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Model of State Support for Industrial Parks as a Tool for Sustainable Development

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Abstract. The study focuses on government support for industrial parks as tools for sustainable development in Russia and other countries. The work investigates the influence of industrial activities, particularly those within eco-industrial parks, on the economic, social, and environmental conditions of regions and the country as a whole. The authors examined the main forms of support, financing, and regulation of industrial park activities and identified problematic aspects of state support for them. The experience of state support for industrial parks in China, Germany, and the USA is analyzed. The main features, approaches, and development tools are highlighted. Based on the analysis, a revised model of state support for industrial parks was developed within the framework of the concept of sustainable development, which can be implemented in Russia. The model consists of three stages of support, which are initiated at various levels of government, impacting both the federal and regional levels, as well as the actions of private investors. It is proposed to increase the use of indirect state support, creating favorable conditions for private investors. This approach is expected to result in more efficient investment utilization, enhanced competitiveness of enterprises, and a shift towards an environmentally-focused approach in industrial parks.

Keywords: Eco-industrial park; Government support; Industrial park; Sustainable development

1. Introduction

In 1992, the United Nations announced the most important goal of sustainable development in the 21st century: to achieve a high-quality environment and a healthy economy for all people around the world (Bobylev, 2017). In 2015, the UN General Assembly adopted the 2030 Agenda (United Nations, 2015). It contains 17 goals and 169 targets aimed at ending poverty, conserving the planet's resources, and ensuring prosperity for all (Moyer and Hedden, 2020). It is evident that sustainable development has become a priority focus of government policy during the implementation of the 2030 Agenda. One of the key trends aimed at achieving high results in terms of sustainable development indicators was the establishment and development of industrial infrastructure in the regions (Borodavkina and Mukovnina, 2021). In this context, industrial parks (IPs) can play a significant role in achieving sustainable development. They serve as instruments for sustainable development, fostering economic growth while minimizing adverse effects on the environment and society (UNIDO, 2019b).

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An industrial park serves as a strategic government-developed instrument for implementing industrial policies, with the primary goal of attracting investments and fostering overall economic growth and development (UNIDO, 2021). They have several differences from clusters, industrial zones, and other types of production agglomerations in a specific territory. These differences include (UNIDO, 2019b):

1. The presence of a geographically defined plot of land includes a range of services such as utilities, telecommunications, industrial waste and wastewater treatment, landscaping, emergency services, security, and access to transportation, among others.

2. Detailed master planning establishes standards and specifications for all aspects of the built environment, including buildings.

3. A single governing or administrative body that approves and facilitates the entry of new companies into the park, enforces its rules and provides long-term planning to facilitate the park's long-term development.

Researchers highlight several advantages and reasons for establishing industrial parks (IPs): these include fostering the growth of the manufacturing sector, facilitating both direct and reverse economic relationships, and promoting the expansion of added value (UNIDO, 2019; Kuznetsova *et al.,* 2018). They also attract technology and investment, promote innovation (Borodavkina and Mukovnina, 2021), and contribute to the creation of modern production and social infrastructure, the development of industrial symbiosis, and the improvement of the business environment (UNIDO, 2019b; Erkman, 2001). Additionally, they create economic benefits for the region, support regional development by creating jobs, causing the development of new industries, and reducing production costs (Kuznetsova *et al.,* 2018). Furthermore, they help reduce the negative impact on the environmental situation (Borodavkina and Mukovnina, 2021; UNIDO, 2019b; Kuznetsova *et al.,* 2018).

It can be argued that the development of IPs is an important instrument of state policy for sustainable development. In particular, a study (Borodavkina and Mukovnina, 2021) shows the contribution of the development of industrial parks to the implementation of individual sustainable development goals (SDGs), and the UNIDO industrial park development guide (UNIDO, 2019b) indicates the main SDGs that are most affected by the development of industrial parks (goals 6, 8, 9, 11, 12,13).

