STIMULATING INDUSTRIAL DEVELOPMENT OF THE REGION IN THE CONTEXT OF TECHNOLOGICAL SOVEREIGNTY USING A LEASING PAYMENT OPTIMIZATION MODEL

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Abstract

This article analyzes the incentives for industrial growth from the perspective of modern Russia's strategic priorities to create an environment conducive for scientific, technological, and engineering advances. The key national challenges lie in overcoming the technological gap in industry at the regional level, which requires systematic, high-quality upgrading of production facilities. Since the technological capacity of the industrial sector is the fundamental factor in achieving technological sovereignty, the role of leasing as one of the instruments of industrial policy in this process is substantiated. The goal of the work is to improve the scientific and methodological approach to the use of leasing in stimulating industrial development in the context of technological sovereignty. The study focuses on several complex issues, analyzing conceptual approaches to technological sovereignty and industrial policy. Furthermore, we constructed a model for optimizing leasing payments adapted to the conditions of post-conflict industrial recovery in a new region of the Russian Federation based on fostering industrial partnerships. The main result of the study is the calculation of leasing payments taking into account the risk premium and interest rate subsidies, allowing to justify measures for economic stimulation of leasing operations in the industry of a region with specific economic conditions, increasing their mutual benefit for the lessor and the lessee.

Keywords: stimulation, industrial development, technological sovereignty, optimization model, leasing.

СТИМУЛИРОВАНИЕ ПРОМЫШЛЕННОГО РАЗВИТИЯ РЕГИОНА В КОНТЕКСТЕ ТЕХНОЛОГИЧЕСКОГО СУВЕРЕНИТЕТА С ИСПОЛЬЗОВАНИЕМ МОДЕЛИ ОПТИМИЗАЦИИ ЛИЗИНГОВЫХ ПЛАТЕЖЕЙ

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Аннотация

В статье стимулирование промышленного развития рассматривается с позиции стратегических ориентиров современной России, которые непосредственно связаны с формированием условий для внедрения достижений науки, технологий и техники. Решение ключевых задач находится в плоскости преодоления технологического отставания промышленности на региональном уровне, в том числе, за счет обновления материальной основы производства на качественной и регулярной основе, что свидетельствует об актуальности исследования. Исходя из того, что технико-технологическая обеспеченность промышленного производства определяется как базовый фактор достижения технологического суверенитета, в данном процессе обоснована роль лизинга, как одного из инструментов промышленной политики. Целью работы является совершенствование научно-методического подхода к использованию лизинга в стимулировании промышленного развития в контексте технологического суверенитета. Исследование сосредоточено на решении ряда комплексных задач, а именно, анализе концептуальных подходов к технологическому суверенитету и промышленной политике, разработке модели оптимизации лизинговых платежей, адаптированной к условиям постконфликтного восстановления промышленности нового региона РФ на основе развития партнерских отношений в промышленности. Основным результатом исследования является расчёт лизинговых платежей с учётом премии за риск и субсидирования процентных ставок, что позволяет обосновать меры экономического стимулирования лизинговых операций в промышленности региона со специфическими условиями хозяйственной деятельности, повышающие их взаимовыгодность для лизингодателя и лизингополучателя.

Ключевые слова: стимулирование, промышленное развитие, технологический суверенитет, модель оптимизации, лизинг.

1. Introduction

The increasing importance of stimulating industrial development and ensuring the technological independence of the national economy necessitates import substitution across a wide range of products and components, making the material and technical base crucial for the domestic industrial sector. In this regard, research on measures and instruments of state support for industrial development in the context of technological sovereignty holds significant scientific and practical interest.

At the present stage, the sovereignty of technological reproduction is designated as the conceptual basis for the industrial development of the Russian economy. Key goals and directions for technological development up to 2030 within the context of the formation of a new industrial policy are enshrined in the Concept of Technological Development (Order of the Government of the Russian Federation dated May 20, 2023, No. 1315-r). The fundamental principle for implementing the Concept's new priorities is the idea of partnerships.

