of a High-tech Polycentric Sociosphere envisions the creation of a more harmonious and stable global structure based on mutual respect for national interests and equal partnership. This model calls for the expansion of mutually beneficial international cooperation with friendly countries and the creation of innovative settlement and payment mechanisms based on the use of national currencies and/or new digital tools. Therefore, the active digitalization of the global economy and world finance will contribute to the successful implementation of this model.

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Determinants of Inflation in Pakistan: A Comprehensive Analysis of Macroeconomic Variables (1991–2022)

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ABSTRACT

This research paper investigates the determinants of inflation in Pakistan from 1991 to 2022, focusing on key macroeconomic variables such as imports, GDP growth rate, GDP per capita, military expenditure, population growth, total debt service, and unemployment. The main objective is to analyse the impact of these variables on inflation and provide policymakers with actionable insights. Utilizing annual time series data from reliable source World Bank WDI, the study employs descriptive statistics, correlation analysis, ADF unit root tests, regression analysis, and the Autoregressive Distributed Lag (ARDL) model. The findings reveal significant interdependencies among the examined variables. The correlation analysis shows strong positive relationships between inflation and imports and military expenditure, while GDP per capita and population growth negatively correlate with inflation. OLS results confirm that imports, GDP growth, and total debt service significantly raise inflation, whereas GDP per capita, military expenditure, and population reduce inflation. The ARDL model reveals that, in the long run, imports, GDP growth, and debt service positively affect inflation, while GDP per capita, population growth, and unemployment exert downward pressure. Short-run dynamics indicate that inflation quickly adjusts to economic shocks, with imports and GDP growth having an immediate impact. These findings highlight the importance of managing imports and debt, while promoting economic growth to maintain price stability. The policy implications emphasize the need for targeted monetary policies to manage imports and optimize debt service strategies, as well as policies aimed at enhancing economic growth and increasing per capita income. Effective debt management and strategic military spending are also vital for maintaining price stability. Despite its comprehensive analysis, the study identifies gaps such as the need for further exploration of structural breaks and non-linear effects in inflation dynamics, and the impact of external factors like global oil prices. The significance of this research lies in its contribution to understanding the complex economic interactions influencing inflation in Pakistan, providing a crucial resource for policymakers to develop effective strategies for economic stability in developing economies.

Keywords: Inflation; Macroeconomic Variables; Imports; GDP Growth Rate; GDP per Capita; Military Expenditure; Population Growth; Total Debt Service; Unemployment; ARDL Model; Pakistan Economy

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1. INTRODUCTION

Inflation analysis is of critical importance due to its direct impact on the economy, businesses, and the overall standard of living. Inflation refers to the increase in the general price level of goods and services over a period, and it can have far-reaching consequences for the economy. In Pakistan, where a significant portion of the population lives below the poverty line, inflation can exacerbate the financial hardships faced by many households.

Federal government spending was the most significant determinant of the recent spike in inflation, aiding policymakers and investors in managing inflation [1].

The graph illustrates the trends of inflation alongside key macroeconomic variables in Pakistan from 1991 to 2022, highlighting significant fluctuations. Notably, inflation peaks correspond with increases in military expenditure, imports, and total debt service, reflecting their direct contribution to rising price levels. Meanwhile, population growth and GDP per capita appear to exert a stabilizing effect on inflation, as evidenced by their inverse correlation with inflationary trends. This visualization underscores the complex interplay

between these variables, which is further explored through econometric analysis in this study.

One of the key reasons why inflation analysis is crucial in Pakistan is its impact on the cost of living. As prices rise, the purchasing power of consumers diminishes, leading to a decrease in their standard of living. This can particularly affect low-income individuals and families who are already struggling to make ends meet. Additionally, businesses may also face challenges as rising costs can erode their profit margins, leading to potential layoffs and reduced investment. Furthermore, inflation analysis is essential for policymakers and central banks to make informed decisions about monetary policy. By closely monitoring inflation trends, authorities can implement measures to control inflation and stabilize prices. This can involve adjusting interest rates, managing money supply, and implementing fiscal policies to curb inflationary pressures. Without accurate and timely inflation analysis, policymakers may struggle to effectively address inflation and its negative consequences on the economy. Moreover, inflation analysis is crucial for investors and businesses to make sound financial decisions. Fluctuations in inflation can impact investment returns, interest rates, and borrowing costs, influencing investment strategies and business planning. By understanding inflation trends and their potential impact on the economy, businesses can adjust their pricing strategies and investment decisions to mitigate the effects of inflation. Foreign direct investment positively impacts Pakistan's GDP, while inflation has a negative relationship with GDP. The long-term impact of FDI on inflation depends on the sectors it is invested in and the overall economic environment [2]. the defence burden in Pakistan negatively impacts GDP growth, but when accounting for feedback and covariance, these effects diminish and become less significant. Increased military spending in Pakistan has been found to contribute to inflation by diverting resources from productive sectors and increasing government borrowing [3].

The economy of Pakistan, despite its potential for growth and development, has been subject to various forces, leading to a complex economic landscape. Over the past few decades, Pakistan's economy has experienced significant fluctuations and challenges, influenced by both domestic and global factors, most notable of which is high inflation. Additionally, occasional inflation spikes affect the country's economic progress. The urgent need for comprehensive strategies and reforms to stabilize and propel Pakistan's economy towards sustainable monetary policy are the main motivation of this research. In this rigorous study factors such as military expenditures, GDP per capita, imports, unemployment, GDP growth rate, total debt service, population will be analysed in dynamics to establish interrelations between those variables and their effects on the Consumer Price Index — main benchmark for the price level changes in the world. The study will explore how these different categories of factors interact and contribute to inflationary pressures, providing insights into the complexity and interplay of various economic forces. In Pakistan, factors such as durable goods, electricity, imports, natural gas, steel mill products, capital goods export, food import, and government borrowing influence inflation. Imports directly influence inflation through import prices, where higher import costs lead to higher domestic prices [4].

Despite previous studies shedding light on specific aspects of Pakistan's economy, there remains a notable absence of integrated analyses spanning multiple decades. The research on the inflation causes and consequences in Pakistan lacks an integrated analysis of key macroeconomic variables, as longitudinal perspectives investigating long-term trends are scarce. Developed countries research their economies plenty, while leaving developing volatile economies without a proper political and economic framework to tackle the issues of the excessive money supply. Consequently, this research endeavours to provide valuable insights for policymakers and stakeholders to formulate main factors stimulating and slowing inflation rates in the Pakistan.

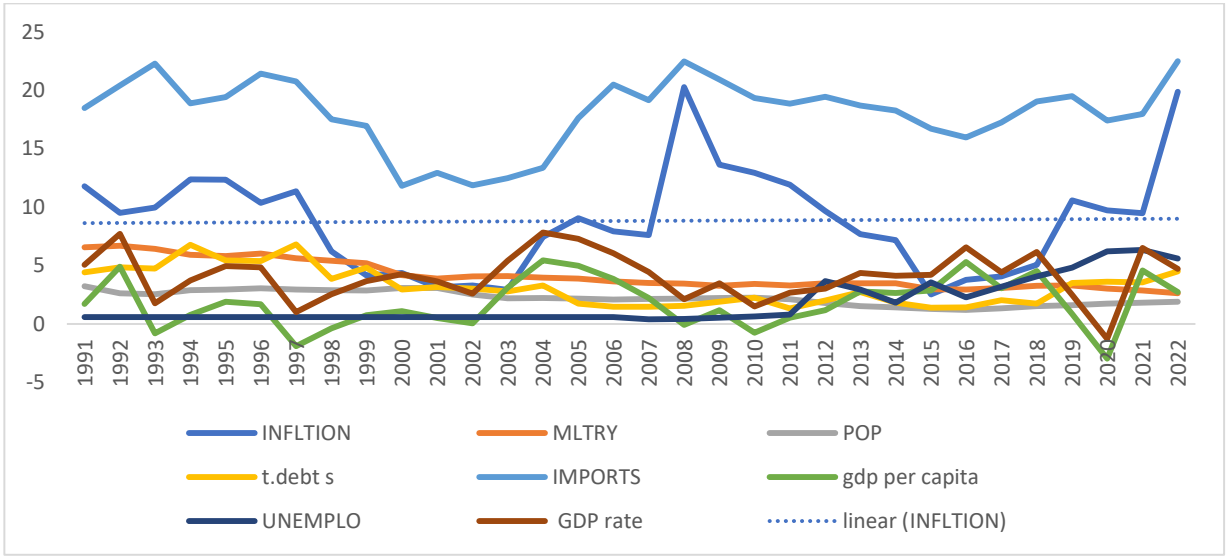

Fig. **Inflation and selected Macroeconomics variables Trends**

Source: Authors own estimations by using Excel charts

2. OBJECTIVES

Given the gaps in existing research, the study seeks to answer the following research questions: What are the key determinants of CPI inflation in Pakistan? How do fiscal, monetary, and external factors collectively influence CPI changes?

To answer the research question, the study poses several objectives:

1) To examine the long-term trends and patterns of military expenditures, GDP per capita, Consumer Price Index (CPI) as a proxy for inflation, imports, unemployment, GDP growth rate, total debt service, total population in Pakistan from 1980 to 2022 using ARDL;

2) To investigate the interdependencies and causal relationships between these macroeconomic variables and focus on CPI;

3) To provide evidence-based recommendations aimed at enhancing monetary stability by determining main factors affecting inflation rates.

3. LITERATURE REVIEW

The study provides a comprehensive analysis of the determinants of inflation in Pakistan, aligning closely with the objectives of our research. This paper investigates both demand-side and supply-side factors influencing inflation, examining key macroeconomic variables over the period from 1972 to 2010. Utilizing advanced econometric techniques, including Johansen Cointegration, Vector Error Correction, and Granger causality tests, the study identifies significant relationships between these variables and the Consumer Price Index (CPI). The findings reveal that in the long run, the money supply, GDP, imports, and government expenditures have a positive impact on CPI, indicating their role in driving inflationary pressures. Conversely, government revenue is found to exert a negative influence on CPI, suggesting its potential in mitigating inflation. By providing empirical evidence on the intricate dynamics of inflation determinants in Pakistan, this study contributes valuable insights into the formulation of effective economic policies aimed at controlling inflation [5].

The paper delves into the intricate relationship between inflation, money supply, interest rate, and unemployment in Pakistan over the period from 1987 to 2019. The study aims to discern both long-run and short-run effects of these macroeconomic variables on inflation. Employing the Autoregressive Distributed Lag (ARDL) cointegration approach, the research tests for long-run and short-run dynamics, while the Augmented

Dickey-Fuller (ADF) unit root test is utilized to ascertain the order of integration of the variables. The empirical results indicate the presence of both long-run and short-run relationships among the studied variables. Specifically, changes in money supply, interest rates, and unemployment are found to significantly influence inflation across different time horizons. Additionally, the study highlights that high-interest payments on debt can exacerbate inflationary pressures by increasing government expenditure, thereby constraining resources available for developmental purposes. This research offers critical insights into the complex interactions between key economic indicators and inflation in Pakistan, providing a robust foundation for policy interventions aimed at stabilizing the economy [6].

The study aims to elucidate the impact of tax revenue, government spending, inflation, gross fixed capital formation, and current account balance on Pakistan's GDP. Utilizing time series data spanning from 1985 to 2021, the research employs the Augmented Dickey-Fuller (ADF) test to ensure data stationarity and the Autoregressive Distributed Lag (ARDL) bound test to identify both long-term and short-term relationships among the variables. The findings indicate that increased government revenue can play a crucial role in controlling inflation by reducing the reliance on external borrowing, thereby contributing to economic stability. However, the study reveals that tax revenue and inflation have a negative impact on economic growth. Conversely, government expenditures and gross fixed capital formation are found to positively influence GDP, underscoring their importance in fostering economic development. This research provides valuable insights into the interplay between fiscal measures, macroeconomic stability, and economic growth, offering significant implications for policymakers in Pakistan [7].

This research aims to establish whether excess money supply growth is a key driver of inflation in Pakistan and examines how monetary policy impacts inflation and real GDP growth. Using correlation analysis, the study explores the association between money supply growth and inflation, and investigates the impact of money supply on real GDP growth. The results indicate that high debt servicing can lead to inflation through increased money supply and reduced investment in the productive sector. The study finds a positive association between money supply growth and inflation, supporting the monetarist view that excess money supply significantly contributes to rising inflation. It suggests that the State Bank of Pakistan's loose monetary policy has prioritized growth over controlling inflation. The key policy implication is that a tighter monetary policy could effectively manage inflation [8].

Ahmad et al. aims to determine the relationship between inflation and economic growth (GDP) in Pakistan, specifically examining whether GDP influences inflation and the nature of their relationship. Using time series data from 1971 to 2011, the study employs the Granger Causality test to explore causality between inflation and GDP, and the Ordinary Least Square (OLS) method to obtain empirical evidence on their relationship. The findings reveal that higher GDP per capita can lead to increased demand and inflationary pressures. The results of the Granger Causality test indicate that GDP causes inflation. Additionally, the OLS results demonstrate a positive relationship between inflation and economic growth, with a 1% increase in inflation raising GDP by 0.45%. This study provides valuable insights into the dynamic interaction between inflation and economic growth in Pakistan [9].

This study aims to determine the impact of inflation on GDP growth in Pakistan, focusing on how inflation influences economic growth and its implications for macroeconomic policy. Using time series data from 1990 to 2015, the study employs the Augmented Dickey-Fuller (ADF) test for data stationarity and the Engel Granger Co-integration test to examine short-run and long-run associations between inflation and GDP growth. The findings indicate a significant positive relationship between GDP growth and inflation, suggesting that higher economic activity can lead to higher prices. Specifically, the results show that a one-unit increase in the inflation rate causes a 0.27-unit increase in

GDP. This strong positive relationship highlights the complexity of inflation's role in macroeconomic stability, suggesting that inflation can positively influence economic growth in Pakistan [10].

Shah et al. aims to determine the impact of unemployment on GDP growth in Pakistan, exploring how unemployment, population growth rate, inflation, foreign direct investment (FDI), and government expenditure influence economic growth. Using the Autoregressive Distributed Lag (ARDL) technique, the study analyses time series data from 1974 to 2020. The GDP growth rate is the dependent variable, while unemployment, population growth rate, inflation, FDI, and government expenditure are the explanatory variables. The findings reveal that high unemployment can reduce inflationary pressures due to lower demand, whereas low unemployment can increase inflation. The study finds that both unemployment and inflation have a negative and statistically significant relationship with economic growth. Conversely, the population growth rate positively and significantly impacts economic growth. The results also indicate short-run cointegration among the variables. The study suggests that government measures to create employment opportunities can accelerate economic growth and reduce unemployment [11].

The selected paper, aims to identify the primary determinants of inflation in Pakistan and analyse how these factors, including money supply (M2), GDP, oil prices (OP), and exchange rate (ER), affect the inflation rate. The study utilizes annual time series data from 1989 to 2019. The Augmented Dickey-Fuller (ADF) test checks for stationarity, and the Autoregressive Distributed Lag (ARDL) model analyses both short-term and long-term relationships between variables. The CPI, GDP, and ER were found to be non-stationary at the first difference, while M2 and OP were stationary. Results, Current account deficits can lead to inflation due to higher foreign debt and currency devaluation pressures.

The ARDL results indicate significant lags for the exchange rate (ER) at lag 2, GDP at lags 2 and 4, and money supply (M2) at lag 2. Specifically:

ER at lag 2 has a negative coefficient (–0.471).

GDP at lag 2 has a negative coefficient (–1.163), and at lag 4, it has a positive coefficient (0.966).

M2 at lag 2 has a positive coefficient (0.473) [12].

The selected paper, aims to assess how real GDP, money supply, imports, government expenditure, and interest rates influence inflation in Pakistan. Using the OLS method and Granger non-causality test, the study analyses the time-series data to determine the effects and causal relationships of the variables on inflation. The results show that real GDP, money supply, imports, government expenditure, and lagged inflation positively affect inflation, while the interest rate has a negative impact. Bidirectional causality exists between money supply and inflation, and unidirectional causality from government expenditure and imports to inflation [13].

The selected paper, primary objective is to determine the impact of fiscal deficits on inflation in Pakistan and assess whether fiscal deficits generate inflation in the long term. The study employs co-integration and Granger-causality tests to analyse secondary data from 1960 to 2010. These methods help establish whether a long-term relationship exists between fiscal deficits and inflation. The study finds a strong relationship between fiscal deficits and inflation in Pakistan. Growth in fiscal deficits, whether measured by absolute amounts or deficit-output ratios, positively Granger-causes inflation. The results suggest that unsustainable fiscal deficits are a major contributor to inflationary pressures in Pakistan [14].

The selected paper, aims to analyse the impact of different fiscal policy instruments, including taxes and government expenditure, on inflation in Pakistan. The study employs the Bounds testing procedure and ARDL (Autoregressive Distributed Lag) approach for co-integration to analyse time series data from 1979 to 2012. These methods are chosen for their suitability in handling small sample sizes and assessing long-term relationships between variables. The study finds that both direct and indirect taxes significantly increase inflation in Pakistan. Additionally, fiscal deficits are identified as a contributing factor to inflation. In contrast,

investment is found to negatively affect the inflation rate, suggesting that promoting investment can help mitigate inflationary pressures [15].

The selected paper, primary objective of the paper is to analyse how budget deficits affect inflation in Pakistan, considering other macroeconomic variables such as money supply, GDP growth, unemployment, and the official exchange rate. The study uses data from 1985 to 2017, sourced from the World Development Indicators and Pakistan Economic Survey. To ensure data reliability, the Augmented Dickey-Fuller (ADF) test is applied to check for unit roots. The Autoregressive Distributed Lag (ARDL) model is used to analyse the long-term and short-term relationships between the variables. The study concludes that budget deficits, GDP growth, and money supply positively impact inflation in Pakistan. Conversely, unemployment and the official exchange rate negatively affect inflation. The findings suggest that addressing the budget deficit and managing money supply growth are crucial for controlling inflation [16].

Inflation in Pakistan is driven by fiscal deficits and money supply, with money supply being both endogenous and exogenous. Total reserves impact inflation indirectly by influencing the exchange rate and the stability of the financial system [17].

The current high rate of inflation in Pakistan is due to a combination of factors, including oil shocks, currency devaluation, and floods, that have exacerbated the country's economic problems. Exchange rate fluctuations significantly affect inflation, with devaluation leading to higher import prices and inflation [18]. Crude oil prices and real effective exchange rate significantly influence the inflation rate in Pakistan, with money supply, exports, and gross fixed capital formation also positively related to inflation. Exchange rate policies and their stability are crucial for controlling inflation [19].

Depreciation of the exchange rate and increase in imports contribute to inflation in Pakistan, while budget deficits do not play a role in boosting inflation indicators over the long run. Increased imports, coupled with a depreciating exchange rate, significantly raise CPI inflation [20].

The study examines the impact of fiscal policy on economic growth in Pakistan. It finds that government expenditure positively affects economic growth, particularly when directed towards infrastructure and social services. Higher tax revenue is also associated with economic growth, underscoring the importance of efficient tax collection. The effects of budget deficits are mixed: moderate deficits can stimulate growth, while high deficits may hinder growth by increasing inflation and interest rates [21].