There are several types of industrial parks, for example, special economic zones, border economic zones, high technology parks, duty-free zones, free trade zones, eco-industrial parks etc. In the context of sustainable development, eco-industrial parks (EIPs) are of particular interest for research. Eco-industrial parks are industrial parks designed to enhance the social, economic, and environmental performance of resident companies. This is achieved through the promotion of industrial symbiosis and the incorporation of green spaces (UNIDO, 2019a). EIPs differ from traditional IPs in several ways. Firstly, they prioritize higher environmental friendliness in production processes. Secondly, they implement the principles of a circular economy and the environmentally friendly use of infrastructure. Lastly, they encourage the sharing of resources among different industries (Kreiner, 2023; Sharma, 2013). In the context of sustainable development, it is important that EIPs create additional benefits for neighboring communities and generate positive net effects from their activities (Lambert and Boons, 2002).

UNIDO (UNIDO, 2017) identifies three main models of EIP management: public, private, or joint management through public-private partnerships. The public management model implies that the government has the largest share in the IP and either manages it through a specialized company or directly oversees the park. In the private management model, the park operator is a private company that is typically contracted by investors. EIPs,

managed under a public-private partnership model, are jointly managed by the government (and its representatives) and private investors.

In any governance model, government support is essential to ensure the success and sustainability of industrial parks (UNIDO, 2017). This support can come in various forms, including financial assistance, regulatory frameworks, and infrastructure development. Government financial assistance can support EIP in implementing sustainable practices and technologies, which may involve higher upfront expenses. There are several financing models (Borodavkina and Mukovnina, 2021): (i) the traditional model, i.e., direct or indirect public sector investment in EIP, includes the direct allocation of the state budget or indirect investment through state-owned enterprises; (ii) financing through the capital market, such as issuing shares, bonds, or trust products, and (iii) project financing based on public-private partnership.

The regulatory framework is also critical for promoting the sustainable development of EIP. In its guidance, UNIDO identifies the most important areas that EIP legislation should cover (UNIDO, 2017). These are the criteria for the placement of EIP, which include the provision of transportation and communication facilities, as well as connections to markets. They also involve the regulation of rights to create, use, and operate infrastructure facilities within the industrial parks' territory. Additionally, they address investor rights and investment incentives, environmental obligations, and the organization of EIP management bodies. It is emphasized that the most important part of state regulation and support for the development of EIP should be a well-developed investment strategy, which includes investment, fiscal, and other incentives.

Russia has accumulated experience in establishing and managing industrial parks since their initiation in 2005. Despite a 2.7-fold increase in the number of parks between 2013 and 2022 (Borodavkina and Mukovnina, 2021), numerous challenges persist. The ongoing issue revolves around substantiating an effective model for state support to ensure the sustained functioning of industrial parks within the framework of promoting regional development, especially in the context of a federal state.

Researchers point out that one of the important but often problematic aspects of supporting industrial parks is the coordination of national, regional, and municipal policies (Babkin *et al.,* 2021; Sisto *et al.,* 2020; Kreiner, Franco-García, and Bressers, 2015). In addition, several studies indicate that traditional government support measures, such as direct budgetary investments in physical infrastructure, do not adequately guarantee the implementation of SDGs in the operation of industrial parks (Sisto *et al.,* 2020; UNIDO, 2017), particularly when there is a problem of policy inconsistency at different levels. Researchers also highlight the issue that the developed complex models of IP functioning are primarily descriptive and lack sufficiently specific proposals and practical recommendations for governing bodies (Babkin *et al.,* 2022b; Gibbs and Deutz, 2007). In this article, the authors understand government support models as a framework of models that can be used as a basis for creating individual support models in different countries. Based on these practical and research problems, the authors aimed to develop a model for state support in the development of industrial parks, specifically eco-industrial parks, in Russia. The model should ensure the effective implementation of sustainable development goals and facilitate the coordination of actions across various levels of management.

