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The digital transformation of subjects of investment and construction activities interaction mechanisms

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***Abstract* — Currently, the intensification of the digital development of the investment and construction sector is an urgent task both abroad and in Russia. The article substantiates the relevance of conducting a comprehensive digital transformation at the level of various subjects of investment and construction activities, analyzes foreign and domestic theoretical approaches to digital transformation of construction organizations, and also discusses the problems of digital transformation of subjects of investment and construction activities from the point of view of technological support and human resourcing. As a result of the study, the authors evaluated some practical results of the transition of the Russian construction sector to digital economy technologies, identified the need for a multilateral approach to the digital transformation of construction, recommended measures to improve the interaction processes of investment and construction entities, and also proposed a mechanism for intensifying the digital transformation of investment and construction activities in Russia.**

Keywords — digital transformation, investment and construction activities, construction, construction organizations, digital platform

I. INTRODUCTION

Russia is at the initial stage of the digital transformation of the investment and construction sector, and currently it is important to develop proposals for intensifying the digital transformation of construction in order to create a digital economy and ensure sustainable economic growth of the country. In order to intensify the digital transformation of construction in Russia in 2018, the federal project “Digital Construction” was formed, according to which a unified digital platform should be created in Russia by 2024, combining information systems in the field of construction at all stages of the life cycle of objects capital construction [1].

It is planned that upon completion of this federal project, the period between the decision of implementing the investment construction project and the commissioning of the facility will be reduced by 30%, and cost savings will be 20%. The federal project is aimed at stimulating the digital transformation of the industry in the framework of construction of facilities with the involvement of budgetary funds, which in the future should lead to the spread of digital technologies in the entire construction sector, regardless of the form of financing.

The main participants in the digital transformation of the investment and construction industry are organizations involved in the creation of construction products and the provision of services directly related to the implementation of investment and construction projects. The digital transformation of construction organizations is a process of comprehensive improvement of activities, including both the introduction of digital technologies and the rationalization of personnel policies and the improvement of management and control processes [2]. Nevertheless, we believe that a successful transition to digital construction involves not only the digitalization of the activities of construction organizations, but also a comprehensive transformation of the interaction mechanisms of all subjects of investment and construction activities.

II. METHODS

Previous studies have shown that the concept of digital transformation in construction has specific features [3], however, the basis for making changes in the direction of digitalization, as well as for organizations in other sectors of the economy, is a digital strategy [4], in which not only the development vector of the organization is set, but also the final results of the events are determined, which increases the controllability of the process of implementing a digital strategy [5, 6].

According to foreign scientists, due to the active spread of innovation, as well as the development of forms of interaction with customers, digital transformation allows organizations to increase sales [7]. Moreover, as a result of the transformation process, the models of doing business are subject to change [8]. Nevertheless, one cannot fail to note the fact that the scientific community still does not have an answer to the question of the optimal digitalization degree of organizations [9], since the introduction of digital technologies entails an increase in financial costs for their acquisition and operation, and also requires human resource development within the organization. Therefore, even at the stage of planning the digital transformation, it is necessary to assess the amount of required resources and compare it with the available possibilities of using equity and the possibilities of attracting external sources of financing.

The digital transformation of construction is based on changing tools and mechanisms of interaction between subjects of investment and construction activities on the basis of technologies such as blockchain, which is associated with a qualitatively new level of transaction [10], and also implies the use of the most advanced nanomaterials and technologies to

solve the problems of the construction industry “smart home”, “green building”, etc. [11].

Speaking about the digital transformation of the investment and construction sector in St. Petersburg, we note that one of the most important results of digitalization in the city is the creation of the Unified System of the Building Complex of St. Petersburg (USBC), which is a regional integration platform. The USBC ensured electronic interaction of construction organizations with executive bodies of state power, and also acted as an effective tool for interagency cooperation.

According to experts, the period of execution of public services at the expense of the USBC was reduced by 30% [12], and this indicator can be increased, since the formation of big data within the framework of the Distributed Regional Data Processing Center will allow to analyze and optimize business processes in the construction sector.