In Pakistan, military expenditures are insignificant, but the number of military personnel positively

Table 1

Detail of Variables and data sources

Variable	Indicator	Source
Inflation	Inflation, consumer prices (annual %)	WDI
Military Expenditure	Military expenditure (% of GDP)	WDI
GDP per capita	GDP per capita growth	WDI
Imports	Imports of goods and services (% of GDP)	WDI
Unemployment	Unemployment, total (% of total labour force ILO est.)	WDI
GDP growth Rate	GDP growth (annual%)	WDI
Total Debt Service	Total debt service (% of GNI)	WDI
Population	Annual population Growth Rate (annual%)	WDI

Source: compiled by the authors.

and significantly impacts economic growth in the long run. The relationship between military spending and inflation is significant, with higher defence budgets often resulting in higher inflation rates due to increased money supply and decreased investment in social and economic development [22].

4. DATA AND METHODOLOGY

4.1. Data Collection

Table 1 provides the general information on the variables used in the analysis. Annual frequency is used in this paper and the main data source is the WDI, World Bank from 1991 to 2022. The dependent variable is CPI, while independent variables include military expenditures, GDP per capita, GDP growth, imports, unemployment, total debt service and total population.

4.2. Methodology

This study adopts a quantitative research design to investigate the determinants of inflation in Pakistan from 1991 to 2022. The primary objective is to explore the relationships between inflation, as the dependent variable, and several key macroeconomic factors, including military expenditure, GDP per capita, GDP growth rate, imports, unemployment, total debt service, and population growth. A combination of statistical and econometric methods is used to examine these relationships over time.

4.2.1. Econometric Methods

This study adopts a rigorous multi-step econometric approach to examine the relationship between inflation and its determinants, using descriptive statistics, correlation analysis, unit root tests, the Ordinary Least Squares (OLS) method, and the Autoregressive Distributed Lag (ARDL) model.

Initially, descriptive statistics are computed to summarize the central tendencies and variability of the variables used in the analysis. This includes measures like mean, standard deviation, minimum and maximum values, as well as the skewness of the distribution.

Subsequently, **correlation analysis** is performed to assess the degree of linear association between inflation and other macroeconomic variables. The study finds strong positive correlations between inflation and imports, as well as military expenditure. These high correlations suggest that higher import prices and defense spending may drive inflationary pressures. Conversely, GDP per capita and population growth exhibit negative correlations with inflation, implying that economic prosperity and demographic factors contribute to price stability.

Before conducting regression analysis, the **Augmented Dickey-Fuller (ADF) test** is applied to check for stationarity in the time series data. This step is crucial as non-stationary variables can produce misleading results in time series regression. The results indicate that inflation, GDP growth rate, and GDP per capita are stationary at level, while other variables become stationary after first differencing. These findings validate the inclusion of both $I(0)$ and $I(1)$ variables in the ARDL model, which accommodates this mix of integration orders.

The **OLS method** is used to estimate the relationship between inflation and the independent variables. This method provides unbiased and efficient parameter estimates under the assumption of no multicollinearity, autocorrelation, or heteroscedasticity. The results of the OLS regression reveal that imports, GDP growth rate, and total debt service have a positive and statistically significant impact on inflation. Conversely, GDP per capita, military expenditure, and population growth negatively affect inflation. Unemployment, while having a negative coefficient, is not statistically significant.

The high **R-squared** value (0.776) indicates that approximately 77.65% of the variation in inflation is explained by the independent variables, signifying a robust model fit. The significant **F-statistic** ($p < 0.001$) confirms that the overall regression model is statistically significant, and the **Durbin-Watson statistic** (close to 2.0) suggests no serious issues with autocorrelation.

Given the mixture of $I(0)$ and $I(1)$ variables, the study employs the **Autoregressive Distributed Lag (ARDL) model** to capture both short-term and long-term dynamics in the relationship be-

Table 2

Descriptive Statistics Table

Variable and statistic	INF.	Imports	GDP, CAP	POP	GDP. Rate	T. Debt Service	Unemployment
Mean	8.823	18.140	1.825	2.233	4.122	3.199	1.772
Median	9.279	18.796	1.711	2.184	4.239	2.982	0.586
Max	20.286	22.502	5.447	3.230	7.831	6.814	6.340
Min.	2.529	11.830	−2.970	1.204	−1.274	1.327	0.400
Std. Dev	4.432	2.964	2.131	0.603	2.027	1.586	1.887
Probability	0.217	0.223	0.803	0.412	0.814	0.252	0.012
observations	32	32	32	32	32	32	32
	MLTRY. Expend.						
Mean	4.153						
Median	3.578						
Max	6.698						
Min.	2.630						
Std. Dev	1.235						
Probability	0.1020						
observations	32						

Source: compiled by the authors.

Note: Table 2. Explains the descriptive statistics, The Descriptive Statistics results were computed using EViews 12 software.

Table 3

ADF Unit Root Test

Variable	At Level		At First Difference	
	T-Statistic	Probability	T-Statistic	Probability
Inflation (INF)	−4.716	0.001		
Imports	−1.842	0.354	−4.771	0.0006
GDP per Capita	−3.990	0.004		
Population (POP)	−1.526	0.505	−4.379	0.0024
GDP Growth Rate	−4.449	0.001		
Military Expenditure	−1.677	0.432	−4.753	0.0006
Total Debt Service	−1.825	0.361	−8.470	0.0000
Unemployment	−0.318	0.910	−6.692	0.0000

Source: compiled by the authors.

Note: The ADF unit root Test results were computed using EViews 12 software.

tween inflation and its determinants. The ARDL model is particularly suitable for small samples and does not require the variables to be integrated at the same order, making it an ideal choice for this study's dataset.

The ARDL model is specified as follows, utilizing the OLS method for parameter estimation:

$$\Delta Y_t = \alpha_0 + \sum I = 1 p \alpha i \Delta Y_{t-i} + \sum_j = 0 q \beta_j X_{t-j} + \epsilon t, \quad (1)$$

where ΔY_t represents the change in inflation; α_0 — is the constant term; X_t — represents the independent variables; ϵ_t — is the error term.

The dynamic relationship among the variables is examined using the bounds testing approach within the ARDL framework. The F-bounds test is employed to determine the existence of a level relationship. A significant F-statistic indicates a stable long-run relationship among the variables.

For short-run dynamics, the error correction model (ECM) derived from the ARDL model is estimated using OLS. The ECM integrates the short-run adjustments with long-run equilibrium without losing long-run information, specified as:

Table 4

Correlation results

Variable	INF	IMPORT	GDP RATE	GDP.CAP	MLTRY	POP	T. DEBT	UNEMPL
INF	1.000	0.745	−0.230	−0.252	0.643	0.126	0.239	0.061
IMPORT	0.745	1.000	−0.168	−0.137	0.161	−0.068	0.184	0.117
GDP RATE	−0.230	−0.168	1.000	0.957	0.033	−0.092	−0.143	−0.094
GDP.CAP	−0.252	−0.137	0.957	1.000	−0.193	−0.374	−0.321	0.097
MLTRY	0.643	0.161	0.033	−0.193	1.000	0.778	0.744	−0.566
POP	0.126	−0.068	−0.092	−0.374	0.778	1.000	0.648	−0.646
T. DEBT	0.239	0.184	−0.143	−0.321	0.744	0.648	1.000	−0.112
UNEMPL	0.061	0.117	−0.094	0.097	−0.566	−0.646	−0.112	1.000

Source: compiled by the authors.
Note: The Correlation results were computed using EViews 12 software.

Table 5

Least Squares Method

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IMPORTS	1.264	0.160	7.872	0.000
GDP_RATE	113.022	46.595	2.425	0.023
GDP_PER_CAPITA	−115.417	47.602	−2.424	0.023
MLTRY	−3.148	0.822	−3.829	0.000
POP	−114.604	48.868	−2.345	0.027
T_DEBT_S	1.264	0.599	2.108	0.045
UNEMPLO	−0.588	0.441	−1.332	0.195
C	−3.295	6.570	−0.501	0.620
R-squared	0.776 Mean dependent var			8.823
Adjusted R-squared	0.711 S.D. dependent var			4.432
S.E. of regression	2.381 Akaike info criterion			4.785
Sum squared resid	136.128 Schwarz criterion			5.152
Log likelihood	−68.571 Hannan-Quinn critter.			4.907
F-statistic	11.910 Durbin-Watson stat			2.148
Prob(F-statistic)	0.000002			

Source: compiled by the authors.
Note: The Least Square Test results were computed using EViews 12 software.

$$\Delta Y_t = \gamma_0 + \sum I = 1 p \gamma_i \Delta Y_{t-I} + \sum_j = \\ = 0 q \delta j \Delta X_{t-j} + \lambda \mathrm{ECM}_{t-1} + \epsilon_t, \quad (2)$$

where ΔY_t — the change (or first difference) of the dependent variable ΔY_t; γ_0 — the intercept term or constant; $\sum I$ — the sum of the lagged differences of the dependent variable Y_{t-1}; $\sum_j$ — the sum of the lagged differences of the independent variable; ECM_{t-1} — the error correction term from the cointegration equation; ϵ_t — The error term, representing the unexplained part of the model.

To ensure the reliability and robustness of the results, several diagnostic tests are conducted:

R-Squared and Adjusted R-Squared: These indicate how much of the variability in inflation is explained by the independent variables, with a high value confirming a good fit.

Durbin-Watson Statistic: This statistic checks for autocorrelation in the residuals, confirming that the model is free from serial correlation issues.

F-Statistic: This test assesses the overall significance of the regression model, indicating whether the included variables collectively explain a significant portion of inflation's variation.

5. RESULTS AND DISCUSSION

5.1. Main Findings

ADF tests in *Table 3* show that only inflation, GDP per capita and GDP growth are stationary, while other variables become stationary after taking a difference. It means that those regressors either have time-dependent mean, variance or autocorrelation function.

In our research endogeneity is a huge issue and that is why the correlation is less relevant, but several important observations have been made in the *Table 4*. Mainly, there is high positive correlation between inflation and imports and military expenditures, 0.74 and 0.64 respectively. This phenomenon can be mainly explained through the increase of the demand, which changes the equilibrium output with a higher price level. It is also worth noting that GDP growth and GDP per capita have a small negative association coefficient, which can imply that the wealthier and the more economically successful a country is, the lower is the inflation rates. Inflation usually represents uncertainty and risk in the economy and in stable countries those factors are generally lower compared to the developing world.

The regression analysis investigates the impact of macroeconomic factors on inflation by using the least squares method (*Table 5*). The dependent variable is inflation (INFLTION), and the independent variables include imports (IMPORTS), GDP growth rate (GDP_RATE), GDP per capita (GDP_PER_CAPITA), military expenditure (MLTRY), population (POP), total debt service (T_DEBT_S), and unemployment (UNEMPLO). The regression analysis of inflation determinants reveals that imports, GDP growth rate, GDP per capita, military expenditure, population, and total debt service significantly impact inflation. Imports (1.264164) and total debt service (1.264538) positively correlate with inflation, while GDP per capita (–115.4178), military expenditure (–3.148854), and population (–114.6041) show negative correlations. GDP growth rate (113.0222) also positively affects inflation. Although unemployment has a negative coefficient (–0.588657), it is not statistically significant. The model, with an R-squared of 0.776480, suggests that about 77.65% of the variation in inflation is explained by these variables. The significant F-statistic (11.91040, $p = 0.000002$) indicates a robust overall model fit, with the Durbin–Watson statistic (2.148244) showing no significant autocorrelation.

Our analysis utilizing the Autoregressive Distributed Lag (ARDL) model showed dynamics and significant relationships between inflation and macroeconomic variables (*Table 6*). The dependent variable is inflation, and the independent variables include imports, GDP growth rate, GDP per capita, military expenditure, population, total debt service, and unemployment. the coefficient for lagged inflation (INFLTION (–1)) is –0.809456, indicating a significant negative autocorrelation ($p = 0.0003$). This suggests that higher past inflation tends to reduce current inflation, possibly due to corrective economic measures taken in response to prior inflation spikes. Imports showing a substantial immediate positive impact on inflation, with a coefficient of 2.575389 ($p = 0.0000$). However, the effect of imports re-

verses at the second lag (–1.572327, p = 0.0014), highlighting the complex short-term dynamics where initial increases in import prices may be offset by adjustments in subsequent periods. the GDP growth rate positively influences inflation both contemporaneously (128.9903, p = 0.0007) and with lags, underscoring the strong linkage between economic growth and inflationary pressures. This finding aligns with Fischer's study, which found a positive correlation between GDP growth and inflation in developing economies. and, GDP per capita consistently shows a significant negative relationship with inflation [23]. The coefficients for the current period (–133.3364, p = 0.0007) and lagged periods shows that higher living standards, represented by GDP per capita, tend to lower inflation. This supports the results of Barro [24], who suggested that higher income levels are associated with better economic stability and lower inflation rates. Military expenditure has a nuanced impact on inflation. The immediate effect is significantly negative (–4.710493, p = 0.0047), but the second lag reveals a positive effect (4.216175, p = 0.0175), suggesting initial reductions in inflation due to increased military spending may be followed by inflationary pressures in the longer term. This

Table 6

ARDL MODEL Test (Dependent Variable — INFLATION)

Variable and statistic	Coefficient	Std. Error	t-Statistic	Prob.*
INFLTION (–1)	–0.809	0.122	–6.587	0.000
IMPORTS	2.575	0.199	12.919	0.000
IMPORTS (–1)	–0.072	0.203	–0.356	0.732
IMPORTS (–2)	–1.572	0.308	–5.101	0.001
GDP_RATE	128.990	22.460	5.743	0.000
GDP_RATE (–1)	69.694	23.056	3.022	0.019
GDP_RATE (–2)	139.723	31.107	4.491	0.002
GDP_PER_CAPITA	–133.336	22.954	–5.808	0.000
GDP_PER_CAPITA (–1)	–73.046	23.616	–3.092	0.017
GDP_PER_CAPITA (–2)	–144.436	31.872	–4.531	0.002
MLTRY	–4.710	1.152	–4.086	0.004
MLTRY (–1)	–1.551	1.599	–0.969	0.364
MLTRY (–2)	4.216	1.364	3.090	0.017
POP	–129.625	23.954	–5.411	0.001
POP (–1)	–81.679	24.741	–3.301	0.013
POP (–2)	–153.299	33.529	–4.572	0.002
T_DEBT_S	0.789	0.428	1.840	0.108
T_DEBT_S (–1)	1.974	0.403	4.896	0.001
T_DEBT_S (–2)	–0.729	0.349	–2.088	0.075
UNEMPLO	–1.790	0.329	–5.438	0.001
UNEMPLO (–1)	–0.573	0.373	–1.535	0.168
UNEMPLO (–2)	–1.422	0.416	–3.413	0.011
C	65.562	10.89238	6.019091	0.0005
R-squared	0.991	Mean dependent var		8.701
Adjusted R-squared	0.966	S.D. dependent var		4.545
S.E. of regression	0.827	Akaike info criterion		2.538
Sum squared resid	4.797	Schwarz criterion		3.612
Log likelihood	–15.071	Hannan–Quinn critter.		2.881
F-statistic	39.428	Durbin–Watson stat		2.693
Prob(F-statistic)	0.000			

Source: compiled by the authors.

Note: The ARDL Test results were computed using EViews 12 software.

Table 7

ARDL Long Run Form and Bounds Test (Dependent Variable — D (INFLTION)

Conditional Error Correction Regression				
Variable	**Coefficient**	**Std. Error**	**t–Statistic**	**Prob.**
C	65.562	10.892	6.019	0.000
INFLTION (–1) *	–1.809	0.122	–14.725	0.000
IMPORTS (–1)	0.930	0.221	4.193	0.004
GDP_RATE (–1)	338.408	47.808	7.078	0.000
GDP_PER_CAPITA (–1)	–350.819	49.162	–7.135	0.000
MLTRY (–1)	–2.045	1.112	–1.839	0.108
POP (–1)	–364.605	51.053	–7.141	0.000
T_DEBT_S (–1)	2.0334	0.780	2.605	0.035
UNEMPLO (–1)	–3.786	0.563	–6.725	0.000
D (IMPORTS)	2.575	0.199	12.919	0.000
D (IMPORTS (–1))	1.572	0.308	5.101	0.001
D (GDP_RATE)	128.990	22.460	5.743	0.000
D (GDP_RATE (–1))	–139.723	31.107	–4.491	0.002
D (GDP_PER_CAPITA)	–133.336	22.954	–5.808	0.000
D (GDP_PER_CAPITA (–1))	144.436	31.872	4.531	0.002
D (MLTRY)	–4.710	1.152	–4.086	0.004
D (MLTRY (–1))	–4.216	1.364	–3.090	0.017
D(POP)	–129.625	23.954	–5.411	0.001
D (POP (–1))	153.299	33.529	4.571	0.002
D (T_DEBT_S)	0.789	0.428	1.840	0.108
D (T_DEBT_S (–1))	0.729	0.349	2.088	0.075
D (UNEMPLO)	–1.790	0.329	–5.438	0.001
D (UNEMPLO (–1))	1.422	0.416	3.413	0.011
* p-value incompatible with t-Bounds distribution				
Levels Equation Case 2: Restricted Constant and No Trend				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
IMPORTS	0.514	0.116	4.402	0.003
GDP_RATE	187.022	22.348	8.368	0.000
GDP_PER_CAPITA	–193.881	22.904	–8.464	0.000
MLTRY	–1.130	0.606	–1.863	0.104
POP	–201.499	23.686	–8.506	0.000
T_DEBT_S	1.123	0.411	2.730	0.029
UNEMPLO	–2.092	0.255	–8.183	0.000
C	36.233	5.262	6.884	0.000

Source: compiled by the authors.
Note: The ARDL and Bounds Test results were computed using EViews 12 software.

aligns with Benoit [25] who found mixed effects of military spending on economic growth and inflation across different countries and time periods. Population size reveal a strong negative impact on inflation, both in the current period (–129.6258, $p = 0.0010$) and with lags. This could indicate econo-

mies of scale in larger populations leading to lower inflation, consistent with studies such as that by [26], which highlighted the demographic influences on economic performance. Total debt service presents mixed effects on inflation. While the immediate impact is positive (0.789089, $p = 0.1083$), the second lag shows a negative effect (–0.729762, $p = 0.0752$). This suggests that while initial debt servicing might be inflationary due to increased financial burden, over time, fiscal adjustments and debt repayments can lead to reduced inflationary pressures. Unemployment shows a consistently negative relationship with inflation, with significant coefficients across different lags. This supports the traditional Phillips curve relationship, suggesting that higher unemployment rates are associated with lower inflation. The constant term is significantly positive (65.56226, $p = 0.0005$), reflecting other unobserved factors influencing inflation. The ARDL model's high R-squared (0.991995) and adjusted R-squared (0.966836) values shows a strong explanatory power, suggesting that the included variables effectively capture the variability in inflation. The F-statistic (39.42880, $p = 0.000024$) confirms the overall significance of the model. Additionally, the Durbin–Watson statistic (2.693144) suggests no serious autocorrelation issues, indicating reliable model estimates.