As global experience shows, the growing imperative to apply scientific discoveries and inventions into practice strengthens the involvement of state, business, and society in addressing the challenges of advancing technological innovation. Consequently, issues of technological sovereignty should be fully integrated into the goals and instruments of industrial policy (Crespi, Caravella et al., 2021). The dynamic nature of industrial policy, means that it evolves in response to changes in its goals, the chosen policy instruments and the level of support measures, which together shape how actively it is implemented (Heinrich et al., 2025). Technological sovereignty is considered as an organized action by the state that complements innovation policy, going beyond outdated perspectives or paradigms of economic competitiveness and socio-technological transformations (Edler et al., 2023). Therefore, the concept of technological sovereignty bridges industrial and innovation policies, forging stronger links between the industry and the economy by generating a synergistic effect.

However, the incomplete nature of systemic and structural reforms accompanying the implementation of industrial policy in Russia negatively affects achieving the country's technological sovereignty objectives (Shkodinsky, Prodchenko et al., 2024).

The scale of the necessary structural transformations in Russia, along with their place on the agenda for technological and industrial progress, depend on the realities and future trajectories for industrial development in regions with specific economic conditions. A key priority for modern Donbass is to address the problem of manufacturing on technologically obsolete equipment, whose wear and tear across the region amounts to more than 70%. In practice, a number of industries struggle to reach a new competitive level in the context of technological sovereignty if they rely solely on market mechanisms and classical support measures.

The specifics of leasing payments determine the benefits of leasing as a tool for technological modernization of production and stimulation of industrial development. Government subsidies are the primary tool for stimulating sales of equipment and machinery on the Russian market, directly influencing the dynamics of new transactions in the domestic machinery, equipment, and machinery segments. Market participants see underfunded regions as promising for business expansion.

A leasing transaction, when viewed from the perspective of a partnership, requires a balance of interests of the parties, so the execution of a leasing contract should result in achieving mutual benefit for both parties. Accordingly, it seems appropriate to construct an economic mathematical model for optimizing leasing payments based on the principles of partnership or mutual benefit for the participants.

This study aims to refine the modeling method proposed for optimizing leasing payments (Shmyrev and Osadchiy, 2001, Shmyrev and Safronova, 2004).

The object of the study comprises the economic processes involved in advancing technological sovereignty and executing the industrial policy to stimulate the industrial growth.

The subject of the research is the refinement of the scientific and methodological approach to usng leasing as a catalyst for industrial growth, taking into account the specific economic conditions.

The hypothesis of the study is that improving the methods and instruments of state support based on partnership principles focused on production logistics will stimulate the industrial sector and help achieve the objectives of technological sovereignty.

2. Literature review

Prioritizing technological sovereignty in state strategies reflects a commitment to enhancing competitiveness and driving transformation, aimed at promoting production based on key technologies securing economic and political sovereignty (March and Schieferdecker, 2021).

In the geostrategic space, technology-intensive countries and major economic players compete for technological and industrial leadership. The configuration of global value chains reflects this process. Productivity and security are becoming vital interests of states and interstate relations. Therefore, the geopolitical context has important implications for the distribution of technological capacity in the global economy. Structural dependence on leading countries in various fields requires other countries to increase their level of technological sovereignty (Crespi, Caravella et al., 2021). The influence of global technological competition motivates countries specializing in high-value activities in global value chains to modernize their technological capabilities. Therefore, technologically leading countries seek control over key technologies and technological sovereignty (Edler et al., 2023).

The concept of technological sovereignty was shaped by the spread of technology platforms in global economic practice as an element of the open innovation model, which was subsequently identified as a source of extraterritorial institutional influence (Gareev, 2023).

In the developed market economy, leading industrialized countries provide comprehensive government support for technological development. A well-developed system of government regulation and incentives ensures the introduction of advanced technologies, new equipment, and the upgrading of personnel skills (Beliakov et al., 2019).

Globally, the importance of industrial policy as a tool for targeted stimulation of structural transformation of national economies, ensuring sustainable growth, is determined by economic crises and deepening globalization. In recent years, the needs and objectives of industrial policy have changed fundamentally under the influence of the emergence of a new face of the global economy, in which the demand for industrial policy is increasing (Aiginger and Ketels, C., 2024).

