

# The Role Of Artificial Intelligence In Digital Transformation Processes In Construction Enterprises

**Arifdjanova Zilola Dilshodovna**

PhD, Associate Professor, Department of Management

Tashkent University of Architecture and Construction

[zilolaarifdjan@gmail.com](mailto:zilolaarifdjan@gmail.com)

## Abstract

The article investigates the role and functions of artificial intelligence (AI) in the digital transformation processes of construction enterprises. It is substantiated that digital transformation is not the adoption of separate technologies but a fundamental redesign of the enterprise's business processes, management model and culture. The analysis demonstrates that AI acts not as a mere tool but as the core that converts data into value. The study examines the application of AI across all stages of the construction life cycle, its economic efficiency and prospects in the context of Uzbekistan. The analytical results are visualized through three figures and two tables.

**Keywords:** digital transformation, artificial intelligence, construction enterprise, BIM, digital core, life cycle, predictive analytics, digital maturity, business process, efficiency.

*This work is Licensed under a Creative Commons Attribution 4.0 International License.*

**Annotatsiya.** Maqolada qurilish korxonalarida raqamli transformatsiya jarayonlarida sun'iy intellekt (SI) ning o'рни va vazifalari tadqiq etilgan. Raqamli transformatsiya alohida texnologiyalarni joriy etish emas, balki korxonaning biznes-jarayonlari, boshqaruv modeli va madaniyatini tubdan qayta qurishni anglatishi asoslab berilgan. Tahlil natijalari SI ushbu jarayonda oddiy vosita emas, balki ma'lumotlarni qiymatga aylantiruvchi yadro rolini bajarishini ko'rsatadi. Tadqiqotda SI texnologiyalarining qurilish hayotiy tsiklining barcha bosqichlaridagi

qo'llanilishi, iqtisodiy samaradorligi va O'zbekiston sharoitidagi istiqbollari yoritilgan. Maqolada uchta rasm va ikkita jadval orqali tahlil natijalari vizuallashtirilgan.

**Tayanch so'zlar:** raqamli transformatsiya, sun'iy intellekt, qurilish korxonasi, BIM, raqamli yadro, hayotiy tsikl, bashoratli analitika, raqamli yetuklik, biznes-jarayon, samaradorlik.

**Аннотация.** В статье исследуются роль и функции искусственного интеллекта (ИИ) в процессах цифровой трансформации строительных предприятий. Обосновано, что цифровая трансформация означает не внедрение отдельных технологий, а коренную перестройку бизнес-процессов, модели управления и культуры предприятия. Результаты анализа показывают, что ИИ выполняет роль ядра, преобразующего данные в ценность. Рассмотрены применение ИИ на всех этапах жизненного цикла строительства, экономическая эффективность и перспективы в условиях Узбекистана.

**Ключевые слова:** цифровая трансформация, искусственный интеллект, строительное предприятие, BIM, цифровое ядро, жизненный цикл, предиктивная аналитика, цифровая зрелость, эффективность.

## Introduction

In the global economy, digital transformation has become one of the key factors determining the competitiveness of enterprises. Although the construction industry has traditionally been regarded as one of the sectors with a relatively low level of digitalization, significant digital changes have accelerated in recent years. Digital transformation is not merely the mechanical adoption of new technologies; rather, it is a fundamental restructuring of an enterprise's business processes, management model, organizational structure, and corporate culture in accordance with a new data-driven paradigm.

At the center of these changes are Artificial Intelligence (AI) technologies. While Building Information Modeling (BIM), the Internet of Things (IoT), and cloud technologies constitute the infrastructural foundation of digital transformation, artificial intelligence serves as the core mechanism that converts data into practical value in the form of informed decisions, accurate forecasts, and optimized processes. Therefore, defining the role of AI in the digital transformation processes of construction enterprises is an important issue from both theoretical and practical perspectives.

According to recent studies, a significant proportion of construction professionals currently utilize AI tools in at least one stage of project implementation, while BIM is widely recognized as the primary infrastructure for the digital future of the industry. At the same time, the fact that AI adoption in many organizations remains at the initial or pilot stage indicates a growing need for scientifically grounded approaches in this field.

## Literature Review

The topic of digital transformation and Artificial Intelligence (AI) in construction has been widely explored in academic literature in recent years. Researchers identify AI as a key driver of digital transformation, as it optimizes project planning, quality control, and safety management while shifting decision-making processes toward a data-driven approach. Empirical studies have confirmed that integrated smart construction management systems, which combine machine learning, IoT sensors, and Building Information Modeling (BIM) within a unified environment, achieve significantly higher efficiency compared to traditional management methods.

