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THEORETICAL AND METHODOLOGICAL BASIS OF THE APPLICATION OF SMART SERVICES IN INCREASING THE ECONOMIC EFFICIENCY OF CONSTRUCTION ENTERPRISES

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Abstract
The purpose of this article is to highlight the main benefits of implementing intelligent services in construction companies. Among them, such technologies as digital twin, BIM (building information modeling), construction robots and autonomous vehicles are analyzed. Intelligent services also contribute to increasing the transparency of construction processes and enhancing interaction between all project participants. Thanks to sensors, real-time monitoring systems and cloud platforms, data is collected in one place, accelerating and increasing the accuracy of decision-making. This is of great importance for reducing unexpected risks, improving the quality of work and ensuring strict compliance with safety measures. Overall, the article discusses how intelligent services can not only simplify the construction process, but also lead the entire industry ecosystem to a more innovative and sustainable future.

Keywords: Construction, intelligent services, digital twin, BIM technologies, artificial intelligence, 3D printing, intelligent construction technologies.

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INTRODUCTION

Today, thanks to the widespread use of digital technologies worldwide, the efficiency of construction companies is increasing. Global experience shows[1] that the use of BIM technologies in construction can increase net profit by up to 25% and the profitability index by up to 14-15%. This reduces the payback period by 17% and reduces project costs by up to 30% due to lower construction costs. Furthermore, most countries have chosen green construction for a number of reasons. Despite its central role in stimulating economic development and accelerating urbanization, the construction industry consumes large quantities of resources, creating a number of environmental problems. Buildings annually account for approximately 40% of total energy consumption and a third of total greenhouse gas emissions globally [1].

Uzbekistan is implementing large-scale institutional and structural reforms aimed at creating a market-based digital economy and increasing its transparency. Due to the rapid development of the construction industry, special attention is being paid to modernizing infrastructure and stimulating economic activity. According to the Agency of Statistics under the President of the Republic of Uzbekistan[2], the volume of completed construction work in 2025 amounted to 50.3 trillion soums, a 10.7% increase compared to the same period last year. The gross added value of the construction industry reached 20.87 trillion soums, and its share of GDP was 7.4%. At the same time, the participation of small businesses is increasing: small and micro enterprises account for more than 74% of the total construction volume, indicating a change in the organizational structure of the industry and its increased flexibility.

This confirms the role of the construction industry as a key link in economic growth, infrastructure modernization, and investment attraction. Resolution No. 231 of the Cabinet of Ministers of the Republic of Uzbekistan dated April 23, 2024, "On measures to harmonize regulatory documents in the field of construction with international standards" provides for the implementation of advanced design and management methods, in particular, the use of information modeling (BIM) technologies in construction, taking into account the national

[1] https://uzbunyodkor.uz
[2] https://stat.uz

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regulatory framework[3]. These measures are aimed at increasing transparency, reducing costs, improving the quality of design documentation, and mitigating technological risks in construction projects.

Currently, our government is paying special attention to the development of the construction industry at the public policy level. For example, in his December 2022 Address to the Oliy Majlis and the People of Uzbekistan, President Shavkat Mirziyoyev stated the following: "We have set ourselves the goal of building a New Uzbekistan based on the principle of a 'social state,' and we must enshrine this in our Constitution"[4]. With these words, our esteemed President emphasized the need for a systemic approach to ensuring a decent standard of living. This, in turn, requires the development of a sustainable construction policy that facilitates the expansion of infrastructure projects, the construction of affordable housing, and the improvement of the urban environment. In this regard, the development of effective models for managing the economic potential of construction companies is urgent, including the digitalization of business processes, the rational use of material and investment resources, the implementation of investment project management tools, and the evaluation of their effectiveness.

LITERATURE REVIEW

Digitalization of the construction industry is the process of using modern technologies to transfer all construction processes to a digital format, reduce construction time and improve the quality of building materials. Today, construction companies are actively implementing automation processes to gain competitive advantages and optimize business processes. The state and governments, in turn, are both interested in the digital transformation of the construction industry and are taking an initiative in the legislative sphere [2].