The prospects for industrial policy are linked to the emergence of new, more flexible forms of cooperation between the public and private sectors, aimed at addressing new challenges in a broader sphere than a focus on industry or manufacturing. The concept of industrial policy in the 21st century is to support and develop modern economic activities, including the service sector, and not just manufacturing (Aiginger and Rodrik, 2020). Gereffi et al. (2025) propose a concept of integrating

industrial policy and global value chains as a response to geopolitical upheavals and the reorientation of industrial policy by governments from welfare to security.

Establishing public-private partnerships in conflict-affected areas is a relatively new area of research. In such settings, specific conditions exacerbate the risks, resulting in stakeholder uncertainty about the feasibility of financial and non-financial investments and the effectiveness of government support measures (Kawther et al., 2025). The key role of public-private partnerships in the development of modern infrastructure is demonstrated in (Son and Duong, 2024). When implementing complex PPP projects, governments attract funding and expertise from the private sector. The effectiveness of partnerships is demonstrated in the management and sharing of risks, the alignment of stakeholders, and financial sustainability (Ehab et al. 2025).

Achieving Russia's technological development goals largely depends on the effectiveness of the science and technology governance system and the ability to adapt to the challenges of restoring the country's technological sovereignty (Kamolov et al., 2022). An effective national research and innovation sector requires a network of support organizations at various levels of the economic system. Network interaction, taking into account the synergy effects of various types of regional and state organizations, should ensure the growth of Russia's scientific and technological potential (Byvshev et al., 2020). However, even if Russia successfully pursues its course towards technological sovereignty, progress in innovation or sustained economic growth is by no means guaranteed (Smorodinskaya and Katukov, 2024).

Territorial differences across the Russian Federation are an undeniable economic factor influencing how the industry transforms to meet the state's industrial policy and technological sovereignty objectives. The uneven industrial development of Russia's regions results from their economic specialization, sectoral structure and resource base. Conversely, the technological embargo poses a direct challenge to the Russian economy faced with the dual objectives of achieving technological sovereignty and import substitution (Kapoguzov, Sheresheva, 2024).

Russia's industrial regions are potentially hubs of technological development and productivity growth. Timely and effective government support will be essential to realizing this potential (Korovin, 2021).

Despite the scope and relevance of the subject area of the stated research topic, measures to stimulate industrial development in the context of technological sovereignty require further development and improvement.

3. Materials and Methods

To confirm the proposed hypothesis, solve the stated problems, and validate the obtained results, general scientific and modern methods were used, including synthesis, induction and deduction, abstraction and systematization, economic analysis, and economic-mathematical modeling.

The research information base consists of statistical materials and reports from relevant agencies, departments, and organizations, as well as scientific and periodical literature.

The mathematical formulation of the problem, to be solved by constructing a lease payment optimization model, is based on the modeling method proposed in the works (Shmyrev and Osadchiy, 2001, Shmyrev and Safronova, 2004). The study's core premise is that modifying the lease payment optimization model by expanding its parameters will make it possible to solve the classical optimization problem. By incorporating a balance of interests to apply the partnership principle, the refined

model will help stimulate leasing operations in the industry of a new region of the Russian Federation in the context of post-conflict reconstruction.

The model describes the following leasing scheme: a bank provides a loan to the lessor; the lessor purchases the leased asset from the supplier using the loan amount; the lessor transfers the leased asset to the lessee for use; the lessee makes periodic lease payments to the lessor and, upon termination of the lease, can purchase the leased asset at its residual value; the lessor divides the payments received into two parts: one goes toward repaying the loan and paying taxes, and the other is retained as compensation for the service provided.

According to the assumption, the lessor's risk premium (ρ) and the interest rate subsidy (λ) are used as regulating parameters when calculating the discount factor. Table 1 summarizes the model assumptions used in its construction.

Table 1. Assumptions for constructing the lease payment optimization model

Designation	Description
Assumption 1	All settlements between the lessee and the lessor and the lessor and the bank, as well as the payment of taxes, occur simultaneously at the end of the i-th period.
Assumption 2	Value Added Tax is not taken into account or is considered to be automatically refundable.
Assumption 3	The lessor takes into account additional risk in the form of a risk premium, which increases the total interest rate, while the state can subsidize the high interest rate, thereby making it more profitable.
Assumption 4	The income tax rate, the risk-free interest rate, the lessor's risk premium and the amount of the interest rate subsidy are constant throughout the term of the lease agreement.