International reviews categorize the major application areas of AI in construction as cost estimation and forecasting, schedule optimization,

quality and safety monitoring through computer vision, and risk management. At the same time, scholars emphasize that the integration of generative AI introduces new challenges, including data bias, lack of transparency, and cybersecurity risks. Several industry reports (RICS, Autodesk/Deloitte, and NBS) indicate that digital transformation in construction is accelerating; however, AI adoption in most organizations remains at an early stage of implementation.

The literature review demonstrates that existing studies mainly focus on specific technical applications of AI or on global development trends. The role of AI as the systemic core of digital transformation in construction enterprises—particularly its function in the comprehensive restructuring of business processes—has received limited scholarly attention, especially in the context of Uzbekistan. This article aims to address this research gap.

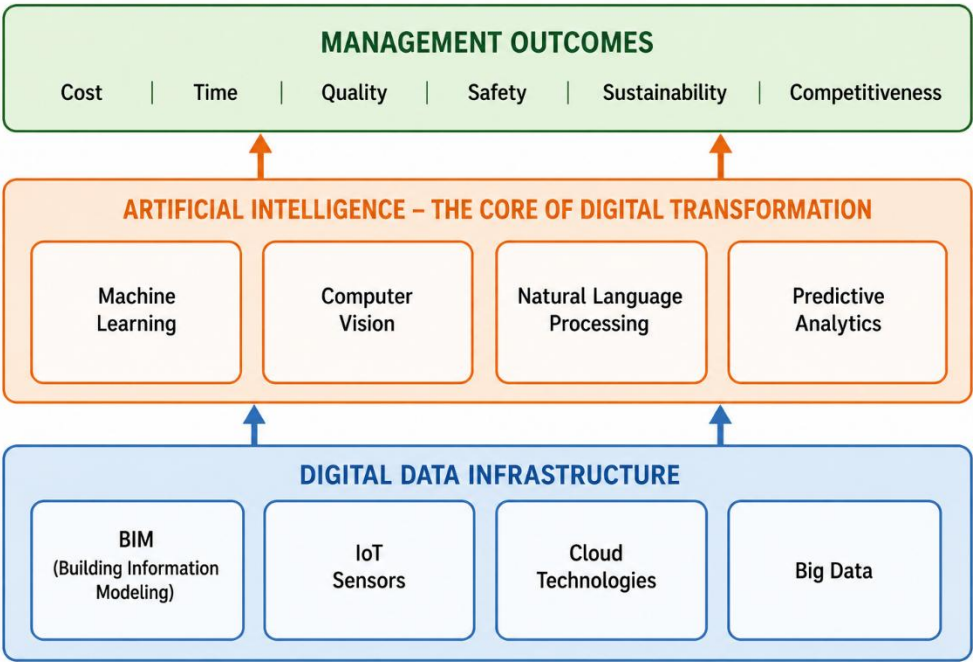
### **Research Methodology**

The study is based on a qualitative research approach and employs systematic literature review, comparative analysis, system-structural analysis, and logical generalization methods. The empirical basis consists of peer-reviewed international publications issued between 2024 and 2026, analytical reports from reputable organizations (RICS, Mordor Intelligence, Autodesk/Deloitte), and normative-legal documents of the Republic of Uzbekistan related to digitalization and the development of artificial intelligence. The findings are systematized and presented through three figures and two tables.

### **Analysis and Results**

#### **1. The Core Role of Artificial Intelligence in Digital Transformation**

The digital transformation of a construction enterprise can be conceptualized as a three-layer model. The foundational layer consists of a digital data infrastructure, including Building Information Modeling (BIM), IoT sensors, cloud technologies, and big data systems, which ensure the collection, storage, and management of information. Positioned in the middle layer, Artificial Intelligence processes and analyzes this data, transforming it into actionable insights and management outcomes. These outcomes are reflected in the upper layer through improvements in project cost, schedule, quality, safety, and sustainability performance indicators. This conceptual framework is illustrated in Figure 1.



**Figure 1. The Core Role of Artificial Intelligence in the Digital Transformation of Construction Enterprises**

As illustrated by the model, Artificial Intelligence is not merely an independent technology within the digital transformation process; rather, it serves as the critical link that connects digital data infrastructure with real managerial value. Without a robust data infrastructure, AI lacks the information required for effective analysis and decision-making. Conversely, without AI, the collected data remain largely unprocessed and fail to generate practical value for enterprise management.