2. Methods

Healthcare The primary research methodology proposed is a systematic approach, a choice validated by its effective application in prior studies within the realm of industrial and eco-industrial park analyses. This approach allows us to consider an industrial park as

"a structured system that has its own relationships, operating principles, and connections between the initiator of the creation (which can be authorities and local communities), the management company, and park participants" (Melnychenko *et al.,* 2022). At the same time, the industrial park is considered a subsystem of the regional economic space, being an open system with connections beyond its borders. When employing a systematic approach to analyze government support in each country, the preliminary examination focused on general aspects of the country's economic development, mechanisms of government regulation, the establishment of industrial parks, and related factors. At the second step of system analysis, the obtained data was structured. That is, the subjects and objects of management, mechanisms, and tools for their interaction were determined. At the third step, a framework model was built based on the obtained knowledge structure. At the last step of the system analysis, the features of the model were highlighted, and the positive and negative aspects of government support were emphasized.

As the first part of the research, the study provides a qualitative comparative analysis of government support models in three countries: China, Germany, and the United States. The countries were selected based on the requirement to explore a variety of approaches to the implementation of government support, as well as examples of economies with different characteristics. When conducting a comparative analysis, the aforementioned systematic approach was maintained. The study is structured as a comprehensive comparative description of the features of state support for industrial parks in the selected countries. It examines the main types of management, financing models, forms of state support at different levels, and the main trends in the parks' development. For this purpose, content analysis of documentary sources and statistics published by government agencies are used. Using logical methods, models of government support in the selected countries are further developed. On the second stage of the study, based on a deductive analysis of the modeling results, a proposal is made for an effective model of state support for Russia.

3. Results and Discussion

3.1. Chinese model of state support

Considering China's experience, it is possible to formulate a general Asian model for state support in industrial park activities. Industrial parks began to develop in the country in the 2000s, and over the past decade, there has been an active trend of creating eco-industrial parks in the country. Today, there are approximately 110 operational eco-industrial parks in the country, and China's experience is widely regarded as the most successful (Karpenko, 2021). In China, there is no specific national legislation for industrial parks. Instead, their activities are regulated by governing documents and regulations at the regional level. These regional regulations establish the fundamental provisions for the management systems and policies of industrial parks. However, at the national level, general directions and strategies for industrial development are set (UNIDO, 2021). In addition, one strategy for supporting national-level industrial parks is to attract foreign companies to collaborate with Chinese enterprises. The influx of foreign capital stimulates the development of infrastructure and priority sectors of the country's economy, increases employment levels, and promotes technological development (Deryugin and Zvyagintsev, 2018). Government support for industrial parks in China typically includes tax incentives, financial assistance, fee reductions, and other forms of support. For example, in the early stage of industrial park development, enterprises recognized as high-tech receive a 15 percent income tax break. Additionally, those who establish high-tech enterprises are exempt from income tax for two years (Titov, 2023). It is worth noting that representatives of local authorities are also involved in the development of industrial parks. They have a

direct influence on the development of industrial parks in their territory by investing in their creation and development and providing organizational support.

The model of government support for industrial parks in China (created by authors) is presented in Figure 1.

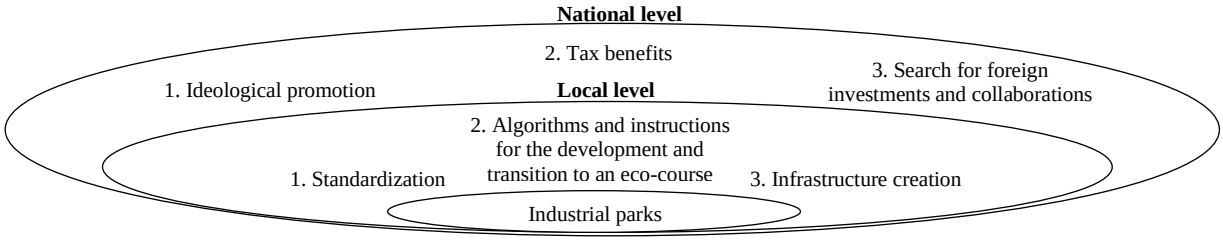

Figure 1 Asian model of state support for industrial parks (*Source*: authoring)

Thus, we can highlight the following features of the Asian model of government support: (i) local government offers significant support; (ii) the promotion of ideology at the national level; (iii) international collaborations in industrial parks; (iv) availability of social infrastructure in the industrial park area.