The functioning scheme of the USBC (Figure 1) is the basis for the distribution of similar digital platforms in construction to other regions.

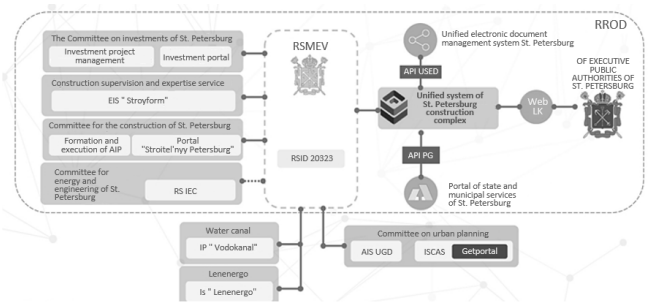

Fig. 1. USBC function scheme [12]

In general, the measures on the digital transformation of construction taken in St. Petersburg allowed the city to take 4th place in the national rating of the investment climate in the constituent entities of the Russian Federation in 2018, which is 13 positions higher than the level of 2017 [13].

Digital transformation processes in the construction industry in Russia are also recognized at the global level: World Bank estimates that in 2019 Russia will take the 31st place in the Doing Business rating [14], having risen 4 positions in a year. The largest contribution to the change in position was made by the indicator related to obtaining building permits, according to which in 2019 Russia takes 48th place, although in 2017-2018 it was only 115th place [15].

III. Results

In our opinion, the priority stages of the digital transformation of the investment and construction sector are the introduction of the most modern technologies by construction organizations, in particular BIM-technologies, as well as the comprehensive improvement of activities taking into account the multi-aspectness of the digital transformation process.

An important direction of the digital transformation of organizations is also the adoption of uniform project implementation standards by all participants of the construction industry. In order to provide information modeling of buildings and structures with a regulatory framework, a system of regulatory and technical documents is being developed both in the fundamental areas of BIM-technology development and in separate areas for various stages of the life cycle of capital construction projects. We would like to emphasize that information modeling technologies for buildings and structures can and should be applied at all stages of the life cycle of construction projects, which is already reflected in the practice of implementing renovation projects [16].

Universal observance of standards allows to guarantee the safety of construction products to society, and gradually leads to a full-scale digital transformation of construction due to the presence of uniform rules and norms for the entire industry that take into account global trends in the development of innovative construction technologies. The process of improving the regulatory framework should be carried out in cooperation with the state organizations of the construction sector, because the participants in the construction market can reliably assess their needs and capabilities.

The transition to uniform principles for the implementation of investment and construction projects is inextricably linked with the formation of intra-industry associations of participants in the construction sector, within which uniform standards of relations have been adopted, which, however, does not replace the availability of mandatory state standards in the field of investment and construction activities, but only supplements them. We also note the importance of developing standardized software in the industry to increase the degree of consistency between project participants, the rules for determining the value of projects with a view to their further comparability, legal support standards for transactions, etc.

We believe that the transition to digital construction requires the transformation of investment and construction activities based on the intensification of cooperation between various institutions of the construction sector. An increase in the degree of interaction can be achieved through the spread of the practice of comparative analysis of indicators, as well as the exchange of experience in implementing digital technologies between industry organizations. The exchange of experience and knowledge allows organizations at the initial stages of digital transformation to accelerate the pace of their digital development by taking into account the features and difficulties that other organizations have already encountered in implementing digital technologies [17]. Such cooperation can be achieved through the creation of industry-specific interaction platforms, however, we note that these associations should not impede free competition in the market and violate the requirements of antitrust laws.

Speaking about the practice of a comparative analysis of digital transformation in construction effectiveness, we note that in Russia there is no unified system of indicators for assessing the degree of digitalization of the construction sector, as well as no responsible attitude of organizations for analysis of the effectiveness of investment and construction projects during the digital transformation [18].