Digital transformation in the construction industry is the process of integrating new technologies across all teams and functions to increase the efficiency, productivity and profitability of construction projects.

[3] Resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 231 dated April 23, 2024 “On measures to harmonize regulatory legal acts in the construction sector with international standards”. – [lex.uz].
[4] Mirziyoyev Sh.M. Address of the President of the Republic of Uzbekistan to the Oliy Majlis and the people of Uzbekistan. - December 2022. - Official website of the President of the Republic of Uzbekistan. - [president.uz].

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According to Professors E.A. Arens and DJ.K. Lobbeck of the University of California, Berkeley, indoor air temperature and thermal power are two important aspects of the quality of the indoor environment of a building, which building designers should pay special attention to. International and regional building standards set the conditions for creating a suitable environment for residents. For this, it is advisable to use the feedback of residents to systematically assess their satisfaction in a large number of buildings. [3]

These global theoretical approaches serve as a fundamental basis for bringing the quality, deadlines and environmental standards of construction to world standards in rapidly growing markets such as Uzbekistan.

CIS scientists D.V. Gabalova, E.V. Knyazkina and S.A. Rashchepkina note that the dynamism of the modern construction industry is manifested not only in the formation of sustainable criteria for future development, but also in the implementation of advanced innovations used to comprehensively improve the quality of construction, reconstruction, modernization, etc. operations [4].

L.V. Oveshnikova, E.V. Sibirskaya and R.S. Tolmasov believe that the development trends of the construction industry are primarily aimed at society. This approach determines the main vector of development of construction companies - meeting the growing needs of the population and business. In addition, the authors' research shows that economic shocks that lead to changes in the level of demand for the services of construction companies become a factor that significantly accelerates the development of growth trends [5].

A similar idea can be observed in the work of A.Yu. Fedotovsky. According to him, innovations in the construction sector are the result of a response not only to the stabilization of economic relations or the growth of investment activity, but also to other changes in the familiar environment [6]. The crisis and economic uncertainty in general become factors determining changes in environmental conditions for the activities of domestic construction companies, thereby influencing new trends. introduction of cleaning devices (for example, scrubbers).

RESEARCH METHODOLOGY

This study uses a mixed methods approach that combines qualitative and quantitative methods to comprehensively analyze the benefits of a smart services

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economy in the construction industry. The first phase involves an in-depth analysis of existing case studies and best practices on the implementation of digital technologies such as BIM, IoT, and drones. The qualitative analysis involves interviews with construction company executives and lead engineers to understand their current challenges and expectations regarding digital transformation. The data obtained is used to formulate hypotheses about the impact of smart services on increasing efficiency and competitiveness. The next phase will be a large-scale quantitative study in the form of an online survey among a wide range of construction industry professionals. The questionnaire includes questions aimed at measuring key performance indicators such as reducing operating costs, reducing project delivery time, and improving quality and safety. The collected data is processed using statistical methods such as correlation and regression analysis to identify patterns and validate hypotheses. This stage allows us to obtain objective data and determine the economic impact of implementing smart services. In the third stage, we analyze the collected data using specialized programs such as SPSS or R. Particular attention is paid to comparing the results for companies with different levels of digital maturity [7]. We consider how the implementation of specific smart services (for example, predictive analytics or automated management systems) is associated with increased profits and reduced project risk. At this stage, we also conduct a comparative analysis of the effectiveness of implementing different technologies. In the final part, we summarize the results. The research results allow us to develop practical recommendations for construction companies on how to integrate the smart service economy into their business processes. Particular attention is paid to the potential return on investment (ROI) and risk reduction. We also identify the main obstacles to digitalization and propose strategies to overcome them. Thus, this methodology provides reliable and actionable information that helps construction companies make informed decisions about their future.