**2. Application of AI Technologies Throughout the Construction Project Life Cycle**

The role of Artificial Intelligence becomes evident throughout the entire life cycle of a construction project. Table 1 systematizes the key digital transformation technologies and the specific functions performed by AI at different stages of the project life cycle. It demonstrates how AI contributes to planning, design, construction, operation, and maintenance processes by enhancing efficiency, accuracy, and decision-making capabilities.

Table 1. Application of Artificial Intelligence Across the Construction Project Life Cycle

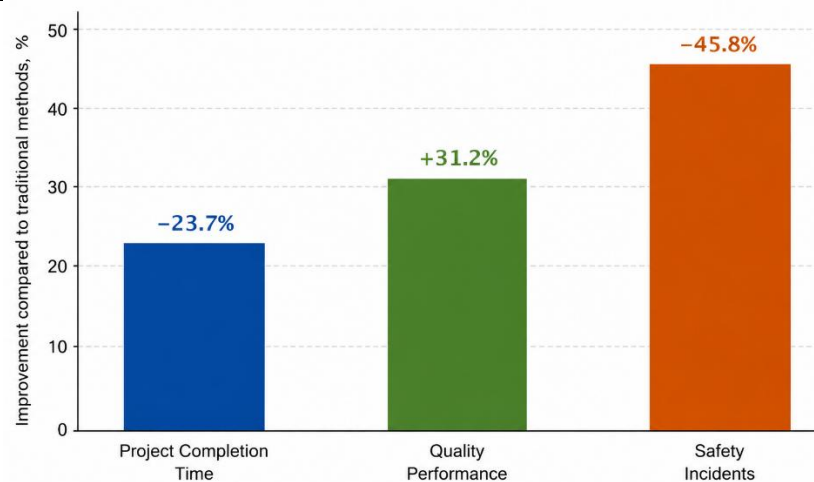
| Life Cycle Stage | Key Digital Technologies | Functions of Artificial Intelligence |
|------------------|--------------------------|--------------------------------------|
|------------------|--------------------------|--------------------------------------|

|                                          |                                         |                                                                                                                        |
|------------------------------------------|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| <b>Design and Concept Development</b>    | BIM, Generative Design, Cloud Platforms | Automatic generation of design alternatives, selection of optimal solutions, detection of design clashes and conflicts |
| <b>Planning and Cost Estimation</b>      | Big Data, Machine Learning              | Cost forecasting, schedule optimization, prediction of resource requirements                                           |
| <b>Construction Process</b>              | IoT, Drones, Computer Vision            | Real-time monitoring of construction activities, detection of defects and safety violations                            |
| <b>Operation and Facility Management</b> | Digital Twin, Sensor Networks           | Predictive maintenance, optimization of energy consumption, anomaly detection                                          |

The data presented in Table 1 indicate that the role of Artificial Intelligence extends across all stages of the project life cycle, from the initial conceptual design phase to the operation and maintenance of completed facilities. In particular, when integrated with Digital Twin technology, AI enables a holistic and continuous management approach throughout the entire building life cycle, thereby improving decision-making, operational efficiency, and asset performance.

### 3. Economic and Operational Efficiency of Artificial Intelligence

The role of Artificial Intelligence in digital transformation can be assessed through its measurable economic and operational benefits. According to the results of experimental studies, an integrated intelligent management system combining AI, IoT, and BIM achieved substantial improvements compared to traditional management approaches. Specifically, the implementation of these technologies reduced project completion time by 23.7%, increased quality performance indicators by 31.2%, and decreased safety-related incidents by 45.8%. These results demonstrate the significant contribution of AI-driven digital transformation to enhancing the efficiency, quality, and safety of construction projects (Figure 2).



