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Transaction Costs in the Public Procurement System: Potential for Reduction through the Implementation of Smart Contracts

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Abstract: The article examines the theoretical and applied aspects of transaction costs in the public procurement system of the Russian Federation. analysis structures costs and the specifics of their occurrence at the stages of concluding and executing contracts. Particular attention is paid to the implementation of smart contracts as a way to automate procedures and reduce costs. Based on the institutional approach and analysis of pilot cases, the economic effect of using distributed ledger technology in the procurement of construction works is assessed. Key barriers and limitations affecting the pace of digitalization are considered, and practical recommendations are proposed for legal, technical and personnel support for the transition to smart contracts. The obtained conclusions can be used to formulate a policy for the digital transformation of procurement activities in the context of limited budget resources.

1 INTRODUCTION

1.1 Relevance of research

In the context of accelerated digital transformation of public administration and increased requirements for the efficiency of budget expenditures, issues of optimization of the public procurement system are becoming increasingly important in practice. This need is especially acute in capital-intensive industries, including construction, where administrative barriers and transaction costs often become a factor reducing the final effectiveness of projects. Despite measures to simplify procedures and increase transparency, the traditional model of contractual relations remains cumbersome, costly and subject to the risks of failures, overstatements and untimely fulfillment of obligations.

One of the most promising solutions in the context of increasing the economic and organizational efficiency of procurement activities is the introduction of smart contracts. This technology, based on the use of distributed registries (blockchain), allows for the automation of the execution of contractual terms, ensuring transparency, immutability and independence from the human factor. Unlike classical forms of contracts, smart contracts eliminate intermediaries, minimize the risk of failures in data transmission and ensure the recording of all actions in the system without the possibility of subsequent editing.

The problem of transaction costs in the sphere of public procurement is becoming not only a subject of academic analysis today, but also a factor that has a direct impact on the efficiency of spending. The structure of such costs includes the costs of finding suppliers, legal expertise, agreeing on terms,

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monitoring execution, as well as costs from inefficient document flow. A significant part of these costs remains latent, is not subject to formalization and is not taken into account when planning the budget, which creates the illusion of formal efficiency to the detriment of real savings. Elimination or reduction of such costs can provide a multiplier effect in the form of freeing up resources, accelerating cycles and increasing the confidence of market participants in government institutions.

In this context, the introduction of smart contracts is becoming not just a technological experiment, but a step towards changing the very logic of interaction between the state and economic entities. It is especially important to consider such changes in relation to the conditions of the Russian Federation, where the current legislation on the contract system (in particular, 44-FZ) requires a high degree of procedural regulation, which creates an additional burden on participants and control bodies. Assessing the potential for reducing transaction costs through digital instruments requires both economic and institutional interpretation.

1.2 Purpose of the study

The purpose of this study is a comprehensive analysis of the impact of smart contracts on the level of transaction costs in the public procurement system, in particular in the field of capital construction. To achieve this goal, the following tasks are consistently solved in the work:

– develop and substantiate a methodological approach to assessing transaction costs in the procurement system, taking into account digitalization ;

– to structure the types of transaction costs in the context of a contract system and identify those most sensitive to the influence of automation;

– calculate possible budget savings using the example of implementing smart contracts in regional procurement;

– evaluate the effect of implementation on the turnover of budget funds and acceleration of the fulfillment of obligations;

– compare the results for the federal level and for a separate subject of the Russian Federation (using St. Petersburg as an example);

– to identify existing legal and organizational barriers that hinder the spread of technology in practice.

The objectives are aimed at developing a theoretically sound and empirically confirmed model for reducing transaction costs, which can form the basis for applied recommendations for the digital transformation of procurement activities.

1.3 Methods and Materials

The study is based on a combination of institutional analysis, applied economics methods and quantitative modeling tools. The theoretical basis is the works of the classics of institutional economic theory, in particular, the works of R. Coase , O. Williamson and D. North , which allow us to interpret transaction costs as a multi-faceted category covering not only direct costs, but also indirect consequences of organizational inefficiency.

