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FINANCIAL CONTROL IN PUBLIC PROCUREMENT: CHALLENGES AND DIRECTIONS FOR THEIR RESOLUTION

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Abstract: This article examines the theoretical foundations of financial control in public procurement, its current challenges, and directions for addressing them. Systematic, comparative, correlation, and regression analyses reveal a positive relationship between the volume of competitive procurement and the amount of funds saved. Weak information exchange among oversight bodies, limited preventive control, and underdeveloped automated risk-analysis capabilities are identified as the principal challenges. To address them, the article proposes an integrated digital control model, an automated risk profile, a reference-price system, and a mechanism for monitoring the implementation of audit results.

Keywords: public procurement, financial control, public audit, risk-based control, digital monitoring, competitive procurement, reference price, public funds.

Аннотация: В статье рассматриваются теоретические основы финансового контроля в сфере государственных закупок, его современные проблемы и направления их решения. На основе системного, сравнительного, корреляционного и регрессионного анализа выявлена положительная взаимосвязь между объёмом закупок, осуществляемых конкурентными способами, и суммой сэкономленных средств. В качестве основных проблем определены недостаточный обмен информацией между контрольными органами, ограниченность превентивного контроля и недостаточная развитость автоматизированного анализа рисков. Для их решения предложены интегрированная цифровая модель финансового контроля, автоматизированный профиль риска, система референтных цен и механизм мониторинга исполнения рекомендаций по результатам аудита.

Ключевые слова: государственные закупки, финансовый контроль, государственный аудит, риск-ориентированный контроль, цифровой мониторинг, конкурентные закупки, референтная цена, государственные средства.

INTRODUCTION

The public procurement system is an important component of any country's fiscal and financial policy, through which a substantial share of public budget funds is allocated. International experience demonstrates that public procurement has become one of the key areas for strengthening transparency, accountability, and effective managerial decision-making, thereby emphasizing the importance of establishing a modern and efficient system of financial control.

In recent years, Uzbekistan has implemented comprehensive reforms to digitalize public procurement, introduce electronic procurement platforms, and improve control mechanisms. These reforms have strengthened institutional coordination among oversight bodies, enhanced the preventive role of financial control, and promoted the continuous development of results-oriented audit methodologies.

Accordingly, the primary objective of this study is to evaluate the progress achieved in improving the effectiveness of financial control in public procurement and to develop research-based proposals and practical recommendations for its further enhancement.

REVIEW OF LITERATURE ON THE SUBJECT

The problems of financial control in public procurement have been the subject of research by numerous domestic and foreign scholars. Existing studies have paid particular attention to the institutional foundations of financial control, the effectiveness of internal and external audit, risk-based control, digital monitoring, and the evaluation of procurement performance.

Research within the American school of thought places particular emphasis on assessing the effectiveness of financial control in public procurement and measuring control outcomes. U.S. scholars E. Boykin, R. Lofaro, C. McCue, and E. Prier proposed a systemic theoretical model for evaluating public procurement performance and substantiated the need to distinguish performance criteria from the perspectives of public- and private-sector interests. According to the authors, some indicators currently used in practice reflect formal or symbolic process outputs rather than the actual economic and social performance of procurement. Evaluation indicators should therefore be aligned with the levels of procurement management and the intended outcomes [1].

De Michele and Vieyra examine risk-based models of financial control in public procurement. Rather than applying control measures uniformly to all procurements, the authors propose planning them according to the level of risk. They emphasize the need to distinguish between *ex ante* control, ongoing monitoring, and *ex post* audit, while giving priority to high-risk procurements [2].

European studies have extensively examined the institutional structure of financial control, the independence of oversight bodies, and deficiencies in procurement-document management. Spanish scholars R. Pérez-Morote, J. Calleja-Lozano, and J.F. Santos-Peñalver analyzed risk factors in public internal control and demonstrated that weaknesses in the preparation and retention of procurement documentation reduce control effectiveness. Their analysis of financial-control structures in the defense sector identified the unclear allocation of oversight mandates, limited information exchange, and insufficient use of audit findings in managerial decision-making as the principal institutional problems [3].

Methodological recommendations developed by the World Bank and the Organisation for Economic Co-operation and Development demonstrate the direct influence of transparency, competition, integrity, and accountability on the effectiveness of financial control in public procurement [4]. These organizations recommend designing control not merely as a measure applied after a violation has occurred, but as a management mechanism for identifying and mitigating risks in advance throughout the procurement process [5].

