IQTISODIY TARAQQIYOT VA TAHLIL ILMIY ELEKTRON JURNAL

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CURRENT STATUS AND MAIN PROBLEMS OF INNOVATIVE DEVELOPMENT OF REGIONAL INFRASTRUCTURE

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Abstract. *This article analyzes the current state and current problems of innovative development of regional infrastructure in our country. The process of modernization of infrastructure and the introduction of innovative solutions plays an important role in increasing the economic stability and competitiveness of regions. Therefore, the study examines the main factors affecting the development of regional infrastructure, existing problems and ways to solve them. The analysis shows that the main obstacles to the implementation of infrastructure projects are the lack of financing, outdated technologies, institutional problems and territorial disparities. The article also analyzes advanced foreign experience and puts forward effective strategies for the formation of innovative infrastructure. The article also develops scientific and practical recommendations for the development of regional infrastructure and highlights its impact on sustainable innovative development. The results of the study can be of practical importance in the processes of regional policy formation and infrastructure planning.*

Keywords: *infrastructure, regional infrastructure, innovation, innovative development, progress, economic stability, digital technologies, investments, innovative technologies, infrastructure modernization, digitalization processes, social infrastructure, smart systems, economic development.*

MINTAQAVIY INFRATUZILMANI INNOVATSION RIVOJLANTIRISHNING HOZIRGI HOLATI VA ASOSIY MUAMMOLARI

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Annotatsiya. *Ushbu maqolada mamlakatimizda mintaqaviy infratuzilmani innovatsion rivojlantirishning hozirgi holati va dolzarb muammolari tahlil qilinadi. Infratuzilmaning modernizatsiyasi va innovatsion yechimlarni joriy etish jarayoni hududlarning iqtisodiy barqarorligi va raqobatbardoshligini oshirishda muhim rol o‘ynaydi. Shu boisdan, tadqiqotda mintaqaviy infratuzilmani rivojlantirishga ta’sir etuvchi asosiy omillar, mavjud muammolar hamda ularni hal etish yo‘llari ko‘rib chiqiladi. Tahlillar shuni ko‘rsatadiki, infratuzilmaviy loyihalarni amalga oshirishda moliyalashtirish yetishmovchiligi, eskirgan texnologiyalar, institutsional muammolar va hududiy nomutanosibliklar asosiy to‘siqlar sifatida namoyon bo‘lmoqda. Shuningdek, maqolada ilg‘or xorijiy tajriba tahlil qilinib, innovatsion infratuzilmani shakllantirishning samarali strategiyalari ilgari suriladi. Shuningdek, mazkur maqolada mintaqaviy infratuzilmani rivojlantirish bo‘yicha ilmiy-amaliy tavsiyalar ishlab chiqilib, uning barqaror innovatsion taraqqiyotga ta’siri yoritiladi. Tadqiqot natijalari hududiy siyosatni shakllantirish va infratuzilmani rejalashtirish jarayonlarida amaliy ahamiyat kasb etishi mumkin.*

Kalit so'zlar: *infratuzilma, mintaqaviy infratuzilma, innovatsiya, innovatsion rivojlanish, taraqqiyot, iqtisodiy barqarorlik, raqamli texnologiyalar, investitsiyalar, innovatsion texnologiyalar, infratuzilma modernizatsiyasi, raqamlashtirish jarayonlari, ijtimoiy infratuzilma, aqlli tizimlar, iqtisodiy rivojlanish.*

СОВРЕМЕННОЕ СОСТОЯНИЕ И ОСНОВНЫЕ ПРОБЛЕМЫ ИННОВАЦИОННОГО РАЗВИТИЯ РЕГИОНАЛЬНОЙ ИНФРАСТРУКТУРЫ

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Аннотация. *В данной статье будет проанализировано современное состояние и актуальные проблемы инновационного развития региональной инфраструктуры в нашей стране. Процесс модернизации инфраструктуры и внедрения инновационных решений играет важную роль в повышении экономической устойчивости и конкурентоспособности регионов. Поэтому в исследовании будут рассмотрены основные факторы, влияющие на развитие региональной инфраструктуры, существующие проблемы и пути их решения. Анализ показывает, что основными препятствиями на пути реализации инфраструктурных проектов являются нехватка финансирования, устаревшие технологии, институциональные проблемы и территориальный дисбаланс. Также в статье анализируется передовой зарубежный опыт и выдвигаются эффективные стратегии формирования инновационной инфраструктуры. Также в данной статье будут разработаны научно-практические рекомендации по развитию региональной инфраструктуры и освещено ее влияние на устойчивое инновационное развитие. Результаты исследования могут иметь практическое значение в процессах формирования территориальной политики и планирования инфраструктуры.*

Ключевые слова: *инфраструктура, региональная инфраструктура, инновации, инновационное развитие, прогресс, экономическая стабильность, цифровые технологии, инвестиции, инновационные технологии, модернизация инфраструктуры, процессы цифровизации, социальная инфраструктура, интеллектуальные системы, экономическое развитие.*

Introduction.