3.2. German model of state support

By analyzing the experience of developing industrial parks in Germany, it is possible to formulate a pan-European model for government support.

Industrial parks began to develop in Germany in the 1970s as part of the popular trend of industrial associations in Europe at that time. Already in 1984, there were 24 industrial parks in Germany that were solely financed by the state. To attract private investors, the German government had to subsidize the creation of parks, provide tax incentives, and implement interstate projects. Due to the lack of infrastructure, industrial parks were located near large cities. This, in turn, led to a deterioration of the environmental situation due to the constant increase in production (Festel and Wurmseher, 2014).

Around 2000, the German government embarked on a path of environmental development. Since the 2000s, the concept of industrial ecology has gained increasing prominence in the development of new industrial parks. Today, the primary trend in the development of industrial parks in Germany is the establishment of eco-industrial parks (Del Baldo and Baldarelli, 2015). An eco-industrial park is essentially an industrial park that is managed in a way that minimizes environmental harm caused by production. This is achieved through the shared use of resources and infrastructure, which helps to reduce harmful emissions and allows for the establishment of environmentally friendly industries within urban areas. Government policies aimed at promoting environmentally friendly industries have resulted in higher business costs in urban areas. As a result, industrial capacity has been relocated outside of cities where land, labor, and untapped space are more affordable. This shift has proven advantageous for both businesses and the European "environmental lobby" (Boysen *et al.,* 2020).

Over time, industrial park management has increasingly shifted their production to other countries, notably in Eastern Europe and Asia. This shift is primarily driven by significantly lower maintenance costs in these regions. At the same time, the number of industrial parks in Germany has not decreased; instead, they have been repurposed to focus more on information, logistics, and communication services. Thus, government support for industrial parks in Germany can be divided into two main categories: support for economic growth and support for environmental stability.

The model of government support in Germany (created by authors) is depicted in Figure 2.

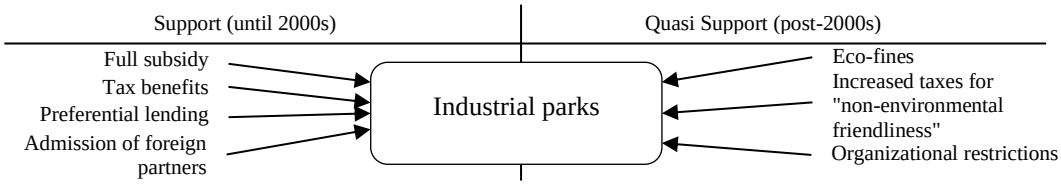

Figure 2 European model of state support for industrial parks (Source: authoring)

Thus, we can highlight the following features of state support for the development of industrial parks in Germany: admission of foreign manufacturers to integrate with the production facilities of other European countries; the prevalence of financial support over other measures; transformation from "supporting parks" to "supporting ecology."

The strengths of this model include direct investment by the state, which significantly reduces the implementation period of projects. However, this support measure is not the most cost-effective in terms of state budget spending. In addition, while strict measures to support environmental stability did achieve the desired result, they also led to the relocation of production facilities. This, in turn, caused a significant change in the structure and specialization of the economy. An undeniable advantage of support measures is the opportunity to allow foreign partners to enter their market and integrate production forces.