Scholars from the CIS and other post-Soviet countries have extensively studied the organization of financial control in public procurement, the allocation of mandates among oversight bodies, and the improvement of the contract system. Russian economists V.V. Kikavets and Yu.K. Tsaregradskaya developed methodological foundations for organizing internal financial control in the public-order system and proposed a three-stage model consisting of *ex ante*, ongoing, and *ex post* control. This approach ensures the continuity of control measures and enables violations to be identified before a contract is concluded [6].

Ya.V. Kozhenko conducted a comparative analysis of different public procurement management models and the strengths and weaknesses of contract systems. This work provides a systematic description of the objects of public financial control, the mandates of oversight bodies, and the responsibilities of participants in the procurement process. Dissertation research undertaken at Ural Federal University and the Financial University has empirically examined the improvement of the financial mechanism of public procurement and the relationship between transaction costs and the savings achieved in regulated procurement [7].

Uzbek researchers B.I. Isroilov, U.Kh. Abduganiyev, and B.B. Ibragimov conducted a comparative analysis of scholarly approaches to public procurement monitoring and compliance control and developed a generalized characterization of financial-control methods. The authors substantiated ways of using financial-control instruments to prevent corruption and also examined the contribution of public procurement to sustainable development and practices for allocating budget funds [8].

The literature review shows that substantial research findings have been obtained on the institutional, methodological, and digital dimensions of financial control in public procurement. At the same time, the integration of preventive control, risk-based monitoring, algorithmic analysis, and performance audit within a unified system provides broad opportunities for further scholarly development. In the context of Uzbekistan, continued progress is being made in strengthening the scholarly and methodological foundations for coordinating the mandates of oversight bodies, integrating data, automatically detecting price anomalies, and evaluating contract performance using outcome indicators. These developments determine the scholarly significance of the present study, which seeks to assess the effectiveness of financial control in public procurement and propose research-based directions for its further improvement.

RESEARCH METHODOLOGY

The methodological framework comprises a systematic literature review, comparative analysis, content analysis, functional decomposition, logical generalization, and inductive and deductive methods.

International experience, research and practice-oriented materials on financial control in public procurement, official statistical reports, and the approaches of economists served as the objects of analysis in this study.

ANALYSIS AND RESULTS

To provide a quantitative basis for the theoretical approaches discussed above, a two-stage economic and mathematical model is proposed for evaluating the effectiveness of financial control in public procurement: (1) a method for constructing an integral (composite) index of control effectiveness; and (2) a multivariate econometric regression model that identifies the relationship between control factors and the rate of budgetary savings.

For a comprehensive assessment of financial-control effectiveness, an integral index combining individual indicators is constructed as follows:

$$IFC = \sum (w_i \times x_i), \quad i = 1, n$$

where: IFC is the integral index of financial-control effectiveness (ranging from 0 to 1); x_i is the normalized value of the i -th individual indicator (for example, audit coverage, the rate of detected violations, the share of recovered funds, or the transparency index of electronic procurement); w_i is the weight assigned to the i -th indicator ($\sum w_i = 1$); and n is the number of indicators.

To transform individual indicators measured in different units to a common scale from 0 to 1, the following linear normalization formula is applied:

$$x_i = (X_i - X_{\min}) / (X_{\max} - X_{\min})$$

To reduce subjectivity in determining the weights w_i , the entropy weighting method is recommended. The information entropy of each indicator is calculated as $e_j = -k \cdot \sum (p_{ij} \cdot \ln p_{ij})$, where $k = 1/\ln m$ and m is the number of observations; the weight is then defined as $w_j = (1 - e_j) / \sum (1 - e_j)$. This method assigns greater weight to indicators with higher statistical dispersion - that is, stronger discriminatory power - and reduces dependence on experts' subjective assessments.

To determine the effects of financial-control factors on the rate of budgetary savings, the following multivariate linear regression model is proposed:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

where: Y is the rate of budgetary savings in public procurement, % (dependent variable); X_1 is the level of audit coverage, % (the share of audited contracts); X_2 is the share of electronic procurement, %; X_3 is the index of institutional independence of the oversight body (0–1); X_4 is the index of bureaucratic complexity of procurement procedures (1–5, where a higher value indicates greater complexity); β_0 is the intercept; $\beta_1 \dots \beta_4$ are regression coefficients; and ε is the random error term.

Hypotheses: H1 – greater audit coverage has a positive effect on savings ($\beta_1 > 0$); H2 – a higher share of electronic procurement increases transparency and strengthens savings ($\beta_2 > 0$); H3 – savings increase as the independence of the oversight body rises ($\beta_3 > 0$); H4 – greater bureaucratic complexity adversely affects effectiveness ($\beta_4 < 0$). Where cross-sectional data are insufficient for a more accurate assessment of causality, the use of the difference-in-differences method based on panel data is recommended. This method has been applied effectively in international studies (including Olken, 2007; Zamboni and Litschig, 2018) to identify the effect of audit probability on procurement prices.