Regional infrastructure is one of the important factors in the economic and social development of any region. The effective functioning of the infrastructure system directly affects the growth of industry, agriculture, transport and services. Today, innovative development of infrastructure is one of the pressing issues, which plays a decisive role in the sustainable development of regions and improving the living standards of the population. In particular, the development of modern technologies and digital solutions is shaping new directions for improving infrastructure.

The development of regional infrastructure is one of the priority areas of state policy, and the effective organization of this process serves to reduce interregional disparities, increase investment attractiveness and strengthen competitiveness. However, there are a number of problems in infrastructural development, the main of which are the lack of financial resources, technological obsolescence and insufficient efficiency of engineering and communication networks. In such conditions, solving infrastructure problems through the introduction of innovative approaches and advanced technologies is of great importance.

Today, innovative approaches such as "smart city" concepts, digital management systems, environmentally friendly technologies and energy-saving devices are widely used in the modernization of regional infrastructure. This serves to increase the efficiency of infrastructure and ensure its long-term sustainable development. At the same time, the use of public-private

partnership mechanisms also plays an important role in the successful implementation of infrastructure projects.

Currently, Uzbekistan is undergoing comprehensive reforms to develop infrastructure. In recent years, much attention has been paid to the modernization of the road and transport system, energy, telecommunications and engineering and communication networks. In particular, strategic programs have been developed in the regions to form a modern infrastructure and its digitalization, and advanced technologies are being introduced based on international experience. However, there are still a number of problems in this area that need to be resolved.

The main problems faced by Uzbekistan in the process of developing regional infrastructure include a lack of financial resources, outdated technologies, infrastructural imbalances between regions, weak integration between sectors, and bureaucratic obstacles to project implementation. At the same time, the issues of forming an environmentally sustainable infrastructure, developing digital infrastructure, and effectively using public-private partnership mechanisms are also relevant.

Literature review.

Scientific research on the development of regional infrastructure based on innovations, identifying and substantiating its importance in increasing its efficiency and competitiveness of regions has been conducted by a number of scientists. There are many scientific developments in this area, which are aimed at increasing the economic efficiency of infrastructure, introducing innovative technologies, improving legal and financial conditions, as well as studying international experience.

Foreign scientists Glezman, Isayev and Urasova (2022) conducted research on innovative infrastructure in their studies and defined it as follows: “Innovative infrastructure is an integrated term that reveals the essence of the supporting system (infrastructure) and more accurately expresses it in accordance with the innovative aspects of the field in which it is used. As for the regional level, for this study, by innovative infrastructure we understand a system of interconnected and interacting elements that form a unique supporting environment for the implementation of innovative initiatives for the effective socio-economic development of the region in new economic conditions, and innovative activities related to them in the regional space”.

Russian researcher Garmashova (2020) based on a systematic approach to studying the innovative infrastructure of regions, introduced four major systems into the innovative infrastructure. These are technological or production, financial, personnel and information systems, each of which includes relevant elements.

Sakhanevich (2021) studying the functional balance of subsystems of the innovative infrastructure of regions, pays special attention to the conditions of modern digital transformations. These changes determine the characteristics of the innovative infrastructure and its structural subsystems. The author includes financial, personnel, production-technological and information systems in these subsystems, emphasizing their close interrelation and complementarity.

Among the studies devoted to the study of innovations at the regional level, the works of Brueckel and Brenner (2009) deserve special attention. In their research, they identified 12 regional structural factors of innovative development. These include research and development, industry characteristics, level of urbanization, employment structure, regional economic structure, availability of universities, quality of human capital, potential human capital, availability of state research institutions, financial resources of the region, financial capabilities of firms, and investment attractiveness of the region.