Assumption (3) is taken into account when calculating discount factors:

$$c_i = \frac{1}{\left(1 + (r + \rho)\right)^i},$$

$$v_i = \frac{1}{\left(1 + (r + \rho - \lambda)\right)^i},$$

The model has the following form:

objective function:

$$\sum_{j=1}^{i} c_j x_j \rightarrow min,$$

assumption:

$$\sum_{j=1}^{i} \quad x_i \geq \sum_{j=1}^{i} \quad a_i + t \sum_{j=1}^{i} \quad p_i, \quad i = 1, \dots, n,$$

$$p_i - l_i = x_i - b_i - \sum_{j=1}^{i-1} k_{ij} l_j, \quad i = 1, \dots, n,$$

$$\sum_{j=1}^{n} \quad v_j (x_j - a_j - t p_j) \geq S,$$

$$p_j l_j = 0, \quad j = 1, \dots, n,$$

$$x_j, p_j, l_j \geq 0, \quad j = 1, \dots, n.$$

where: i, j are the period indices; c_i are the coefficients for bringing lease payments to the initial point in time; x_i is the amount of the lease payment in the ith period; a_i are the costs allocated to the lessor's cost; t is the income tax rate; p_i is the amount of losses in the jth period of the lessee; n is the term of the lease agreement; l_i is the amount of losses in the jth period of the lessee; b_i are the costs allocated to the cost of the lessee; k_{ij} are the coefficients that take into account the losses of the lessee's previous periods in the current period; v_i are the coefficients for discounting the amount of the lessor's remuneration; S is the specified level of the total present value of the lessor's remuneration.

4. Results

Optimal lease payment calculation scenarios were developed for the Donetsk People's Republic, Table 2. The risk-free rate corresponds to the Central Bank of the Russian Federation key rate, net of inflation. The lessor's risk premium reflects the current transition period conditions (ρ regulator). The interest rate subsidy reflects government support options (λ regulator)

Table 2. Optimal Lease Payment Calculation Scenarios

	Risk-free rate, r	**Rate subsidy, λ**	**Risk premium, ρ**
scenario 1	12%	0%	25%
scenario 2	12%	8%	25%
scenario 3	12%	8%	1%