ANALYSIS AND RESULTS

The construction industry occupies a very important place in the structure of the national economy. The reason is that the national economy creates all the

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necessary conditions for the comprehensive development of each industry and sector. If we pay attention to statistics, the construction sector accounts for 6% of the gross domestic product of Uzbekistan [8]. This means that it is the construction sector that determines the possibilities for the economy to build the necessary infrastructure, communications, buildings and structures, and other real estate objects, and thereby forms promising directions for the development of territorial entities. In addition, the activities of the construction industry can affect the final gross regional product, that is, the development of construction is inextricably linked with determining the final prospects for long-term economic growth.

In 2024, compared to 2023, the volume of construction work increased by 8.8%. In particular, the growth rate was 105.5% in the construction of buildings and structures, 124.7% in the construction of civil facilities, and 106.4% in specialized construction work. The volume of construction work in 2024 amounted to 233832.9 billion soums. The share of large construction organizations in the total volume of construction work was 23.6%, the share of small enterprises and microfirms was 46.2%, and the share of individuals was 30.2%[5].

In the conditions of the digital economy, the construction industry has become one of the fastest growing sectors. Construction enterprises continue to actively introduce innovative new technologies into their activities and strive to promote the latest modern trends, which allows them to increase demand for the industry and achieve high competitiveness. The relevance of the study of modern trends and innovations in the construction industry is that identifying such trends allows not only to track the path of change in the construction sector, but also to identify the characteristic criteria for future changes in real estate, which ultimately affect the entire economy. Growth trends, if taken into account in a timely manner, can serve as a basis for forecasting the state of related economic sectors closely related to the construction industry. Thus, identifying new trends in the development of the construction industry and characteristic innovation processes affects the possibility of changing the vector of industry development, sets criteria for increasing the economic activity of business entities.

[5] https://stat.uz

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The economic potential of a construction enterprise is a combination of material, financial, labor and technological resources, as well as the ability to effectively use them to achieve strategic development goals. Effective management of this potential involves purposeful planning, organization, stimulation and control of all elements of the production process aimed at increasing the competitiveness of the enterprise and ensuring sustainable growth. This task is becoming especially urgent in the context of the market transformation of the economy of the Republic of Uzbekistan. The country's construction industry maintains stable positive dynamics, as evidenced by data for the first quarter of 2025. According to the Statistics Agency under the President of the Republic of Uzbekistan, the volume of construction work completed in January-March 2025 amounted to 50.3 trillion soums, which is 10.8% more than in the same period last year. The gross added value of the construction sector reached 20.87 trillion soums, and its share in the gross domestic product was 7.4% (Figure 1). At the same time, the participation of small businesses is increasing: more than 74% of the total volume of construction work is provided by small and micro entrepreneurs, which indicates the need to change the organizational structure of the sector and increase its flexibility [9].