3.3. The USA model of state support

In the United States, the development of industrial parks began in the 1970s. Currently, there are over 400 operating facilities in the country, making it one of the leading countries in terms of quantity. An interesting fact about the development of industrial parks is the minimal involvement of the state in their development process. The USA is famous for its market-oriented attitude and the competitive nature of its industries. These factors have also influenced the development of industrial parks, which have attracted significant investment from private investors (Deineko and Romaniuk, 2015). At the same time, researchers note that the state also played an important role in the development of industrial parks. It acted as the main regulator of activities, providing financial support and developing specialized regulations (Burykh, 2012). The model of government support for industrial parks in the USA created by authors) is shown in Figure 3.

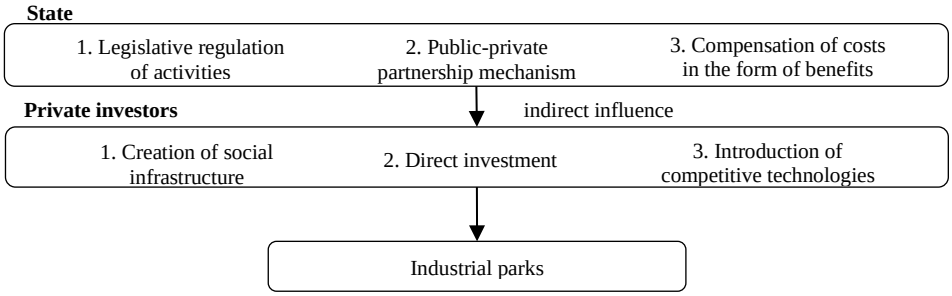

Figure 3 The USA model of state support for industrial parks (*Source*: authoring)

A distinguishing characteristic of the state support model is the indirect impact of the government on industrial parks as a result of its direct influence on investors. The state accomplishes this through the implementation of public-private partnerships, offering diverse incentives as part of cost compensation, and permitting private investors to directly fund the development of industrial parks. The participation of private investors has consequences that include the establishment of free market conditions in the industrial park sector. This, in turn, leads to a shift towards the development of technology parks that

focus on innovation and technology. These technology parks are seen as a natural progression from industrial parks, aligning with the principles of sustainable development and considering the environmental factor. In contrast to the German support model, this approach focuses on the optimal allocation of budget funds to stimulate investor activities rather than directly establishing production facilities.

3.4. Enhanced model of state support for Russia

Analyzing foreign experience in supporting and developing industrial parks, it is proposed to introduce new concepts - the industrial park environment and the industrial park zone.

An industrial park zone is a geographical area that encompasses both an industrial park and its surrounding industrial environment. It is viewed as a unified socio-economic entity.

The industrial park environment is an integral part of the industrial park zone, with the goal of preserving the park's appeal and enhancing the comfort of its workers. This environment includes social infrastructure facilities that are not located within the boundaries of the industrial park itself. Thus, from this perspective, the concept of an industrial park can be expanded. The industrial park itself is a component of the industrial park zone, which is a complex of manufacturing enterprises. These enterprises are equipped with engineering, technological, and transport infrastructure to facilitate their direct production activities.

To date, the Russian model of government support mainly involves direct investments in industrial parks (Radygina and Semyonova, 2020). Following an analysis of foreign government support measures and the experiences in industrial park development, it is recommended to enrich the government support model by integrating the strengths observed in foreign models. An enhanced model of state support for industrial parks in Russia is presented in Figure 4.

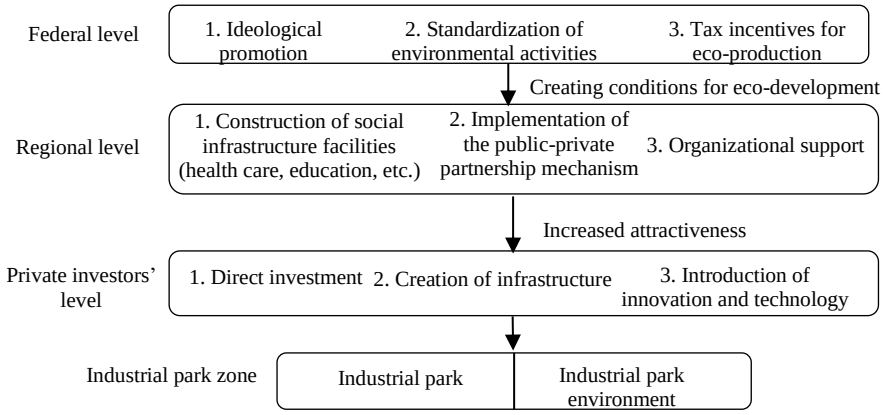

Figure 4 Russian improved model of state support for industrial parks (*Source*: authoring) Figure is blur, please redraw with better quality