Computational experiments are conducted based on a special algorithm developed for implementing the scenarios and an economic-mathematical model, which was tested using data from the annual reports of Sberbank Leasing JSC. The algorithm reflects the sequence of calculating the parameters of economic incentives for industrial leasing using an interest rate subsidy mechanism. Its purpose is to determine the subsidy amount λ that ensures a specified level of the lessor's total present value remuneration S. The calculation results are illustrated in Figure 1, which presents profitability graphs for all scenarios for the entire term of the leasing agreement. Based on the results of calculating optimal lease payments for a five-year lease agreement, the average profitability of the lessor for the scenarios was as follows: 6.08% for Scenario 1, 6.92% for Scenario 2, 11.25% for Scenario 3.
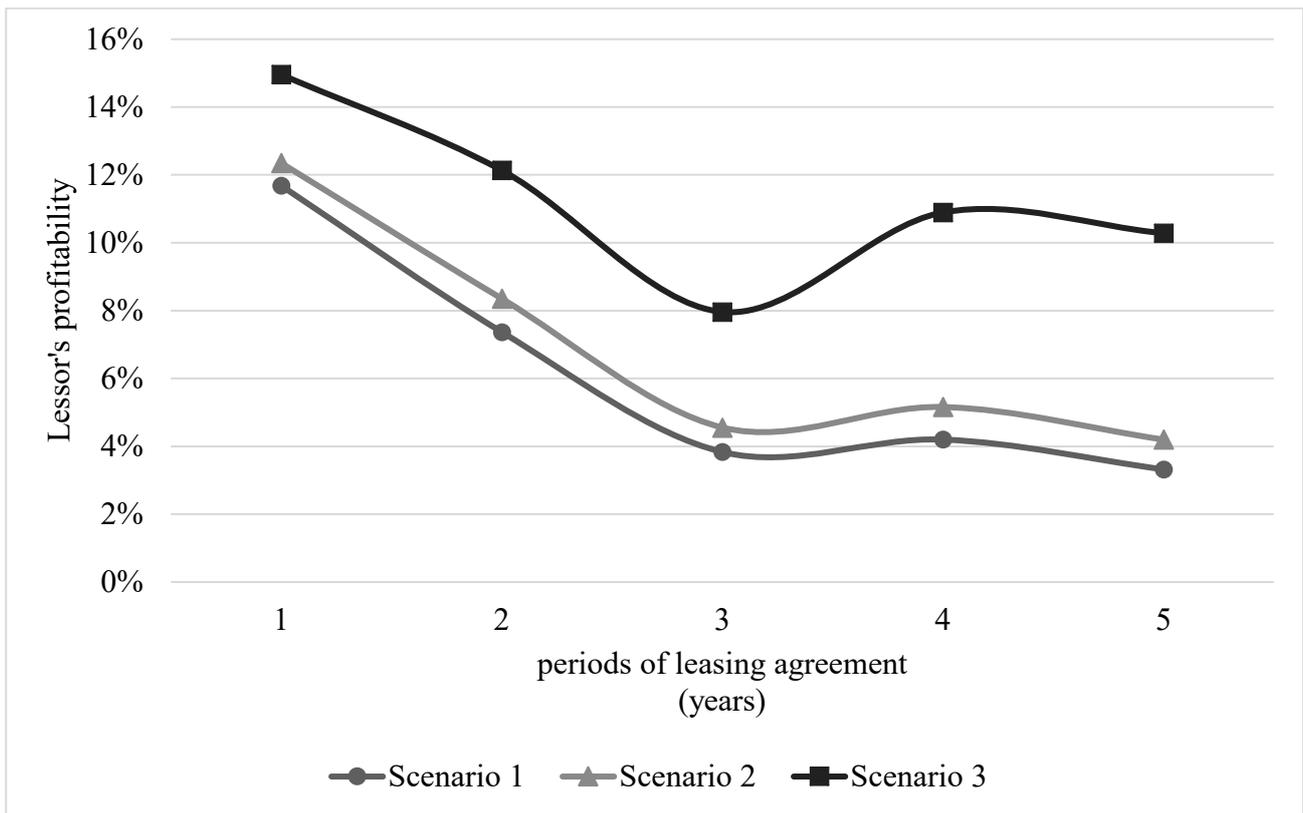
Figure 1. Lessor profitability under different economic incentive scenarios

As Figure 1 shows, under scenario 1 (business as usual), leasing operations have low profitability due to the very high real key rate of the Central Bank of the Russian Federation and the high risks of the post-conflict economy, which are factored into the discount rates. Scenario 2 (application of an interest rate subsidy) and scenario 3 (reduction of the risk premium), assuming optimal leasing payments, will have a positive impact on the attractiveness of leasing in the industry of the new region of the Russian Federation due to a significant increase in the lessor's profitability, which is the ratio of the average discounted profit for the period to the cost of the leased equipment.

The model is designed to substantiate measures to economically stimulate leasing operations in the industry of the new region, increasing their profitability for both the lessor and the lessee. It reflects modern approaches to leasing development using various forms of government subsidies, such as reimbursement of a portion of the advance payment under the leasing agreement; Providing a preferential loan to form an advance payment, allocating preferential finance to leasing companies for the subsequent conclusion of cheaper leasing transactions.