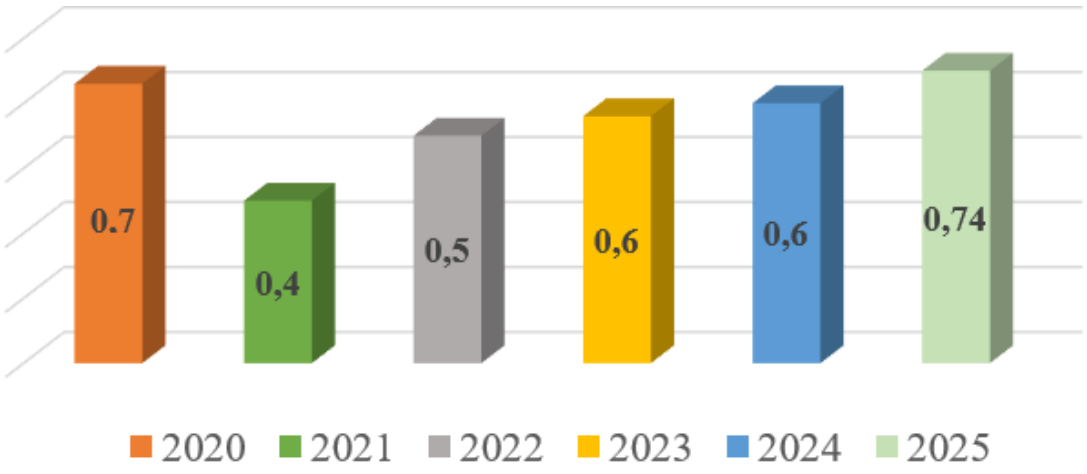

Figure 1. Dynamics of the construction sector's contribution to GDP growth, (in %)[6]

[6] Author's work based on data from Stat.uz

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As can be seen from the data in the figure, the share of construction in GDP in Uzbekistan decreased sharply in 2020-2021. This decrease in the contribution to GDP directly led to increased financial risks for construction enterprises (for example, TREST 12 JSC) and difficulties in financing projects. This period of decline proves the need for companies to reduce costs and rely on internal resources.

Starting from 2022, the contribution of construction to GDP has shown a recovery trend: in 2022 - 5%, in 2023 and 2024 - 6%, and in 2025 - 7.4%. This recovery means the following:

The effect of the state's economic stimulus policies, including the Central Bank's measures to curb inflation and optimize credit resources, has borne fruit. The contribution of construction to GDP growth has increased due to the reactivation of large infrastructure projects in the overall economy. Construction entities have adapted to new market conditions, increased labor productivity by introducing innovations such as digital technologies (BIM, Digital Twin) and energy efficiency. The return of the contribution to 7% by 2025 is a strong indicator confirming the sustainability of the construction sector in GDP growth and its continued role as a key driver of economic recovery.

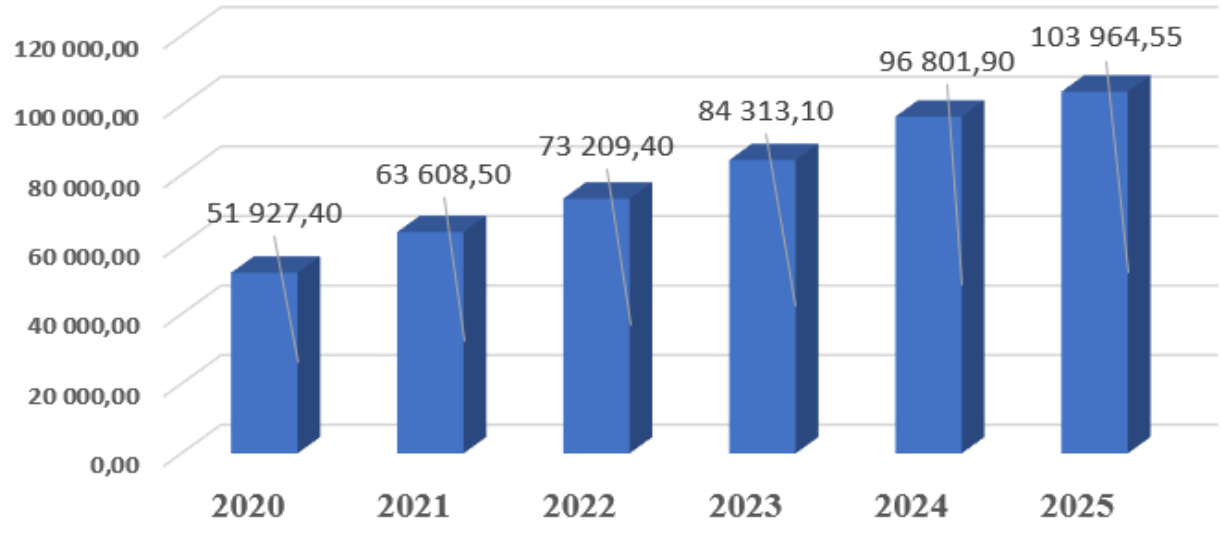

Figure 2. Gross value added of the construction sector (volume, billion soums)[7]

[7] Prepared by the author based on Uzstat data

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In 2025, the construction sector showed a significant growth of 10.7%, reaching a gross value added (GVA) of 103,964.55 billion soums. The high rate of construction of 10.7% proves that this sector maintains its strong position as the main driver of investment activity at the macroeconomic level.