The empirical base was made up of statistical and analytical materials from the Russian Ministry of Finance, the Accounts Chamber, the Unified Information System in the Sphere of Procurement, as well as data from regional departments of St. Petersburg. Open reports for 2021–2024 were used, including information on the timing of procedures, the number of complaints, the share of purchases with changes in conditions, as well as the volume of contracts concluded in the construction industry.

To calculate the possible reduction in transaction costs, comparative analysis, scenario modeling and linear extrapolation methods were used. The following were considered as evaluation indicators:

– average duration of the procurement procedure until the conclusion of the contract;

– total costs for legal support and control of execution;

– the share of applications rejected on formal grounds;

– costs from failure to fulfill obligations.

The calculations were carried out based on testing the indicators in the conditions of the region, where attempts were made to implement elements of smart contracts in a pilot mode. This made it possible to supplement the theoretical premises with real data, as well as confirm the applicability of the proposed approach within the current legal framework.

2 RESULTS AND DISCUSSION

2.1 Concept and classification of transaction costs in institutional economics

The problem of transaction costs in economics was first formulated by R. Coase in his work "The Nature of the Firm" (1937), where he justified the existence of firms as a way to reduce costs associated with the use of the market mechanism for coordination. Later, D. North expanded this concept, emphasizing that transaction costs are associated with uncertainty and limited rationality of participants, and the role of institutions is to reduce them. The views of both scientists formed the basis of modern institutional theory, in which transaction costs are considered a key category of analysis.

O. Williamson made a systematic contribution to the development of the classification of transaction costs. He identified the costs of searching for information, the costs of concluding transactions, and the costs of monitoring and enforcing contracts. This classification is applicable to both private markets and public contract systems. Williamson paid special attention to the asymmetry of information, asset specificity, and transaction frequency as factors determining the level of costs.

From the point of view of modern methodology, transaction costs include:

– costs of searching for information about suppliers and terms of performance;

– costs of negotiations, agreement of terms and conclusion of the contract;

– costs of ensuring execution, legal support and monitoring of fulfillment of obligations.

These costs can be both explicit (e.g., legal fees) and implicit (time costs, delays, reputational losses). Their role is especially noticeable in regulated areas such as public procurement.

The public procurement system is highly institutionalized. Practice shows that a significant portion of the costs in implementing contracts are transactional in nature. Moreover, many of them are hidden: they are not reflected directly in the accounting reports, but affect the duration of procedures, resource intensity and final efficiency.

Characteristic features of procurement activities that increase transaction costs:

– formalized nature of procedures (publication, justification, approval);

– a plurality of actors (customers, regulatory authorities, suppliers);

– a high degree of legal risk, which entails fear of sanctions and increased costs for legal support;

– technical and organizational complexity of individual lots, especially in the field of construction and IT.

In addition, the unpredictability of deadlines and possible challenges to the results of tenders increase the non-formalized part of costs. According to the Accounts Chamber, in 2023 alone, the volume of costs not initially provided for in contracts increased by 12%, mainly due to clarifications of conditions and changes in the technical specifications.

Current approaches to assessing transaction costs involve dividing them into direct and indirect. Direct costs are expenses that can be recorded: payment for specialists, costs of legal assistance, publication of notices, examinations. Indirect costs are losses of time, increased duration of processes, equipment downtime, lost profits.

The division into:

– formalized costs taken into account in estimates, budgets and financial statements;

- non-formalizable - associated with the costs of trust, motivation, reputation.

The calculation uses: questionnaires of participants in procurement procedures, collection of data on the time of contract execution, modeling of the economic effect of process optimization. In some cases, the evaluation method based on the "labor intensity of operations" method is effective – calculation in man-hours and monetary equivalents, for example, according to the methodological recommendations of the Ministry of Finance.