To test the proposed model, official public procurement statistics for the Republic of Uzbekistan for 2020–2024 were used, covering budgetary contracting authorities, corporate contracting authorities, and major state-owned enterprises. Three principal quantitative indicators were selected for the analysis: the total volume of public procurement, the volume of public procurement conducted through competitive methods, and the amount of funds saved.

The aggregated annual indicators for budgetary and corporate contracting authorities are presented in the following table (Table 1):

Table 1
Public Procurement Indicators by Type of Contracting Authority, 2020–2024¹

Type of contracting authority	Year	Total procurement, UZS billion	Procurement conducted through competitive methods, UZS billion	Savings, UZS billion
Budgetary contracting authorities	2020	42,629.40	14,144.50	300.70
Budgetary contracting authorities	2021	57,007.70	25,298.90	3,527.50
Budgetary contracting authorities	2022	69,589.96	27,746.80	5,250.20
Budgetary contracting authorities	2023	76,971.18	39,883.00	3,638.57
Budgetary contracting authorities	2024	78,709.12	35,259.72	6,720.84
Corporate contracting authorities	2020	81,460.00	24,233.39	184.30
Corporate contracting authorities	2021	90,380.37	43,022.09	2,258.79
Corporate contracting authorities	2022	134,953.23	61,527.79	9,017.95
Corporate contracting authorities	2023	176,341.16	75,125.96	4,559.34
Corporate contracting authorities	2024	169,900.31	98,152.52	7,887.26

As shown in the table, total procurement, competitive procurement, and savings all displayed an overall upward trend across both categories of contracting authorities between 2020 and 2024. For budgetary contracting authorities, total procurement increased from UZS 42,629.4 billion to UZS 78,709.1 billion (1.85 times), competitive procurement from UZS 14,144.5 billion to UZS 35,259.7 billion (2.49 times), and savings from UZS 300.7 billion to UZS 6,720.8 billion (22.4 times). For corporate contracting authorities, these indicators rose, respectively, from UZS 81,460.0 billion to UZS 169,900.3 billion (2.09 times), from UZS 24,233.4 billion to UZS 98,152.5 billion (4.05 times), and from UZS 184.3 billion to UZS 7,887.3 billion (42.8 times). The markedly faster growth in savings relative to competitive and total procurement suggests that the effectiveness of financial-control instruments operating through competitive procurement methods strengthened over time. However, the growth trajectory was uneven, warranting formal econometric testing of the relationships among the three indicators.

The data for budgetary and corporate contracting authorities were combined in panel form (2 groups × 5 years = 10 observations), and Pearson correlation coefficients were calculated for the three indicators (Table 2):

Table 2
Pearson Correlations among Public Procurement Indicators²

Variable pair	Pearson correlation coefficient (r)	p-value	Interpretation
Total procurement ↔ Competitive procurement	0.954	0.000	Very strong positive correlation (expected, as competitive procurement is a component of total procurement)
Competitive procurement ↔ Savings	0.665	0.036	Moderately strong positive correlation, statistically significant ($p < 0.05$)
Total procurement ↔ Savings	0.586	0.075	Moderate positive correlation, marginally significant ($p < 0.10$)

¹ Source: Author's calculations based on official public procurement statistics of the Ministry of Economy and Finance of the Republic of Uzbekistan for 2020–2024.

² Source: Author's calculations based on the official data presented in Table 1.

The results indicate, as expected, a very strong relationship between total procurement and competitive procurement ($r = 0.954$), because competitive procurement is a component of total procurement. Using both indicators simultaneously as independent variables in a regression model would therefore create a multicollinearity problem. By contrast, the relationship between savings and the volume of competitive procurement is statistically significant and moderately strong and positive ($r = 0.665$; $p = 0.036$), confirming a genuine economic relationship between the expansion of competitive procurement methods and increased budgetary savings.

Because total procurement and competitive procurement are highly collinear ($r = 0.954$), including both indicators in the same model does not produce reliable estimates; in a preliminary test, the coefficients were statistically insignificant. The analysis was therefore conducted in two stages, using a simple bivariate model and a logarithmic model that accounts for elasticity.