At present, in Russia there is a tendency towards active interaction of participants in the construction sector in the framework of industry forums, round tables, and conferences. The digital transformation of construction in Russia is at the satge of beginning, and those organizations that have achieved

some success are ready to share their experience. Nevertheless, many discussion platforms have the nature of an intersectoral round table with the participation of organizations in various sectors of the economy, since there are still not enough organizations in the construction industry that have significant success in the field of digital transformation. Digitalization of construction in Russia is often understood as the introduction of BIM technologies, and industry interaction is focused on the dissemination of digital technology data, and not on the comprehensive improvement of organizations.

Note that the greatest effect of intra-industry interaction is achieved not in cooperation with similar organizations, but in the exchange of experience with third-party contractors who also participate in the project, but perform work other than the organization being compared [17]. It is important for manufacturers of building materials and contractors to understand the needs of customers, while product consumers should be aware of existing technologies and project implementation methods. In order to establish long-term cooperation in the field of knowledge exchange between many organizations, it is important to create a platform within which organizations that perform various functions in the value chain of products can freely and efficiently offer innovative ideas and ways to implement them.

Moreover, cooperation in the construction industry is impossible without interaction with the labor market, government agencies and civil society [17]. In the framework of the digital transformation of construction, an important task is to increase the awareness of potential employees about the innovative development of construction organizations in order to attract personnel with professional competencies in the field of digital transformation.

Interaction with the public is also one of the conditions for the successful digital transformation of investment and construction activities. The final consumers of construction products are citizens who value safety and a comfortable environment. When implementing investment and construction projects, especially those that include the construction of infrastructure facilities, an integral requirement is cooperation with the public in order to develop design solutions that suit citizens who are affected by the project implementation process.

Even at the stage of designing objects, it is possible to take into account the expectations of the society about the preferred ways of transporting building structures, their storage locations; interaction with citizens at the construction stage dispels speculation and fears about the progress of the project, and also helps to increase public support for the project.

Based on the analysis of the existing practice of digital transformation and assessment of the main directions of digital development of construction, a mechanism for intensifying the digital transformation of the interaction processes of investment and construction activities in Russia is proposed (Figure 2).

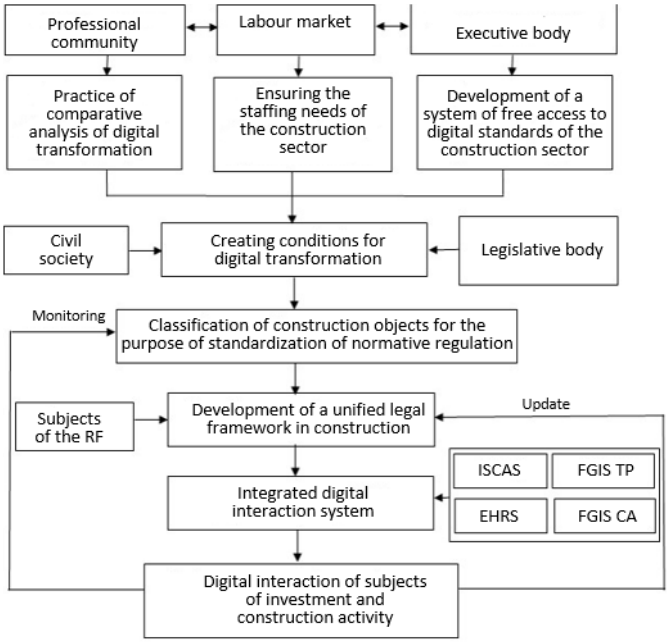

Fig. 2. The mechanism of digital transformation of investment and construction activities intensification in Russia

In our opinion, the transition to digital construction requires the transformation of investment and construction activities based on the intensification of cooperation between all institutions of the construction sector of the economy. Separate digital platforms are already being created, such as the federal state information system for territorial planning, the federal state information system for pricing in construction, the information system for providing urban planning activities, the unified state register of expert opinions on design documentation for capital objects construction and other regional digital systems, which generally leads to the creation of a single integrated systems of digital subjects interaction of investment and construction activities with government bodies.

