Digitalization as the basis for the construction industry development

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Abstract. Russia is entering a new technological order. The transfer to the digital technological format will raise the national economy to a new level in the innovative orientation of all companies. At the same time, the digital economy is based on digital transformations of all industries. The implementation of digital technologies into the construction industry is an irreversible process. The digitalization can radically transform the construction industry and create new opportunities for its development. Digital construction is based on the use of information and communication technologies for more efficient and high-quality execution of construction and installation works and management of capital construction facilities. Many new information technologies offer numerous opportunities for construction companies. However, to consolidate the position of a single digital space in the construction industry, it is necessary to develop new approaches to the interaction of all participants in the investment and construction activities.

1. Introduction

The construction industry has always been one of the leading economic sectors, while remaining resistant to any innovations. But new technologies and materials, decreased production costs, increased volumes of investment in the construction industry, government support, reduced construction time require significant transformations. One of the leading construction journals Builder described the following trend: increased public attention to various factors of environmental protection (e.g., strict requirements for environmental friendliness and energy efficiency). \([9, 11]\)

Therefore, innovations in the construction industry should improve the quality and reliability of the construction process and become a condition for the growth of the industry's competitiveness. The digitalization of the industry is one of the elements of innovation. At the same time, to implement the digital technologies in the construction sector, it is necessary to create conditions that will contribute to the implementation of information technologies and construction process automation.

The issue of digitalization of various economic sectors is solved at the government level. This is facilitated by the coronavirus pandemic. Those sectors of the economy where the digitalization has already begun are in the most economically stable state. One of the most striking and recent examples of digital transformation is Instruction of the President No. Pr-1235 "On the modernization of the construction industry and improvement of the quality of construction". It is aimed at implementing the
information modeling technologies into the life cycle management system of capital construction projects. Decree of the Government of the Russian Federation No. 143 of September 15, 2020 approved the rules for creating and maintaining the information model of capital construction objects. [3, 4, 5]

2. Materials and methods

Currently, the digital economy is a priority in the development of the Russian Federation, since it is the level of digitalization that will allow the most reliable and accurate assessment of the competitiveness of the country and the current state of markets and industries. [6]

The digital economy will ultimately become global. According to the E-Government Development Index, the Russian Federation was included in the group of countries with a "very high" level of development. The EGDI is updated every two years and calculated based on three indicators:

- development of online services;
- development of human capital;
- development of telecommunications infrastructure.

In 2018, the UN Department for Economic and Social Affairs published data on the E-Government Development Index in different countries. According to this study, Russia improved its position and moved up from 35th to 32nd place (in 2016). In Russia, the EGDI was 0.7969, which allowed the country to enter the group of countries with a very high index (the maximum value is 1).

According to the E-Participation indicator, Russia moved up from 34th to 23rd place in the group of countries with the highest indicator of e-participation of citizens in government decision-making.

According to the Online Services indicator, Russia also had a high indicator (0.9167).

In 2020, the situation has changed. According to the UN global ranking, Russia’s EGDI is 0.8244. The country ranked 36th, while in 2018 it ranked 40th (figure 1). [1]

By the level of e-participation, Russia ranks 27th with an indicator equal to 0.7723. In 2018, it ranked 23rd.

![Figure 1. Russia's place in the international ranking of information society development.](image_url)

Russia is catching up with the leading Western countries in the implementation of digital platforms for economic management.

In this regard, the digitalization of the economy is a strategically important direction aimed to restore the material production and lay the basis for future innovations and outstripping development in relation to other countries.

It should be noted that the digital economy requires the digitalization of all industries. Implementation of innovations in the construction industry (sales channels, the Internet of things, "smart" systems, BIM-design, 3D-modeling, cloud services, smart contracts, electronic money, full-fledged ecosystems) should not be just a visible sign of scientific and technological progress or a simple reflection of current trends in modern society. [6]

The coronavirus pandemic and self-isolation confirmed the importance of digitalization. Digital technologies have contributed to the smooth operation of the construction industry during the pandemic. The efficiency of the industry has been maintained thanks to the availability of electronic
services that allow for remote sales, electronic registration of transactions, automation of all processes and data processing. [7, 8]

The digitalization provides numerous opportunities for construction companies: efficiency, profit, cost savings, safety and environmental impacts.