EC = INFLTION — (0.5144*IMPORTS + +187.0221*GDP_RATE — 193.8810 * *GDP_PER_CAPITA — 1.1305*MLTRY– –201.4998*POP + + 1.1238 *T_DEBT_S– –2.0928*UNEMPLO + 36.2331).

The results of the ARDL (Autoregressive Distributed Lag) model presented in the *Table 7* offer significant results into the determinants of inflation. The analysis employs the bounds testing approach to cointegration, revealing both short-run and long-run relationships between inflation and targeted economic variables. The long-run equation indicates a significant cointegration relationship among the variables, as evidenced by the F-bounds test (F-statistic = 27.96033) in the *Table 8*, which surpasses the critical values at the 1% significance level. The null hypothesis of no levels relationship is rejected, confirming a stable long-term equilibrium among the variables.

5.2. Key Long-Run Coefficients

1. Imports (IMPORTS): The coefficient of 0.514354 ($p = 0.0031$) showed a positive long-run relationship with inflation. This aligns with existing literature indicating that higher import prices can lead to increased inflationary pressures through cost-push inflation mechanisms [27].

Table 8

F-Bounds Test (Null Hypothesis: No levels relationship)

Test Statistic	Value	Signify I(0) I(1)		
		Asymptotic: n = 1000		
F-statistic	27.96033	10%	1.92	2.89
k	7	5%	2.17	3.21
		2.5%	2.43	3.51
		1%	2.73	3.9
Actual Sample Size	30	Finite Sample: n = 30 10% 2.277 3.498		
		5%	2.73 4.163	
		1%	3.864 5.694	

Source: compiled by the authors.

Note: The ARDL and Bounds Test results were computed using EViews 12 software.

2. GDP Growth Rate (GDP_RATE): The coefficient of 187.0221 ($p < 0.0001$) highlights a substantial positive impact on inflation. This is consistent with demand-pull inflation theories, where increased economic activity and demand lead to higher price levels [28].

3. GDP Per Capita (GDP_PER_CAPITA): The negative coefficient of −193.8810 ($p < 0.0001$) suggests that higher per capita GDP reduces inflation, possibly reflecting improved productivity and efficiency in the economy, which counteracts inflationary pressures.

4. Military Expenditure (MLTRY): With a coefficient of −1.130526 ($p = 0.1047$), the impact is negative but not statistically significant. This might indicate that military spending does not have a direct inflationary impact in the studied context, aligning with some studies that show mixed results on the relationship between military expenditure and inflation [29].

5. Population (POP): The coefficient of −201.4998 ($p < 0.0001$) suggests a significant negative relationship with inflation. This could reflect demographic dynamics where a larger working-age population can enhance economic output and reduce inflationary pressures (Bloom & Canning, [30].

6. Total Debt Service (T_DEBT_S): The coefficient of 1.123796 ($p = 0.0293$) indicates a positive relationship with inflation, implying that higher debt servicing costs may lead to higher inflation, possibly due to fiscal deficits and monetary expansion [31].

7. Unemployment (UNEMPLO): The negative coefficient of −2.092778 ($p < 0.0001$) confirms the inverse relationship between unemployment and inflation, consistent with the Phillips curve theory [32].

5.3. Short-Run Dynamics

The short-run error correction model highlights how deviations from the long-run equilibrium are corrected over time. The error correction term (EC) has a coefficient of −1.809456 ($p < 0.0000$), indicating a strong and significant speed of adjustment back to equilibrium.

1. Imports (D(IMPORTS)): The positive coefficients for the contemporaneous (2.575389, $p < 0.0000$) and lagged (1.572327, $p = 0.0014$) terms indicate that changes in imports have immediate and lasting inflationary effects in the short run.

2. GDP Growth Rate (D(GDP_RATE)): The mixed signs of the contemporaneous (128.9903, $p = 0.0007$) and lagged (−139.7235, $p = 0.0028$) terms reflect the dynamic and potentially cyclical nature of GDP growth's impact on inflation.

3. GDP Per Capita (D(GDP_PER_CAPITA)): Similar to the GDP growth rate, the negative contemporaneous (−133.3364, $p = 0.0007$) and positive lagged (144.4364, $p = 0.0027$) coefficients suggest complex short-term effects on inflation.

4. Military Expenditure (D(MLTRY)): The negative coefficients for both the contemporaneous (−4.710493, $p = 0.0047$) and lagged (−4.216175, $p = 0.0175$) terms indicate that increases in military spending reduce inflation in the short run.

5. Population (D(POP)): The negative contemporaneous (−129.6258, $p = 0.0010$) and positive lagged (153.2999, $p = 0.0026$) coefficients again point to complex short-term demographic effects on inflation.

6. Total Debt Service (D(T_DEBT_S)): The short-run impact is positive but less significant, suggesting that debt servicing has a more pronounced long-term effect on inflation.

7. Unemployment (D(UNEMPLO)): The significant negative contemporaneous (−1.790149, $p = 0.0010$) and positive lagged (1.422841, $p = 0.0112$) terms reflect the immediate deflationary impact of rising unemployment, with some delayed inflationary pressures possibly due to decreased production costs.

The ARDL model's findings underscore the multifaceted nature of inflation, influenced by both demand and supply-side factors. The significant long-term relationships align with theoretical expectations and previous empirical studies, while the short-term dynamics reveal the complexity of economic interactions affecting inflation. Future research could further explore these relationships, considering potential structural breaks and non-linear effects for a more comprehensive understanding.

6. DISCUSSION

Addressing the research question regarding the main factors that influence inflation in Pakistan

between 2018–2022, there have been uncovered significant interdependencies and intercorrelations between considered variables. The findings of the study uncover the intricate dynamics of macroeconomic variables in Pakistan, providing valuable insights into the main influences of the inflation rates in the country.

Firstly, the application of descriptive statistics offers a comprehensive overview of the central tendencies and variability of the macroeconomic indicators. Despite moderate economic growth, disparities exist across variables, with notable variability observed in GDP per capita, GDP growth rate, CPI, and imports. Such insights underscore the need for nuanced monetary policy as those variables may influence price level change spikes. The ADF unit root test confirms the stationarity of most variables, indicating that most are stationary at level while others become stationary at first difference, which is essential for robust econometric analysis.

Correlation analysis reveals relationships between macroeconomic variables, with CPI exhibiting strong positive correlations with military expenditures and imports, underscoring their pivotal role in driving demand and economic activity in general. On the other hand, GDP per capita shows an inverse correlation with inflation, suggesting that the wealthier countries are on average, the smaller the price inflation there is. The conclusion about government expenditures have also been proven to be statistically significant [5]. In the paper studying economic growth [7] negative association between inflation of GDP have been established, which confirms results of this paper.

The Autoregressive Distributed Lag (ARDL) model further investigates the long-term relationships between CPI and other macroeconomic variables. Inflation has high autocorrelation, as the lagged term is significant on any confidence level with the negative coefficient, meaning that inflation has a general decreasing trend in the Pakistan. Furthermore, the ARDL model highlights the impact of same–time and lagged imports, GDP per capita, total population, unemployment and GDP growth. The stability of long-run relationships, confirmed by the F-bounds test, increases confidence in the reliability of our results.

In summary, this study contributes to the existing literature by offering a comprehensive analysis of macroeconomic dynamics in Pakistan to determine main factors that influence inflation. By investigating the interconnected relationships between key economic indicators, it provides valuable insights for policymakers and stakeholders to formulate evidence–based strategies aimed at enhancing monetary stability and fostering stable economic growth. Moving forward, continued monitoring and proactive policy interventions will be essential to navigate evolving economic challenges and capitalize on emerging opportunities in Pakistan's dynamic economic landscape.

7. CONCLUSION

The analysis of this study has provided valuable insights into the complex dynamics influencing inflation in Pakistan between 1991 to 2022. By Utilizing a comprehensive set of macroeconomic variables, including imports, GDP growth rate, GDP per capita, military expenditure, population, total debt service, and unemployment, this research investigates the multifaceted nature of inflation and its determinants in Pakistan. The results showed significant interdependencies and correlations among these variables.

Descriptive statistics reveal substantial variability in key economic indicators, highlighting the disparities in GDP per capita, GDP growth rate, CPI, and imports. These findings emphasize the necessity for nuanced and targeted monetary policies to manage the intricate interplay of these variables and their influence on inflation. The ADF unit root test results indicate that inflation, GDP per capita, and GDP growth are stationary at level, while other variables become stationary after taking the first difference. This distinction is crucial for ensuring robust econometric analyses and reliable conclusions. The correlation results shows that CPI has strong positive correlations with military expenditures and imports, suggesting their pivotal role in driving demand and economic activity. and GDP per capita shows an inverse correlation with inflation, indicating that wealthier nations typically experience lower inflation

rates. These correlations align with previous empirical studies and theoretical expectations, reinforcing the validity of the findings.

The regression analysis reveals that imports and total debt service positively correlate with inflation, while GDP per capita, military expenditure, and population show negative correlations. Although unemployment has a negative coefficient, it is not statistically significant. The model's R-squared value of 0.776480 suggests that approximately 77.65% of the variation in inflation is explained by these variables, indicating a robust overall model fit. The Autoregressive Distributed Lag (ARDL) model demonstrate the significant long-term relationships between CPI and other macroeconomic variables.

The findings reveal that inflation exhibits high autocorrelation, with a significant negative coefficient for the lagged term, indicating a general decreasing trend in Pakistan. The model also underscores the impact of same-time and lagged imports, GDP per capita, total population, unemployment, and GDP growth on inflation. The ARDL model's short-term dynamics reveal the complexity of economic interactions affecting inflation. Imports, GDP growth rate, and GDP per capita have significant short-term effects on inflation, with contemporaneous and lagged coefficients indicating intricate relationships. Military expenditure, population, total debt service, and unemployment also exhibit significant short-term impacts, reflecting both demand and supply-side influences on inflation. The findings of this study have several important implications for policymakers and stakeholders in Pakistan. Given the significant correlations and causal relationships identified, policymakers should consider targeted monetary policies that address the specific drivers of inflation. For instance, managing imports and military expenditures could be crucial for stabilizing prices. The inverse relationship between GDP per capita and inflation suggests that policies aimed at enhancing economic growth and increasing per capita income could help mitigate inflationary pressures. The positive correlation between total debt service and inflation highlights the need for effective debt management strategies. Reducing the burden of debt servicing could help alleviate inflationary pressures in the long term.

The study underscores the necessity for comprehensive economic reforms that address the multifaceted nature of inflation. Policies should consider both demand and supply-side factors, ensuring a balanced approach to economic stability. Continuous monitoring of macroeconomic variables and further research into their dynamic interactions are essential for developing effective policy interventions. Future research could explore potential structural breaks and non-linear effects to provide a more comprehensive understanding of inflation dynamics in Pakistan.

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I. Ali – development of the general concept of the study.
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Financial Framework for Non-Resource Exports to Foster the Dynamic Growth of the Russian Economy

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ABSTRACT

The relevance of the article is rooted in the critical role of the non-resource sector in the Russian economy, particularly in the face of increasing sanctions. **The purpose** of the article is to propose a comprehensive framework for financial assistance to non-resource exports, fostering the sustained growth of the Russian economy in the current context. **Methods:** the research methodology is based on general and special methods of cognition; analysis of reports of international organizations, official databases of statistical data, normative documents, monographs and scientific publications. **Scientific novelty:** Drawing on the analysis of successful international approaches, we have developed a holistic framework for financial assistance to non-traditional exports in Russia. This framework is designed to complement the national project "International Cooperation and Export", which is focused on implementing the Strategy for the Development of Foreign Economic Activity of the Russian Federation until 2030. **Research results:** The article explores the global experience of comprehensive export support systems and suggests financial measures to help Russian manufacturers of industrial products. **Practical significance** of the article lies in the fact that the financial instruments developed for non-primary non-energy exports can be used in the implementation of the Federal National Project "International Cooperation and Export".

Keywords: financial measures; non-primary exports; exporters; international cooperation; digital economy; tax incentives; subsidies

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INTRODUCTION

Since the early 1990s, Russian exports have been primarily focused on raw materials, mostly oriented towards Western countries. In light of the sanctions imposed in 2022, it is especially important for our country to increase the share of the manufacturing sector in GDP to reduce the domestic economy's dependence on the export of raw materials (such as mineral products, metals, and precious stones). Thus, it becomes crucial to more widely and effectively apply financial support measures for Russian enterprises to help them independently enter foreign markets with high value-added products.

Amid increasing sanctions pressure, it is particularly relevant for the Russian Federation to promote cross-border financial services, including the use of digital technologies and the establishment of proxy financial networks, which enable efficient trade operations with foreign partners.

Improving financial measures to stimulate non-raw material exports supports the implementation of the national project "International Cooperation and Export", aimed at developing Russia's foreign economic activity until 2030. We believe that the creation of a comprehensive system of financial support for Russian exports will help develop production and sales chains, and consequently, enhance the export potential of industrial products.

GLOBAL EXPERIENCE OF INTEGRATED EXPORT SUPPORT SYSTEMS

Foreign national export development institutions provide subsidies and tax incentives to both large companies and SMEs, make grants to equity capital, and simplify borrower requirements for export-oriented projects. In the system of trade regulation, export guarantee and insurance support on favorable terms becomes of great importance, along with the implementation of a flexible approach to market interest rates for firms exporting goods or services.[1]

As international practice shows, export financing is carried out by governments through export credit agencies (ECAs). National ECAs assist export activities in collaboration with development banks, insurance companies, and private and state funds. For example, export agencies in developed countries primarily create targeted financial support programs for small and medium-sized enterprises (SMEs). These national institutions actively apply various methods of export stimulation and support, such as equity financing, providing grants, and applying a zero VAT rate.[2]

In most developed and developing countries, export financing is handled by the Export-Import Bank (Eximbank), a development institution owned by the government. Typically, Eximbank provides credit to a commercial bank, which, in turn, offers a loan to the importer at a preferential rate and receives compensation from the development bank for the difference between the market rate and the commercial rate.[3]

In current practice, foreign ECAs and national banks mainly follow the guidelines set by the Organization for Economic Cooperation and Development (OECD) in their 2023 Arrangement on Officially Supported Export Credits[4] (OECD Arrangement).

The main provisions of the OECD Arrangement on acceptable export credit financing include:

[1] URL: http://english.eximbank.gov.cn/tm/en-TCN/index_617.html; https://www.exim.com.my/en/; http://www.asei.co.id/index.php/en/product; http://www.ecic.co.za/Products/Export-Credit-Insurance; https://www.gov.uk/government/organisations/uk-trade-investment; https://www.ksure.or.kr/english/index.jsp

[2] URL: ci.pdfhttps://thedocs.worldbank.org/en/doc/0534eca53121c137d3766a02320d0310–0430012022/original/Subsidies-Trade-and-International-Cooperation-April-19-ci.pdf

[3] URL: ci.pdfhttps://thedocs.worldbank.org/en/doc/0534eca53121c137d3766a02320d0310–0430012022/original/Subsidies-Trade-and-International-Cooperation-April-19-ci.pdf

[4] URL: https://www.wto.org/library/events/event_resources/agri_2802202310/83_377.pdf.

1. Minimum Advance Payment by the Importer: the recommended advance payment (initial contribution from the government) should be at least 15% of the export contract value. In this case, the government support should not exceed 85% of the contract value (Article 10).

2. Favorable Loan Repayment Terms for Periods of 2 to 10 Years (excluding high-income countries): the duration of concessional financing depends on the economic development level of the country (Article 11). Loan repayments are made in equal installments (semi-annually). A lump-sum payment cannot exceed 25% of the total loan (Article 14). The OECD Arrangement allows for extended financing terms of up to 15–18 years for socio-environmental projects.

3. Low-Interest Loans: the government may set a minimum interest rate for loans according to the CIRR (OECD Commercial Interest Reference Rate) (Article 19). CIRRs are set by national ECAs within each country, based on the interest rate of government bonds in the national currency (Article 20). The duration of the concessional rate cannot exceed 120 days (Article 21).[5]

In accordance with the OECD Arrangement, a minimum credit risk premium is established. Exporters of industrial products (excluding agricultural and military goods) can be recipients of subsidies. The methodological recommendations of the OECD Arrangement serve as a model for many national institutions in creating unified mechanisms for financial support of industrial exports. Currently, foreign ECAs are paying particular attention to the digitalization of the products and service channels they offer to national exporters [1]. In collaboration with exporters, they focus on reducing administrative barriers through the transition to electronic document flow and the development of remote service technologies. At the same time, leading foreign ECAs primarily concentrate on providing financial services to SMEs.

The digitalization of the SME segment facilitates access to additional financing sources, training, new technologies, and timely receipt of various government support tools. For example, in Malaysia, since 2019, the Industry4WRD program has been successfully operating, aimed at helping SMEs transition to Industry 4.0 to improve the efficiency of local companies.[6]

Leading foreign ECAs also place significant emphasis on improving climate finance. For example, in 2022, the United Nations established the Zero-Emission Export Credit Agency Alliance[7] (NZECA), which brings together leading state ECAs and financial-credit institutions to decarbonize global trade by 2050. In 2023, the financial alliance allocated $ 120 billion to support "green" trade between participating countries.[8]

In both developed and developing countries, great importance is placed on stimulating the entry of export-oriented SMEs into foreign markets. The most common measures of state export support for SMEs are presented in *Table 1*.

Based on the study of the best global practices, UNCTAD experts identified the opportunities and advantages of government support tools for SMEs. These are aimed at expanding access to preferential financing, such as equity participation, grants, and insurance services.[9]

In addition, the most common tools for entrepreneurs include: financial incentives, tax benefits, and support to enhance export potential through the provision of consulting services by national institutions (such as market research, staff training, establishing business connections between partner countries, and receiving practical recommendations from leading experts) (*Table 1*).