Model 1 (simple linear regression): $Y = \beta_0 + \beta_1 \cdot X + \varepsilon$, where Y is savings (UZS billion) and X is the volume of procurement conducted through competitive methods (UZS billion) (Table 3):

Table 3
Simple Linear Regression Results for Savings and Competitive Procurement³

Variable	Coefficient (β)	Standard error	t-statistic	p-value
Intercept (β_0)	977.01	1,529.64	0.639	0.541
X — volume of competitive procurement, UZS billion	0.0756	0.0301	2.516	0.036

Model 1 results: $R^2 = 0.442$, adjusted $R^2 = 0.372$, and $F = 6.330$ ($p = 0.036 < 0.05$); thus, the model is statistically significant overall. The regression equation is $\hat{Y} = 977.01 + 0.0756 \cdot X$. The coefficient $\beta_1 = 0.0756$ is statistically significant ($p = 0.036$) and may be interpreted in practical terms as follows: when the volume of procurement conducted through competitive methods increases by UZS 1 billion, average savings increase by UZS 75.6 million (that is, by approximately 7.56 percent). This may be interpreted as the average “marginal savings effect” of the competitive procurement mechanism.

Model 2 (logarithmic elasticity model): $\ln(Y) = \beta_0 + \beta_1 \cdot \ln(\text{Total}) + \beta_2 \cdot \ln(X) + \varepsilon$, where Total denotes total procurement and X denotes competitive procurement. The logarithmic specification helps mitigate the effect of multicollinearity and allows both factors to be controlled simultaneously (Table 4):

Table 4
Logarithmic Elasticity Model Results for Public Procurement Savings⁴

Variable	Coefficient (elasticity)	Standard error	t-statistic	p-value
Intercept (β_0)	7.003	8.708	0.804	0.448
$\ln(\text{Total procurement})$	-4.689	2.069	-2.266	0.058
$\ln(\text{Competitive procurement})$	5.147	1.631	3.156	0.016

The results of Model 2 are substantially stronger: $R^2 = 0.704$, adjusted $R^2 = 0.619$, and $F = 8.316$ ($p = 0.014 < 0.05$). The elasticity coefficient for competitive procurement, $\beta = 5.147$, is positive and statistically significant ($p = 0.016$). This means that, holding total procurement constant, a 1 percent increase in competitive procurement is associated with an average 5.15 percent increase in savings; in other words, the share of competitive procurement exhibits high elasticity with respect to savings. The elasticity coefficient for total procurement is negative and marginally significant ($\beta = -4.689$; $p = 0.058$): holding competitive procurement constant, an increase in total procurement—that is, an expansion in the share of procurement conducted through non-competitive or other methods—reduces savings in relative terms. Put differently, savings generated by financial control are determined not by procurement volume itself, but by the extent to which procurement is conducted through competitive methods.

Methodological note: the sample used in the analysis ($n = 10$, comprising 2 categories of contracting authorities $\times$ 5 years) is subject to the natural limitation inherent in an initial econometric analysis based on a

³ Source: Author's econometric estimates based on the official data presented in Table 1.

⁴ Source: Author's econometric estimates based on the official data presented in Table 1.

short series of annual official statistics. Nevertheless, the results—particularly those of Model 2 ($p = 0.014$)—are statistically significant, economically coherent, and substantively consistent with the international studies reviewed in the theoretical section.

The econometric results support the following practical conclusions. First, an expansion in procurement conducted through competitive methods has a statistically confirmed positive relationship with budgetary savings (Model 1, $p = 0.036$). Consequently, further increasing the share of competitive methods—particularly electronic stores and tenders—should be a policy priority in public procurement. Second, the high elasticity estimate (5.15) indicates that even a relatively small change in competitive procurement can materially affect savings. For financial oversight bodies, this suggests that measures to increase the share of competitive procurement offer a high “return on investment.” Third, the negative elasticity of total procurement indicates that control policy must address not only procurement volume but also its structural quality, namely the ratio of competitive to non-competitive procurement.

CONCLUSIONS AND SUGGESTIONS

The findings demonstrate that the effectiveness of financial control in public procurement cannot be determined solely by the number of control measures or the volume of detected violations. Effective financial control must cover every stage from procurement planning to contract performance and the evaluation of final outcomes, and must assess not only legality but also the economy, efficiency, and effectiveness with which funds are used.

The theoretical approaches and international experience examined show that financial control comprises such interrelated components as institutional independence, data integration, risk-based monitoring, and follow-up of the implementation of audit findings. If any one of these elements fails to function adequately, the effectiveness of the entire control system declines. Therefore, neither centralizing financial control nor merely increasing the number of oversight bodies will, by itself, resolve the problem. The principal task is to define the mandates of oversight bodies clearly, ensure their functional independence, and establish coordinated operations within a unified information environment.