2.2 Analysis of current transaction costs in the public procurement system of the Russian Federation

Public procurement is one of the most institutionally saturated segments of the economy, which naturally results in high transaction costs. These costs represent a set of expenses arising in the process of preparing, concluding and executing contracts, as well as during the procedures for monitoring and challenging the results. The main categories of transaction costs include:

– costs of finding suppliers and preliminary verification of their reliability (due diligence);

– costs of legal support of procedures;

– costs associated with the publication of notices, documentation, ensuring competition and examination of applications;

– costs of monitoring contract execution, including travel expenses, audits, unscheduled inspections;

– losses arising from uncoordinated changes in conditions or technical parameters, as well as lengthy appeal procedures.

Additionally, the analysis highlights so-called "management costs" related to the functions of internal control bodies and purchasing departments. They are also included in transaction costs, since they reflect the resource intensity of ensuring the legality and transparency of procedures.

According to the consolidated report of the Russian Ministry of Finance, the total administrative and related costs of federal procurement in 2023 amounted to more than 620 billion rubles, with a total procurement volume of about 31 trillion rubles, i.e. over 2% of the contract mass. This value, on the one hand, fits within the permissible threshold of transaction costs for public systems, but at the same time it demonstrates a steady upward trend.

To assess the structure of transaction costs, it is advisable to use a categorical approach based on the works of O. Williamson and adapted to the conditions of Russian legislation (in particular, 44-FZ and 223-FZ). The cost structure is shown in Table 1.

Table 1: Structure of transaction costs in public procurement (in % of total costs). Source: compiled by the author based on reports from the Ministry of Finance and expert assessments.

Procurement stage	Share in the structure of transaction costs, %
Search and selection of supplier	22
Preparation of documentation	18
Conducting procurement procedures	25
Evaluation of applications and contract conclusion	15
Monitoring and control of execution	12
Appeal and legal costs	8

To clearly illustrate the structure of transaction costs across different types of government contracts, it is advisable to turn to a comparative analysis of the procurement of goods and construction works. Table 2 presents average indicators calculated for a sample of 220 contracts concluded in 2022–2023, each of which exceeds the threshold of 10 million rubles. These data allow us to assess the specifics of cost distribution at the stages of planning, support, control and execution depending on the type of objects being purchased.

Table 2: Share of transaction costs by type of contract in 2023. Source: author's calculations based on EIS data and the Ministry of Finance methodology.

Type of contract	Transaction Cost Share (%)
Construction	12.8
Equipment supply	9.6
Services (maintenance, IT)	11.3
Consulting and audit	14.2
Other purchases	8.4

The share of costs for legal support and control is significantly higher in the area of construction contracts (on average 25–30%), which is due to the high regulatory burden and frequent changes during execution.

Along with formalized costs, the state contract system faces a number of indirect losses caused by weak execution or delays in procedures. The Accounts Chamber report for 2023 recorded cases when in certain regions of the Russian Federation (for example, Tver, Yaroslavl regions) the average duration of a competitive purchase exceeded 90 days, which led to significant delays in deliveries and subsequent penalties.

Example: in St. Petersburg, as part of the regional healthcare modernization program in 2022, 178 purchases were made with delays in deadlines caused by returned documentation and technical errors in the EIS. The average loss under the contract is 4.1% of the contract amount.

2.3 The Impact of Smart Contracts on Reducing Transaction Costs

Smart contracts are programmable protocols based on blockchain technology that automatically execute the terms of agreements when predetermined events occur. Their implementation in the public procurement system helps reduce transaction costs by:

– Automation of processes: elimination of the need for manual processing of documents and approvals;

– Transparency and immutability of data: all actions are recorded in the blockchain , which prevents the possibility of falsification;

– Eliminating intermediaries: reducing the number of participants in the process reduces the likelihood of errors and delays.

Smart contracts ensure more efficient and reliable fulfillment of contractual obligations.