Our local scientists have also conducted research on the innovative development of regional infrastructure. Aliyev (2019) noted that “In order to develop a modern innovative

infrastructure, it is important to introduce innovative approaches in public administration, support science and innovation, and attract investments. To ensure the sustainable development of regions, it is necessary to establish innovation centers and introduce high technologies into production. The use of advanced technologies in agriculture and industry, expanding international cooperation, and improving the regulatory framework are the main directions of the innovative economy".

Akhmadalieva and Zayniddinov (2022) conducted research on the innovative development of the regional economy. In their opinion, "The goal of forming the innovative development of the region is the integration of territorial and municipal authorities, scientific and technical organizations and entrepreneurs. The formation of a regional innovative infrastructure is an important task for federal and regional authorities".

The author also conducted research on the development of regional infrastructures in his research work. Innovation can be implemented through the application of the digital economy in the development of regional infrastructures. The application of the digital economy in regional infrastructures creates an infrastructure system that facilitates digital transformations, digital renewal and integrated innovative services. Information infrastructure based on the evolution of new generation information technologies is an integral part of the new infrastructure (Sayfulina, 2024).

Research methodology.

This study is aimed at analyzing the process of innovative development of regional infrastructure and identifying its current state and main problems. The study used a comprehensive approach, that is, the main trends in infrastructure development were studied based on economic, statistical and systematic analysis methods.

First of all, scientific literature and international experience were analyzed, concepts and models of innovative development of infrastructure were studied. In this process, the main attention was paid to the impact of infrastructure on economic growth, the introduction of modern technologies, and cooperation between the public and private sectors.

The study widely used statistical data. In particular, official data on macroeconomic indicators, investment flows, transport and engineering and communication infrastructure in recent years were analyzed. Based on this data, the level of development of regional infrastructure and its economic efficiency were assessed.

Also, projects implemented in the regions of Uzbekistan for innovative development of infrastructure were studied using the method of empirical analysis. The infrastructural potential, existing problems and investment opportunities in various regions were analyzed. As a result, the main problems of innovative development of regional infrastructure were identified and recommendations were developed to solve them. The methodology used in the study allowed for an objective assessment of the current state of infrastructure and the development of effective strategies.

Analysis and discussion of results.

The development of regional infrastructure based on modern innovations is one of the main directions of economic growth, which will help increase regional competitiveness, improve the investment climate and raise the standard of living of the population. Currently, our country is implementing large-scale reforms in this area, and the transport system, energy sector, information and communication and engineering infrastructure are being gradually modernized. The following areas are mainly important for the innovative development of regional infrastructure (Table 1).

All of these areas contribute to the sustainable and effective development of infrastructure networks and ensure the economic growth of regions. We will analyze and draw conclusions on each of the work being carried out in our country in this regard.

Table 1

Main directions of innovative development of regional infrastructure

№	Main directions	Functions
1	***Widespread adoption of digital technologies***	The smart city concept, digital transportation systems, and automated control technologies help manage infrastructure effectively.
2	***Developing public-private partnerships***	It is necessary to actively use private sector investments and strengthen cooperation between the state and business in financing infrastructure projects.
3	***Creating environmentally sustainable infrastructure***	It is important to introduce "green energy" technologies, use energy-efficient building materials, and comply with environmental standards.
4	***Modernization of transport and logistics systems***	It is necessary to improve interregional and international relations by developing road, rail, air, and water transport infrastructure.
5	***Strengthening regional integration***	It is necessary to reduce the infrastructure imbalance between regions and build and develop infrastructure facilities in strategic areas.
6	***Diversification of financial sources***	Sustainable infrastructure development can be achieved by attracting international financial institutions, public funds, and private investment.
7	***Implementation of innovative management systems***	Effective planning and monitoring of infrastructure projects, the use of artificial intelligence and big data technologies are necessary.

First of all, if we look at the direction of the widespread introduction of digital technologies, significant work is being carried out in our country on the innovative development of regional infrastructure. A number of resolutions and decrees have been adopted by our President in this regard. For example, in order to support the widespread introduction of digital technologies and related projects for the innovative development of regional infrastructure, the Decree of the President of the Republic of Uzbekistan No. PF-25 dated February 1, 2024 “On priority measures to establish an international center for digital technologies” was adopted. The purpose of this Decree is to create more favorable conditions for increasing the investment attractiveness of the digital technologies market in our country, actively attract foreign investment to the development of the digital economy, accelerate the export activities of enterprises in the field of digital technologies and expand their integration with international markets (Decree, 2024).