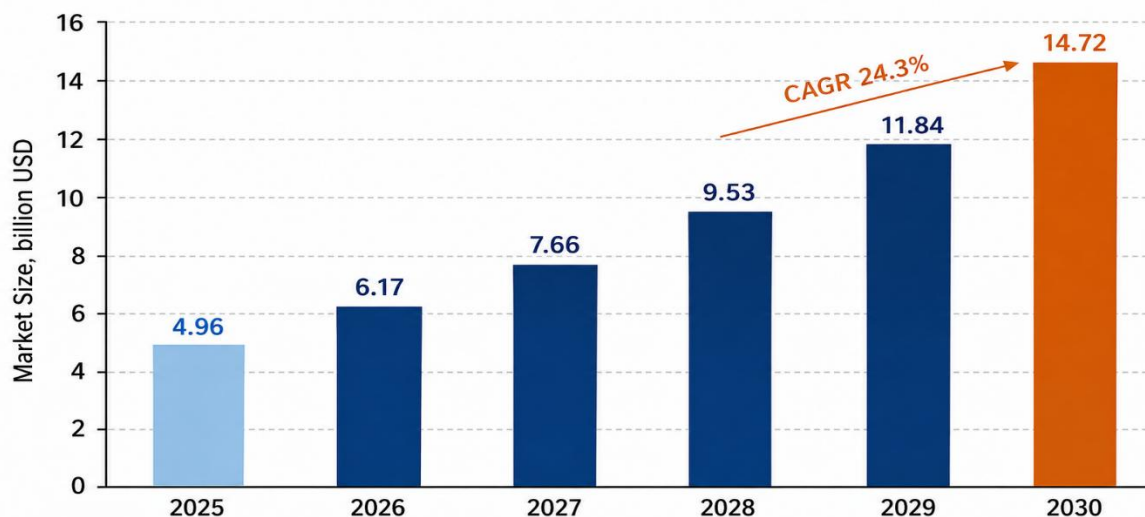
**Figure 2. Efficiency of the Intelligent Management System Compared to Traditional Methods**

These results confirm that the role of Artificial Intelligence in digital transformation is not only technological but also economically justified. Reductions in project costs and completion time contribute directly to improved financial performance, while the decrease in safety incidents enhances corporate social responsibility, workforce protection, and organizational reputation. Consequently, AI serves as a strategic tool for increasing both operational efficiency and long-term competitiveness in construction enterprises.

#### **4. Market Trends and the Context of Uzbekistan**

The rapidly growing demand for Artificial Intelligence indicates that digital transformation in the construction industry has become an irreversible trend. According to analytical forecasts, the global market for AI in construction is expected to expand from approximately **USD 5 billion in 2025** to **USD 14.7 billion by 2030**, representing an average annual growth rate of more than **24%** (Figure 3).

This growth reflects the increasing recognition of AI as a critical enabler of productivity improvement, cost optimization, risk reduction, and sustainable development within the construction sector. In Uzbekistan, ongoing digitalization reforms and government initiatives aimed at promoting artificial intelligence create favorable conditions for the wider adoption of AI technologies in construction enterprises. As a result, the integration of AI into construction management is expected to become one of the key factors driving the industry's modernization and international competitiveness.



**Note:** CAGR (Compound Annual Growth Rate) 24.3%

**Source:** Market analysis and industry reports, 2024.

**Figure 3. Forecast of the Growth of the Artificial Intelligence Market in the Construction Industry (2025–2030)**

In Uzbekistan, digital transformation and the development of Artificial Intelligence have become priority areas of state policy. The **“Digital Uzbekistan – 2030” Strategy** and the **Strategy for the Development of Artificial Intelligence Technologies until 2030**, approved by the Resolution of the President of the Republic of Uzbekistan No. PQ-358 dated October 14, 2024, have established the legal and institutional framework for the widespread adoption of AI across various sectors of the economy, including construction. These initiatives create a favorable external environment for accelerating digital transformation and enhancing the adoption of AI technologies by domestic construction enterprises.

### 5. Barriers and Measures for Overcoming Them

Realizing the full potential of Artificial Intelligence in digital transformation requires addressing a number of significant barriers. Despite the considerable benefits associated with AI implementation, construction enterprises continue to face challenges related to data quality, technological infrastructure, workforce competencies, investment requirements, and regulatory support. **Table 2** summarizes the key barriers to AI adoption and the corresponding measures proposed to overcome them.