The analysis of official data for 2020–2024 revealed a statistically significant positive relationship between the volume of competitive procurement and savings ($r = 0.665$; $p = 0.036$). According to the simple regression model, an increase in competitive procurement is associated with increased savings, and the model explains 44.2 percent of the variation in the dependent variable. The logarithmic model likewise shows that the extent to which procurement is conducted through competitive methods is more important for savings than the total volume of procurement.

At the same time, given the limited number of observations ($n = 10$) and the presence of multicollinearity among the indicators, the identified relationships should not be interpreted as strict causal effects. The results represent preliminary empirical evidence of an association between competitive procurement and budgetary savings. More reliable estimation of this relationship requires further research based on an expanded database covering contracts, contracting authorities, regions, and periods.

The study identified the following principal factors supporting the continued improvement of financial control in Uzbekistan's public procurement: expanding information exchange among oversight bodies; strengthening preventive control alongside post-violation control; enhancing automated risk-analysis capabilities; further developing mechanisms for comparing initial and contract prices with market prices; expanding the use of outcome indicators in evaluating contract performance; and continuously improving the professional competence of procurement specialists.

To address these problems, the following research-based and practical proposals should be implemented.

1. Introduce an Integrated Digital Model of Financial Control

It is proposed that financial control in public procurement be organized according to an integrated model comprising the following four interrelated levels:

- institutional regulation and clear delineation of the mandates of oversight bodies;
- integration of public authorities' information databases into a unified data environment;
- preventive control based on the automated detection of risks;
- subsequent monitoring of the implementation of audit findings and issued instructions.

This model would enable financial control to move from a collection of isolated and uncoordinated inspections to a unified system that continuously monitors every stage of the procurement process.

2. Establish an Automated Risk Profile for Every Public Procurement Procedure

It is proposed that an automated module be introduced into the electronic public procurement system to assess the risk level of each procurement on a scale from 0 to 100 points. The risk level should be calculated using the following principal indicators:

- deviation of the initial and contract prices from the average market price;
- a small number of participants in the procurement procedure or the presence of a single bid;
- repeated awards to a particular supplier in procurements conducted by the same contracting authority;
- artificial splitting of procurements into amounts below the prescribed threshold;
- indications of possible affiliation between the contracting authority and participants;
- frequent amendments to the contract value and implementation deadlines;
- failure to meet deadlines for the delivery of goods or the performance of works.

Low-risk procurements should remain subject to automated monitoring, medium-risk procurements should undergo remote analysis, and high-risk procurements should be subject to additional human review before contract award. The risk score should not be interpreted as evidence that a violation has occurred; rather, it should serve as an informational signal for initiating enhanced scrutiny.

3. Introduce an Integral Index of Financial-Control Effectiveness into Practice

For comparative evaluation of the performance of public contracting authorities and oversight bodies, it is advisable to introduce the Integral Index of Financial-Control Effectiveness (IFC) proposed in this article. The index should comprise the following four blocks:

- compliance of procurement with statutory requirements;
- economical use of budget funds;
- efficiency and effectiveness of procurement outcomes;
- transparency and accountability of processes.

Determining the weights of individual indicators by the entropy method reduces the influence of experts' subjective assessments. Publishing index results by public contracting authority, region, and sector would increase the comparability and accountability of control activities.

4. Automatically Compare Initial and Contract Prices with Reference Market Prices

It is proposed that a reference-price database based on a unified classification of goods, works, and services be established within the electronic procurement system. When an initial or contract price deviates beyond a prescribed threshold from the average market price calculated for the relevant region, period, and quality characteristics, the system should automatically generate a risk alert.

For major purchases and durable goods, evaluation should consider not only the lowest bid price but also life-cycle cost, which covers all costs throughout the useful life of the procured item. This would reduce the risk of purchasing low-priced goods that entail high maintenance and operating costs.

5. Coordinate Mandates and Information Exchange among Oversight Bodies

Rather than mechanically consolidating oversight bodies into a single institution, it is proposed that their responsibilities be clearly delineated and common standards for information exchange be established. For each control function, the responsible body, information source, review period, and procedure for documenting results should be specified.

Internal audit units may remain administratively within public contracting authorities; however, their functional independence must be ensured with respect to audit plans, findings, and professional judgments. This would reduce conflicts of interest and enhance the objectivity of audit conclusions.

Comprehensive implementation of the proposed mechanisms would redirect financial control in public procurement from detecting violations after they have occurred toward anticipating and mitigating financial risks. As a result, unjustified expenditures of budget funds would decline, competition would improve, contract performance would become more effective, and the accountability of oversight bodies and public contracting authorities would be strengthened. Most importantly, financial control would evolve from an administrative instrument for verifying legality into a modern management mechanism that secures the economic efficiency and public value of public procurement.

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