[5] URL: https://one.oecd.org/document/TAD/PG(2018)8/En/pdf

[6] URL: https://unctad.org/system/files/official-document/diae2023d7_en.pdf

[7] URL: https://www.unep.org/news-and-stories/press-release/export-credit-agencies-supporting-billions-global-trade-form-net

[8] URL: https://www.unep.org/news-and-stories/press-release/export-credit-agencies-supporting-billions-global-trade-form-net

[9] URL: https://unctad.org/system/files/official-document/diae2023d7_en.pdf

Table 1

Evaluation of export and investment promotion initiatives in line with UNCTAD guidelines

Export Support Measure	Comparative Characteristics
Financial Incentives	• In most countries, loans, subsidies, grants, and equity participation tools are primarily targeted at the SME segment • The benefits for SMEs are greater, as small businesses, unlike large corporations, are limited in their sources of financial resources. • Due to information asymmetry, access to export support tools may be more complex for the SME segment
Simplification of Tax and Budgetary Policies	• In some countries, fiscal incentives include exemptions from profit tax for a certain period and preferential taxation for high-tech products. • SMEs generally do not participate in tax arbitrage schemes and may benefit from reinvesting foreign income
Investment Guarantees and Insurance	• Access to investment guarantees for SMEs is difficult due to the requirement to comply with ESG criteria set by foreign partner countries. • Guarantees and insurance services are provided by the Multilateral Investment Guarantee Agency (MIGA) and Eximbank

Source: compiled by the author using data: URL: https://unctad.org/system/files/official-document/diae2023d7_en.pdf

In modern global practice, fiscal and financial instruments are provided to participants in foreign economic activities alongside other informational services to promote exports and investments. A clear example is the non-profit Indian SME Forum, which, in addition to a range of acceleration programs for innovative enterprises and support for accessing financial resources, actively uses the International Trade Desk platform. This platform is designed for international knowledge exchange and allows national SMEs to obtain comprehensive information about global markets and how to expand business contacts abroad.[10]

For example, the European Intellectual Property Support Service assists SMEs in obtaining patents or trademarks. It is worth noting that supporting the export of competitive products helps stimulate investment activities, as it leads to an expansion of the cooperation geography. For instance, the Australian Trade and Investment Commission (Austrade) provides financial support to SMEs in the form of grants for up to 8 years, as well as offering practical advice on entering international markets. Additionally, Austrade helps export companies gain access to tax incentives in foreign countries.[11]

As of 2024, there are over 24 million SMEs operating in the European Union. Their share in the EU GDP averages around 50%. This segment accounts for approximately 99% of all businesses in the non-financial sector of European industry, providing 70% of jobs in the EU.[12]

Despite positive trends in the development of SMEs, the EU continues to provide comprehensive support for them. In particular, in 2020, the European Commission developed a strategy aimed at stimulating their activities in the fields of sustainable development and digitalization (*Table 2*).

When considering country-specific aspects of SME stimulation in the EU, a number of key government support measures can be identified. In 2021, Germany announced its intention

[10] URL: https://unctad.org/system/files/official-document/diae2023d7_en.pdf

[11] URL: https://www.austrade.gov.au/en/how-we-can-help-you/australian-exporters

[12] URL https://single-market-economy.ec.europa.eu/system/files/2023–08/Annual%20Report%20on%20European%20SMEs%202023_FINAL.pdf

Table 2

The strategy for holding a commission to encourage the activity of SMEs

Support Measures for SMEs	Types
Expanding Access to Financing	• Creation of a public-private primary public offering (IPO) fund for SMEs under the InvestEU program using EU budget guarantees* • Implementation of a business financing initiative considering gender aspects, aimed at promoting women entrepreneurship. • Development of funds for investments in "green" technologies to increase access of innovative SMEs to equity financing. • Implementation of an initiative for the adoption of blockchain technologies allowing SMEs in the EU to trade exchange bonds
Increasing Export Potential and Transition to Sustainable Development and Digitalization	• Modernization of the innovation business support network, including the provision of new specialized services to achieve the UN Sustainable Development Goals (SDGs) ** • Development of digital accelerated courses for SME employees in artificial intelligence, cybersecurity, and blockchain technologies

Source: compiled by the author using data: URL: https://www.europarl.europa.eu/RegData/etudes/BRIE/2023/745679/EPRS_BRI(2023)745679_EN.pdf

* URL: https://www.european-microfinance.org/news/investeu-programme-questions-and-answers

** URL: https://een.ec.europa.eu/about-enterprise-europe-network

to focus on the "green" transition, specifically developing targeted programs for the development of eco-friendly wooden construction and implementing decarbonization investment projects aimed at innovative SMEs by 2030. In 2023, Belgium declared its intention to accelerate the development of European blockchain infrastructure[13] in the coming years.

It is worth noting that in developed countries, there is an active development of alliances, allowing various SMEs to pool resources both among themselves and with large businesses. The creation of strategic business alliances based on a cluster approach reduces the financial burden on national export credit agencies (ECAs). At the same time, many ECAs not only provide support for individual trade projects but also offer comprehensive assistance to national enterprises to enhance their export potential and intensify foreign economic activity. For example, since July 2020, the UK has implemented the "Export Development Guarantee" program, under which companies can receive funding from a public-private fund of up to $ 500 million without signing an export contract by applying to participate in a tender.[14]

International export financing practices also show high demand for factoring services. In 2022, the total volume of the global factoring services market exceeded $ 3.64 trillion. According to consulting firm Straits Research, the volume of factoring transactions worldwide will nearly double by 2031, reaching $ 5.68 trillion.[15] This is due to the active use of advanced technologies in the global factoring market. The implementation of blockchain technology increases the transparency and security of international factoring transactions, reducing the risk of fraud and errors. Meanwhile, artificial intelligence and data analysis allow both factoring companies and business clients to

[13] URL: https://www.cryptopolitan.com/ru/%D 0%B 1%D 0%B 5%D 0%BB%D 1%8C%D 0 B 3%D 0%B 8%D 1%8F-%D 0%B 2%D 0%BE%D 0%B 7%D 1%80%D 0%BE%D 0%B 6%D 0%B 4%D 0%B 5%D 0%BD%D 0%B 8%D 0%B 5-%D 0%B 1%D 0%BB%D 0%BE%D 0%BA%D 1%87%D 0%B 5%D 0%B 9%D 0%BD%D 0%B 0-%D 0%B 5%D 1%81/

[14] URL: https://www.gov.uk/guidance/export-development-guarantee

[15] URL: https://straitsresearch.com/report/factoring-market

make informed decisions. Modern technological solutions make the process of providing international factoring services more automated.

According to Rosstat, the Russian factoring market reached 2.26 billion rubles in 2023, continuing to show a trend of steady growth. However, despite the increase in absolute indicators, Russia lags behind leading countries in the development of factoring services. In 2023, the share of SMEs in the total amount of factoring financing in the Russian market accounted for 9% (compared to 8% in 2022)[16]; compared to 2022, the volume of disbursements in this segment increased. It is also worth noting that there is a lag of Russian SMEs in the use of export factoring as a trade financing tool compared to large companies.

Thus, during the period from 2020 to 2024, the following trends were observed in export financing assistance:

- Strengthening the financial support measures for SMEs implemented by national institutions and development banks in international trade.
- Improvement in the automation and digitalization processes of export. In the current environment, there is a broader use of blockchain technology, artificial intelligence, and digital trade and financial platforms in the context of export support [2].
- Development of real-time data exchange technologies, enabling export-oriented enterprises to quickly access required information.[17]
- Increased financing of supply chains, with major participants being both multinational corporations (MNCs) and SMEs. In this case, large corporations and small enterprises do not compete but develop partnership relationships based on trust and complementarity. This allows enterprises to access funds through various financing instruments.
- Expansion of financial support tools for export ESG projects when entering foreign markets, based on the OECD Arrangement recommendations, taking into account the UN SDGs until 2030 [3].
- The growing role of innovation in financial market development, driven by the deepening interaction between fintech companies and commercial banks.[18] The partnership between fintech firms and banking institutions allows the latter to access advanced technologies.
- Development of international factoring. Export financing with deferred payment as a form of export credit is becoming increasingly popular. Additionally, leasing facilitates the entry of MNCs into third-country markets with their unique equipment, providing additional competitive advantages for exporters.

FORMATION OF A END-TO-END SYSTEM OF FINANCIAL SUPPORT FOR EXPORTS IN THE RUSSIAN FEDERATION

The export support measures provided by the Russian Export Center (REC) align with global practices. At the same time, based on the conducted research, we believe it is advisable to introduce a number of additional proposals aimed at creating a end-to-end system of financial support for non-resource exports, ensuring the dynamic development of Russia's economy.

Considering the tasks of diversifying Russian exports, it is possible to develop specialized regional and/or sectoral export support programs with a specific (targeted) focus. For SMEs, for example, when introducing high value-added products to foreign markets, the subsidies and compensation for R&D costs provided by the government could be higher than those for resource-based companies. It should be emphasized that each country has its own peculiari-

[16] URL: https://asfact.ru/wp-content/uploads/afc-y2023_open_upd.pdf

[17] URL: https://www.tradewindfinance.com/news-resources/international-trade-finance-trends-2023/

[18] URL: https://www.tradewindfinance.com/news-resources/international-trade-finance-trends-2023/

ties in doing business, as well as varying levels of economic and technological development across industries. In this regard, exporters' entry into foreign markets is associated with different levels of country risks (economic and geopolitical). For example, Russian exporting companies face different barriers when entering industry markets in rapidly growing Southeast Asian economies compared to less developed African markets, and the methods for overcoming these barriers vary. We suggest the possibility of creating an expert (working) group within the REC, whose activities would focus on developing systemic measures to support the entry of high value-added products into potential target markets. In this case, the financing volume for export deliveries will depend not only on internal factors but also on the level of country risk, which is particularly important in the context of the turbulence in the global economy.

In the context of supporting industrial cooperation within the EAEU, the creation of joint Eurasian enterprises for the production of high-tech products that comply with environmental requirements is highly relevant. Minimizing the negative impact of jointly produced products on the environment requires a comprehensive approach involving all economic entities of the EAEU member countries, including development institutions, commercial banks, and other financial and credit structures. Therefore, it is advisable to systematize the leading industries of the EAEU countries and establish competitive enterprises in partner countries. This will strengthen cooperation between large businesses and SMEs, increase funding for rapidly growing companies in manufacturing sectors such as machine engineering, metallurgy, and biotechnology. We believe it is necessary to implement this initiative based on the Eurasian Development Bank (EDB) with expert-analytical support from the Eurasian Economic Commission (EEC). In this context, Rosselkhozbank, together with the development banks of the EAEU member countries, can make a significant contribution to the development of a cross-cutting system of credit support for the export of high value-added products to the markets of friendly states. Thus, expanding industrial cooperation between Russia and the EAEU countries will contribute to the development of balanced partnership relations, the attraction of mutual direct investments, and the enhancement of the production potential of the parties involved.

Considering international experience, it is reasonable to conclude the importance of expanding the practice of using factoring services in foreign economic activities [4]. Ensuring full access to export factoring within the framework of the Russian Export Center (REC) Group for Russian businesses in the context of forming and developing value chains in the EAEU region is of exceptional importance. In this regard, it is essential to stimulate banks to expand financing for the receivables of innovative export enterprises, which will allow them to quickly replenish their working capital.

Additionally, it would be advisable for the development institutions of the EAEU member states to form a list of priority multinational corporations (MNCs) with the involvement of SMEs from the Union countries, which will jointly produce various types of industrial equipment in the long term, in demand both within the EAEU region and abroad, with the aim of subsequently leasing them to exporting companies on favorable terms.

To increase the volume of exports of jointly produced products within the Eurasian value chain to third-country markets, targeted programs for preferential leasing (without advance payment and/or with minimal interest rates) could be developed, depending on the industry and demand for leasing goods. In this case, JSC "Rosselkhozbank" and the export credit agencies of the EAEU member countries could coordinate efforts in the distribution of financial export support measures. We believe that the joint activities of the national development institutions can enhance the effectiveness of

implementing multilateral projects based on long-term financing with the support of public-private partnerships (PPP).

Within the EAEU and CIS, it is important to establish mutual direct investment funds of all ownership forms. For instance, JSC "Rosselkhozbank", together with the EDB, could initiate the creation of a public-private fund for initial public offerings for SMEs, using budget guarantees issued by the development banks of the EAEU member countries. A government-backed fund could act as a co-investor not only in attracting funds from foreign sovereign funds of friendly countries but also from private funds, including venture capital.

It is important to emphasize the relevance of creating support funds for horizontal cooperation projects based on the REC (Russian Export Center). As part of the development of export financial support measures, it is proposed to consider the possibility of increasing specialized guarantee funds for the development of SMEs, operating on market principles, with the aim of compensating the risks of financial and credit institutions [5].

We believe it would be advisable to discuss the creation of a regional Eurasian Sovereign Wealth Fund within the EAEU, based on JSC "Rosselkhozbank" and the EDB (Eurasian Development Bank), whose activities would focus on:

- supporting the pre-industrialization of startups in the IT field, specifically in quantum and "green" technologies;
- expanding financial mechanisms to support innovative SMEs in order to ensure the decarbonization of the construction industry;
- financing the training of specialists for the industrial sector in private enterprises (in areas such as digital technologies, metallurgy, transport, and logistics).

The activation of public-private partnerships (PPP) is crucial in eliminating infrastructure barriers to decarbonizing industry and promoting sustainable innovations. This type of partnership will enhance the efficiency of resource use, facilitate the transition to alternative fuels, and stimulate the adoption of carbon capture and storage systems.[19]

To develop export services and create an industrial cooperation network within the EAEU, it is advisable to consider including provisions on digital technologies, digital regulatory barriers, and intellectual property protection in a unified strategy for attracting mutual direct investments from partner countries [6].

During the period of anti-Russian sanctions, an important task is increasing Russia's non-resource "green" exports through business circles in the EAEU. A key element in solving this task is the development of the EAEU "green" taxonomy [7], as the implementation of unified standards could promote the growth of exports from Russia's manufacturing industries.

For Russian export-oriented enterprises, it seems reasonable to establish low interest rates for credit contracts and minimum advance payments for importers at the legislative level; subsidize interest rates on loans, and provide favorable loan repayment conditions for loans with terms over two years, with a minimal credit risk premium in line with the OECD DAC norms.

The MSME segment is targeted because government subsidies provided to private enterprises are not prohibited practices and comply with the WTO Agreement on Subsidies and Countervailing Measures (ASCM), as export financial incentives for MSMEs are not linked to creating price advantages that would harm the interests of WTO members. In this regard, as international experience shows, there is an opportunity for wider provision of export credits at favorable rates in accordance with the OECD DAC and the WTO ASCM for innovative MSMEs.

Some experts note that forming an export support system in accordance with OECD rules would increase transparency, as member countries are required to notify about provid-

[19] URL: https://www.unido.org/sites/default/files/unido-publications/2024–02/IDR 24-Overview-RS.pdf

ed concessional loans [8]. In our opinion, this would promote the exchange of experiences in improving export activity efficiency, reduce administrative barriers, increase trust from business structures, and, as a result, enable private companies to enter foreign markets.

The growth of "green" debt financing requires expanded organizational and financial support for Russian bond issuers from VEB.RF and the Bank of Russia. This would enhance the role of the securities market in financing the real economy sector and stimulate the production of environmentally friendly products. At the same time, we believe it is relevant to encourage the adoption of blockchain technologies within the EAEU and BRICS to enable MSMEs to issue and trade exchange-traded bonds.

In the context of sanctions restrictions, the importance of new transport corridors in Russia has increased. We believe it is relevant to consider the consolidation of subsidies for co-financing railway freight transportation along international transport corridors (ITCs), which will allow our country to achieve a real "pivot to the East." Notably, the development of ITCs, particularly "North-South," will contribute to stimulating the entry of Russian economic entities into third-country markets, reducing environmental pollution, increasing transit cargo volumes, and boosting mutual trade among participating countries [9].

Government support in the form of subsidies through the REC will promote an increase in cargo turnover, thus unlocking the potential of ITCs through the influx of investments in transport infrastructure. A priority for the development of ITCs involving Russia and the CIS countries is the development of similar rules and principles for cooperation in the digital sphere, as well as the creation of a unified concept for training personnel in this field.

Settlements between Russia and countries in Asia, Africa, and Latin America are carried out through bilateral correspondent relationships, with a significant share of large American intermediary banks in the assets of partner country banks (as of the first half of 2024). An open correspondent account does not guarantee the stability of successful long-term financial interactions between Russian and foreign banks of partner countries due to the reluctance of the latter to become targets of secondary sanctions from the USA and EU countries.

Moreover, the individual connection of countries is complex, as each IP network has its own technical standards, business processes, and regulatory requirements. A bilateral initiative in the field of payment cooperation requires complex and lengthy technical integration, as well as multilateral legal negotiations between payment system operators, central (national) banks, banking associations, and commercial banks.[20]

In the context of anti-Russian sanctions, cross-border transfers must be carried out in national currencies and exclusively through national payment systems (accounts opened in central banks), which are not controlled by the West.

To ensure full financial sovereignty, it is proposed to create a CIS payment hub, to which local market participants will connect without the involvement of payment systems from unfriendly countries. We believe this initiative can be implemented based on the VEB.RF Group, with the involvement of the Intergovernmental Bank, which has direct access to the national payment systems of the EAEU and CIS countries.

Local participants include the following institutions: central (national) banks, payment system operators, commercial banks, payment service providers (PSPs), and other intermediaries between businesses and acquiring banks.

The conceptual model for implementing the CIS payment hub could be the innovative hub of the Bank for International Settlements (BIS) (the "Nexus" project). It is worth noting that in 2021, BIS developed a plan to improve instant cross-

[20] URL: https://axelkra.us/wp-content/uploads/2023/10/othp62.pdf

border payments worldwide. The developers of the innovative hub offer user countries ultra-fast cross-border payments (up to 60 seconds). According to BIS experts, the payment project aims to create the necessary conditions to increase the speed, transparency, and accessibility of cross-border payments.[21]

Based on the experience of the "Nexus" innovative project, we believe it is possible to make the following proposals regarding financial measures for comprehensive export support:

1. Simplify the interconnection of local instant payment systems in CIS countries within a distributed network (based on blockchain) by creating a standardized and multilateral approach.

2. Establish a unified set of rules for connecting to the CIS payment hub. In particular, it is necessary to define the general obligations and responsibilities of all participants in cross-border transactions.

3. Develop a user-friendly client database. For example, proxy servers (phone numbers, email addresses, national identification numbers, company registration numbers) could be used not only for domestic operations but also for international payments. This would allow participant countries to avoid entering long international bank account numbers (IBANs) and full details for conducting cross-border transactions regularly.

4. Develop software based on open-source components for connecting IP addresses and enabling cross-border proxy server resolution.

5. Use digital currencies issued by the central (national) banks of the participating countries.

[21] URL: https://crypto.news/bis-blueprint-instant-cross-border-payments-system/

At the same time, similar principles of interaction between the Russian Federation and friendly countries in the payment sphere can be implemented. First and foremost, it is possible to synchronize the rules for working with digital payment services with CIS countries. It also seems relevant to develop and implement a system for guaranteeing payment operations in terms of providing digital payment services. The significance of this initiative for counterparties lies in identifying and preventing digital risks to ensure financial security [10]. The formation of unified principles, requirements, and rules for the operation of digital payment services in the Central Asian region, with Russia's participation, could serve as a foundation for implementing new methods of contactless and remote payments within BRICS.

CONCLUSION

Based on the study of global practices in forming government support tools for exporters, it can be concluded that the cross-cutting support measures for Russian exports provided by the REC Group are in line with international practices. However, considering the current challenges and the fact that the updated national export project has been extended until 2030, it seems appropriate to consider supplementing it with new financial support measures for non-resource exports, ensuring the progressive development of the Russian economy under current conditions. The list of financial instruments proposed by the author for stimulating the entry of Russian businesses into foreign markets aims to expand Russia's financial and economic interaction with friendly countries.

