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FINANCIAL ANALYSIS AND CONTROL OF PUBLIC PROCUREMENT

The article is devoted to the study of the phenomena of financial control, audit and analysis in the context of their use as part of the toolkit for regulating public procurement at the macro level of the state. Auditing of public procurement becomes one of the types of control by the state and guarantees the reliability of bidding. The development of social relations and the introduction of martial law in Ukraine sets its own requirements for public procurement and, accordingly, forms various control results. The relevance of the study lies in the need for state regulation of public procurement as a set of organizational, economic and legal methods and tools, general and specific, with the help of which interconnected functions are performed to ensure purposeful, continuous, effective influence of the state on processes and procedures in the country for the needs of sustainable functioning and development of the economy. The hypothesis of

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ФІНАНСОВИЙ АНАЛІЗ ТА КОНТРОЛЬ ПУБЛІЧНИХ ЗАКУПІВЕЛЬ

Досліджено феномени фінансового контролю, аудиту та аналізу в контексті їх використання у складі інструментарію регулювання публічних закупівель на макрорівні держави. Аудит публічних закупівель постає одним із видів контролю з боку держави і гарантує достовірність проведення торгів. Розвиток суспільних відносин і запровадження воєнного стану в Україні ставить свої вимоги щодо здійснення публічних закупівель і відповідно формує різні результати контролю. Актуальність дослідження полягає у необхідності вдосконалення державного регулювання публічних закупівель як сукупності організаційно-економічних та юридичних методів, а також інструментів, як загальних, так і специфічних, за допомогою яких виконуються взаємозв'язані функції для забезпечення цілеспрямованого, безперервного, ефективного впливу держави на процеси та процедури у країні для потреб сталого функціонування її



the scientific study consists in justifying the importance of implementing the toolkit of financial control and analysis within the framework of a systematic, structured process of state regulation, optimized for Ukraine in view of the conditions of the external and internal environment (restrictions, problems and opportunities) that appear in order to promote the realization of the potential of the national economy. A system of measures aimed at improving financial control and analysis of public procurement is proposed. The authors of the article: developed a scheme of regulated measures aimed at improving financial control and analysis of public procurement; typical violations that arise as a result of public procurement audits are summarized and a model of risk audit organization and decision-making during public procurement is formed. The authors make proposals for the development of a system of measures aimed at improving financial control and analysis of public procurement, which ensure greater transparency, efficiency and honesty by improving the system of financial control and analysis at the level of procurement monitoring. The conducted scientific research is confirmed by statistical data, on the basis of the analysis of which conclusions were formed.

Keywords: public procurement, state regulation, financial control, audit, analysis, NATO standards.

JEL Classification: M42, M48, H57, H83.

Introduction

Under the conditions of modern economic development, the state actively influences economic processes by regulating various areas, including public procurement. Under martial law, such intervention serves as a necessary regulatory mechanism that must ensure discipline in economic relations. State regulation of public procurement aims to ensure fairness, economy, and effectiveness in the use of public funds. In view of this, the scientific and practical issues of ensuring the effectiveness of state regulation of public procurement are becoming particularly relevant, primarily due to the large volume of financial flows associated with public procurement processes (and the related risks of corruption and other risks), as well as the need, arising from these risks, to ensure the conditions and means necessary to enhance the transparency, manageability, and efficiency of budgetary financial resource expenditure.

Under these circumstances, financial control, auditing, and analysis acquire particular importance as key instruments for ensuring the effective use of public resources in the field of public procurement (Nazarova, 2017), as they make it possible to assess the efficiency and effectiveness of procurement procedures, prevent abuse and corruption, and monitor compliance with legislation in this field.

розвитку економіки. Висунуто гіпотезу щодо важливості реалізації інструментарію фінансового контролю та аналізу в межах системного, структурованого процесу державного регулювання, оптимізованого для України з огляду на умови зовнішнього і внутрішнього середовища (обмеження, проблеми і можливості), що з'являються з метою сприяння реалізації потенціалу національної економіки. Запропоновано систему заходів, спрямованих на вдосконалення фінансового контролю та аналізу публічних закупівель. Розроблено схему регламентованих заходів, спрямованих на вдосконалення фінансового контролю та аналізу публічних закупівель; узагальнено типові порушення, що виникають за результатами проведення аудиту публічних закупівель та сформовано модель організації аудиту ризиків і прийняття рішень при проведенні публічних закупівель. Сформульовано пропозиції щодо розробки системи заходів, спрямованих на вдосконалення фінансового контролю та аналізу публічних закупівель, які забезпечують більшу прозорість, ефективність і чесність шляхом вдосконалення системи фінансового контролю та аналізу на рівні моніторингу закупівель.