5. Discussion

The public-private partnership is a relatively new instrument in the state management of industrial development in Russia, focused on technological economic growth, as evidenced by the structure of the distribution of the total number of PPP projects across various sectors of the economy, Figure 2.
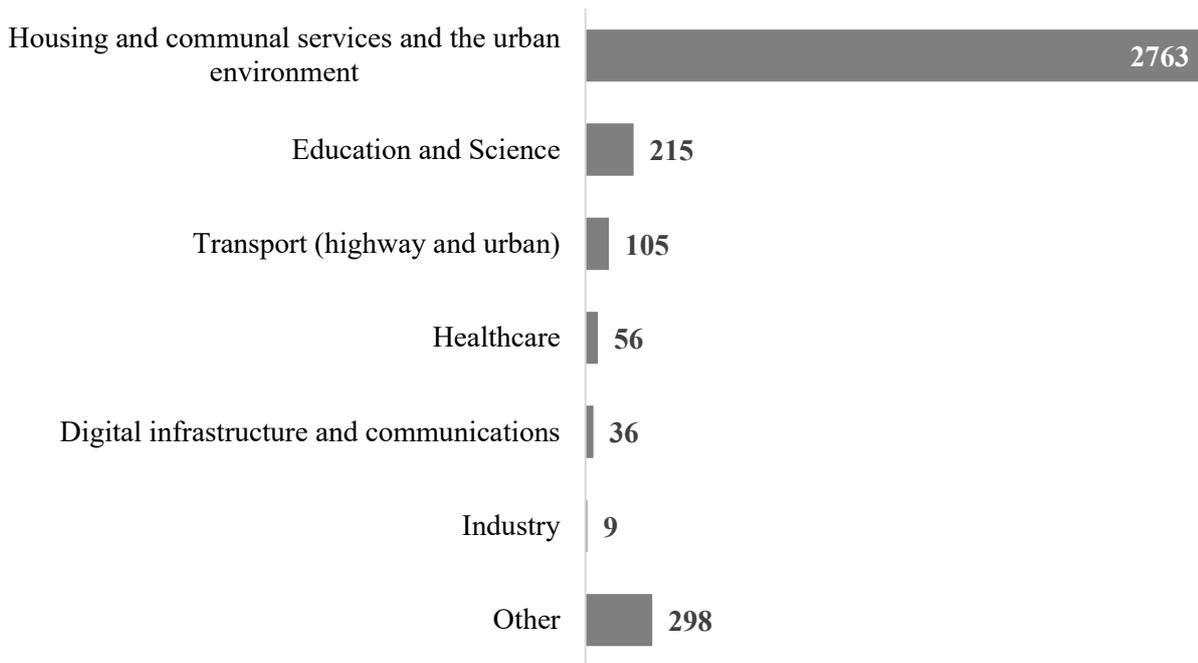
Figure 2. Number of PPP projects in various areas of infrastructure and industry[1,2,3]

A statistical analysis of the PPP market reveals that, globally, as in Russia, public-private partnerships are used largely as a tool for infrastructure development. By design, the PPP mechanism represents a means for overcoming budget constraints and a new style of public administration. Public-private partnership mechanisms are traditionally applied in sectors like transportation and utilities infrastructure, housing and other real estate, education, healthcare, culture, sports, fire protection, the penitentiary system, and fundamental science, that is, sectors that are state-owned and/or under the responsibility of state and municipal governments.

According to the World Bank, the global regional dynamics of private investment in infrastructure PPP projects are as follows, Figure 3.

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[1] Investments in infrastructure and PPP 2023. Analytical review / National Center for Public-Private Partnerships, VEB RF. Moscow: Rosinfra, 2023. https://rosinfra.ru/library/956-investitsii-v-infrastrukturu-i-g-ch-p-2023-analiticheskii-obzor

[2] Key trends and statistics of the PPP market by the end of 2023. Analytical review / National Center for Public-Private Partnerships, VEB RF. Moscow: Rosinfra, 2023. https://pppcenter.ru/upload/iblock/b0f/b0fcbdbe6927a5b75f7526d86642cf47.pdf