Also, a number of works have been carried out in our country to improve digital technologies for the innovative development of regional infrastructure. As one of these, the Ministry of Digital Technologies of the Republic of Uzbekistan, with the participation of interested ministries and departments, representatives of the business community and scientific circles, as well as foreign experts, developed the “Digital Uzbekistan - 2030" strategy, and in this regard, the Decree of the President of the Republic of Uzbekistan No. PF-6079 dated October 5, 2020 “On approval of the “Digital Uzbekistan – 2030” strategy and measures for its effective implementation" was adopted (Decree, 2020). The strategy envisages two programs: digitalization of regions and digitalization of networks, and focuses on priority areas such as digital infrastructure, e-government, the national market for digital technologies, and the development of education and training in the field of information technologies. Significant work has been done in these areas. In particular, as of January 2024, 56 percent of public services were provided through my.gov.uz, and the number of public services on this e-government platform reached 575. During 2013-2023, the number of applications received through the my.gov.uz portal exceeded 100 million.

The widespread introduction of digital technologies poses a number of problems, one of which is crimes committed using digital technologies. Crimes committed using digital technologies are offenses committed using modern information and communication technologies, which are mainly called cybercrimes. In order to prevent these and similar crimes in Uzbekistan, the Resolution of the President of the Republic of Uzbekistan dated January 22, 2025 No. PQ-17 "On measures to introduce a system of professional training for combating crimes committed using digital technologies" was adopted. This resolution was adopted to ensure the implementation of the Resolution of the President of the Republic of Uzbekistan No. PQ-381 dated November 30, 2023 "On measures to protect the rights of consumers of digital products (services) and strengthen the fight against crimes committed using digital technologies", as well as to introduce a system of targeted training, retraining and advanced training of specialists in the field of combating crimes committed using digital technologies (Resolution, 2025).

Uzbekistan is striving to become one of the leading countries in Central Asia in the field of innovation. In recent years, a number of reforms have been implemented in the country aimed at developing the innovation ecosystem. Technoparks, innovation clusters, venture funds and business incubators have been launched in Uzbekistan, and the startup ecosystem is being developed. The state is implementing measures to provide financial support to innovative projects and integrate science and business. Areas such as artificial intelligence, the digital economy, biotechnology and alternative energy are being identified as priority areas. At the same time, Uzbekistan does not yet occupy a sufficiently high position in international innovation rankings, but it is improving its position in the global innovation index every year (Figura 1):

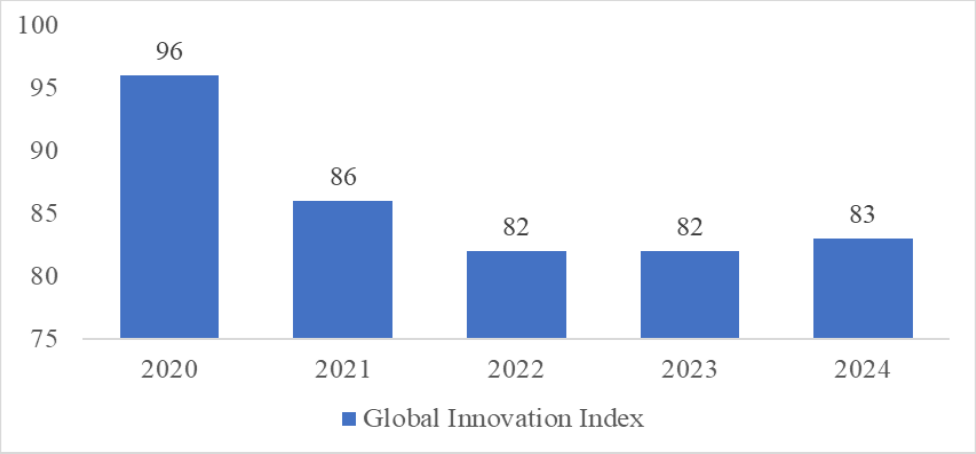

Figura 1. Uzbekistan's role in innovation (innovation.gov.uz, 2024)

According to the data in the figure above, Uzbekistan's position in the Global Innovation Index has been improving year by year. In 2020, the country was in 96th place, but in subsequent years this indicator improved, rising to 86th place in 2021 and 82nd place in 2022. In 2023, it maintained 82nd place, and in 2024, it slightly dropped to 83rd place. This process shows that Uzbekistan has achieved positive changes in innovative development, but in the last year its position has slightly decreased due to increased competition or internal factors.