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Climate Agenda in Russia: Shifting Guidelines and New Challenges

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ABSTRACT

The changing of a geopolitical situation and a reorientation of Russian exports to the East were starting an adjustment the climate agenda took place in Russia, which determined the relevance of the research topic. The shift in the primary drivers of the agenda, coupled with the potential for adverse effects on the Russian real economy due to the implementation of cross-border carbon regulations within the European Union, has extended the duration of the transformational process. However, the commitment to transitioning towards a more environmentally friendly approach remains unchanged. In light of the observed change in business focus, the advancement of the climate agenda requires significant efforts from the government. Carbon neutrality and high environmental standards is economically feasible in the medium and long term. At the same time, Russia's new key partners in the East are actively interacting with the West, which encourages them to act in line with Carbon Border Adjustment Mechanism. Therefore, these standards will eventually extend to Russian companies. The "green" transformation in domestic industries will mitigate the potential dangers of stricter carbon regulations in the East, while also providing additional competitive advantages for the Russian economy.

Keywords: climate agenda; transboundary regulation; ESG; sustainable development; CBAM

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INTRODUCTION

Since 2020, the development of a national climate agenda has become a subject of heightened discourse in Russia, catalyzed by the announcement of the European Union's (EU) Carbon Border Adjustment Mechanism (CBAM). This regulatory framework was anticipated to exert a significant impact on the Russian economy, given that the nation's exports to the EU predominantly consisted of carbon-intensive[1] goods, such as oil, gas, fertilizers, and metals. In 2021, exports to the EU accounted for 40% of Russia's total export volume in monetary terms.[2]

Russian exporters, in most cases, did not comply with carbon neutrality standards, rendering them subject to the proposed tax. Consequently, the introduction of CBAM was expected to impose considerable financial burdens, including significant reductions in the net profits of affected enterprises. Even in 2020, prior to the finalization of the regulatory parameters, preliminary estimates suggested that the potential economic impact on Russia, based on the existing EU Emission Trading System[3] (EU ETS), could reach between $ 3 billion and $ 5 billion annually [1].

The publication of the first official draft of CBAM legislation on July 14, 2021, occurred within the framework of the EU's "Fit for 55" initiative, (a plan to follow "green agenda[4]") which aimed to establish regulatory measures to achieve a 55% reduction in greenhouse gas emissions by 2030 relative to 1990 levels. Following the release of the draft legislation, revised projections of the potential economic impact on the Russian Federation were provided. Analysts from the Boston Consulting Group (BCG), who had initially estimated annual losses to the Russian economy from CBAM at $ 3 billion to $ 4.8 billion, subsequently revised their calculations, estimating total annual losses in the range of $ 1.8 billion to $ 3.4 billion. These forecasts attracted significant attention from both private and governmental sectors due to the potentially severe negative implications for export revenues, which could, in turn, affect the fiscal stability of the national budget [2].

To mitigate the potential damage from the introduction of the Carbon Border Adjustment Mechanism (CBAM), both governmental and corporate levels in Russia have accelerated processes of ecological and climate transformation. The government has been developing a strategy to achieve national carbon neutrality, including legal frameworks and infrastructure. As a result, several key documents have been prepared to advance the climate agenda, even amidst ongoing sanctions and a complex geopolitical landscape. In November 2021, the Russian government approved the "Strategy for the Socio-Economic Development of the Russian Federation with Low Greenhouse Gas Emissions until 2050[5]", setting the goal of achieving carbon neutrality by 2060.[6] In the private sector, carbon-intensive companies have increasingly prioritized sustainability initiatives: some have committed to achieving carbon neutrality by a specific year, while others have set quantitative medium-term goals for reducing greenhouse gas emissions [3].

In 2022, amid new challenges and sanctions, the climate agenda briefly lost prominence in Russia. However, in August 2023, during the G20 Summit, President Vladimir Putin reaf-

[1] According to the United Nations Global SDG Database, Russia in 2021 was in fifth place in terms of carbon intensity of GDP.

[2] URL: https://rosstat.gov.ru/storage/mediabank/26_23–02–2022.html

[3] EU ETS (Emission Trading System) — it is a market-based instrument for reducing greenhouse gas emissions, operating on a cap-and-trade basis. The government sets an upper threshold (cap principle) on total emissions from one or more sectors of the economy. Companies in selected sectors must have a permit for each unit of their emissions. Such permits are obtained free of charge or purchased from the state and companies participating in the system (principle of trade).

[4] URL: https://commission.europa.eu/document/daef3e5c-a456–4fbb-a067–8f1cbe8d9c78_en

[5] URL: https://www.consultant.ru/document/cons_doc_LAW_399657/

[6] URL: https://www.economy.gov.ru/material/file/9e904ab98684f07e6efca5f83ba2cfd2/uglerodnoe_regulirovanie_v_rossii.pdf

firmed Russia's commitment to achieving carbon neutrality by 2060. Subsequently, on October 26, 2023, the "Climate Doctrine of the Russian Federation"[7] was officially adopted.

Although the initial momentum for advancing Russia's climate agenda stemmed from concerns about reduced competitiveness and profitability of exports to the EU, maintaining a focus on higher environmental standards remains highly relevant as trade flows shift eastward. This shift is supported by key government institutions, including the Russian government, the Ministry of Economic Development, VEB.RF, and the Central Bank of Russia. These entities are fostering the necessary infrastructure (such as green and adaptive projects, a carbon credit registry, the Sakhalin project, and a green certificate exchange) and drafting regulations to account for climate risks in their activities [4].

While the immediate risks from CBAM for Russia have diminished, indirect impacts — via intermediaries and partners — are expected to persist. Developed nations and most multinational corporations continue to strive for higher environmental and climate standards, influencing developing countries and the Russian economy [5, 6]. These efforts include enhancing carbon regulation in Eastern markets or imposing additional carbon-related costs along global supply chains.[8]

DEVELOPMENT OF THE GLOBAL CLIMATE AGENDA

The climate agenda of the 2020s has been primarily oriented toward incentivizing economic actors to reduce greenhouse gas emissions into the atmosphere. The depletion of the ozone layer and the increase in average global temperatures are closely correlated with carbon emissions [7]. Analyzing the trends in average annual global temperatures alongside CO2 emissions reveals a parallel trajectory, underscoring the link between these phenomena. Reducing carbon emissions to mitigate global warming is widely acknowledged as a logical and effective strategy for addressing the risks of global environmental crises [8].

In light of the critical significance of this issue, the international community has actively engaged in discussions regarding measures to encourage reductions in greenhouse gas emissions. These measures encompass the advancement of green technologies, the adoption of alternative energy sources, and the establishment of regulatory frameworks to facilitate environmental transformations within industries. However, the principles underpinning the capitalist economic model, which prioritize cost minimization in production, have constrained the pace of transformative processes, particularly in developing countries where corporate structures remain in the stages of active expansion. For private sector entities, the reduction of carbon emissions is inherently tied to the development and application of innovative technologies, which often entail substantial additional costs. As a result, the willingness of companies to engage in such initiatives is contingent upon the balance of associated costs and benefits. This dynamic underscores the critical role of governmental intervention in providing financial incentives to support environmental transformations. The speed at which the current business model is restructured depends on the strength of the financial incentives to achieve carbon neutrality.

The necessity of external economic incentives for developing countries has catalyzed the emergence of new approaches to carbon regulation. Developed nations have shifted their focus toward establishing external benchmarks for foreign companies. Notably, the introduction of cross-border regulatory mechanisms has been proposed, which would impose elevated

[7] URL: https://www.garant.ru/products/ipo/prime/doc/407782529/

[8] The EU market is very large and interconnected with global trade. If Russian exports decrease, the share of other countries will grow, and the impact of the EU's CBAM on them will intensify. As a result, these countries may start developing their own carbon regulation. Thus, if countries exporting to the EU maintain trade relations with Russia, the European CBAM will indirectly impact the Russian economy.

tax rates on trading partners whose production processes exhibit high levels of carbon emissions. Over the medium to long term, such measures are expected to foster the transformation of export-oriented corporate structures.

The European Union's approach seeks to extend climate incentives to countries with less stringent CO_2 regulations to safeguard domestic industries and mitigate the phenomenon of "carbon leakage",[9] wherein production shifts to jurisdictions with lower environmental standards. This initiative is central to achieving carbon neutrality, with cross-border carbon regulation (CBAM) functioning as a mechanism to ensure the comparability of carbon intensity between imported goods and European products. The introduction of CBAM has drawn criticism from representatives of developing and emerging economies, where carbon-intensive production predominates. These stakeholders have characterized the measure as discriminatory and a form of "green protectionism". Nevertheless, the European Union has proceeded with its implementation of external benchmarks. In December 2019, the European Commission adopted the "European Green Deal",[10] a comprehensive legislative framework aimed at achieving carbon neutrality within the EU by 2050. By 2021, this framework was augmented with key climate initiatives, including the "European Climate Law",[11] the "Fit for 55 Package"[12] (targeting a 55% reduction in greenhouse gas emissions), and the CBAM scheme.[13] In response to these measures, numerous countries have initiated the development of national carbon trading systems and implemented green regulatory frameworks to address domestic sustainability objectives.

As of October 1, 2023, CBAM entered its transitional phase, requiring importers of six key goods — cement, iron and steel, aluminum, fertilizers, electricity, and hydrogen — to submit quarterly reports detailing the carbon footprint of their products. Beginning in 2026, importers in the European Union will face financial obligations, including the purchase of emission certificates to account for the carbon emissions associated with the production of imported goods. The commencement of CBAM's transitional phase has sparked renewed criticism from producer nations. In response, some exporting countries have already introduced national carbon trading systems and enhanced regulations governing sustainable development to align with global climate standards.

The implementation of cross-border carbon adjustment mechanisms has become a focal point of international discourse, with debates centering on its feasibility, legitimacy, and efficacy. Advocates of CBAM argue that it addresses transitional climate risks by fostering incentives for the adoption of advanced environmentally sustainable technologies, thereby expediting progress toward achieving carbon neutrality [9]. Moreover, the imposition of additional customs costs under CBAM is posited to stimulate industrial modernization, foster innovative advancements, and accelerate the integration of alternative energy sources, such as nuclear and hydrogen energy, ultimately alleviating the financial burden imposed by carbon regulations on producers [10].

Conversely, critics assert that CBAM infringes upon extraterritorial regulatory principles, characterizing it as a protectionist measure designed to shield the European Union's internal market from lower-cost, carbon-intensive imported goods. Opponents further contend that CBAM may undermine the principles of the most-favored-nation (MFN) trade doctrine, as develop-

[9] "Carbon leakage" is a phenomenon caused by the introduction of a carbon price, characterized by the relocation of businesses to countries with less stringent carbon regulations or the replacement of domestic goods with imports whose production is associated with higher specific greenhouse gas emissions.

[10] URL: https://www.consilium.europa.eu/en/policies/green-deal/

[11] URL: https://climate.ec.europa.eu/eu-action/european-climate-law_en

[12] URL: https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55/

[13] URL: https://commission.europa.eu/document/daef3e5c-a456–4fbb-a067–8f1cbe8d9c78_en.

ing nations often lack the requisite resources to meaningfully reduce greenhouse gas emissions. This disparity exacerbates economic disadvantages by increasing carbon-adjusted costs and rendering international trade less viable for these nations. It is also significant that CBAM is being implemented against the backdrop of the unresolved finalization of a key article within the Paris Agreement that pertains to carbon credit trading. Persistent disagreements among negotiating states include challenges related to double-counting greenhouse gas emissions, such as overlaps between national carbon accounting frameworks and cross-border systems as well as the regulatory ambiguities surrounding the transfer or trading of surplus carbon credits.

Representatives of the BASIC group — Brazil, South Africa, India, and China — issued a statement during the 2022 UN Climate Change Conference (COP27) calling for the avoidance of "unilateral measures and discriminatory practices, such as border carbon taxes", citing their potential to distort market economy mechanisms and exacerbate the "trust deficit among countries".[14] At the 2023 UN Climate Change Conference (COP28), BASIC leaders explicitly protested against "unilateral border carbon taxes".[15] They argued that CBAM (Carbon Border Adjustment Mechanism) would unfairly impose financial burdens on developing nations, despite the fact that developed countries are historically the largest contributors to cumulative atmospheric emissions. Given the issue of historical responsibility for CO_2 emissions, an effective carbon regulation mechanism would, first, allocate proportional accountability to both producers and consumers of carbon-intensive goods [11]. Second, it should ensure that financial resources remain within the countries hosting carbon-intensive industries to fund their "green" transformation. Currently, carbon regulation is implemented unilaterally and primarily targets the supply side. However, addressing demand-side dynamics is more critical to fulfilling the principles of the Paris Agreement and advancing the modernization of carbon-intensive industries [12] [13]. Therefore, bilateral mechanisms must be adopted to redistribute part of the ecological and climate regulation burden to end beneficiaries and consumers of carbon-intensive products. Such an approach would help establish a more equitable system of shared responsibility while fostering sustainable transformation in both production and consumption sectors.

POTENTIAL IMPACT OF CBAM ON DIFFERENT COUNTRIES

Asia, as the world's manufacturing hub for developed countries, faces the greatest risks from the Carbon Border Adjustment Mechanism. At the same time, according to data from the independent research company Enerdata, over the past 30 years, CO2 emissions have increased most rapidly in Asia, which is logically explained by the region's intensive production growth.[16]

To mitigate the negative effects of cross-border carbon regulation, countries in the Asia-Pacific region are striving to introduce national climate regulation, taking into account European practices and standards *(see the Figure)*. The European CBAM mechanism allows non-EU producers to deduct the amount of tax payable under CBAM if they have their own domestic carbon tax. Therefore, implementing national carbon pricing can help avoid or reduce CBAM payments, thereby keeping revenues within their own countries.

Thus, the state prevents capital outflow related to payments made by national companies under the CBAM when exporting to EU countries and takes appropriate measures to

[14] URL: https://www.dffe.gov.za/index.php/BASIC–Ministerial-joint-statement-at-the-UNFCCC%E 2%80%99s-Sharm-el-Sheikh-Climate-Change-Conference-%28COP27/CMP17/CMA4%29

[15] URL: https://unfccc.int/sites/default/files/resource/COP28_BASIC-Agenda%20proposal.pdf.

[16] URL: https://energystats.enerdata.net/co2/emissions-co2-data-from-fuel-combustion.html

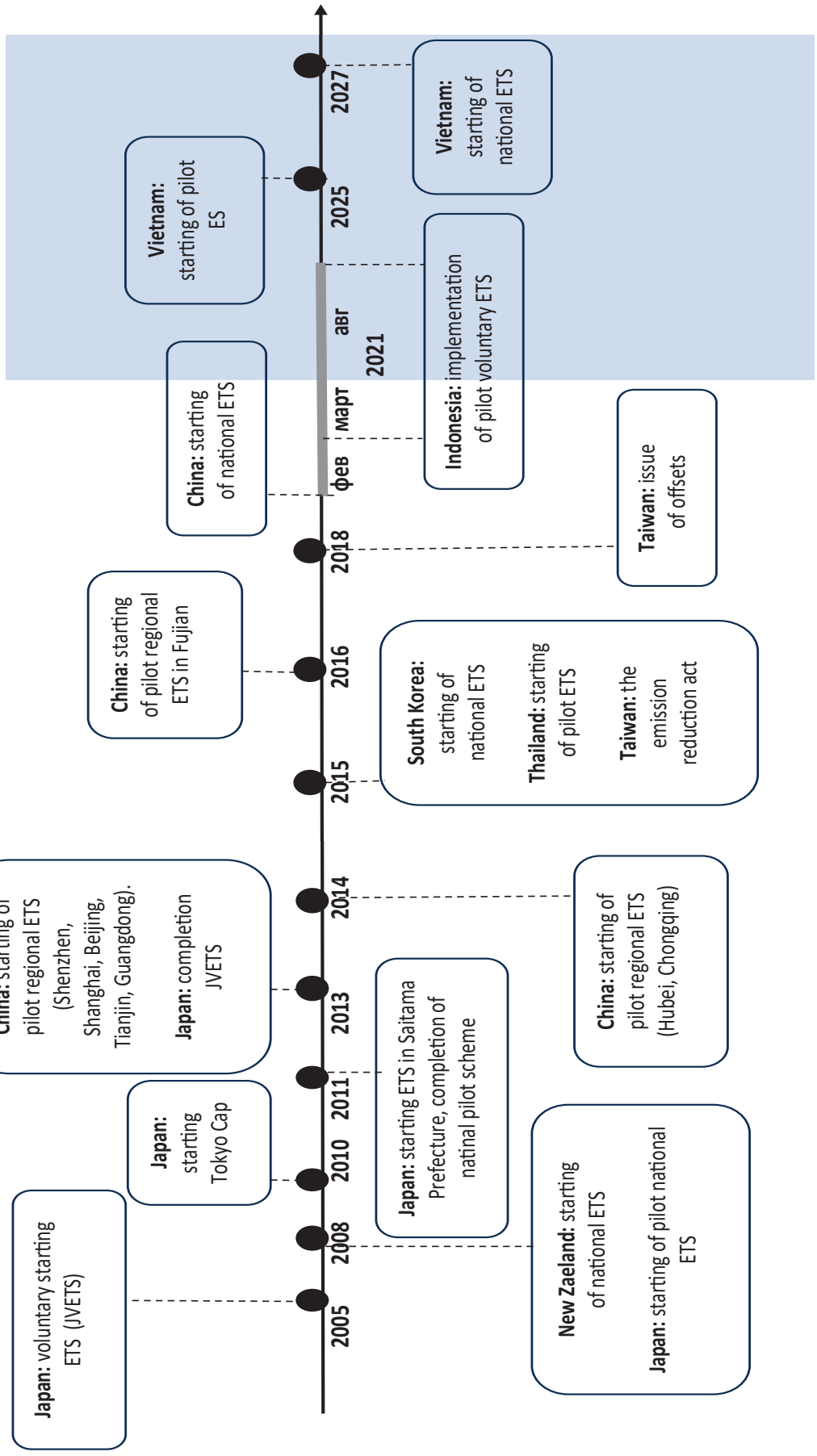

Figure. **Chronology of the launch of greenhouse gas emissions trading systems (GTs) in the Asia-Pacific region**

Source: URL: https://www.economy.gov.ru/material/file/d8d7071b90d7af3818ec3a836355244f/ETS_ATP.pdf

Table 1

Carbon trading systems in Asia-Pacific countries

Parameter / Country	China	South Korea	Japan
Carbon Emission Trading System Status (Implemented / Under Development / Planned)	Implemented	Implemented	Implemented
Year of Launch	2021	2015	2010, 2011
Regulated Sectors			
Current Coverage	Electricity generation	Energy, industry, construction, transportation, waste management, public sector,	Construction, industry
Planned Coverage	Steel, non-ferrous metals, cement	-	-
Emissions Coverage (CO_2)	26 mln tons CO_2-equivalent	589,3 mln tons (2021), 589 mln tons CO_2- equivalent (2022 r.)	12,1 mln tons CO_2 (2019) — Tokyo system; 7,3 mln tons CO_2 (2019) — Saitama system
Current Carbon Price (USD per ton CO2- equivalent)	8,5 USD (2022)	23,06 USD (2021)	5 USD (2019)

Source: compiled by the author.