The highest growth was observed in the following segments (-figure):

- Specialized construction works: 149.0% growth.
- Construction of civil facilities: 125.7% growth.
- Construction of buildings and structures: 103.0% growth.

Table 1: Annual volume of construction work in the Republic of Uzbekistan[8]

Regions	2021	2022	2023	2024	2025
Republic of Uzbekistan	107492,7	130790,9	202819,2	263679,2	301 258,3
Republic of Karakalpakstan	4480,6	5272,4	7457,8	8667,6	9 902,3
Khorezm	4228,5	4878,4	8652,6	11503,87	13 140,8
Andijan region	5657,8	6864,1	10070,8	12936,2	14 779,5
Bukhara region	7401,1	8448,7	13400,4	16863,8	19 266,4
Jizzakh region	3085,4	3446,4	5543,6	6532,4	7 461,8
Kashkadarya region	6336,6	7793,8	12971,7	15614,8	17 836,3
Navoi region	5155,5	5855	9675,4	14343,1	16 388,6
Namangan region	5556,7	6653,2	10819,1	13385,2	15 289,8
Samarkand region	7385,7	8895,4	12226,9	15563,89	17 779,0
Surkhandarya region	5868,4	6521,9	10880,8	13175,5	15 053,5
Syrdarya region	2708,8	3260,1	4705,6	4874,2	5 569,9
Tashkent region	9401,2	12237,4	20169,9	29331,43	33 506,0
Fergana region	6993,7	8646	14014,5	16130,3	18 433,8

As can be seen from the table, the growth rate of more than 55% in 2023 compared to 2021 reflects a high investment shock, that is, a large amount of capital was invested in new projects at once. This growth is mainly due to government programs and major changes in the mortgage market.

[8] Author's work based on stat.uz data

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In 2024–2025, the growth rate is expected to decrease to a relatively moderate level (14.25%). This may indicate the maturation of the construction market, its adaptation to international standards (for example, benchmarking and green construction), and an increased focus on improving quality and efficiency (intensive growth). If we pay attention to the territorial distribution of construction volumes, there is a significant divergence in the analysis. Here, the leading "Lokomotiv" regions can be cited as the growth rates of Tashkent, Bukhara and Fergana regions.

Tashkent region has the highest volume (33.5 trillion soums in 2025). This is explained by the region's proximity to the capital, high urbanization rates, and priority of state investments in logistics/industrial infrastructure. Bukhara and Fergana regions are also considered regions with high absolute volumes (19.2 trillion and 18.4 trillion soums), which provide stable growth due to tourism infrastructure (Bukhara) and population density/regional trade center (Fergana).

While the absolute volume is low in some regions, the relative growth between 2021 and 2024 is very high. For example, Navoi region will see an increase of more than 178% from 2021 to 2024. This indicates a sharp increase in investments in the Navoi free economic zone and large industrial (mining and metallurgy) projects.

In the Khorezm region, construction volumes increased by 172% in 2021–2024. This is a high dynamics achieved due to new tourist clusters and agro-logistics projects.

Syrdarya and Jizzakh regions show the lowest absolute construction volumes (5.6 trillion and 7.5 trillion soums by 2025). These regions have not yet attracted large-scale capital, but their proximity to Tashkent and location along major transit routes represent a large potential (reserve) for investments in industrial and logistics construction in the future.

This analysis shows that the construction market of Uzbekistan is on the path of sustainable growth. Modern project management methods (e.g. benchmarking) and sustainability criteria (LEED, BREEAM) are essential for increasing efficiency and optimizing resources in this rapidly growing but regionally uneven market. Construction safety, compliance with environmental standards, and a

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balanced distribution of infrastructure across regions are of strategic importance for the further sustainable development of the sector.

