Features of digital transformation in the construction industry

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Abstract. The introduction and development of digital technologies and innovations is one of the necessary elements for the long-term and effective functioning of most sectors of the economy, not only in Russia, but also in the world. The construction sector accounts for a significant portion of Russia's GDP. Therefore, the issue of introducing digital and innovative technologies is quite acute. In order to develop a mechanism for digital transformation of the construction sector, special attention should be paid to the possible maximum coverage of business processes existing in construction. Since the synergistic effect of the introduction of digital technologies in the construction sector will be to increase the competitiveness of construction organizations in the construction market. The formation and development of the concept of digital transformation of the construction industry is one of the necessary elements for the full implementation of the digital economy of the state.

1. Introduction

The construction sector of any state belongs to one of the main production complexes that occupy a significant place in the world or within the state economic system. In connection with the global transformation of the world economic system, the construction industry already needs to apply current scientific achievements in the field of technology, new technologies and effective methods of production organization for effective functioning and formation of competitive advantages. The creation of prerequisites for the introduction of new construction organization schemes should be based on the implementation of design solutions in the context of the entire life cycle of construction objects.

Currently, the effective implementation of construction projects is largely determined by and at the same time depends on the level and quality of the technological connection of administrative, managerial and construction processes. Since modern methods used in the design, management, technology and organization of construction determine and have a greater impact on the performance of construction and installation works and processes. The construction of buildings and structures is carried out using modern requirements of building codes and rules used in the design and construction of the object. But we cannot limit ourselves to this aspect only, because today it is important to comprehensively introduce elements of digital technologies into the production process. Another impetus for the development of digitalization in the construction industry is the large-scale growth of the population of cities – on average, the number of citizens in the world increases by 200 thousand people every day and this number will grow year by year. Thus, according to forecasts of the world health organization, by 2050, about 70% of the World's population, or about 6.4 billion people, will live in urban areas. At the same time, most of the population will live in large cities, making very different demands on their places of

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residence, which will lead to the need to provide the population not only with affordable and high-quality housing, but also with infrastructure facilities.

2. Materials and methods
To date, the global construction industry has begun to undergo large-scale changes, primarily due to the use of innovative ways to implement construction projects instead of the established methods of design and construction. Increased requirements for modern project documentation, increasing pressure on deadlines, problems with communication between participants, a large amount of information or lack of it at the right time – all this contributes to the poor performance of the industry as a whole.

Digital representation of information has much greater capabilities than traditional methods, allowing the formation of complete technological environments (ecosystems, platforms, platforms), within which the user can create the necessary friendly environment for himself (technological, instrumental, methodological, documentary, partner, etc.) in order to solve entire classes of problems [11, 12].

For Figure 1, it is presented what aspects of society's life are affected by the digital transformation of the investment and construction sector.

![Figure 1. The impact of digital transformation of the investment and construction sector on the life of society.](image)

It should be noted that the introduction of digital technologies in business at the basic level has already taken place several years ago, but the management of the transition to digitalization, in its essence, is an endless process, because the introduction of new and new technologies in business will continue and the process will go deeper and deeper into the relevant industry. Digital transformation is being implemented in different areas of business in waves and they are moving with a shift in time. The baton passes from one industry to another (Figure 2).
In general, scientists pay a lot of attention to the development of digitalization in organizations. For example, foreign scientists, Burman S.J. and Bel R. of the IBM Institute for business value, identified three stages in the evolution of digital transformation of organizations (Figure 3). [1, 9]

A significant part of the existing business models and ecosystems used by western companies are an obstacle to successful competition in the digital economy. Therefore, the only option is digital transformation, which can work on the basis of continuous improvements in the entire process of product value formation. [5, 6, 7, 8]