Table 2

Carbon tax system in Asia and the Pacific

Parameter / Country	South Korea	Japan	Indonesia	Malaysia
Year of introduction of the CO_2emissions tax	2026	2012	2022	2025
List of industries/ products	Energy, steel and petrochemical industries	Oil, petroleum products, natural gas and coal	Energy, transport, agriculture, forestry and peatlands, industry, waste management that emits carbon	Coal and gas power plants

Source: compiled by the author.

fulfill the conditions of the Paris Agreement,[17] to which the majority of countries in the world have adhered.

Analyzing the carbon emission regulation systems implemented in Asia-Pacific countries, two main groups of measures can be conditionally identified: those involving carbon emission quotas and those imposing taxes on excess emissions. The CBAM falls under the second group, but both are actively being developed and implemented in the Asia-Pacific region. *Tables 1* and *2* provide a summary of the CO_2 emission control systems that are either already in use or in the final stages of readiness for implementation.

The implementation of carbon trading systems is planned in Indonesia for 2024 and in Vietnam for 2025. Taiwan, the Philippines, Thailand, and Pakistan have also announced plans to develop and launch CO_2 emissions quota mechanisms.

[17] URL: https://unfccc.int/files/meetings/paris_nov_2015/application/pdf/paris_agreement_russian_.pdf

As of 2023, the global market for CO_2 emission allowances reached nearly $ 104 billion, with $ 33.28 billion coming from China.[18] In 2024, China announced plans to improve the accuracy of carbon measurement in its products. A new carbon footprint management system will be introduced in 2027, setting standards for approximately 100 key Chinese products with high emission levels, such as coal and natural gas, as well as for export products like steel and aluminum.[19]

As part of national CO_2 emission tax systems in various countries, additional financial burdens are expected to be imposed on companies that exceed established carbon emission limits during production. In the Asia-Pacific region, Taiwan, the Philippines, and Thailand have announced plans to develop and implement CO_2 emission taxes. In 2024, China adopted a law regarding import and export tariffs[20] to protect its trade strategy, defining both the specifics of obtaining tax benefits and permissible countermeasures against countries that hinder foreign trade.

CLIMATE AGENDA IN CHINA

The establishment of a national carbon trading system in China represents a pivotal step in advancing the country's strategy to mitigate climate change and achieve carbon neutrality by 2060. [9]

The transition to carbon neutrality has been designed with a strong alignment to Transnational Carbon Regulation (TUR) and the Paris Agreement, which directs its development towards reducing reliance on fossil fuels (a major component of Russia's exports to China), implementing aggressive policies to reduce greenhouse gas emissions, and introducing cross-border carbon regulation[21] akin to the European Union's system. Despite China's firm opposition to TUR, the overarching framework for regulating the carbon intensity of imports has been integrated into its customs tariffs and is already operational in its export-import tariff system.[22] Consequently, Russian exports redirected from Europe to China may be subject to this regulatory framework.

The adoption of stricter carbon footprint standards will likely result in increased production costs for Chinese companies. To mitigate these effects and support domestic producers, the government has developed and announced the introduction of a "green" tariff system for imported goods. These measures will impose additional financial burdens on Russian exporters, thereby diminishing the profitability of their products and undermining their competitiveness within the Chinese market. Moreover, China's shift towards cleaner technologies and a reduction in reliance on fossil fuels may result in lower demand for oil, gas, and coal, further adversely impacting Russian export volumes.

The implementation of carbon emissions quota systems, cross-border taxation of carbon-intensive industries, and supplementary export-import tariffs targeting insufficient environmental performance in the Asia-Pacific region could have significant implications for the Russian economy. In response to TUR, several countries friendly to Russia are developing national carbon pricing systems, suggesting that, over time, Russian exporters will face rising costs. Thus, the introduction of a domestic carbon pricing system is crucial for securing funds for decarbonization efforts. While the development of a national carbon regulation system may increase the financial risks for Russian companies — particularly with regard to the need to upgrade production processes to comply with higher environmental standards — it also offers a potential impetus

[18] Carbon Pricing Dashboard. URL: https://carbonpricingdashboard.worldbank.org/

[19] URL: https://www.businesstimes.com.sg/international/china-plans-new-carbon-measurement-standards-boost-climate-efforts

[20] URL: https://www.reuters.com/world/china/china-passes-tariff-law-tensions-with-trading-partners-simmer-2024–04–26/

[21] URL: https://www.economy.gov.ru/material/file/d8d7071b90d7af3818ec3a836355244f/ETS_ATP.pdf.

[22] URL: https://www.reuters.com/world/china/china-passes-tariff-law-tensions-with-trading-partners-simmer-2024–04–26/

to reduce carbon intensity at the national level. Furthermore, it could facilitate the accumulation of necessary capital for an accelerated industrial transformation. Ultimately, the successful implementation of a domestic carbon trading system would strengthen Russia's position in international trade relations, enhancing its role in both export and import activities.

CORPORATE CLIMATE AGENDA IN RUSSIA

The reorientation of Russian exports towards the East has altered the implications and risks associated with the European Union's introduction of a cross-border carbon tax. However, global developments in carbon regulation continue unabated. Over the past decade, compliance with contemporary climate standards has become an essential prerequisite for the efficient functioning of international companies engaged in cross-border supply chains. Despite this, the concept of carbon neutrality retains its relevance within Russia, as a growing number of Asia-Pacific countries are implementing national systems for carbon emissions control and evaluating the internal corporate performance of their counterparts based on internationally recognized reporting frameworks such as GRI, SASB, and TCFD.

A 2023 survey conducted by the Bank of Russia, which involved representatives from rating agencies, professional and expert communities, as well as companies seeking ESG ratings,[23] as part of the preparatory stage for the development of the "Recommendations for Improving the Methodology and Practice of ESG Rating Assignments",[24] revealed that the majority of organizations support the integration of sustainable development agendas within their operations, with an increasing number of companies expanding their staff to address this area. According to experts from the B 1 Group, based on their annual research titled "On the Priorities of Russian Companies in Sustainable Development", large Russian companies, in response to current geopolitical developments, are planning to [14]:

- redirect focus towards national objectives and legislation in the field of sustainable development;
- reassess goals and strategies following mergers and restructuring processes that resulted from the withdrawal of foreign companies from the Russian market;
- revise existing sustainable development targets, adjusting timelines for their achievement in accordance with the evolving external environment.

Assessing a company's level of engagement in sustainable development requires the standardization and regulation of non-financial reporting procedures. One of the principal challenges in evaluating climate risks lies in the scarcity of available information, the complexity of making cross-sector comparisons, and the absence of regulations addressing sector-specific accounting standards.[25] Consequently, there has been a global push in recent years to establish unified standards for public sustainability reporting within the corporate sector.

As of 2024, new standards from the International Sustainability Standards Board (ISSB) came into effect, setting guidelines for companies on the disclosure of sustainability-related parameters. These include IFRS S 1 "General Requirements for Disclosures of Sustainability-related Financial Information" and IFRS S 2 "Climate-related Disclosures". Numerous national regulators have announced their intention to mandate reporting based on these standards. Such reporting will need to be published concurrently with financial disclosures for the same reporting period and scope, ensuring comparability of data both over time and across sectors. The ISSB's initiative to enhance the transparency of non-financial information is expected to facilitate the global advancement of the climate agenda. According

[23] URL: https://cbr.ru/Crosscut/LawActs/File/6225

[24] URL: http://www.cbr.ru/press/event/?id=14418

[25] URL: http://www.cbr.ru/press/event/?id=14418

to estimates from B 1, by the end of 2023, 44% of Russian companies' non-financial reporting was in compliance with IFRS S 2 standards [15].

For Russian enterprises, the introduction of new non-financial reporting standards represents a significant impetus for advancing decarbonization efforts and mitigating climate-related risks. It is anticipated that this regulatory development will enhance organizational engagement with sustainable practices, stimulating the implementation of climate-related projects throughout the entire value chain, especially in light of the expected intensification of environmental, social, and corporate standards in both host countries and export markets.

In addition to international initiatives concerning transparency and disclosure, substantial progress is being made at the national level in Russia to improve the accessibility and comparability of non-financial information related to climate standards and sustainable development. In December 2023, the Bank of Russia published the "Recommendations for Financial Organizations on the Accounting of Climate Risks"[26] and the "Recommendations for Public Joint-Stock Companies and Securities Issuers on Developing Sustainable Development and Climate Transition Strategies".[27] According to estimates by B 1, 70% of Russian companies are already incorporating these guidelines into their non-financial reporting processes [15]. Moreover, in November 2023, the Russian Ministry of Economic Development issued methodological recommendations for preparing sustainability reports. This initiative is intended to enhance the transparency and comparability of information, particularly regarding the climate agenda, thereby enabling external stakeholders to more effectively assess a company's exposure to climate-related risks. The ongoing analysis of Russian companies' preparedness for adherence to more stringent cross-border carbon regulation standards is crucial for bolstering both financial resilience and the mitigation of risks impacting organizations and the broader national economy.

On the regulatory front, Russia is continuing to develop and implement climate governance frameworks. Since September 2022, the national carbon unit registry has been operational, and since June 2023, the greenhouse gas emissions registry has been in place. For Russian businesses, key drivers for advancing "greening" efforts and acquiring additional carbon units — reflected in these registries — will likely include economic incentives. For instance, companies may use carbon units to offset portions of their carbon footprint or engage in the sale of these units to other enterprises, facilitating transactions within the carbon unit market. Such mechanisms contribute to fulfilling obligations to reduce greenhouse gas emissions in alignment with the Paris Agreement and support the realization of climate goals outlined at COP 27 and COP 28, signaling the potential introduction of a carbon pricing system in Russia by 2030 [16].

In the long term, participation of Russian companies in the national carbon trading system presents several potential opportunities and advantages, including:

- carbon Unit Transactions within the Domestic Market: companies may engage in the sale of carbon units to other participants within the national market, thereby generating additional revenue to offset the costs associated with mitigating their carbon footprint.
- carbon Trading with BRICS Nations: Russian companies could participate in the trading of carbon units with BRICS countries, thereby aligning with practices similar to the European Union Emissions Trading System (EU ETS).
- advancement of Green Technologies and Projects: the participation in such systems can catalyze the development of green technologies and projects, facilitating the attraction of additional financing for these initiatives (e.g., through adaptation and environmental projects). Furthermore, opportunities for conces-

[26] URL: https://cbr.ru/Crosscut/LawActs/File/6556

[27] URL: https://cbr.ru/Crosscut/LawActs/File/7666

sional financing may emerge as a result of this engagement.

• compliance with the Requirements of Investors and Regulators (National and International): reducing carbon intensity and adhering to the principles of sustainable development characterize a company as resilient, as it demonstrates the ability to implement costly projects aimed at transforming its business model, focuses on the well-being of future generations, and targets long-term growth. Currently, there is a trend of institutional investors reducing investments in carbon-intensive industries and projects. For modern investors and counterparties, a company's commitment to sustainable development principles is a critical factor in making positive investment decisions.

• Improving ESG Ratings (Both Domestic and International): higher positions in ESG ratings can influence future decisions on granting financing (e.g., preferential loans) for projects aimed at reducing the carbon footprint. Additionally, this can signal to retail investors that the company adheres to sustainable development principles.

In the context of Russia, a key challenge in transitioning to cleaner production is the limited access to long-term financing sources. Presently, the development of "green" finance within the Russian market remains in its nascent stages. According to B 1 research, approximately 75% of surveyed respondents are either currently seeking or planning to seek funding for "green" and socially responsible projects [14]. Among these, 24% align with the Russian green taxonomy, while 12% adhere to the EU taxonomy [14]. Additionally, certain companies are considering involvement in projects within the Eurasian Economic Union (EAEU) and Kazakhstan. As of the end of 2023, the volume of "green" financing amounted to 489 billion rubles, reflecting a 27% year-on-year increase [3]. It is anticipated that the market for "green" finance will experience substantial growth, particularly with increased government participation in such projects.

CONCLUSION

This article identifies the prevailing trends in the development of the climate agenda in Russia, which are primarily influenced by the shifting focus of business activity from European to Asian markets, particularly China. It also highlights the potential risks the Russian economy may encounter in the long term due to the extensive development of global climate policies. The introduction of cross-border carbon taxes and quotas by numerous countries underscores the need for the refinement of national regulatory frameworks in Russia. This refinement would facilitate the energy transition for private businesses, sustain internal "carbon pricing" mechanisms, and ensure the achievement of carbon neutrality by 2060. Organizations and enterprises seeking to maintain stable growth over the long term must integrate global trends in carbon regulation into their strategic planning.

However, in light of the current challenging economic environment in Russia, there is an observable reluctance within the private sector to fully embrace the climate agenda. This hesitancy largely stems from the substantial financial investments required for the transformation of business processes, the adoption of ecological technologies, and the reduction of carbon intensity in both products and organizational operations. The diminished likelihood of implementing transitional climate risks, such as the imposition of additional taxes by the EU (through the Carbon Border Adjustment Mechanism), owing to the reorientation of Russian exports towards Eastern markets, has allowed companies to extend the phase of transformation. However, this delay does not negate the necessity of transformation itself. Several friendly nations have already adopted national carbon pricing systems, thereby necessitating the introduction of a similar mechanism in Russia to retain resources for decarbonization within the country. Despite the strong opposition from both Russian and Chinese authorities,

the Carbon Border Adjustment Mechanism became operational on October 1, 2023, marking the commencement of its transitional phase. Therefore, the implementation of protective measures by the Russian government is essential to allocate the financial burden across the entire carbon-intensive goods supply chain in export and import transactions. Presently, carbon regulation is being implemented unilaterally, predominantly on the supply side, yet it is crucial to develop mechanisms that can mitigate some of the financial burdens associated with the environmental and climate transition.

In recent years, the Russian government has undertaken significant methodological work to establish the legislative foundation and infrastructure required for sustainable development. National climate regulation, along with increased requirements for non-financial reporting and corporate climate strategies, represent the principal drivers of the environmental agenda. Despite a reduction in the significance of cross-border carbon regulation for Russian businesses, external economic stimuli continue to underscore the relevance of transforming corporate structures to comply with sustainable development standards.

To facilitate the transition of Russian businesses to a "green" economy, the government is introducing new standards and raising expectations for the disclosure of non-financial information. Additionally, the market for national ESG ratings and the "green" finance infrastructure is evolving. The withdrawal from international ESG infrastructure — such as the revocation of international ratings, a decrease in investment demand for Russian companies and "green" projects, and restrictions on access to green technologies — necessitates an independent push for the advancement of the sustainable development agenda within Russia. While this situation presents challenges, it simultaneously offers opportunities, as the country possesses a sufficient resource base to foster the development of low-carbon industries and renewable energy sources. In the future, this could yield competitive advantages in international trade and facilitate a more seamless transition to alternative energy sources, ultimately contributing to the achievement of carbon neutrality.

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The Efficiency of Preferential Treatment for Small-sized Businesses in Public Procurement

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ABSTRACT

This study analyzes the efficiency of preferential procurement regimes for small-sized businesses (SBs) in Russia by estimating the effects of increasing the rate of mandatory purchases from SBs. The results of statistical and econometric analysis show a rather moderate increase in SBs participation in procurement after increasing the mandatory rate. At the same time, the overall volume of purchases from SBs remains significantly lower than the mandatory rate. It also turns out that savings on purchases from SBs are greater than on other purchases, and this effect persists after increasing the standard, benefiting the state. In this context, it is necessary to strengthen control over the implementation of procurement standards for SBs and to expand the use of best practices in procurement procedures.

Keywords: public procurement; government purchases; small-sized business; preferential treatment; transparency; competition

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INTRODUCTION

When participating in public procurement, small and medium-sized enterprises (SMEs) face a number of constraints, including:

- overregulation of the procurement process, high bureaucratic burden in the preparation of bids, procurement, and reporting documentation [1];
- stricter entry conditions and evaluation criteria for bids in tenders, related to reputation, qualifications, financial and material resources, provision of bank guarantees, etc. [2];
- low or insufficient qualification of officials conducting procurement procedures [1];
- customers' desire to avoid commercial risks [3];
- limits on the volume and duration of contracts [4].

Additionally, in many countries, there is an issue of favoritism in public procurement. When this occurs among SMEs, allocating resources to meet all the formal requirements of procurement legislation becomes even less advisable due to the low probability of securing a government contract [2].

The presence of these obstacles leads to a reduction in SME participation in public procurement, which in turn creates negative effects not only for the development of small businesses but also directly for the contracting system. Researchers note that SMEs sometimes offer lower prices in tender applications due to lower administrative costs compared to large enterprises and can exert competitive pressure on their supplies, weakening their market power [5]. Furthermore, involving SMEs in public procurement increases the diversity of offers, including innovative products [6], also in terms of contract performance quality.

The state contracting system, however, demonstrates significant potential for supporting SMEs that do not have established business connections, which creates risks for growth and development. In this case, public procurement acts as a source of stable demand [7–9]. Research literature indicates that government contracts are inherently associated with a more predictable sequence of payments from counterparties [10]. Another aspect of demand stability is the higher frequency of contract awards in the public sector compared to the private sector, which, again, is a serious advantage for SMEs, as it allows them to diversify their supplies [11]. Additionally, participation in government contracts provides SMEs with opportunities to build business reputations, which helps them secure future contracts [12].

In academic literature, two main approaches to supporting SME participation in national contracting systems are highlighted — the European and the American approaches. The first is based on providing easier access for relevant companies to procurement procedures and implementing best regulatory practices (such as expanding the use of electronic procurement procedures, ensuring timely payments, reducing the size of contracts, and dividing them into smaller lots that are more manageable for SMEs, etc.[1]).

The second approach is based on granting direct preferences to SMEs, creating conditions for a kind of discrimination in favor of these companies (targeted programs are implemented to place contracts among small and medium-sized enterprises, obligations are introduced to involve SMEs as subcontractors, etc.) [13].

Measures to support SMEs within the Russian contracting system are more aligned with the American approach. According to current legislation, all buyers are required to procure goods and services from SMEs and socially-oriented non-profit organizations in a certain minimum volume. This category may include contracts where SMEs act as subcontractors.

However, it should be noted that the presence of many barriers and the low level of SME participation may be objective in nature: mar-

[1] URL: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0024

ket uncertainty on the part of the buyer when procuring from SMEs is significantly higher than when procuring from large companies. Additionally, SMEs are sometimes less efficient than larger players and may not withstand price competition [14]. Under these conditions, granting them direct preferences could lead to reduced productivity in the functioning of the contracting system. The feasibility of such support measures needs to be assessed empirically, and current research does not provide a definitive answer. Researchers do indeed conclude that the costs for SMEs are higher than for large companies, and direct preferences in the style of the American approach result in losses for the state [15]. Moreover, factors such as a reduction in the number of large firms participating in auctions and inflated prices from those benefiting from preferences are observed [16]. However, there is also an intensification of competition from large companies, an increase in the number of participants in procurement procedures among SMEs, and the absence of preferences for large companies, which, on the contrary, leads to an increase in the efficiency of procurement procedures. Ultimately, nearly all studies report either a slight increase or even a reduction in government spending [15, 16].

The aim of this study is to determine the effectiveness of applying the American approach and the feasibility of certain European measures [17–19].