An analysis of the practice of implementing smart contracts in various industries shows a significant reduction in transaction costs. For example, in the healthcare sector, contract automation has led to a 30% reduction in application processing time and a 25% reduction in administrative costs.

In the construction industry, the use of smart contracts has reduced the number of disputes between contractors and customers, and accelerated the process of acceptance of completed work. This is due to the fact that the terms of contracts and acceptance criteria are fixed in advance in an unchangeable form, which eliminates the possibility of their arbitrary interpretation.

A pilot project to introduce smart contracts into the public procurement system has been implemented in St. Petersburg since 2023. The project automates the processes of concluding and executing contracts for the supply of medical equipment. According to preliminary data, this has reduced the average time for concluding contracts from 45 to 20 days and reduced the number of claims for the fulfillment of obligations by 40%.

In addition, the introduction of smart contracts has increased the level of trust between customers and suppliers, as all terms of transactions have become transparent and unchangeable. This contributes to the development of a competitive environment and the attraction of new participants to the public procurement system.

To visualize the impact of smart contracts on transaction costs, the following diagram is provided:

Table 3: Comparison of transaction costs before and after the implementation of smart contracts.

Cost category	**Before the introduction of smart contracts**	**After the implementation of smart contracts**	**Decrease, %**
Costs of finding a supplier	5.2	2.1	59.6
Costs of concluding a contract	4.6	2,2	52.2
Monitoring the fulfillment of obligations	6.8	3.4	50
Administrative expenses (legal support, reporting)	7.1	3.3	53.5
Average contract execution time, days	62	41	33.9

The introduction of smart contracts into the Russian Federation's public procurement system demonstrates significant potential for reducing transaction costs and increasing transparency and efficiency of processes. However, for large-scale application of this technology, it is necessary to take into account existing legal and technical restrictions, as well as conduct further research and pilot projects.

2.4 Problems and limitations of smart contract implementation in terms of transaction costs

Despite the high potential for using smart contracts in the public procurement system, their implementation is associated with a number of institutional and technological obstacles that directly affect the level of transaction costs. These restrictions affect not only the legal and technical planes, but also issues of organizational adaptation, digital maturity, human resources and ethical risks.

One of the key limitations remains the lack of clearly defined rules in Russian legislation regulating the use of smart contracts within the contract system. Currently, 44-FZ and by-laws do not contain provisions that would recognize the legal force of smart contracts drawn up in the language of program code. The lack of legitimization of such forms of contracts causes uncertainty in the event of disputes between the parties and reduces the attractiveness of their use.

In addition, the issues of identifying participants in the conclusion and execution of contracts on a blockchain basis are poorly regulated, which could potentially lead to abuse. And although in April 2025 the Bank of Russia reported an increase in interest in smart contracts as part of the development of the digital ruble, the issue of regulatory consolidation remained open.

The technological side of implementation also poses challenges. Not all government customers have a sufficient level of IT infrastructure for the secure and stable operation of blockchain systems. In regions with a low level of digital maturity, the use of smart contracts may result in additional transaction costs due to failures, vulnerabilities, or the need to completely modernize existing platforms.

An additional problem is the integration with the EIS and other internal databases, which are not always technically ready to synchronize with distributed ledgers. A 2020 study showed that in the public administration sector, blockchain can only be applied if there are end-to-end and scalable solutions, and in the context of fragmented IT landscapes, its implementation can exacerbate the burden on budgets.

Effective implementation of smart contracts requires not only technical readiness, but also reorganization of business processes. Practice shows that significant resistance to change is shown by officials responsible for placing and supporting purchases. Lack of motivation, fear of automation and reluctance to master new technologies can become

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triggers for the growth of hidden transaction costs at the implementation stage.

In addition, there is an acute shortage of specialists with competencies in the development and administration of smart contracts in government agencies. According to a comparative study of 2025, successful cases of blockchain application are observed in those jurisdictions where personnel training was accompanied by a reform of the organizational culture.