The Table 1 illustrates the nature of business changes when switching to digital platforms.
| Business before switching to digital platforms | Business based on digital platforms |
|-----------------------------------------------|-----------------------------------|
| Supply chain (a linear addition of values)    | Ecosystem based on a digital platform (nonlinear value addition) |
| Ability to control the supply chain           | Ability to control the ecosystem   |
| Economies of scale on the supply side         | Economies of scale on the demand side |
| Increase in value as the number of suppliers increases | Increase in value with an increase in the number of consumers |
| Reduction of return on tangible assets due to their depreciation | Increasing returns as the network effect of the digital ecosystem develops |
|                                               | Ability to quickly search for partners – effective cooperation with other participants |
|                                               | Moving production of products and services closer to the consumer |
|                                               | Avoiding intermediaries, direct access to resources, savings due to collective (crowd) projects (organized collective purchases, construction in a warehouse) |
|                                               | Avoiding long supply chains and eliminating a succession of intermediaries |
|                                               | Accelerate the introduction of new products |
|                                               | Reduce the cost of manufactured products and significantly reduce the time of its release |

To create a successful ecosystem, an organization must have the maximum number of relevant competencies, such as:
- management of integration processes;
- flexible organization management;
- customer relationship management;
- organization of interaction between the center for innovative solutions and existing divisions of the company;
- innovation management.

### 3. Results

Trying to assess digital transformation in various industries, including construction, it should be noted that the essence of it is that the organization must have the ability or final competence to regularly transform its processes using digital technologies.

If we consider the impact of a particular industry on the size of GDP, we should highlight the construction industry. According to research and analytical bases, construction accounts for no more than 6% of world GDP [1, 2]. At the same time, in developed countries, the construction industry accounts for 5% of GDP, in developing countries up to 8% of GDP. By 2025, it is planned to increase the total annual income of construction organizations to 15 trillion dollars. 10 trillion dollars USA in 2015 [3]. Already, more than 100 million people in the world are employed in the construction sector [4].

In Russia, the indicator for total investment in fixed assets is 50% and it is accounted for the construction of buildings (residential and non-residential) and structures. The indicator of profitability of construction organizations for goods and services sold for the period 2010-2018 was in the range of 4.8–7%, while the average economic indicator was 7.7-12.3%. Currently, the construction industry in Russia employs about 6.3 million people. Calculations by the Analytical center based on OECD data showed that the GVA per person employed in the industry in 2017 was 41.6 thousand dollars. (in current
prices), which is significantly lower than in developed countries- Sweden (96.7 thousand dollars), France (93.4 thousand dollars), Great Britain (77.4 thousand dollars), USA (76.7 thousand dollars), Germany (75 thousand dollars), Japan (58.8 thousand dollars)

The issues of the development prospects of the construction industry are dealt with at the highest state level. To date, the work on the formation and approval of a Strategy for the development of the construction industry until 2030 is being carried out by the Ministry of construction of Russia. According to the decree of the Government of the RF dated August 16, 2018 № 1697-r, the strategy under consideration is included in the action plan ("road map") for the development of competition in the country's economic sectors.

This strategy is based on a number of principles that will eventually lead to a competitive, efficient, and innovatively viable construction industry (Figure 4).

![Figure 4. Principles underlying the development of the construction industry until 2030.](image)

For effective implementation of digital technologies in the construction organization, changes must affect all areas of the organization's activities. It is not possible to implement the technology separately only in the production department, at the level of a separate project or a separate specialty. This approach gives some results, but in the end does not lead to significant changes, bringing only a small share of the benefits that are possible with the full implementation of digitalization. The entire process requires a number of tools or systems that the organization will operate on (Figure 5).

![Figure 5. Digital tools for construction organizations.](image)
Without a clear concept and good management at the top level, attempts to implement digital platforms will lead to a waste of resources, so organizations need their own strategy that takes into account the specific features of their activities.

4. Conclusion
Having a certain specificity, digital technologies have their own characteristics and their own set of technologies that are suitable for a specific industry and that define the essence of such a phenomenon as digital transformation. In relation to investment and construction, digital transformation has an impact on many aspects of society's life, for example, it reduces construction costs, increases the efficiency of construction organizations, reduces the negative impact of construction on the environment, and increases the pace of economic development both at the level of individual regions and countries, and at the global level.

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