Russian practice of using digital technologies in public procurement management in the construction industry

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Abstract. The article discusses the relevance of the public procurement management system in the construction industry under conditions of digital economy. The main approaches to the formation of an effective mechanism of state management of the procurement system in construction industry taking into account the peculiarities of digital economy are disclosed. It is shown by the example of international experience that the transition of the public procurement system to digital technologies provides a number of competitive advantages to participants in the investment and construction market. The main procurement functions performed by the public procurement management tools using digital technologies are systematized. The features and practical aspects of public procurement management in the construction industry using digital technologies are considered. The most successful implemented projects in the field of procurement management for state needs are presented. The author formulates the main directions for improving the implementation of modern public procurement tools in construction in conditions of the digital economy.

1. Introduction
The economic growth of the country as a whole and the effectiveness of the construction sector in particular depend on an efficiently built procurement system for state and municipal needs. Construction is a strategic industry, which is entrusted with the priority tasks of building potential for the development of national economy, among other things through funding from the budget system. The public procurement system is a priority mechanism for generating demand for innovation. The construction sector has significant potential for targeted project support for economic development. The state as a subject of the investment and construction market places orders and purchases of goods and services, while investing and financing enterprises in the construction industry, ensuring sustainable development of business activities. Thus, the state order is a powerful market tool for regulating socio-economic development.

The main role in the strategic state management of the construction sector is played by the effective implementation of the mechanism for managing public procurement system. The result of functioning of the public procurement system that is harmonious and well-organized from a regulatory and
technological point of view is the innovative growth, creation of new jobs, as well as development of small and medium-sized businesses in the construction sector.

The strategic importance of government orders in the structure of budget expenditures is proven by the international experience. The share of public procurement in the OECD countries averages 45% of GDP, it is more than 30% in Russia according to 2017 data and there is a tendency to increase [1].

According to the official website of the Unified Procurement Information System, the total amount of orders placed by the state and municipal customers of the Russian Federation (44-FZ) was equal to 7,113,744.0 million rubles in 2017 (118.16% by 2016), and by corporate state customers (223-FZ) — 27,041,203.7 million rubles (152.23% by 2016). At the same time the share of purchases for construction organizations to perform works at structures and construction operations in the field of civil engineering in 44-FZ amounted to 28% in 2017 [2].

Thus, the role of government procurement in the construction sector in Russia is significantly increasing. In general, procurement is one of the factors of growth of the national economy, playing an important role in the development and participation of small and medium-sized businesses in the economic development of the country and regions. Therefore, it is necessary to improve the quality of management in the construction sector by increasing the efficiency of the state as a subject of contractual relations. Procurement management tools for state needs in construction form the basis for the implementation of an effective fiscal policy and the provision of services in the public sector.

The relevance of effective management of public procurement in the construction sector is that it is necessary to increase the level of trust to the state among the participants in the investment and construction market. This, in turn, will stimulate the development of the construction sector, increase the return on budgetary funds and attract additional investments. Considering the above the transition to information support for the implementation of management tools of the state procurement system in the construction industry is relevant under the present day conditions of the digital economy.

2. Mechanism of state management of the procurement system in construction taking into account peculiarities of digital economy

The global changes in the world economic processes caused by the dictating role of the innovation and information factor against the background of the fourth industrial revolution contribute to the organization of Governments for the Future [3]. These circumstances lead to fundamental changes in the public administration system at all levels, which in practice is manifested in the development and implementation of public procurement infrastructure management tools for state and municipal needs using innovative information systems. The innovative approaches to implementation of public procurement are accompanied in the conditions of scientific and technological revolution by the transition to digital technologies. The digital economy is making global changes in the functioning of the public procurement system in the construction industry.

The use of digital technologies is fundamentally changing the approaches to managing public procurement in construction, the traditional government tools are being replaced by innovative ones that require maximum involvement from participants in the investment and construction market. These tools make it possible to increase the transparency of interaction in the procurement system for state needs changing the approach to doing business and organizing production relations in the construction industry. In this context the new requirements for communications, digital platforms, information systems and services are being formed. As a result, the ongoing modernization and the emergence of a new system of organization of the state order market forming the ‘smart’ procurement economics is natural [2]. At the same time, the state order management tools that take into account the peculiarities of digital economy require transformation of the existing institutional structure. It is advisable to study both theoretical and practical aspects of procurement management in a digital economy.

Thus, the task of increasing efficiency of the procurement management for state needs in the construction sector, ensuring the rational use of budget savings, and reforming procurement legislation requires the study of public procurement management tools. Increasing transparency and efficiency of
interaction, elimination of corruption in the implementation of competitive procedures is realized through the use of information technology.