[3] Public-Private Partnerships in Russia: 2023 Results and Key Trends / Analytical Digest of the AIIC. 2023. https://data.tedo.ru/publications/ppp-digest.pdf
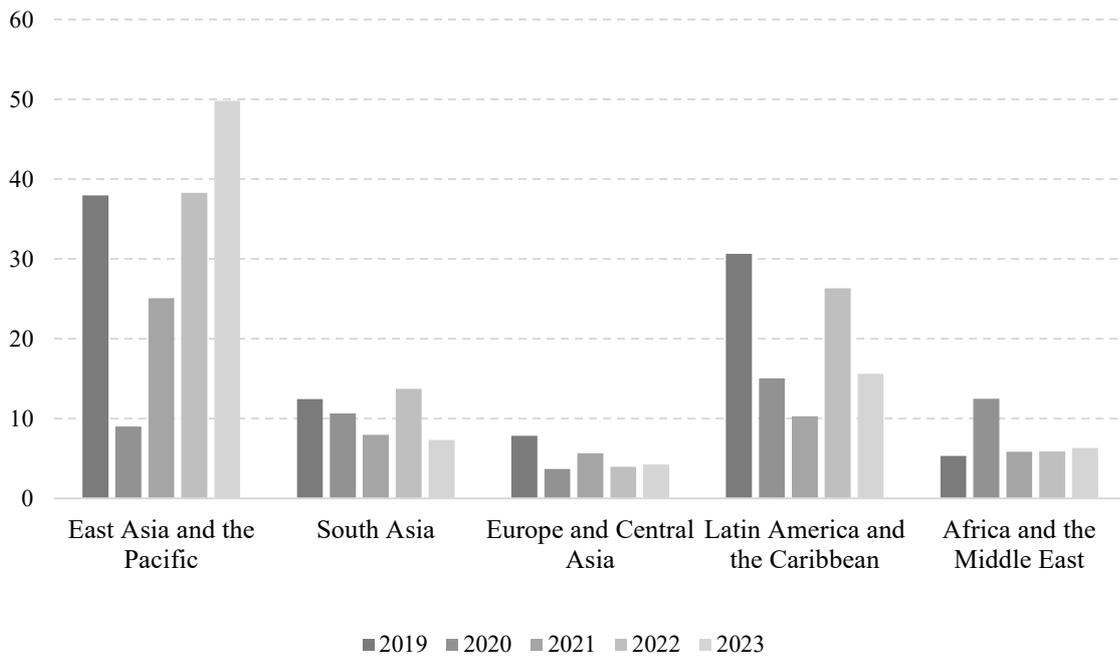
Figure 3. Dynamics of private investment in infrastructure PPP projects by region of the world, billion USD[4]

Of the presented group of countries, Russia demonstrates the lowest volumes of private investment in infrastructure PPP projects. Therefore, strategic approaches must be adopted to support and promote the development of the Russian PPP project market, Figure 4.
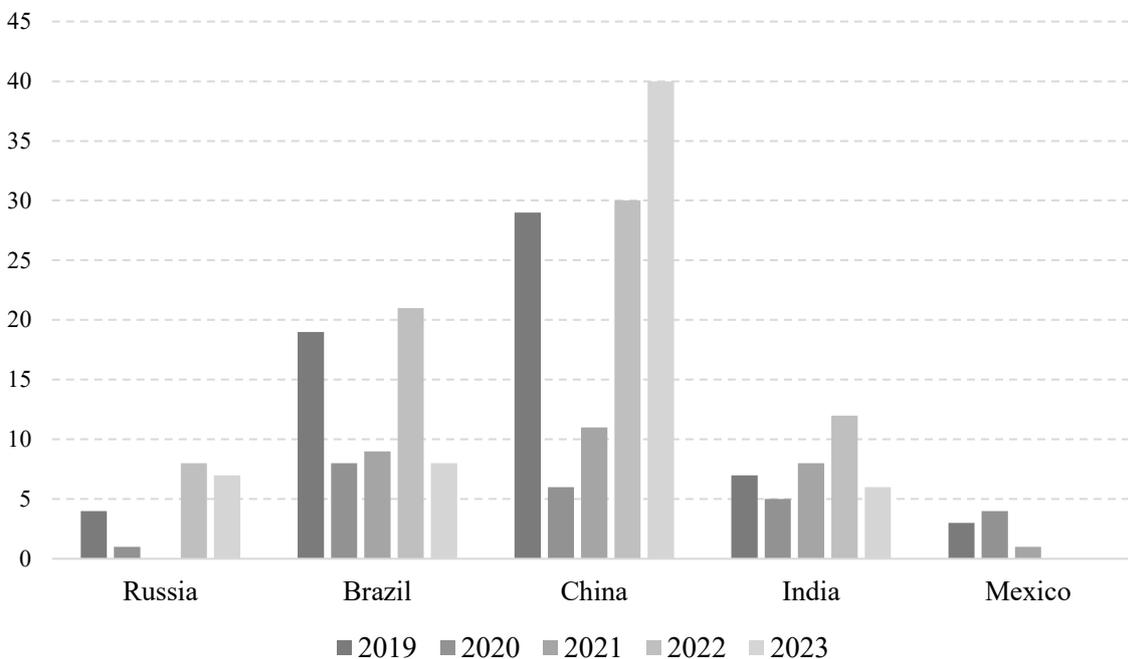
Figure 4. Dynamics of private investment in PPP infrastructure projects in developing countries, billion USD[5]

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[4] The World Bank. Infrastructure Finance, PPPs & Guarantees. https://ppi.worldbank.org/en/customquery.