In order to increase the number of infrastructure entities based on innovative activities in Uzbekistan and improve them, the Decree of the President of the Republic of Uzbekistan No. PF-165 "On Approval of the Strategy for Innovative Development of the Republic of Uzbekistan for 2022-2026" was adopted on July 6, 2022. According to it, it was planned to increase the number of innovative infrastructure entities by 3 times. Innovative infrastructure entities include following elements. (Figura 2).

These entities play an important role in supporting technological development and the entrepreneurial ecosystem. Technoparks implement new technologies in production, while

technology transfer centers put scientific achievements into practice. Innovation clusters develop cross-sectoral cooperation, and venture capital organizations invest in promising ideas. Innovation centers and business incubators support startups, and accelerators help them develop rapidly. This infrastructure serves the sustainable development of the innovative economy.

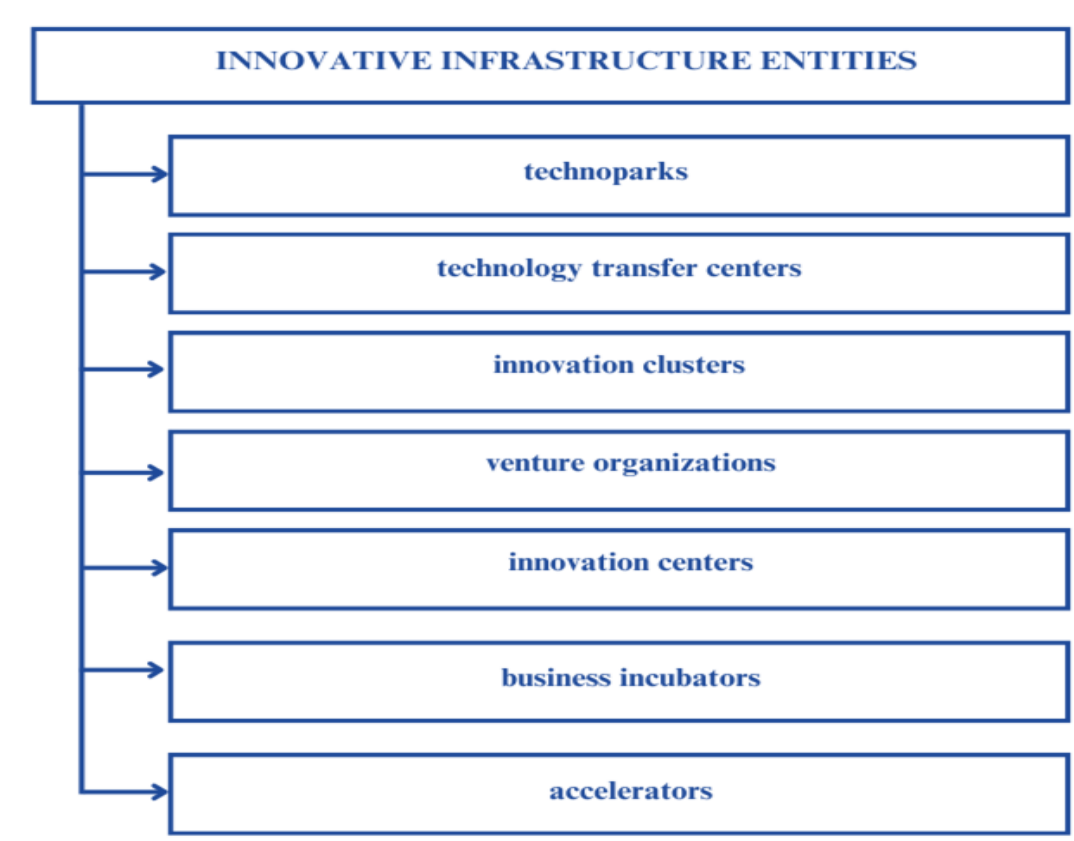

Figura 2. Innovative infrastructure entities

The role of the Agency for Innovative Development in the innovative development of regional infrastructure in our country is also incomparable. This agency was established under the Ministry of Higher Education, Science and Innovation in accordance with the Decree of the President of the Republic of Uzbekistan No. PF-269 dated December 21, 2022 “On measures to implement administrative reforms in New Uzbekistan” in order to ensure the rapid innovative development of all sectors of the economy and the social sphere based on advanced foreign experience, modern achievements of world science, innovative ideas, developments and technologies. The Agency for Innovative Development has carried out significant work on the innovative development of regional infrastructure during 2024 (Table 2).