The toolkit of public procurement management using electronic digital technologies requires implementation with the simultaneous adoption of a system of measures both at the federal level and at the level of participants in the investment and construction market. Digital public procurement management technologies per se cannot be implemented and function effectively without a clear and streamlined regulatory system. All participants in the investment and construction activities, including state, must change the way they organize their work within the supply chain in such a way as to assume obligations, enlist the support of management, and also change the management system. If the traditional practice of public procurement and competitive procedures does not conform to innovations, it is necessary to reorganize the existing procurement practices before introducing digital technologies.

Determining the level of integration between e-procurement solutions and existing information systems is a prerequisite for successful implementation of public procurement management tools. It is especially important to pay attention to digital financial management tools, in particular, those related to the work with electronic invoices – payment processing systems for suppliers and sellers in real time. The solution of the assigned tasks requires analyzing business processes, evaluating the obtained benefits based on the developed key performance indicators, which is important for maintaining the business model of these systems. The users and their level of awareness have a decisive influence on the development of e-procurement systems as a priority way to purchase goods.

The digital public procurement management tools should be implemented in such a way that buyers and sellers have the opportunity to exchange information and electronic documents online. To do this, it is necessary to apply general standards both for conducting communications and creating and using a common procurement data format. The introduction of digital public procurement management tools in an open environment will ensure their compatibility with other systems for further improvement. The peculiarities of the legal nature of government orders and payments require that the government procurement instruments are provided with mechanisms for identifying and authenticating users who place orders (electronic signatures).

In modern conditions companies aim to apply digital technologies for more efficient, predictable, transparent and secure supply management. The latest public procurement management tools allow providing up-to-date information on the status of customer needs, close agreements with sellers on the automatic shipment of materials when the customer’s stocks reach the bottom. This also applies to the request for quotations, where buyers can track incoming offers prior to selecting a supplier. Procurement using the real-time digital technology provides predictability as sellers know what to expect and can analyze the progress of an order, as well as track the status of goods. The product is displayed in the system as delivered, accepted and processed for payment, while the seller does not need to call and request information in the accounting department. The electronic exchange and storage of data instead of using paper documents contribute to the increased transparency and accuracy.

3. Role of digital technologies in the development of competition
The world experience suggests that the transition of purchases into electronic format is a global trend, characteristic not only of the Russian public procurement system. The transition to full digitalization of procurement by the end of 2018 is provided for by the European Union Procurement Directive within the framework of the Europe 2020 strategy. According to this regulatory document, the legislation of the countries of the Union should be unified, and government procurement should be formalized and fully digitized [4, 5]. A legislative support of the transition of public procurement to electronic format is a prerequisite for further development of the procurement system using digitalization tools.

The digital technologies in international trade transactions are subject to the relevant legal and regulatory framework. Most of the world trade participants have adapted their national legislation to
innovative changes in the digitalization of the procurement system. In particular, UNCITRAL has developed the Model Law on Electronic Commerce, the Convention on the Use of Electronic Communications in International Contracts and the Model Law on Electronic Signatures [15].

Through CEFACT, UNECE have adopted recommendations aimed at ensuring the legal security of transactions of participants in the international trade relations. This concerns Recommendation No. 26 and Recommendation No. 31 containing sample agreements between trading partners [15]. These regulations also provide for the need to adapt national legislation to the peculiarities of electronic data interchange in international trade agreements, as well as the use of electronic signatures. The UNECE Recommendation No. 32 sets out a Code of Conduct for the exchange of electronic trade documents [15].

The modern digital technologies are widely used at the international level to reduce costs and improve the efficiency and transparency of public procurement processes at the level of governments and state enterprise suppliers. Figure 1 shows the main examples of these systems.

![Figure 1. Digital technologies in the public procurement management system.](image)

The main procurement functions that are performed by public procurement management tools using digital technologies are shown in table 1.

| Procurement function                           | Description and benefits                                                                 |
|-----------------------------------------------|-----------------------------------------------------------------------------------------|
| **Online applications**                       | formed to create and approve purchase requisitions, and place purchase orders using software based on digital technology and the Internet |
| **Selection of suppliers in real time**      | allows to identify new suppliers with specific procurement requirements using digital online technologies. For example, it is possible to create 'electronic catalogs' of goods and services, as well as a database of suppliers |
| **Electronic tenders**                        | they work on the basis of the mechanism for placing notifications about electronic tenders and electronic requests for accepting bids, receiving tender bids and offers and informing about the assignment of contracts to participants in the online mode |
| **Electronic reverse auctions**               | allow to receive, evaluate offers and tender bids, as well as organize the purchase of goods online, which may not necessarily be an element of the electronic bidding system |
Procurement function | Description and benefits
---|---
**Electronic administration** | the main purpose is to collect and distribute information on procurement among participants in procurement operations, tracking and receiving goods, and conducting electronic payments. The integration of these functions in the financial system of the buyer allows to work with electronic invoices

Thus, digital public procurement management tools allow to automate and expand traditional buying and selling operations, from the moment the order is created to payment to suppliers. These tools include operational ordering systems, online platforms (e-markets), suppliers' websites.