Ключові слова: публічні закупівлі, державне регулювання, фінансовий контроль, аудит, аналіз, стандарти НАТО.

As the volume and complexity of public procurement increase, and given the limited availability of budgetary resources, the relevance of which is significantly heightened by the need to conduct large-scale public procurement in Ukraine under martial law to meet the country's security and defence needs, the importance of researching financial control, auditing, and analysis as instruments of state regulation of public procurement (ProZorro, n. d.) is growing. Their effectiveness is crucial not only for achieving specific regulatory objectives but also for attaining the country's strategic goals, ensuring its defence capability, and maintaining its capacity to mobilise and allocate public funds to strategically important areas of financing critical societal needs.

The scholarly work of Ukrainian researchers has devoted considerable attention to investigating the specific features of and providing a scientific justification for an effective mechanism for managing the public procurement system, as well as overcoming organisational, economic, and legal constraints on activities in the field of public procurement, particularly in view of the current specific needs to adjust processes under martial law in Ukraine (Nazarova, 2017; Pedchenko, 2023).

Economists have demonstrated that ensuring the transparency and efficiency of procedures, providing adequate legal and organisational support, and establishing well-coordinated processes at all levels are important prerequisites for the stable development of the public procurement system and the country's economy as a whole (Zaiets, 2016; Okulich-Kozarin, 2021). At the same time, potential corrupt practices, methods for detecting them, and instruments of state oversight have not been sufficiently specified. Researchers emphasise the need to develop effective mechanisms for monitoring public expenditure and to conduct a systematic analysis of the efficiency and effectiveness of public procurement procedures.

The types and procedures of state regulation of public procurement have been studied and characterised in considerable detail (Vorovska & Kolesnyk, 2020; Horbatiuk, 2016; Zdyrko, 2019). At the same time, researchers do not specify in sufficient detail the measures to be undertaken by supervisory authorities, which limits the possibilities for an in-depth analysis of state oversight procedures in the field of public procurement.

The identification of types of public procurement is based on grouping and classification methods. Contemporary scholars devote considerable attention to investigating and systematising issues in this field, updating relevant approaches, and identifying ways to address problems related to abuse and violations in public procurement in Ukraine (Nazarova, 2017; Rusin, 2019). This represents a positive development in the study of public procurement procedures, but it does not specify financial control methods or the role of grouping and classification in the practical activities of auditors.

Given the dynamic changes in economic activity, particularly investment activity, in Ukraine amid Russia's military aggression, as well as the specific features of public procurement under martial law, research into the theoretical and methodological foundations, problems, and prerequisites for improving financial control and analysis as important instruments for ensuring the transparency and effectiveness of the state regulation system for public procurement remains relevant and requires further scientific investigation.

The analysis of scholarly sources demonstrates that, despite positive developments in this area, certain aspects of the broader issue remain insufficiently addressed. These include optimising public procurement control mechanisms, developing and improving new control procedures in computerised data processing environments, coordinating the control functions of government authorities in the field of public procurement, and improving financial control methods in the context of public procurement, among other issues.

Particular attention should be devoted to developing a comprehensive approach to defining criteria for public procurement efficiency and establishing a link between the results of financial control and the achievement of the state's strategic objectives in this area.

These factors, together with the need to systematise issues related to financial control and analysis within the framework of state regulation of public procurement, identify key problems at the theoretical, methodological, and practical levels, and outline ways to address them, determine the relevance of the topic and shape the aim of the study.

The relevance of financial control over public procurement has increased significantly under the conditions of the full-scale war in Ukraine. Corruption is one of the most significant problems, alongside the consequences of Russia's armed aggression, the rising cost of living, and declining household incomes. Particular attention must be paid to ensuring the transparency and efficiency of procurement for the needs of the Armed Forces of Ukraine and the Ministry of Defence of Ukraine, since the irrational use of budget funds in this area may negatively affect the provision of military personnel with the necessary resources and the country's defence capability.