Based on the data in the table above, we can say that in 2024, 10 new infrastructure entities will be established in the regions to develop innovative activities, bringing their total number to 55. Technoparks, technology transfer centers, innovation clusters, venture funds, business incubators and accelerators will be included in this infrastructure. A total of 318.1 billion soums were allocated for 146 projects selected by entrepreneurs operating in districts being formed as innovation zones, of which 10.9 billion soums were financed from local budget funds and 307.2 billion soums from the initiators' own investments.

The main problems in the innovative development of regional infrastructure are related to financial, technological and human resources. The lack of sufficient investment is causing the slow development of projects, while digital technologies are being introduced slowly in the regions. To solve this, it is necessary to attract investments, train IT specialists and develop "smart city" technologies.

Table 2

The work of the Innovation Development Agency during 2024 (innovation.gov.uz, 2024)

№	Work carried out during 2024
1	In 2024, 119 new technologies were created and patents were obtained in accordance with the established procedure by scientific and innovative entities. This figure increased by 1.3 times compared to 2023 (93).
2	As part of the startup project competitions, 65 startup projects with a total value of 27.6 billion soums were financed.
3	14 scientific research institutes were equipped with 61 types of modern scientific laboratory equipment worth 73.61 billion soums.
4	In 2024, 10 innovative infrastructure entities will be established in the regions, bringing their total number to 55.
5	146 projects selected by entrepreneurs operating in districts being transformed into innovative zones were financed for 318.1 billion soums, of which 10.9 billion soums were financed from the local budget and 307.2 billion soums from the funds of the initiators.
6	As a result of innovative entrepreneurship, 4,733 new jobs were created, an increase of 52.5% compared to 2023.
7	During 2024, in order to establish and develop international cooperation in the field of science and innovation, meetings were held with more than 30 foreign partners, as a result of which 5 Memorandums of Understanding were signed, 23 Agency employees were sent to China to participate in advanced training courses, and about 10 international events were organized.
8	In 2024, 17.5 million US dollars were disbursed within the framework of 2 investment projects.
9	In 2024, a total of $10.1 million was disbursed under international grant funds for 9 projects.
10	The coverage of structural indicators in the 2024 Global Innovation Index ranking was increased to 97.4%. In addition, our country improved its positions in 40 out of a total of 78 indicators in the ranking, and achieved the highest growth in 10 indicators.
11	Within the framework of the innovative development strategy of the Republic of Uzbekistan for 2022-2026, work has begun on 408 projects out of a total of 441 projects by economic sectors. In this regard, 7187.7 billion soums have been spent, and work on a total of 310 projects in 28 sectors has been fully completed.

The concentration of innovative infrastructure mainly in large cities limits the development of remote areas. Therefore, it is important to distribute infrastructure evenly across the regions. The shortage of personnel is also relevant, and in this regard it is necessary to improve the education system and develop international cooperation. At the same time, ensuring environmental sustainability and focusing on green technologies is also an important factor for the consistent development of innovative infrastructure.

Conclusion and suggestions.

In conclusion, the innovative development of regional infrastructure is important for increasing the economic activity of regions, improving the investment climate, and raising the standard of living of the population. Although a number of reforms are being implemented in Uzbekistan in this regard, problems such as lack of financial resources, outdated infrastructure networks, imbalances between regions, and the slow process of introducing innovative technologies still remain relevant.

To address these issues, the following measures should be taken:

1. Improving the financing system - it is important to develop public-private partnerships, expand cooperation with international financial institutions, and use infrastructure bonds;

2. Developing digital technologies - the use of smart cities, automated transport management, and geographic information systems will help optimize infrastructure processes;

3. Creating an environmentally sustainable infrastructure - it is necessary to develop green energy and introduce energy-saving technologies;

4. Strengthening territorial integration - it is necessary to increase the efficiency of infrastructure by connecting transport and energy networks to national and international corridors;

5. Improving the institutional environment - it is necessary to bring the regulatory framework into line with international standards, strengthen project management systems, and create favorable conditions for investors.

Thus, developing regional infrastructure through a comprehensive strategic approach will not only ensure economic stability, but also increase international competitiveness.

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