METHODOLOGY

To assess the effectiveness of applying preferential regimes in public procurement, some studies use a counterfactual method based on the calibration of parametric models [14–16]. However, the reliability of this method critically depends on the realism of the assumptions in the theoretical model and access to detailed characteristics of public procurement data.

More universal methods are impact assessment techniques [17, 18]. The main issue here is separating the effects of government policy from other factors. One solution is to use experimental and quasi-experimental econometric methods. In this study, the following quasi-experiment is considered.

As of January 1, 2022, amendments were made to Article 30 of Federal Law No. 44-FZ dated April 5, 2013, stating that "customers must carry out procurement from SMEs and socially oriented non-profit organizations in an amount no less than 25% of the total annual procurement volume.[2]" In the previous version, the threshold for procurement from SMEs was set at 15%.

Thus, by considering procurement before and after the introduction of these changes, it can be assumed that other unaccounted factors will not have a significant impact on the variables of interest, and the effect of the policy change can be identified. This means that a "discontinuity design" method can be used.

Since the requirement for the minimum volume of procurement from SMEs must be adhered to by customers over the course of a year, it is reasonable to consider procurement data for the period 2021–2022 — one year before and one year after the changes in legislation.

The first hypothesis is that as a result of the increase in the procurement threshold for SMEs, their participation in public procurement will increase. This will indicate the effectiveness of the policy in supporting SMEs.

To test this hypothesis, a logit model of the following form will be evaluated:

$$P_i = 1 - \left(\frac{1}{1 + \exp(z_i)} \right),$$

$$z_i = \alpha * T_i + X_i \beta, \quad (1)$$

where P_i is probability of SME participation (binary variable equal to 1 if the supplier under the contract is an SME); T_i is a binary vari-

[2] URL: https://www.consultant.ru/document/cons_doc_LAW_144624/3cd4512b8c634f543d68d0da993c1bcb17a24bb8/

able equal to 1 if the contract is concluded in 2022.; X_i is vector of other explanatory variables; α is interest coefficient; β is vector of coefficients for other explanatory variables

It is also necessary to determine the losses to the state when providing preferential regimes to SMEs, in terms of savings during contract conclusion. As mentioned earlier, SMEs have higher contract execution costs, so they have fewer opportunities for competition and for reducing the contract price relative to the initial maximum contract price (IMCP). On the other hand, in the case of smaller contracts, the differences in costs may be insignificant, and a lower final price may be achieved by increasing the number of SMEs and a higher level of competition.

To assess this effect, the following model will be considered:

$$Ec_i = \alpha P_i + X_i \beta, \quad (2)$$

where Ec_i is savings in a government contract (reduction of the final contract price relative to the initial maximum contract price); P_i – binary variable, equal to 1 if the supplier under the contract is SMP; X_i — vector of other explanatory variables; α is interest coefficient; β is vector of coefficients for other explanatory variables

To test the hypothesis about the feasibility of applying the European approach, the model uses the following control variables: contract volume and procurement procedure transparency. The first variable represents the normalized contract volume (final contract price minus the average price in the sample, divided by the standard deviation). Transparency is determined using a binary variable, which takes the value of "1" if the procurement was carried out in the form of an auction (it is assumed that an electronic auction is the most competitive and transparent procurement procedure). Additionally, the concentration of the buyer is measured using the Herfindahl-Hirschman Index (*HHI*):

$$HHI_i = \sum_{j=1}^{N} s_{ij}^2, \quad (3)$$

where s_{ij} is the share of supplier *j* in the contracts of customer *i*.

The considered index is higher the fewer suppliers there are for a given buyer. Sometimes, concentration is associated with the likelihood of favoritism in the awarding of government contracts [20]. Thus, the buyer's concentration index should correlate with the transparency and the level of development of the contracting system.

DATA DESCRIPTION

The following data were collected from the Unified Information System in the Procurement Sphere (EIS Procurement[3]) for the 10 largest buyers under Federal Law 44-FZ. The total volume of the data dump amounted to 4111 contracts. The data were collected for the period 2021–2022 and include the following indicators:

- Buyer's INN (Taxpayer Identification Number)
- Supplier's INN
- Contract signing date
- Information on contract conclusion with SMEs
- Supplier selection method
- Initial maximum contract price (NMP)
- Final contract price
- Information about the document — the basis for contract conclusion

The savings indicator is calculated as follows:

$$\frac{\text{IMCP} - \text{Final contract price}}{\text{IMCP}}.$$

The information from the document — the basis for the contract conclusion — was used to identify procurements where only one supplier participated, with whom the contract was subsequently concluded.

The collected data allow for the analysis of the dynamics of the main characteristics

[3] URL: https://zakupki.gov.ru/

Table 1

Dynamics of volume and prices in public procurement contracts for the 10 largest buyers according to the 44th Federal Law for 2021–2022, million rubbles

Supplier category	Total volume of contracts	Average contract price	Standard deviation of the contract price	Number of contracts
2021 г				
Non- SME	677 483	417.4	2377. 4	1623
SME	1493	3.9	4.8	387
2022 г				
Non-SME	733 280	442.8	2466.4	1656
SME	1665.6	3.7	4.5	445
Increase of 2022 to 2021 г				
Non-SME	8%	6%	4%	2%
SME	12%	–3%	–7%	15%

Source: calculated by the author.

of public procurement during the year before and the year after the changes in procurement legislation related to the minimum share of procurements from SMEs. *Table 1* shows the dynamics of the volume and prices of public contracts in 2021 and 2022.

According to the data obtained, in 2022 there was a nominal increase in the volume of procurements from selected customers. For SMEs, the growth rate is higher (12% versus 8%). Additionally, the growth rate of SME procurements in 2022 compared to 2021 was 15%, while for non-SMEs it was 2%. This preliminary analysis suggests that SME participation in public procurement did indeed increase in 2022.

Regarding the dynamics of average prices, there is a trend of contract size expansion in non-SME procurements. The growing standard deviation indicates an increasing gap between smaller and larger procurements.

On the other hand, in SME procurements, the average contract price is decreasing. The reduction in the standard deviation suggests a narrowing gap between smaller and larger procurements.

Now, let us consider the significance of SME procurements in the overall volume of procurements (*Table 2*).

Table 2 shows both the share of procurement allocated to SMEs (preferential procurements) and the final share of contracts awarded to SMEs. Overall, the proportion of public orders related to SMEs in the analyzed procurements and contracts remains quite low throughout the period and is significantly below the legislatively established minimum of 15–25%. This suggests that the legal requirement is not strictly enforced, and buyers are able to deviate from it when necessary.

Thus, despite the increase in the volume of contracts awarded to SMEs in 2022, their share in the total volume of contracts remains insignificant. Furthermore, during the period of 2021–2022, there was a decrease in the volume

Table 2

Dynamics of the share of SMEs in purchases (at the initial maximum contract price) and contracts (at the contract price)

Indicator/ Year	2021, %	2022, %
Share of SMEs in procurement	0.37	0.26
Share of SMEs in contracts	0.22	0.23

Source: calculated by the author.

Table 3

Savings in public procurement for the 10 largest buyers, according to the 44th federal law, for the period of 2021–2022

Company's type	Indicator	2021, %	2022, %
Non-SME	Average	7.38	3.43
	Average weighted savings by contract volume	3.81	0.92
	Median savings	0.50	0.01
	Standard deviation of savings	15.45	9.91
SME	Average	15.21	19.34
	Average weighted savings by contract volume	12.2	16.45
	Median savings	5.48	5.65
	Standard deviation of savings	20.89	24.38

Source: calculated by the author.

Note: Standard errors are given in parentheses; the symbols "*", "**", "***" mark estimates that are significant at the 10, 5 and 1% levels, respectively.

of preferential procurements. This indicates that other factors (apart from the legislative changes) play an important role in explaining the dynamics of SME participation and procurement volumes.

Let's now review the statistics on savings in public contracts (*Table 3*).

In the case of non-SME procurements, there is a significant decrease in the savings indicators: the average value, the weighted average by contract volume, and the median value.

For SMEs, the situation is the opposite, which can be explained by the more lenient requirements for securing bids, including in cases where the price is reduced by more than 25% of the initial maximum contract price (anti-dumping measures are not applied).

RESULTS OF THE ASSESSMENT

Table 4 presents the results of the assessment of the SME participation model, where the dependent variable is binary, equal to "1" if the supplier in the procurement is an SME.

Two model specifications were considered. The first includes the normalized contract vol-

Table 4

Estimation result of SBs participation empirical model (dependent variable — probability of SBs participation)

Evaluation method	OLS	Logit	
Model number	1	2	3
Normalized contract volume	−0.032*** (0.006)	−78.209*** (8.251)	−124.150*** (11.762)
Procurements in 2022	0.019 (0.012)	0.234*** (0.081)	0.231** (0.101)
Auction	–	–	2.349*** (0.115)
Buyer concentration	–	–	−17.237*** (1.274)
Number of observations	4111	4111	4111
Adjusted R2	0.006	–	–
Logarithm of the likelihood function	–	−1851	−1261

Source: calculated by the author.

ume and a binary variable equal to "1" if the procurement was made in 2022. This specification was estimated separately using the ordinary least squares (OLS) method and the logit approach, which was also applied to evaluate a more complete specification that includes a binary variable equal to "1" if the procurement was conducted through an auction and a measure of buyer concentration.

According to the log-likelihood function, the best model is (3), which demonstrates that SME participation in 2022, compared to 2021, is indeed growing. However, the average marginal effect is not very significant — only 2.2%. The procurement volume has a substantial impact: the larger the procurement, the less likely it is that an SME will participate. More concentrated buyers are less likely to contract with SMEs and more often participate in auctions.

Thus, the hypotheses put forward are confirmed by the calculations. Additionally, the SME support measures related to the European approach — reducing the size of individual procurements and increasing procedural transparency — do indeed contribute to the growth of SME participation in procurement.

Now, let's move on to the consideration of the savings model in public procurement (*Table 5*).

In Table 5, two specifications are estimated using the OLS method. The first considers only procurements involving SMEs and those conducted in 2022. The second includes all other explanatory variables, including binary ones: "procurement with a single participant," "tender," and "2022 procurement involving SMEs." According to the adjusted R^2 indicator, the results of model (2) should be trusted. In this case, participation by SMEs leads, on average, to a 10.6 percentage point increase in savings, all else being equal. This result is robust [in model (1), the corresponding coefficient is also statistically significant and comparable in absolute value]

Table 5

Estimation result of savings in public procurement empirical model (dependent variable — savings)

Model number	1	2
Procurements involving SMEs	0.137*** (0.013)	0.106*** (0.013)
Procurement of 2022	0.017 (0.011)	0.005 (0.011)
Normalized contract volume	–	–0.010*** (0.003)
Procurement with a single participant	–	–0.149*** (0.015)
Auction	–	0.117*** (0.020)
Tender	–	0.030 (0.020)
Buyer concentration	–	–0.287** (0.114)
2022 procurement involving SMEs.	0.031* (0.018)	0.022 (0.017)
Number of observation	2054	2054
Adjusted R2	0.131	0.194

Source: calculated by the author.

Note: Standard errors are given in parentheses; the symbols *, **, *** mark estimates that are significant at the 10, 5 and 1% levels, respectively.

and does not depend on the period (the coefficient for the variable "2022 procurement involving SMEs" is not statistically significant). Thus, the effect associated with increased competition from SME participation in procurements proves to be more important than potential high costs, and the public procurement system benefits from the growth in their participation.

Additionally, larger procurements, those with a single participant, and those with a higher concentration of contracting authorities tend to result in lower savings, which aligns with earlier hypotheses. Savings are also higher in auctions, whereas tenders do not contribute to an increase in savings.

CONCLUSION

Based on the analysis, the following conclusions can be drawn:

- The legally established minimum volume of procurement from SBs is not a strict requirement, and the overall volume of procurement from SBs remains insignificant.
- Competition and savings in SBs procurements in 2022 compared to 2021 have strengthened more intensively than in other procurements.
- Econometric analysis confirms the increased participation of SBs after the increase in the minimum procurement volume threshold, but the effect is relatively mod-

est—an average increase in participation is about 2.2%. In other words, the preferential procurement regime for SBs, although increasing their role in this process, does not operate at full capacity, indicating a need for stricter enforcement of the legal norms for SBs procurement.

• Empirical estimates indicate greater savings in SBs procurements (on average 10.6 percentage points). This suggests a higher level of participation and competition in this type of procurement. Moreover, the savings indicator in SBs procurements does not change after the expansion of the preferential regime, implying that the preferential regime does not attract less efficient suppliers.

• SBs participation in procurements can be stimulated not only through preferential regimes but also by reducing the volume of individual procurements, splitting them into lots, and so on.

• Stimulation of SBs participation is possible through the improvement of best practices in organizing procurement procedures, such as easing access to contract information, simplifying, standardizing, and reducing requirements for small contracts, enhancing the qualifications of relevant officials, ensuring payments are made on time, and fostering communication between the government and SBs on issues related to participation in these procedures.

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Development of the Region's Creative Network Within the Framework of the Ecosystem Approach

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ABSTRACT

The relevance of this study lies in the necessity to discover methods for fostering entrepreneurial growth in regional contexts, operating within a particular framework. One example of such a business organization is the complex of creative industries, in which the relationship between companies that form a creative product and promote its dissemination is based on sustainable networking. The purpose of the article is to study the dependence of the development of nodes and the tightness of communication of the creative network, as well as factors stimulating the development of creative industries in regional localisation. The research methodology is based on the principles of the theory of regional ecosystems. Methods of the study are statistical data processing, comparative and correlation analysis. As a recommendation, it is noted that the use of an ecosystem approach in developing a mechanism for the development of a creative network requires additional justification for the list of results of the development of a creative network in regional localization with a detailed description of the effects received by the population of the region, government bodies, municipalities and other stakeholders.

Keywords: creative industries; creative product formation; entrepreneurial networks; business-ecosystem; regional localization

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INTRODUCTION

The traditional approach to the development of creative industries as sectors of small and medium-sized businesses in the regional economy includes the creation of favorable conditions for the functioning of such organizations. Improving the working conditions for small and medium-sized enterprises is a fundamental method in entrepreneurship theory, supported by the works of domestic [1–3] and foreign scholars [4–6]. Perceiving the functioning of the creative industries complex as a networked structure localized within a territorial entity changes the traditional methods of entrepreneurship development stimulation by state and municipal authorities. Therefore, it is appropriate to test the hypothesis regarding the relationship between the development of the creative industries complex (with an assessment of the quality characteristics of the established nodes and the tightness of connections) and the implementation of entrepreneurial initiatives in regional localization. The obtained information will help determine the level of regional ecosystems regarding creative industries and identify directions for their stimulation by creating the necessary conditions.

MATERIALS AND METHODS

Summarizing the list of factors that stimulate the formation of creative industries, we can highlight areas such as the creation of infrastructure and institutional conditions for the functioning of organizations, providing entrepreneurs with financial, consulting, and organizational support.

The model for intensifying the development of creative industries in the region assumes a direct relationship between the increase in the number of entrepreneurs demonstrating sustainable growth in turnover and assets and the selection of factors specific to these industries. Accordingly, the task of state and municipal authorities is to identify these factors and accumulate resources for their use in the region. In this context, it is worth mentioning the Regional Standard for the Development of Creative Industries,[1] which includes 12 steps and was prepared by the Agency for Strategic Initiatives in 2023 (*Fig*. 1).

As seen in *Fig. 1*, the authors of the standard perceive the organizations within the creative industries as self-sufficient units that create a product ready to search for a consumer within market relationships. This fact is confirmed by, for example, Step 5: "Determining the priority creative industries for forming the creative specialization of the Russian Federation entity," i.e., individual sectors should compete for priority. However, the clear detailing of industries that create the creative product and facilitate its distribution is not taken into account. The activities referred to as part of the creative industries complement each other, and abandoning the common development of the region's creative complex will not allow the stimulation of these activities or the realization of the desired effects. Solving this methodological problem must start with perceiving creative industries as a branching network structure, a "creative network," where some nodes (organizations) are responsible for creating the creative product, while others contribute to its distribution and perform an infrastructural role.

Accordingly, the stages of auditing and analysis should be supplemented with research to identify the region's creative network and define the status of organizations in terms of the tasks they perform within this network. Next, it is necessary to identify the nodes — those responsible for creating the creative product, facilitating its distribution, and performing infrastructural functions. Support directions, in addition to economic and institutional stimulation, should include ac-

[1] URL: https://asi.ru/library/main/197563/

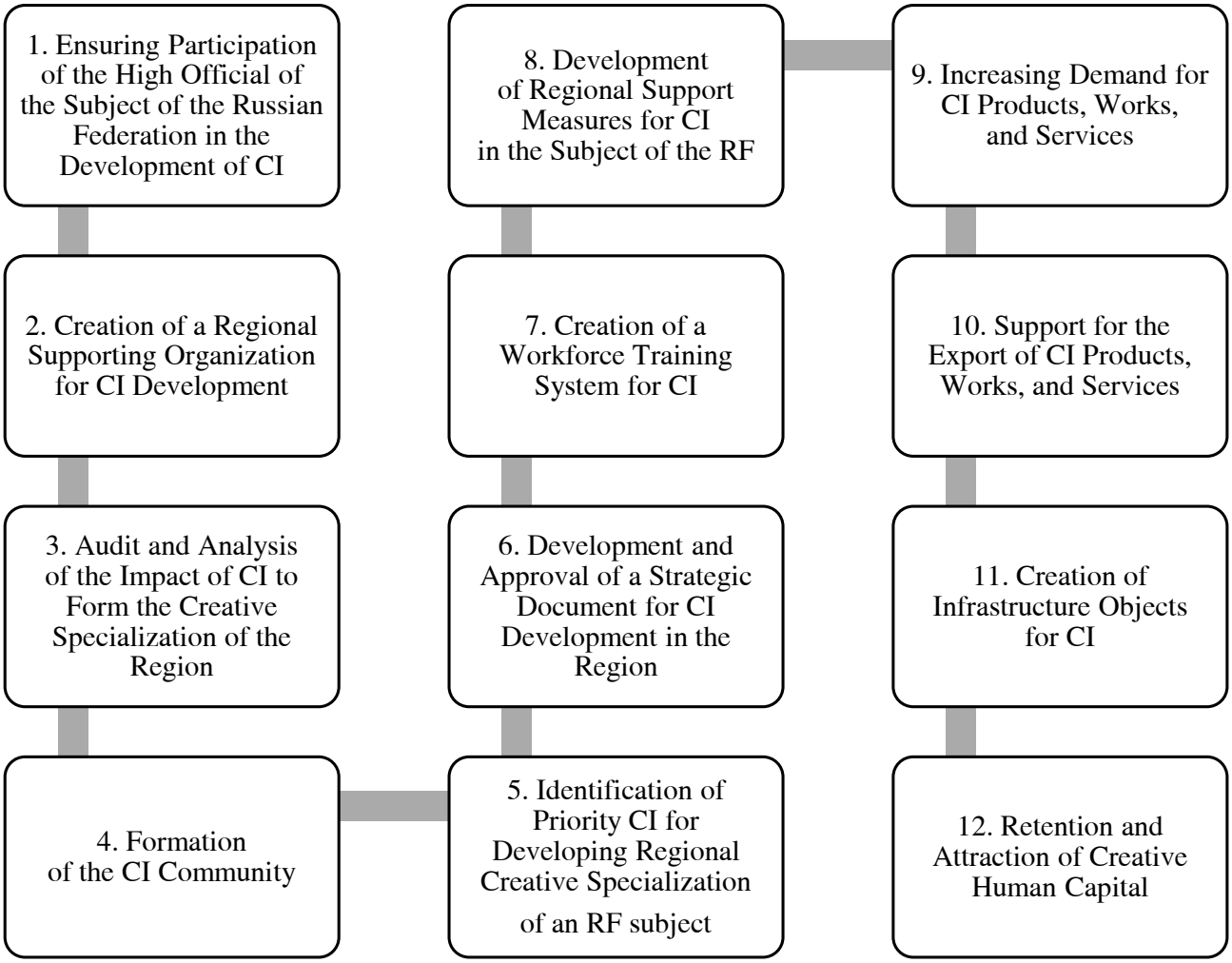

Fig 1. **Twelve steps for the development of creative industries in the subjects of the Russian Federation**

Source: compiled by the authors in the base of URL: https://asi.ru/library/main/197563/

tivities that enable effective distribution of the creative product.