During its monitoring of the Ministry of Defence of Ukraine, the National Agency on Corruption Prevention (NACP) identified a number of risks that contribute to corruption offences in the procurement of goods, works, and services for defence purposes. One of the main reasons for the prevalence of corruption is the lack of effective control over the intended use of budget funds received by suppliers as advance payments.

The aim of the article is to systematise and analyse approaches to financial control and analysis in the context of public procurement, identify their advantages and problematic aspects of financial control, and develop proposals for improving existing regulatory practices in this field.

To achieve this aim, the following objectives were set: to develop a scheme of regulated measures aimed at improving financial control and analysis of public procurement; to summarise typical violations identified through public procurement audits; and to develop a model for organising risk audits and decision-making in public procurement. In addition, particular attention should be paid to developing a comprehensive approach to defining criteria for public procurement efficiency and establishing a link between the results of financial analysis and the achievement of the state's strategic objectives in this area. Achieving the aim through the fulfilment of the specified objectives will contribute to improving the effectiveness of oversight of state regulation of public procurement and optimising the use of public resources, thereby preventing corruption and fraud schemes.

The research hypothesis is based on the assumption that the effectiveness of state regulation of public procurement can be enhanced by integrating financial control and analysis into a unified risk-based system supplemented by digital tools for monitoring and data analytics. It is anticipated that a shift from predominantly retrospective control and analysis towards a preventive, risk-based approach will facilitate the timely detection of violations and corruption risks, enhance the transparency of procurement procedures, promote the rational use of budget funds, and improve the effectiveness of state regulation of public procurement.

The theoretical and methodological basis of the study comprises systemic, process-based, and risk-based approaches to organising financial control and analysis of public procurement. The systemic approach was used to examine the interrelationship between public regulation, financial control, analysis, risk management, and procurement performance. The process-based approach was applied to investigate the sequence of control procedures at the main stages of the procurement cycle, from procurement planning to contract award and the evaluation of the results obtained. The following methods were used to systematise typical violations and risks: grouping, classification, and generalisation. The comparative analysis method was applied to compare different approaches to organising financial control and analysing the efficiency of public procurement. Economic and analytical methods were intended to be used to assess indicators of economy, efficiency, and effectiveness of procurement procedures.

The main body of the article consists of three sections. The first section focuses on the theoretical and praxeological aspects of applying financial control, auditing, and analysis within the scope of state regulation of public procurement. The second section analyses the results of state financial control over public procurement and proposes a systematisation of recommendations for its improvement. The third section examines the analysis of the results of state financial control over public procurement and the systematisation of recommendations for its improvement.

1. Theoretical and Praxeological Aspects of the Application of Financial Control, Auditing, and Analysis within the Scope of State Regulation of Public Procurement

Particular attention should be paid to the international practices of financial control over public procurement in the member states of the European Union (EU). Public procurement within the EU is governed by harmonised rules and procedures that are binding on all 27 Member States. These rules cover the procurement of goods, works, and services whose value exceeds a specified threshold and are based on the fundamental principles of equal treatment, transparency, and competition. They also comply with the provisions and principles of the Treaty on the Functioning of the European Union (TFEU) to ensure equal access to contracts for all tenderers. The European Commission (EC) actively participates in resolving disputes related to violations of procurement procedures and has extensive powers enabling it to initiate legal proceedings against Member States that fail to comply with EU rules. In the event of intervention, the Commission may require the Member State concerned to suspend the performance of a contract. If the country refuses to comply with this requirement, the institution is entitled to bring an action before the Court of Justice of the European Union, which may impose financial penalties on the country for each day of non-compliance with its public procurement obligations. No time limits are established for submitting complaints to the EC. The examination of a case may take three to four years or even longer. At the same time, in certain cases, the EC may implement interim measures more promptly following the results of control exercised by public authorities.