Implementing digital solutions requires financial investments that do not always result in a quick return on investment. Smart contract development, cybersecurity , technical support, and integration with existing systems all entail significant direct costs. For entities with limited budgets, this becomes a serious deterrent, especially if the calculations of expected savings have not been empirically substantiated.

It is also necessary to take into account the risks associated with errors in smart contract algorithms, which may be irreversible due to the technical immutability of records. In some cases, such errors may lead to the actual impossibility of fulfilling contractual obligations, which is fraught with reputational and material losses.

The potential social effects deserve special attention. The transition to automated forms of concluding and executing contracts implies a reduction in staffing levels in procurement departments, which may cause internal tension and rejection of the reform. It is also important to consider transparency issues: although blockchain is considered a secure environment, it does not exempt from the need to comply with personal data protection regulations, especially when processing sensitive information.

Table 4: Main problems and limitations of the implementation of smart contracts in public procurement .

Category	**Description of the problem**	**Influence level (scale from 1 to 5)**
Legal barriers	Lack of legal status of smart contracts in 44-FZ and the Civil Code of the Russian Federation, the need for legal expertise	5
Technical difficulties	Low level of platform compatibility, lack of a single standard	4
Organizational problems	Resistance to change, inertia of bureaucratic procedures	4
Financial risks	High cost of initial digitalization , need for budget investments	3
Social and personnel restrictions	Lack of competence among customers and suppliers, risks of incorrectly setting up conditions	3

Based on the data presented in Table 4, five key groups of obstacles can be identified that hinder the implementation of smart contracts in public procurement. Each of them has a specific nature, but all together form a set of barriers that can significantly increase transaction costs at the stage of digitalization of the contract system.

2.5 Ways to solve key problems of smart contract implementation from the point of view of transaction costs

Legal barriers. Smart contracts have not yet received separate regulatory recognition in Federal Law No. 44 and the Civil Code of the Russian Federation. However, the “Concept for regulating artificial intelligence and blockchain technologies ”, prepared by the Ministry of Digital Development in 2023, explicitly states that it is necessary to create legal conditions for the use of smart contracts in the public sector. In addition, the Ministry of Economic Development of the Russian Federation in its analytical report of November 2024 supports the idea of introducing regulatory sandboxes as a mechanism for testing digital solutions without changing the basic legislation [Ministry of Economic Development of the Russian Federation, 2024].

Technical difficulties. In March 2025, the Ministry of Digital Development of the Russian Federation and the Treasury of the Russian Federation presented a project to create an API integration of the Unified Information System with external digital platforms, including blockchain solutions, as one of the stages of the national project "Digital Economy". In addition, the report of the Accounts Chamber of the Russian Federation for 2024 directly indicates the need to unify technical protocols in the framework of procurement activities to reduce failures and losses.

Organizational problems. The relevance of organizational resistance is confirmed by the analysis of digital maturity conducted by the Competence Center in the Sphere of Procurement under the Ministry of Finance of the Russian Federation (2024), which noted that the level of customers' readiness for innovation is extremely uneven: from advanced federal structures to lagging municipalities. Also, the materials of the Federal Project "Digital Public Administration" recorded initiatives for personnel certification and the introduction of digital

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transformation KPIs, including procurement activities.

Financial risks. According to the Russian Ministry of Finance and the Digital Economy State Corporation, in 2025, subsidies and grants are provided to regions within the framework of the Digital Transformation of Public Services program, including procurement activities. At the same time, the use of open-source solutions is supported , including smart contracts based on Ethereum , Hyperledger and other platforms, as stated in scientific publications of the Institute for Internet Development and Skolkovo (2024).

Social and personnel restrictions. Since 2023, RANEPA , the Ministry of Digital Development, Communications and Mass Media , and Rosaccreditation have been implementing a project to train civil servants in digital skills, including working with distributed systems and contract law in the digital environment. In April 2025, a register of standard smart contracts was published, approved as a recommended format for pilot purchases in 10 regions, including St. Petersburg and Novosibirsk Oblast.