**Table 2. Key Barriers to AI Adoption and Measures for Overcoming Them**

| Barrier | Description | Measures for Overcoming the Barrier |
|---------|-------------|-------------------------------------|
|---------|-------------|-------------------------------------|

|                                        |                                                                                                              |                                                                                                                                 |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>Data Fragmentation</b>              | Data are stored in different formats and isolated systems, limiting interoperability and effective analysis. | Establish a <b>Common Data Environment (CDE)</b> and implement data standardization practices.                                  |
| <b>Skills Shortage</b>                 | Insufficient availability of specialists with expertise in AI, data analytics, and digital technologies.     | Workforce retraining, collaboration with higher education institutions, and continuous professional development programs.       |
| <b>Organizational Resistance</b>       | Internal resistance to change and a low level of digital culture within the organization.                    | Implement change management strategies and build confidence through pilot projects and demonstration initiatives.               |
| <b>Ethical and Cybersecurity Risks</b> | Risks related to algorithmic bias, lack of transparency, and cybersecurity threats.                          | Adopt a <b>human-in-the-loop</b> approach, develop internal governance standards, and strengthen information security measures. |

### Conclusion and Recommendations

The conducted study demonstrates that Artificial Intelligence (AI) occupies a central and core position in the digital transformation of construction enterprises. AI functions as the connecting link between digital data infrastructure—including Building Information Modeling (BIM), the Internet of Things (IoT), and cloud technologies—and real managerial value creation. As a result, AI can be applied throughout the entire project life cycle, from design and planning to operation and maintenance.

The analysis confirms that the effectiveness of AI is supported by measurable outcomes. Intelligent management systems significantly reduce project duration, operational costs, and safety risks while improving overall project performance. Furthermore, the rapid growth of the AI market in construction, combined with Uzbekistan's digital transformation agenda, highlights the strategic importance of AI adoption for the future development of the industry.

From a practical perspective, the following recommendations are proposed for construction enterprises:

- **Begin digital transformation by establishing a unified data environment**, ensuring the integration and standardization of project information.

- **Implement AI solutions gradually through pilot projects** and evaluate their effectiveness using quantitative performance indicators.

- **Continuously invest in workforce development and digital culture**, strengthening competencies in AI, data analytics, and digital technologies.

- **Apply AI under a human-in-the-loop approach**, ensuring compliance with ethical principles, transparency requirements, and information security standards.

Future research should focus on the empirical validation of these findings through case studies and practical implementation within construction enterprises in Uzbekistan. Such studies would provide deeper insights into the effectiveness, challenges, and long-term impact of AI-driven digital transformation in the national construction sector.

## References

1. Resolution of the President of the Republic of Uzbekistan No. PQ-358 dated October 14, 2024, "On Approval of the Strategy for the Development of Artificial Intelligence Technologies until 2030." — lex.uz.

2. Decree of the President of the Republic of Uzbekistan No. PF-6079 dated October 5, 2020, "On Approval of the Digital Uzbekistan — 2030 Strategy." — lex.uz.

3. AI-Enabled Digital Transformation in the Construction Industry: A Comprehensive Framework for Smart Construction Management. Proceedings of the 2025 8th International Conference on Computer Information Science and Artificial Intelligence (CISAI '25). — ACM, 2025.

4. Savaş, S. Artificial Intelligence in Construction Project Management: Trends, Challenges and Future Directions. Journal of Design for Resilience in Architecture and Planning, 2025, Vol. 6, No. 2, pp. 221–238.

5. Giyosov, Ilhomjon Karimovich, and Inomjon Ortikbayevich Karimov. "TARGETED AND EFFECTIVE USE OF INVESTMENT IN CONSTRUCTION INDUSTRY."

6. Ajayi, A.S. A Comprehensive Review of Artificial Intelligence Applications in the Construction Industry. International Journal of Architecture, Arts and Applications, 2025, Vol. 11, No. 2, pp. 48–57.

7. Royal Institution of Chartered Surveyors (RICS). Artificial Intelligence in Construction Report 2025. London: RICS, 2025.
8. Karimov I. UY-JOY QURILISHIDA ESKROU MEXANIZMLARINI JORIY ETISH ORQALI INVESTITSION XAVFSIZLIK VA MOLIVAVIY SHAFFOFLIKNI TA'MINLASH //MUHANDISLIK VA IQTISODIYOT. – 2026. – T. 4. – №. 3.
9. Mordor Intelligence. AI in Construction Market — Share Analysis, Industry Trends & Statistics, Growth Forecasts (2025–2030). 2025.
10. Autodesk & Deloitte. State of Digital Adoption in the Construction Industry 2025. Deloitte Access Economics, 2025.
11. NBS. Digital Construction Report 2025. NBS Enterprises Ltd., 2025.
12. McKinsey Global Institute. Reinventing Construction: A Route to Higher Productivity. McKinsey & Company, 2017.
13. World Economic Forum. Shaping the Future of Construction: A Breakthrough in Mindset and Technology. Geneva: WEF, 2018.