Digital tools for managing public procurement in the construction industry (electronic trading systems, online stores and electronic trading platforms, mobile applications, B2B marketplace and others) make it possible to technically resist abuse, inefficiency of budget spending, and corruption in public procurement. The public procurement management tools in construction are based under the present-day conditions of development on the advanced information technologies and a ‘smart’ procurement system using blockchain technology, smart contracts and neural networks [6].

‘Smart’ contracts are arranged in such a way that suppliers are provided with an automatic return of the enforcement of the contract (pledge) and the crediting of funds to their accounts according to the results of established procedures. Smart contracts are also effective in purchasing from a single supplier and are organized in such a way that based on the built-in algorithms, the system selects the best product, job, service and automatically concludes a contract according to the set parameters. The use of the ‘smart contract’ digital technology is innovative and contributes to fundamental changes in the system of legal regulation of procurement activities [7].

4. Practice of public procurement management in the construction industry
The digital products allow solving a number of problems related to the functioning of the public procurement management system in the construction industry at the level of interaction of participants on the investment and construction market giving them the following competitive advantages:
— greatly simplify the access of small and medium enterprises to procurement;
— provide an ability to create and automatically update a single supplier profile;
— allow optimizing the operating costs of large certification centers, significantly increasing efficiency, informational transparency and safety of the construction sector.

In the international and Russian practice the developed digital solutions are used to optimize the public procurement management process (table 2).

Table 2. Basic digital technologies used to improve the efficiency of public procurement management.

| Digital technology | Description of implemented projects |
|---|---|
| **Blockchain network** | implemented project of the first in the world electronic auction based on the blockchain technology for organizing the process of selling confiscated property in Ukraine [8] |
| **Service for verification of government procurement documentation** | the project was developed and implemented by the *Megafon* mobile operator and works as a legal digital interface, which purpose is to ensure participation in a tender without a lawyer, checking tender documentation and filing a complaint, if necessary [9] |

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Analysis of procurement within one hour
| Digital technology                                      | Description of implemented projects                                                                 |
|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| Neural networks and artificial intelligence algorithms | a project of Gazprom using the Antirutina Corporation system (a set of advanced technologies and algorithms based on neural networks, genetic stabilization and mathematical modeling), which purpose is to catalog their purchases in order to avoid the formation of the so-called ‘administrative catalog’, minimizing the risks of erroneous forecast, increased transparency and manageability in procurement [10] |
| Information and analytical system of remote conduct of external state audit | a project developed and implemented by the Auditing Chamber, which goal is to automate control with the function of tracking violations, among other things through the use of algorithms and procurement intelligence analysis systems [11] |

The reform of the public procurement contract system and the digitization of procurement activities have been completed in present-day Russia. The electronic auction was the only electronic procedure under the contract system until the end of 2017 [12, 13]. The remaining procedures — tenders (and their varieties), quotation requests, requests for proposals and purchases from a single supplier — are still conducted in the ‘paper’ format.

Digitization of the public procurement process is gradually being carried out at all levels of procurement cooperation. In 2018 the organization of procurement from small and medium-sized businesses was radically transformed. The electronic trading platform (ETP) TEK-Torg functioning in Russia must be in accordance with the requirements for the ETP operating under Federal law No. 44-FZ developed by the Ministry of Finance. It is based on the proposals developed by TEK-Torg at the end of 2016 together with the platforms for the state order — Sberbank-AST, UETP, NEP, RTS-Tender and the Tatarstan State Order Agency [21].

After the approval of the Digital Economy of the Russian Federation program since summer of 2017 the digitalization of procurement activities has also affected the construction industry. The changes in legislation only secured practical procurement management tools, especially for commercial companies. The transfer of purchases from small and medium-sized enterprises to electronic form allowed the existing practice to switch to the federal level [21].