3. Results
During the digital transformation of the construction industry, it is important to implement digital technologies. The government has developed principles based on which it is possible to implement digital technologies in the construction industry. The most important principles are as follows:
- focusing on the end consumer;
- reducing the administrative burden on the construction business;
- reducing the risks of violation of legislation due to the lack of awareness;
- reducing the period of registration of documents;
- using machine-readable documents when collecting and processing data;
- automation of information processing processes.

As a result, the digital technologies will increase the efficiency of construction processes throughout the entire life cycle of the construction project and simplify the general organizational issues of construction project management (Table 1). [9, 11, 14]

Table 1. Benefits from the implementation of information technology in the construction industry

| Design                                                                 | Construction                      | Management                        |
|-----------------------------------------------------------------------|-----------------------------------|-----------------------------------|
| Optimization of the project (compliance with client requirements and costs) by information, visual and multi-criteria modeling | Increase in labor productivity through the coordinated planning of the production process at construction sites (logistics, maintenance) | Improvement of management through the electronic workflow in BIM modeling |
| Reducing project implementation costs by automating the design process | Process optimization through the accurate maintenance planning (inspections, repairs) | More efficient building resource management |
| Reduction in the maintenance cost and search for new suppliers by optimizing the database | Reduction in the number of injuries at construction sites by monitoring the employee behavior and raising awareness of possible risks | Reduction in the number of warranty repairs by improving the quality of construction and installation works |
| Reduction in the number of shortcomings and errors due to timely detection and rapid elimination. | Monitoring and control of construction progress using the information technology | Optimization of the liquidation process due to the availability of all documents in electronic format |
| Improvement of project efficiency through more accurate planning and management | - | Risk reduction at all stages of the building life cycle |
| Designing of a construction site as a whole | - | - |
The construction industry has great resources for innovation and digital models. To accelerate the pace of development of information and communication technologies, active government measures are required. In the modern world, the government should fund fundamental projects. Moreover, the government should identify priority areas, critical vulnerabilities, promising niches and companies in order to provide them with financial resources.

The current development of digital technologies in the construction industry is supported at the government level, and construction organizations can only make their business processes digital, which will improve the efficiency and productivity of construction works and give a competitive advantage through the business development.

Currently, the requirements for construction projects are increasing, and the projects themselves are becoming more complex and large-scale. Capital construction objects have to meet the requirements for environmental safety, energy efficiency and energy saving. They have to use innovative materials and innovative technologies. The demand for smart and energy efficient buildings is growing.

The traditional approach to construction must be changed. Construction organizations need to search for ways to improve the efficiency of construction projects. For large-scale transformations, a new level of organization is needed. This effect can be achieved with the help of innovative digital technologies and their implementation in the construction industry, thereby forming a platform for further development and growth of the competitiveness of the industry as a whole. [13]

Figure 2 shows the main ways of transformation of construction projects. All of them are based on innovations that are applicable to the construction industry. They are either implemented or will allow to form a digital information model. [2]

Figure 2. Key trends shaping the future of construction projects. [2]

The results of this transformation are as follows:
- reduction of a construction period;
- improvement of the quality of management of capital projects under construction;
- making management decisions based on reliable and up-to-date data;
- automation of all stages and procedures throughout the entire life cycle of an object;
- creation of a unified information field in the construction industry, allowing digital sites created by participants in the construction industry to interact.

The main task of the construction industry is to erect buildings and structures, and information about them will become the core of the whole process. Figure 3 shows the expected results of construction industry digitalization.
The most important areas of digitalization include:
- implementation of an electronic format in urban planning;
- creation of an electronic database of urban planning projects and project storage;
- maintaining of digital statistics to process and select the required data and publish selected indicators;
- creation of search and reference platforms;
- implementation of information modeling of construction objects at all stages of their life cycle;
- registration of the land plot layout in the form of an electronic document (except for the registration of such layouts by citizens), etc. [15]

4. Conclusion
The information and communication technologies will enable the construction industry to find innovative solutions to facilitate the adaptation to the rapidly changing environmental conditions. The construction industry has not yet mastered new digital technologies whose implementation requires significant financial resources. However, it is evident that the digital technologies in the construction industry are not yet mandatory, but open up a wide range of opportunities for construction companies that introduce some elements of information technologies, increasing their competitiveness. They allow them to promptly respond to global changes and facilitate early integration into the information space.

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