Public procurement conducted by European institutions differs from procurement procedures carried out by the authorities of the 27 Member States. Such processes are governed by specific rules and have a separate review mechanism. If companies encounter unfair treatment during a procurement procedure, they are advised to contact the relevant EU institution as promptly as possible to resolve the issue. Institutions are required to respond to all enquiries and complaints. Regulatory frameworks and financial control in the field of public procurement, both at the EU level and within its Member States, can be rather ambiguous, leaving room for discussion and further development of this research area, particularly with regard to the time limits for implementing decisions made by supervisory authorities (Ivanova & Sevostianova, 2018).

Within the US public administration system, authorised bodies operate in the field of procurement regulation and financial control, including the Office of Federal Procurement Policy and the Federal Acquisition Regulatory Council. The Office of Federal Procurement Policy is a structural unit of the Office of Management and Budget, which is part of the Executive Office of

the President of the United States. Its key tasks include monitoring federal procurement, coordinating rulemaking activities in this area, and ensuring the effective functioning of the regulatory framework. The Office of Federal Procurement Policy is responsible for developing and maintaining a unified system for regulating and controlling public procurement, resolving conflicts between government agencies, organising the activities of the Federal Acquisition Institute, and ensuring the operation of the Federal Procurement Computer System.

The Federal Acquisition Regulatory Council performs an interagency coordination function. The US public market for goods and services has two main segments: civilian goods and services representing traditional manufacturing industries, and military and technical products and services, as well as research and development activities. Under federal law, Congress and the President of the United States are authorised to place orders for all types of goods and services. To exercise this function, authority is delegated to federal departments, agencies, and government-owned business entities, which place orders through their own administrative structures based in Washington or through regional government offices located in the country's largest cities (Carpineti et al., 2006).

German legislation has a clearly defined structure in which the fundamental law is adopted as the principal legal document, while regulatory legal acts are enacted in accordance with its provisions. The articles of the fundamental law remain stable over long periods, whereas subordinate legislation is regularly adapted to changes in social and economic conditions. The principal legal instrument governing the procurement process in Germany is the Act against Restraints of Competition, which forms the core of the country's legal regulation of the market economy. It establishes the key principles governing the functioning of the competitive environment. This Act against Restraints of Competition has a long history of application, spanning more than forty years of development. As a Member State of the European Union, Germany complies with the provisions of EU procurement directives, which establish the rules for conducting international-level tendering procedures. This ensures that companies from all EU Member States have access to tendering activities, thereby promoting transparency and openness in procurement procedures. The federal states of Germany may additionally establish their own regulatory frameworks in this area. In the context of tendering policy, considerable attention is devoted to involving small businesses, which is of significant importance for long-term economic resilience.

Small businesses in Germany frequently win large-scale tendering procedures. The specific features of the country's legal framework help prevent market monopolisation by creating conditions for distributing contracts among different economic entities. For example, part of a supplier's or contractor's order may be subcontracted to another participant on the basis

of competitive pricing. This approach stimulates the development of small enterprises and fosters healthy competition without harming the national economy. Germany has a mechanism for monitoring potential risks arising from links between contracting authorities and monopolistic suppliers or contractors. This maintains a balance of power in the market and prevents the emergence of non-competitive cooperation models. Another important feature is the possibility of compensating participants for the costs of preparing tender documentation when such expenses are substantial (Ivanova & Sevostianova, 2018).

Financial control in the field of public procurement is a set of actions aimed at verifying and assessing the legality, efficiency, and effectiveness of the use of budget funds in the procurement process (Nazarova, 2017). Financial control in public procurement involves verifying the legality, appropriateness, and efficiency of public expenditure on the procurement of goods, works, and services.

In Ukraine, state financial control in the field of public procurement is exercised by the Accounting Chamber. In particular, a preliminary analysis is conducted of the annual report, which contains indicators of the functioning of the public procurement system and summarised information on the results of control in the procurement sector. Control in the field of public procurement is also exercised by the Antimonopoly Committee of Ukraine and the State Audit Service of Ukraine, a central executive authority responsible for implementing state policy in the field of state financial control (On Public Procurement: Law of Ukraine, 2015).

Financial analysis in the field of public procurement is the systematic examination of the financial position and financial results of procurement activities to assess their efficiency and develop recommendations for improvement (Horbatiuk, 2016; On Public Procurement: Law of Ukraine, 2015). Financial analysis helps assess the effectiveness of procurement procedures, identify potential risks, and develop measures to improve the efficiency of public procurement.