IV. Discussion

In Russia, most of the construction industry organizations that are gradually implementing a digital transformation strategy relate either to full-cycle organizations that have enough resources to implement digital technologies, or to design organizations that perform work only at one stage of the life cycle. Moreover, construction is often considered an area that does not seek to introduce innovative technologies and modern ways of doing business, and a change in this view through active cooperation with the labor market in order to improve the image of the industry is required.

Digitalization requires staff to increase competencies in the field of digital technologies, improve cognitive and socio-behavioral skills [19]. Russia took 53rd place out of 119 participating countries in the Global Talent Competitiveness Index (GTCI) in 2018 [20]. Such results are associated both with problems of a general economic nature (insufficient efficiency of government and the interaction of the state and business, bureaucratic difficulties in doing business), and with a lack of personnel capable and willing to conduct professional activities in the digital economy.

Digitalization of the economy will lead to the "polarization of qualifications" in the next decade: High-skilled and low-skilled workers will become the most demanded, while personnel with an average level of qualification will become less demanded [19]. Digital technologies are devaluing some previously important skills and abilities, and employees such as accountants, analysts, and other administrative staff are becoming less and less necessary due to their gradual replacement with digital tools. Digital transformation in construction leads to the emergence of new professions such as the architect of "smart" houses, a specialist in the modernization of building technologies, a designer of 3D printing in construction, a specialist in the reconstruction and strengthening of old building structures [21].

A study by the "Competitor" showed that in 2019 only 22% of organizations in the investment and construction sector use information modeling technologies, and this indicator has not changed since 2017 [22], which may be due to a decrease in investment in fixed assets of investment and construction companies, which observed since 2015, as well as a decrease in the volume of work in construction in the same period, subject to inflation, which led organizations to choose strategies to minimize costs and, accordingly, reduce costs on the introduction of digital technology [23].

The most important reasons for the introduction of BIM organizations include an increase in the efficiency and quality of production, as well as an increase in competitive advantages. As a result of the introduction of BIM-technologies, organizations have achieved the following advantages: higher quality of projects was achieved (74% of respondents), the degree of understanding the design decisions by all project participants increased (72% of respondents), data on the construction object became more accessible, information transfer accelerated (61% of respondents), design time decreased (46% of respondents) [22].

The main obstacles to the implementation of information modeling technologies are the lack of qualified personnel in this area, the high cost of implementation, the lack of a complete system of state standards and a legal framework for implementing projects using BIM-technologies, as well as the lack of customer requirements to apply BIM [22]. Note that the above barriers to the spread of information modeling are infrastructural in nature, affecting the entire investment and construction sector.

Thus, the dynamics of the situation with the introduction of BIM in Russia over the past 2 years shows that more and more organizations consider BIM a tool to increase business efficiency and increase competitiveness. At the same time, the problems of the lack of qualified personnel for working with BIM and the high cost of software were aggravated [18, 22].

V. CONCLUSION

The labor market, the professional community and society to a large extent form the conditions for creating an effective mechanism of digital transformation. In Russia, BIM-technologies are the basis for the digital transformation of the construction industry, and the priority tasks for the digital development of construction are to improve the regulatory framework for the application of these technologies. However, only these measures for dissemination of BIM-technologies will not allow achieving the goals of national projects. The development of truly relevant measures taking into account modern requirements of construction production is possible only if there is feedback from the direct participants in the construction market.

Currently, the main problems hindering the digital transformation of the investment and construction sector in Russia are the lack of a formed regulatory and technical base in information modeling of buildings and structures, the lack of qualified personnel with skills in digital technologies, and the lack of interest of all organizations in digital transformation at the level of individual subjects of investment and construction activities.

We believe that the basis for a successful digital transformation of the investment and construction industry is the adoption of creating construction products of new standards for digital interaction based on elements of the digital economy by all participants. Effective digital transformation requires the interaction of construction sector organizations with the public sector in order to jointly develop industry standards, discuss emerging regulatory conflicts, since the opportunities offered by an open dialogue with the authorities are fully realized only with the private sector's constant cooperation with state bodies.

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