Table 2: Annual growth rate of construction work in the Republic of Uzbekistan[9]

Regions	2021	2022	2023	2024	2025
Republic of Uzbekistan	109,5	106,8	106,6	107	123
Republic of Karakalpakstan	107	103,8	107,3	94,7	103,2
Khorezm	97,4	130,9	101,8	107,1	108,8
Andijan region	109,5	108,7	109,2	102,4	107,4
Bukhara region	119,8	114,9	117	111,8	115,8
Jizzakh region	101,5	116,2	107	108	108,1
Kashkadarya region	98,3	117,6	105,3	109,8	107,6
Navoi region	94,6	116,8	105,5	107,9	105,9
Namangan region	118,3	109,1	108,5	105,3	110,2
Samarqand viloyati	111,7	117,8	111,8	110,1	112,8
Surxondaryo viloyati	121,2	109	112,9	101,6	110,9
Sirdaryo viloyati	110,2	109,9	99,7	101,6	105,3
Toshkent viloyati	107,8	115,3	108,6	106,3	109,5
Farg‘ona viloyati	115,3	115,3	113,8	107,9	113,0

This table reflects the elasticity (adaptability) of the construction sector of Uzbekistan and its sensitivity to regional economic reforms. The analysis is carried out not only in terms of absolute volume, but also in terms of dynamic growth potential. The growth rate at the republic level was relatively stable at 107% in 2021–2024, which indicates that the sector has a solid foundation. The rate of 123% in 2025 is 16% higher, and this growth may be associated with a sharp activation of investment policy or the implementation of one-time large projects (for example, "New Tashkent" or large infrastructure projects). Bukhara, Samarkand, Fergana regions showed rates above 110%$ in all years. Bukhara

[9] Author's work based on stat.uz data

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provided the most stable high growth (115.8% in 2025). This is largely a result of government policy aimed at strengthening the tourism, trade and regional transit functions of these centers. In these areas, construction capital is mainly directed towards commercial infrastructure and premium housing.

The regions of Khorezm, Kashkadarya, Navoi have seen sharp changes in growth rates (for example, Khorezm has increased from 97.4% in 2021 to 130.9% in 2022). This dynamics is usually associated with the start and completion of one or two large industrial projects. In regions with a strong resource base, such as Navoi (started at 94.6%) and Kashkadarya, the volume of construction is determined by the needs of the mining, metallurgical and energy industries.

The growth rates in the Republic of Karakalpakstan, Syrdarya, and Jizzakh regions, especially in 2023-2024, are around 100% or below (Karakalpakstan 94.7% in 2024, Syrdarya 99.7% in 2023). This may indicate limited investment capital or projects stuck in the planning phase. In order to accelerate growth rates for these regions, the priority of regional development programs should be increased. Analysis of annual growth rates of construction work confirms the "two-speed" economic development model in Uzbekistan. On the one hand, large centers (Bukhara, Samarkand) maintain stable and high rates, while on the other hand, resource-rich regions (Navoi, Kashkadarya, Karakalpakstan) continue to grow under the influence of periodic investment investments. The expected nationwide forecast for 2026 represents a targeted policy aimed at further increasing the share of this sector in GDP.

All this confirms the role of the construction sector as one of the main elements of economic growth, infrastructure modernization and investment attraction. Despite the positive dynamics, a number of structural and institutional problems remain in the industry. The most important of them are the limited skills of the workforce, the lack of specialists with digital design and construction process management skills, the slow pace of implementation of modern technologies such as BIM and ERP systems, as well as the difficulty of small and medium-sized enterprises in accessing long-term financing. These factors limit the realization of the economic potential of construction organizations, increase costs and reduce competitiveness. The transition to a market model of management is accompanied by a sharp change in business conditions for construction companies.