State regulation of public procurement is a distinct function of the state, implemented through an appropriate system of means, forms, methods, and instruments employed in the conscious and purposeful activities of the public administration apparatus. Financial control, auditing, and analysis constitute components of a comprehensive set of instruments for state regulation of public procurement and should therefore be regarded as specific types of regulatory activity aimed at the effective performance of particular state regulatory functions in a given field and at addressing specific problems. These functions include:

- *legal* (establishing the necessary legislative framework to ensure the transparency and efficiency of public procurement);
- *social* (ensuring the rights and freedoms of citizens by creating appropriate conditions for the implementation of public procurement);

- *economic* (ensuring the economic development of enterprises, economic sectors, and the national economy as a whole through the effective implementation of public procurement processes and procedures).

The need to apply financial control, auditing, and analysis within the scope of state regulation of public procurement stems from the fact that the economic relations (and, to a considerable extent, social relations) arising in the public procurement process often cannot be realised and developed in the direction determined by historical necessity and the state's objectives.

At the same time, state intervention in public procurement processes, as well as in the activities of economic entities associated with these processes, is driven under current conditions by the increasing complexity of economic relationships between business entities and the emergence of persistent crises in the economy at various levels, which necessitate state adjustment, coordination, and control.

State regulation of public procurement is a set of organisational, economic, and legal methods and instruments, both general and specific (including financial control, auditing, and analysis), through which interrelated functions are performed to ensure the purposeful, continuous, and effective influence of the state on public procurement processes and procedures in the country, thereby supporting the sustainable functioning and development of the economy.

The system of state regulation of public procurement consists of certain elements whose unity and interaction determine its purposefulness, efficiency, and functionality. The effective functioning of this system requires clearly defined goals and objectives, as well as the justification of specific forms and methods, areas of focus, and means of achieving these goals and objectives under the conditions prevailing in a particular country.

The implementation of forms of state regulation of public procurement is ensured through *methods* that exert a purposeful influence on public procurement processes and procedures and their participants in order to direct their specific activities towards the course required by the state and achieve the expected results (i.e. address specific problems). *According to the mode of influence*, public procurement regulation methods are divided into legal, economic, administrative, institutional, and socio-psychological methods (Zdyrko, 2019). *According to their duration*, they are classified as short-term and long-term. *According to the scale of state intervention* in investment processes, they are divided into general methods, which apply to the activities of any enterprise in any region, and selective methods, which concern only specific enterprises within a particular industry and region. *According to the nature of their influence*, public procurement regulation methods are divided into restrictive and incentive-based methods (State Audit Service of Ukraine, 2020). In addition to incentive-based and restrictive methods, there are also mixed methods of regulation that combine incentives and restrictions.

According to the level of influence, methods are divided into national, regional, and local methods (rusin, 2019). Methods of state regulation of public procurement are also differentiated into active and passive methods. Passive methods involve informing economic entities about the conditions of procurement procedures. They also include forecasting the country's economic development prospects and predicting the potential level of activity in the field of public procurement.

Given the wide range of instruments available for state intervention in public procurement processes and procedures, financial control, auditing, and analysis are considered in the context of the state's task of selecting the most effective combination of regulatory instruments, taking into account the specific circumstances of a particular country. Financial control, auditing, and analysis are among the priority instruments in this framework (Zaiets, 2016; Nazarova, 2017), as they are characterised by their effectiveness and potential to produce tangible results in influencing processes and procedures, as well as by a sufficiently developed legal, procedural, and organisational framework and a systematic approach. Therefore, the current system of financial control and analysis in the field of public procurement should be based on the following fundamental principles:

- *internal control* – exercised by public procurement contracting authorities;
- *external control* – conducted by state supervisory authorities, in particular the State Audit Service of Ukraine;
- *public oversight* – exercised by civil society organisations and the mass media.

An analysis of existing approaches to financial control and analysis in the field of public procurement has revealed a variety of methods and instruments used in this area. In particular, economically developed countries most frequently employ comprehensive control systems that encompass not only financial but also organisational and legal aspects. In countries with economies in transition, a greater diversity of approaches can be observed; however, the most widespread methods focus on auditing financial statements and internal financial control (Zdyrko, 2019; Okulich-Kozarin, 2023; ProZorro, 2024). The most effective systems are integrated control systems that combine financial, organisational, and operational control, enabling not only the detection of violations and inefficiencies but also the anticipation and prevention of their occurrence.