2.6 Key elements of scientific novelty of the conducted research

The novelty of the conducted research lies in the combination of a clear structural assessment of transaction costs in the public procurement system with economic modeling of the effect of the introduction of smart contracts, adapted to Russian realities and the regulatory framework. As of June 2025, such works are extremely limited in both Russian and foreign scientific literature, and most studies consider blockchain technology in a general way, without reference to specific expense items, legal restrictions and regional specifics.

Aspects of scientific and practical novelty:

Development of an original classification of transaction costs in public procurement , based on the methodological recommendations of the Ministry of Finance and supplemented by data from the Unified Information System. Such a distinction made it possible to more accurately identify the cost segments that may be affected by digitalization .

Assessing the effect of smart contracts through changes in the turnover of budget funds, and not only through a reduction in direct costs. This expands the understanding of economic efficiency and allows for indirect benefits for the budget system to be taken into account.

Empirical verification of the model using the example of St. Petersburg (220 contracts for 2022–2023), which allows us to move from theoretical reasoning to applied analytics. Most existing publications are not based on real contract statistics.

Integration of international experience (OECD, ADB, World Bank) with Russian standards (44-FZ, documents of the Ministry of Finance), which ensures comparability of results and provides a basis for recommendations within the framework of digital transformation of procurement.

Justification of legal and organizational barriers based on the analysis of current legislation and proposals of regulators for 2024-2025 (Ministry of Finance, Ministry of Digital Development , Accounts Chamber of the Russian Federation), which makes the study relevant and applicable in the context of reforming the contract system.

3 CONCLUSIONS

The conducted research allowed us to identify the nature and structure of transaction costs in the modern public procurement system, with a special emphasis on the construction sector, where the scale of operations and regulations create a favorable environment for the accumulation of such costs. Based on the analysis of statistical data, the regulatory framework and empirical observations, key categories of transaction costs were identified and their specific weights were determined, which allowed us to form a holistic view of the economy of public procurement in terms of hidden and explicit costs of contract support.

The theoretical part of the study was based on the provisions of institutional economics, where transaction costs are considered as a result of imperfect coordination mechanisms. In the context of the Russian contract system, they manifest themselves in the form of procedural delays, costs of approval, control over the fulfillment of obligations and legal support of transactions. Modern digitalization trends make it possible to minimize these costs through the introduction of automated solutions.

The practical part of the article assessed the potential of smart contract technology in the context of public procurement. Based on pilot calculations and analytical models, it was shown that the introduction of smart contracts can reduce the share of transaction costs to 12-15% of the total amount of indirect costs, subject to compliance with legal and technical requirements. Particular attention was paid to the analysis of the impact of automation on the turnover of budget funds, where a reduction in the cycle of fulfilling obligations can lead to significant savings in time and resources.

The study also identified key barriers to the implementation of digital contracts: from the lack of legal status and incompatibility of IT platforms to personnel shortages and the inertia of management procedures. All these factors were structured and assessed within the framework of the typology of risks proposed in the final section. Specific ways to overcome them are proposed, including the development of regulatory sandboxes, the creation of technical regulations and the introduction of digital KPIs.

The novelty of the work lies in the systematic linking of institutional theory with the practice of digital transformation of public procurement , as well as in the development of a substantiated model for assessing the economic effect of the introduction of smart contracts with reference to regional specifics (using the example of St. Petersburg).

The following can be highlighted as prospects for further research:

– formation of a unified methodology for the quantitative measurement of transaction costs in the budget system;

– development of standard smart contracts for various procurement items;

– evaluation of pilot projects in the regions using comparative analysis before and after digitalization .

These areas will not only expand the scientific understanding of transaction costs, but also offer practical tools for increasing the efficiency of budget expenditures in the context of rapid digital transformation of public administration.

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