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To effectively manage the economic potential of construction organizations in modern conditions, it is necessary to introduce systematic and interconnected mechanisms. The digitization of business processes is taking center stage: the use of Digital Twins, BIM technologies, ERP systems, and construction site monitoring platforms allows for resource optimization, error minimization, and real-time project monitoring. These technologies are becoming an integral part of modern construction management.

The second priority is human capital development. Successful implementation of construction projects requires the presence of engineering and technical personnel who are well versed in modern design, management, and digital analysis tools. This requires investing in vocational education, establishing a system of certification for specialists, and encouraging corporate training and retraining programs.

In addition, institutional measures should be taken to improve access to financing. Despite the existing state subsidy and guarantee support programs, existing financial instruments are not sufficiently adapted to the needs of the construction sector. In this regard, it is advisable to introduce specialized financial mechanisms - construction bonds, project financing schemes, infrastructure development funds, and public-private partnership models.

CONCLUSIONS AND SUGGESTIONS.

The formation of an effective model for managing the economic potential of construction organizations in Uzbekistan is a priority task in the context of deep market transformation and rapid modernization of the national economy. In the conditions of a dynamically changing external and internal environment, the construction industry is becoming not only a mirror of current macroeconomic processes, but also an active participant in the structural restructuring of the country's economic complex.

The results of the analysis show that the economic potential of construction organizations is not a static resource, but a multi-component and flexible system that requires flexible strategic management and constant updating. Today, construction companies are faced with the task of not only increasing the volume of work, but also increasing the efficiency of using existing resources, adapting

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to digital challenges, mastering new forms of project cooperation and institutional interaction. The need to combine long-term planning with innovative management mechanisms and sustainable financial instruments is of particular importance. The ability of enterprises to compete in the open market, participate in transnational projects, and contribute to the implementation of Uzbekistan's strategic goals will depend on how deeply they restructure their internal processes and move from an administrative-resource logic to an efficiency-oriented development model.

Taking into account the identified problems and strategic goals, it is appropriate to put forward the following proposals:

First, develop and implement a national strategy for the digital transformation of the construction industry, which includes not only the introduction of Digital Twin, BIM, and ERP systems, but also the creation of a single digital ecosystem for data exchange between designers, contractors, investors, and government agencies. Within the framework of this strategy, it is necessary to take measures to standardize digital processes, develop local IT solutions for project management, and create digital archives of project documentation.

Secondly, to create a network of sectoral educational and scientific and practical centers for training, retraining and advanced training of personnel at leading technical universities and in cooperation with private companies. Particular attention should be paid to training specialists in digital modeling, sustainable construction, project management and quality control, and to introducing dual education with the participation of employers.

Thirdly, to form a multi-stage public-private partnership (PPP) system aimed at attracting private capital for the implementation of innovative and infrastructure projects. In this regard, it is necessary to expand the legal and institutional framework for PPP in the construction sector, including model forms of contracts, risk-sharing instruments and investment return mechanisms.

Fourthly, to deeply harmonize construction norms and technical regulations with international and regional standards, while simultaneously introducing digital platforms for registration, accreditation, licensing and certification of construction market participants. This will significantly reduce administrative

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barriers, increase the transparency of processes and create a predictable regulatory environment for investors.

Fifth, create a specialized construction investment fund aimed at supporting projects for the modernization of production facilities, the introduction of energy-saving solutions, green building technologies and certification according to international standards (for example, BREEAM, LEED). This will create long-term sources of financing and reduce financial risks for innovative enterprises.

Sixth, launch the implementation of a national program for the modernization of the production base of construction enterprises, providing for tax and leasing incentives for the purchase of new equipment, machinery, construction equipment and software. This will ensure a qualitative increase in the technical level of the industry and its transition to an innovative-industrial development model.

The proposals presented reflect the need for a systematic transformation of the construction industry of Uzbekistan aimed at long-term sustainability, technological renewal and institutional improvement. Their implementation will serve to improve the efficiency of economic management and create a competitive environment.

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