The transition from existing industrial parks to eco-industrial parks is a costly process. It requires the replacement and modernization of current production assets, as well as a complete restructuring of the production system and processes. This process is much easier if you initially create eco-industrial parks. Within the framework of this model, the authors propose introducing a phased approach to support the development of parks within the context of sustainable development.

Thus, the model proposes federal support measures aimed at creating conditions for overall environmental development. The federal level includes promoting the ideology of sustainable development, standardizing the activities of manufacturing enterprises in the context of environmental conservation, and introducing tax incentives for eco-friendly

productions to stimulate the transition. This support measure is somewhat similar to the Chinese one, as it emphasizes the significance of promoting ideas and raising awareness. At the same time, the model is reminiscent of the German one, as it emphasizes the importance of sustainable development. The model proposed by the authors differs from the German one in that eco-production is stimulated through gentle incentive measures in the form of benefits rather than through strict measures such as fines, etc.

At the next level of support, regional measures are proposed to create favorable conditions for industrial parks. Such measures include constructing social infrastructure facilities, implementing PPP mechanisms, and providing organizational support for the creation and operation of industrial parks. Thus, this level of support has a greater impact on the environment surrounding the industrial park rather than on the park itself. This model's part combines American and German support measures. Direct investment by the state is planned here, similar to Germany. However, the focus is on creating the attractiveness of the industrial park, which indirectly influences its further development, similar to the approach in the USA. The private investors' level of support is no longer a government measure; it represents the actions of private investors aimed at directly creating, developing, and operating industrial parks. Private investors make direct investments in engineering infrastructure, buildings, and structures. They also introduce innovations and modern technologies to enhance the competitiveness of their industrial parks. It is worth noting that the federal level does not directly influence the level of private investors but indirectly affects it through the regional level.

Thus, by implementing all support measures (both indirect public and direct private), eco-industrial zones can be created in Russia. These zones will possess the following distinctive features: availability of eco-friendly production, high level of competitiveness, and comfortable conditions for employees at these parks.

It is worth noting that Russia differs from China in its federal structure, but according to this principle, it is like the USA and Germany but has its own characteristics of public administration. In their studies, some authors emphasize the significance of government forms as a key factor influencing the implementation of specific recommendations within the public administration system (Anna *et al.,* 2022). This fact suggests that not all proposed measures can be implemented in Russia; they require adaptation to local conditions.

Another disadvantage of the model is that it is designed exclusively for the creation and development of industrial parks from scratch. In addition, some authors note the need to introduce digital tools into the management model of industrial facilities (Babkin *et al.,* 2022a). It is worth noting that the model proposed by the authors does not really touch on these points, but this does not detract from the value of the study, since this model can be refined in further research.

4. Conclusions

The research raised questions about the significance of industrial parks for sustainable development and emphasized the importance of government support. Having analyzed the experience of government support in selected countries, the authors identified the features, strengths, and weaknesses of such support. The results obtained served as the basis for improving the current model of state support for industrial parks in Russia. The model proposed by the authors incorporates the strengths of studied models in supporting industrial parks within the context of sustainable development. Thus, a phased approach to support was proposed, dividing measures by levels of government. An indirect support mechanism has also been proposed to attract more private investors. As further areas of research, the authors will develop models of state support for other instruments of

territorial development (special economic zones, technology parks, industrial clusters, etc.). The authors also plan to introduce elements of adaptive management into the system of public management of these instruments.

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