[5] Ibid.

Currently, public governance in Russian PPP projects is implemented through institutional support of a methodological, organizational, financial, and technological nature. One focus of state industrial policy is promoting the use of leasing, a "quasi" form of PPP. This is consistent with the findings of other studies (Drobot et al., 2021), which consider quasi-PPP forms as mechanisms for extending the potential of the partnership system to create and deploy optimal solutions for innovative modernization of national industry. To enhance regional industrial specialization and competitiveness of territorial industrial systems, it is essential to assess the effects of localization and monitor industrial progress in the region. This will help translate the concept of an effective state into actionable policies aimed at diversification of regional economies (Skhvediani et al., 2024). This concept of an effective state, now a defining feature of public-private partnerships, has evolved from the principles of New Public Management and Good Governance. State and business must combine their efforts in providing domestic manufacturers with high-tech equipment under sanctions, as demonstrated in (Kasatov, 2019), emphasizing the importance of a stable mechanism for renewing fixed assets to produce competitive industrial products. Polovyan et al. (2024) examine how trends in sanctions policy impact Russian industry, including the prospects for operation and industrial expansion in new regions, as well as factors shaping the country's industrial sovereignty..

Reviving industrial potential to spur economic growth is among the top priorities for modern Donbass. Rebuilding the industrial infrastructure and outfitting it with new equipment are critical, resource-intensive tasks for technological modernization of industry in this new region of the Russian Federation. For the Donetsk People's Republic, as for other Russian regions, economic growth and industrial progress depend on its resource base and business environment, as the key factors for recovery (Trubchanin et al., 2023, Shemiakina and Ponomarenko, 2024).

Integrating leasing into the framework of public-private partnerships leverages its advantages as a "protected" investment vehicle, a tool for technological modernization, and a means for improving production competitiveness. This facilitates the renewal of machinery, equipment, and technology, and reduces the risk of investment misuse. The benefits of leasing lie in its economic nature, which distinguishes it from other forms of financing, and the structure of lease payments, generated from revenues from the sale of products manufactured with leased equipment.

6. Conclusion

The new technological landscape for the global economy and its prospects for industrial development are reshaping the organizational and economic interactions between economic actors. In this environment, technological sovereignty and industrial policy, as organized actions of the state, in their interrelationship, ensure a country's competitive position in the global economy. The production of goods in the basic industries of the Donetsk People's Republic today determines the industrial potential of the new region, whose development prospects depend on the pace of modernization of the industrial sector and are directly linked to successfully transitioning towards a more advanced technological base to boost labor productivity.

In the context of technological sovereignty, unlocking the potential of partnerships between government and business is crucial for achieving high-quality industrial transformations. Public-private partnerships serve as a key mechanism for incorporating various elements that stimulate sustainable industrial development. Thus, the need for industrial material and technological retooling determines the organic integration of leasing into the PPP mechanism as one of its elements. Consequently, improving the scientific and methodological approach to leasing will enhance the

effectiveness of PPPs in fostering industrial growth. A unique economic mathematical model was constructed based on this approach for optimizing lease payments, combining a risk component and an interest rate subsidy, which allows the proposed method to be adapted to regions with unique economic conditions. By applying the model, governments can substantiate measures to economically stimulate leasing operations in industry by regulating the amount of the interest rate subsidy based on risk, thereby increasing their profitability for both the lessor and lessee.

Stimulating industrial development in the context of technological sovereignty for regions with specific conditions, such as Russia's newly industrialized regions, is directly linked to ensuring and providing state support for the transition to higher labor productivity based on technological advances. Therefore, further refining multilateral mechanisms for stimulating sustainable industrial development in the context of technological sovereignty based on public-private partnership principles represents a promising avenue, vital for further research.

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