The digital tool considered requires the development and implementation of new services. The ETP should be a full-cycle infrastructure to fully meet the needs of users, namely, provide an opportunity for suppliers or customers to enter into purchase and sale transactions, obtain a loan, bank guarantee, conclude an agreement and send necessary data to the regulatory authorities. Thus, the work of TEK-Torg is consigned to the creation of a digital procurement process. TEK-Torg has already concluded an electronic contract, purchases through an online store with a catalog of goods, works and services, a system of analytics of procurement procedures with details up to item positions. In 2018, an electronic legally significant document flow between customers and suppliers is tested, a supplier’s digital profile is created, a system of recommendation procedures for suppliers is automated and other developments are carried out [21].

TEK-Torg pays special attention to cooperation with small and medium-sized businesses. Together with this electronic trading platform, the SME Corporation implements a program to expand the share of participation of small and medium-sized enterprises in public procurement in the construction sphere of federal and regional customers. To this end, measures are being taken to organize training seminars for entrepreneurs in the constituent entities of the Russian Federation to simplify access and to attract small and medium-sized enterprises registered on TEK-Torg to participate in procurement. Besides, in order to stimulate the participation of these enterprises in the procurement on TEK-Torg they were offered a package of special tariffs. As a result of the use of this management tool the representatives of small and medium-sized enterprises accounted for 80% of suppliers in all existing sections of the platform. The share of small and medium-sized enterprises in the total amount of all awarded contracts is 59.5%, and in cash equivalent it equals 28.9%. According to the forecasts of
The use of blockchain technology in Russia in the field of procurement for state needs began in 2017 after completion of testing the system of unified accreditation of procurement participants on all electronic platforms admitted to trading in accordance with Federal law No. 44-FZ On the contract system in the field of procurement of goods, works and services for public procurement and municipal needs dated 05.04.2013 and Federal law No. 223-FZ On the procurement of goods, works, services by certain types of legal entities dated 18.07.2011. The system was developed and operates on the basis of the MultiChain software; the customer and the project development agency is the information technology directorate of the federal electronic platform for state, municipal and corporate procurement RTS-Tender [14].

The system is based on the principle of a single distributed registry based on blockchain technology, which provides for multiple verification of data and does not allow unauthorized changes. The online platform can be unlimitedly connected by all electronic platforms operating under laws 44-FZ and 223-FZ for free. The opportunities of suppliers will be significantly expanded through participation in government and corporate procurement with the help of a system of unified accreditation of all digital sites.

The development of digital technologies in the construction industry on the blockchain basis is a part of the investment program of the RTS-Tender online platform. A project is envisaged within the framework of this program for implementation of system for the intellectual analysis of a large amount of data from the procurement market. This decision fundamentally changes the traditional approaches to identifying and analyzing the reliability of suppliers, increases the efficiency and accuracy of decision-making on the implementation of a set of related financial products and services that simplify participation in the procurement activities of participants on the construction market.

Thus, the use of blockchain technology in the RTS-Tender project provides a guaranteed and reliable interconnection of heterogeneous data sources for analysis into a single information array that makes the basis of the unified accreditation system.

The electronization of the procurement process is regulated by Federal law No. 223-FZ dated 18.07.2011 On the procurement of goods, works, services by certain types of legal entities and Federal law No. 44-FZ dated 05.04.2013 On the contractual system in the field of procurement of goods, works, services to ensure state and municipal needs as amended. At the same time, all purchases were transferred to electronic format in order to improve the organization of procurement, reduce the number of ‘latent’ procedures disguised as competitive, prevent corruption and increase transparency and accessibility in procurement [19, 20].
5. Conclusion
The digital technologies have a significant impact on the transformation of public procurement procedures. The procurement management tools make it possible to simplify trade procedures and increase transparency and confidence in the process of information exchange between participants on the investment and construction market.

Thus, the elimination of bureaucratic restrictions and an increase in procurement management efficiency for state needs is possible subject to the comprehensive digitalization of the contract system in the field of public procurement of goods, works, services, and simplification of the process of providing public services. The procurement management tools require creation of customer-oriented management systems, selection of the most promising ideas and the best development practices, the formation of a feedback system, the selection and synthesis of feedback and suggestions.

The prospects for the development of public procurement management tools in construction should be as follows in the coming years: approval of a new list of sites for 44-FZ and privatization; the redistribution of market shares between the existing players; reduction of the number of digital platforms in the next 2 years; strengthening the role of the UIS in 44-FZ; maintaining strong competition for the customer; growth of new players, including those employed in the field of state defense orders; the emergence of new digital services in the industry: machine learning, provider’s digital profile, demand automation and planning. And the complete transition of purchases for state needs in the construction sector to digital technologies is the global trend.

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