The methodology for developing network entrepreneurial structures in the region's space is less developed than the methodology for determining factors that stimulate entrepreneurship development. Some theoretical and methodological foundations within the framework of regional and sectoral economics are laid out in cluster theory and in the evolving theory of regional ecosystems.

In some studies, the cluster form of organization is mentioned as a priority method for stimulating the development of creative industries [7–9]. This fact confirms that the complex of creative industries has a network structure, and ignoring this feature when forming directions and development models is not advisable. The analysis of research [10–12] shows that the formation of regional clusters in the Russian Federation is based on an initiative model, implemented by development institutions since the early 21st century. A similar experience is applied to the clustering of creative industries.

Ecosystem theory expands the understanding of the functioning and development of the creative network by including a significant number of external participants as objects. In this case, the analysis of the role of partici-

Table 1

The procedure for testing hypotheses about the dependence of node development and the tightness of connections in a creative network, and the factors stimulating its development, in regional localisation

Correlation Coefficient	Hypothesis	Result Interpretation (Chedok's Scale)
U 1...n n — number of factors stimulating the development of creative industries in regional localization	Testing the presence of connectivity between the development of creative network nodes and the factors stimulating the development of creative industries in regional localization	Range 0.9–1 — very high 0.7–0.9 — high 0.3–0.7 — medium 0–0.3 — low
T1...n n — number of factors stimulating the development of creative industries in regional localization	Testing the presence of the strength of connection between the creative network and the factors stimulating the development of creative industries in regional localization	

Source: compiled by the authors.

pants is somewhat different from the cluster approach, as it is necessary to consider the effects that directly impact the entire regional ecosystem. While in the cluster approach "development institutions in the most common understanding are generally equated with special organizations that differ from others in that they facilitate the allocation of resources in favor of projects that realize new economic growth potential for the industry, region, or country as a whole" [13], for ecosystems, it is possible to use a ranking system that shows the progress of development institutions in a specific region due to the high effectiveness of the support provided. Thus, when developing the creative industry, the list of network effects should include those necessary for the organizations within the ecosystem [14, 15].

METHODOLOGICAL APPROACHES TO RESEARCH

The formation of development directions for the creative network within the ecosystem approach involves a continuous assessment of the impact of a set of stimulating factors on the development of creative network nodes and maintaining the strength of connections within the range of "average" and above in regional localization. A paired correlation analysis is proposed as the evaluation method. The research process includes hypothesis testing (*Table 1*).

The indicator of the development of regional creative network nodes is determined by comparing it with a similar network within the national economy (*Fig.* 2): a score of 10 points is given for full alignment with the regional network, and the points are reduced proportionally for partial alignment.

The strength of the connection in the creative network is measured using correlation coefficients $K_1 - K_6$:

$$K_n = \frac{\Sigma\left(X_i - \bar{X}\right)\left(Y_i - \bar{Y}\right)}{\sqrt{\Sigma\left(X_i - \bar{X}\right)^2 \Sigma\left(Y_i - \bar{Y}\right)^2}},$$

where the values of variables X and Y are presented in *Table* 2.

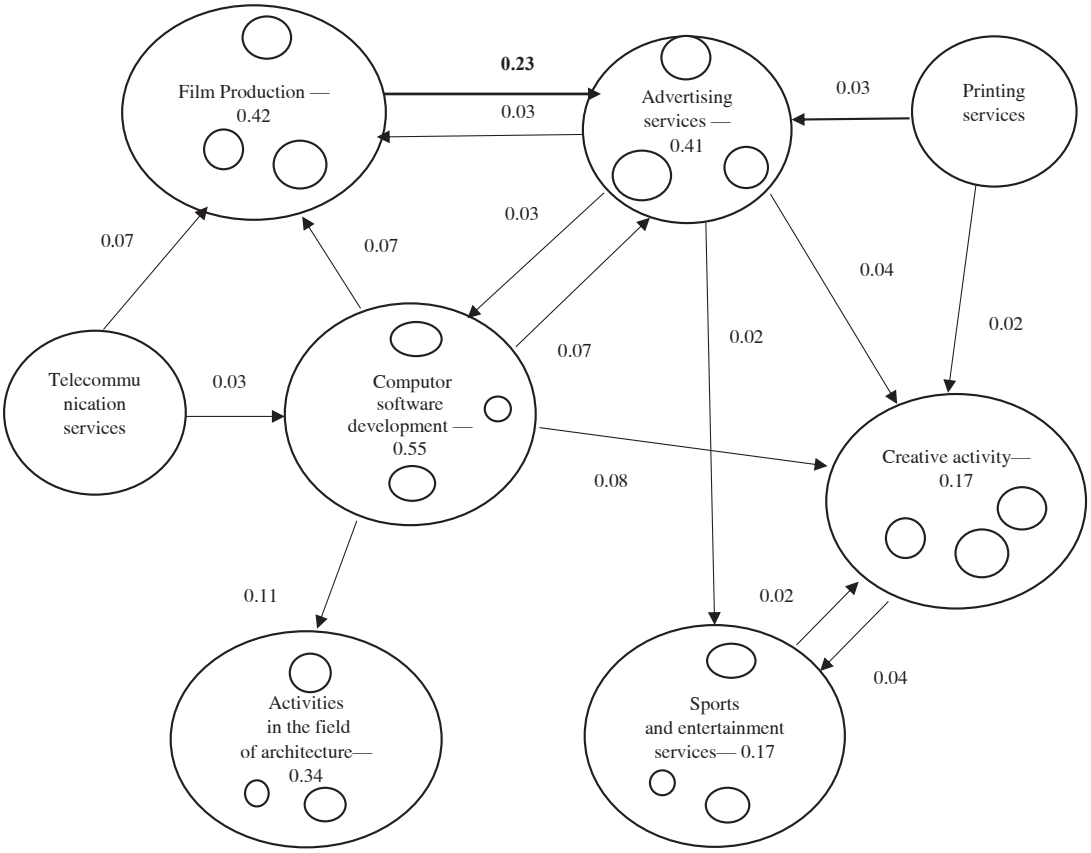

Fig 2. **Configuration of the Creative Industries network**

Source: [16].

Table 2

Values of *X* and *Y* in the calculation of indicators characterizing the closeness of communication in the creative network

Correlation Coefficient	X	Y
K_1	Total assets of organizations forming creative products	Number of organizations working in the promotion and distribution of creative products
K_2	Profit of organizations forming creative products	Number of organizations working in the promotion and distribution of creative products
K_3	Revenue of organizations forming creative products	Number of organizations working in the promotion and distribution of creative products
K_4	Total assets of organizations promoting and distributing creative products	Number of organizations working in the formation of creative products
K_5	Profit of organizations promoting and distributing creative products	Number of organizations working in the formation of creative products
K_6	Revenue of organizations promoting and distributing creative products	Number of organizations working in the formation of creative products

Source: compiled by the authors.

The justification of the stimulating factors is carried out in accordance with the analysis of scientific works and program documents dedicated to the development of creative industries in the Russian Federation (*Fig. 3*).

RESULTS AND DISCUSSIONS

When assessing the development of nodes and the strength of the connection within the creative network for the production and distribution of film products across the regions of the

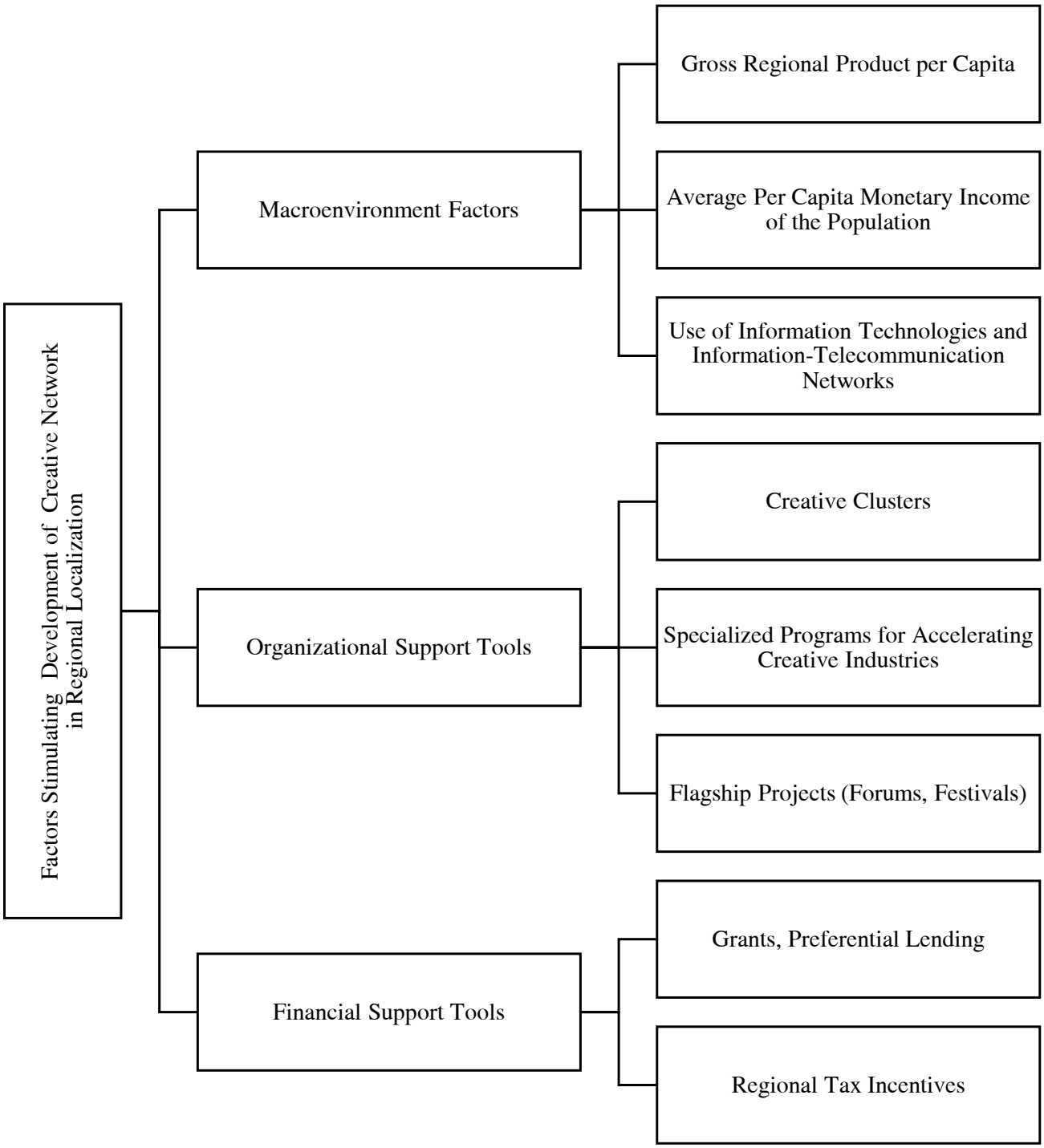

Fig. 3. **Factors stimulating the development of a creative network in regional localisation**

Source: compiled by the authors.

Table 3

Indicators of the development of nodes and the tightness of communication of the creative network of production and distribution of film products in the context of the regions of the Russian Federation with the presence of organisations forming a creative product

Region	Net's node	K_1	K_2	K_3	K_4	K_5	K_6
Moscow	10	0.724752	0.752475	0.722772	0.544554	0.673267	0.39604
Irkutsk region	10	0.633663	0.455446	0.742574	0.415842	0.732673	0.712871
Altai region	7.5	0.579208	0.564356	0.393564	0.534653	0.415842	0.534653
Moscow region	7.5	0.579208	0.556931	0.408416	0.304455	0.549505	0.386139
Perm region	7.5	0.534653	0.445545	0.341584	0.386139	0.50495	0.467822
Bashkortostan (Republic)	7.5	0.50495	0.586634	0.542079	0.45297	0.594059	0.304455
Amur region	7.5	0.475248	0.534653	0.40099	0.50495	0.467822	0.341584
Orenburg region	7.5	0.475248	0.482673	0.556931	0.29703	0.534653	0.549505
Rostov region	7.5	0.467822	0.534653	0.571782	0.519802	0.423267	0.579208
Nizhny Novgorod region	7.5	0.467822	0.334158	0.356436	0.34901	0.423267	0.40099
Voronezh region	7.5	0.45297	0.386139	0.40099	0.527228	0.594059	0.438119
Yaroslavl region	7.5	0.415842	0.45297	0.430693	0.564356	0.50495	0.430693
Kaliningrad region	7.5	0.408416	0.586634	0.371287	0.304455	0.378713	0.527228
Krasnodar region	7.5	0.408416	0.319307	0.371287	0.363861	0.556931	0.408416
Saratov region	7.5	0.386139	0.594059	0.40099	0.490099	0.34901	0.564356
Sverdlovsk region	7.5	0.386139	0.363861	0.475248	0.556931	0.571782	0.29703
Saint Petersburg	7.5	0.378713	0.34901	0.527228	0.326733	0.45297	0.571782
Samara region	7.5	0.363861	0.482673	0.594059	0.549505	0.311881	0.460396
Volgograd region	7.5	0.363861	0.29703	0.571782	0.393564	0.40099	0.527228
Tyumen region	7.5	0.356436	0.519802	0.586634	0.386139	0.386139	0.334158
Chelyabinsk region	7.5	0.356436	0.50495	0.482673	0.415842	0.564356	0.519802
Stavropol Krai	7.5	0.334158	0.363861	0.45297	0.34901	0.371287	0.430693
Krasnoyarsk region	7.5	0.326733	0.579208	0.415842	0.571782	0.519802	0.534653
Mari El (Republic)	7.5	0.319307	0.423267	0.467822	0.430693	0.490099	0.490099
Chuvash Republic-Chuvashia	5	0.326733	0.361386	0.247525	0.391089	0.366337	0.341584
Republic of Crimea	5	0.30198	0.336634	0.39604	0.222772	0.311881	0.267327
Ryazan region	5	0.242574	0.341584	0.287129	0.356436	0.386139	0.287129
Sevastopol	5	0.222772	0.242574	0.311881	0.207921	0.237624	0.356436
Arkhangelsk region	5	0.207921	0.252475	0.272277	0.381188	0.232673	0.30198

Source: compiled by the authors on the basis of data from the SPARK Interfax analytical database.

Russian Federation, the following results were obtained (*Table 3*).

According to *Table 3*, a fully developed creative network is only present in Moscow and the Irkutsk region; organizations involved in the production of creative products (films, video films, and television programs) are present in only 29 regions. Infrastructure organizations providing telecommunications and advertising services are found in almost all regions of the Russian Federation.

The strength of the connection between the nodes of the creative network for the production and distribution of films can be described as "average," although for the entire country, without regional detail, it is considered "strong" [17]. This observation leads to the conclusion about **the interregional nature of the activities within the creative network for the production and distribution of films**. Organizations interact without strict regional localization, which indicates the futility of various organizational activities aimed at developing creative industries based on physical presence, and highlights the benefit of digital tools that support remote interaction.

Next, we will present the results of the correlation analysis of the development of nodes and the strength of the connection within the creative network and the factors stimulating the development of creative industries in regional localization (*Table 4*).

Table 4

The results of the correlation analysis of the development of the nodes and the tightness of the communication of the creative network, as well as the factors that stimulate the development of creative industries in regional localization

Indicator	Gross regional product per capita	Average per capita monetary income of the population	Use of information technologies and information and telecommunication networks	Creative clusters	Specialized acceleration programs for creative industries	Mainline projects (forums. festivals)	Grants. preferential lending	Regional tax breaks
Net's node	0.531	0.434	0.458	0.388	0.458	0.427	0.202	0.384
K_1	0.382	0.263	0.430	0.313	0.256	0.213	0.352	0.352
K_2	0.373	0.219	0.512	0.254	0.217	0.325	0.355	0.284
K_3	0.398	0.202	0.408	0.296	0.395	0.279	0.311	0.244
K_4	0.239	0.312	0.406	0.299	0.203	0.236	0.264	0.292
K_5	0.202	0.302	0.527	0.391	0.240	0.350	0.228	0.302
K_6	0.246	0.328	0.499	0.262	0.275	0.363	0.309	0.362

Source: compiled by the authors.

The obtained data indicate the absence of a developed model for the regional ecosystem of the creative network for the production and distribution of films and a clear correlation between the presence of creative network nodes, the characteristics of the strength of connections, and the factors present in the regional business development ecosystem. The most significant factor for the development of the creative network in a region is the "Use of information technologies and information-telecommunication networks": the correlation coefficient with the parameter of the creative network's development in terms of the number of nodes is 0.458; the correlation coefficients $K_1 - K_6$, which characterize the strength of connections in the creative network for the production and distribution of films in regional localization, range from 0.406 to 0.527. The least influential factors are the availability of grants and preferential credit programs for representatives of creative industries and tax benefits: the correlation coefficients with the parameter of the creative network's development in terms of the number of nodes are 0.202 and 0.384, respectively; the correlation coefficients $K_1 - K_6$ range from 0.228 to 0.362. The main reason for this situation is the lack of such support measures specifically for creative network organizations or their limited coverage. Organizational factors (the presence of creative clusters, specialized acceleration programs, and major projects in the creative field) show moderate correlation with the parameters of the creative network for the production and distribution of films; they are primarily connected with the formation of creative network nodes but have little effect on the strength of the connections.

CONCLUSION AND RECOMMENDATIONS

Based on the conducted research, the following conclusions can be drawn:

Firstly, the results indicate that the development of the creative network in regional localization occurs in a rather fragmented manner.

Secondly, there is an evident absence of a developed model for the regional ecosystem of the creative network for the production and distribution of films.

Thirdly, to implement an ecosystem approach when developing the mechanism for the creative network's development, further justification is required regarding the list of results in regional localization, with a detailed description of the effects received by the region's population, government authorities, municipalities, and other stakeholders.

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