In the context of public procurement, the key aspects of financial analysis include:

- assessing the financial stability of participants in procurement procedures;
- analysing the efficiency and effectiveness of public expenditure;

- identifying and analysing risks associated with financial transactions within procurement procedures.

An important component of financial analysis in public procurement is the comparative assessment of different participants in procurement procedures using various financial indicators, such as liquidity, profitability, and financial stability (Okulich-Kozarin, 2021).

Equally important is the fact that an analysis of the current system of financial control and analysis has revealed a number of problems and shortcomings (Nazarova, 2017; Okulich-Kozarin, 2021) that limit the effectiveness of this system. These include a low level of transparency and accountability in public procurement, which undermines public trust in the system; the absence of a unified financial analysis methodology, which prevents comparisons between the results of analyses conducted by different supervisory authorities; insufficient effectiveness of internal control; limited powers of external supervisory authorities; and inadequate coordination among various supervisory authorities.

Given the identified problems, the following key measures are proposed to improve the system of financial control and analysis in the field of public procurement:

- strengthening oversight of compliance with public procurement legislation;
- developing and applying new control methods that will make it possible to assess not only the formal but also the actual efficiency of procurement;
- developing and implementing a unified financial analysis methodology that will enable comparisons between the results of analyses conducted by different supervisory authorities;
- strengthening internal control through the introduction of modern methods and technologies;
- improving coordination among various supervisory authorities and intensifying cooperation between bodies responsible for financial control in the field of public procurement;
- expanding opportunities for public oversight and improving the qualifications of employees of bodies responsible for financial analysis in the field of public procurement;
- increasing the transparency of the financial control and analysis system by expanding public access to information about control activities conducted and their results.

The implementation of the proposed procedures will make it possible to improve the effectiveness of financial control and analysis in the field of public procurement, thereby contributing to more efficient use of budget funds.

2. Analysis of the Results of State Financial Control of Public Procurement and Systematisation of Proposals for Its Improvement

The analysis of the results of financial control of public procurement conducted by the State Audit Service of Ukraine is summarised in *Table 1*.

Table 1

Dynamics of the Proportion of Violations of Public Procurement Legislation Relative to the Number of Enterprises, Institutions, and Organisations Subject to Control by the State Audit Service of Ukraine in 2020–2024

Indicators	2020		2021		2022		2023		2024	
	од.	%	од.	%	од.	%	од.	%	од.	%
Number of enterprises, institutions, and organisations subject to control (total), including:	6256	100	7631	100	8816	100,0	9286	100	7922	100
• audits	914	14.6	1002	13.1	440	5	702	7.6	744	9.3
• procurement inspections	97	1.6	466	6.1	472	5.4	357	3.8	354	4.4
• joint inspections	1	0	2	0	0	0	0	0	0	0
• procurement monitoring	5244	83.8	6161	80.7	7904	89.7	8227	88.6	6918	86.3
Violations of public procurement legislation detected (total), including:	9 041	100	9 104	100	8414	100	8 354	100	6 604	100
• audits	371	4.1	212	2.3	163	1.9	160	1.9	223	61.8
• procurement inspections	2	0.0	646	7.1	304	3.6	210	2.5	138	38.2
• procurement monitoring	8 668	95.9	8 246	90.6	7 947	94.4	7 984	95.6	0	0

Source: compiled by the authors based on data from the State Audit Service of Ukraine (2020), reports for 2020–2024.

An analysis of the dynamics in the number of enterprises, institutions, and organisations subject to control by the State Audit Service of Ukraine over the period 2020–2024 indicates a rapid increase in this figure. Thus, in 2021, compared with 2020, the number of enterprises, institutions, and organisations subject to control increased by 22%; in 2022, compared with 2021, this number increased by 15.5%; in 2023, compared with 2022, the number of enterprises, institutions, and organisations subject to control increased by 5.3%; and in 2024, compared with 2023, it decreased by 10%, respectively. This trend characterises the qualitative performance indicators of the State Audit Service of Ukraine and highlights its role in the system of financial control over the use of budget funds. Accordingly, the main forms of control over enterprises, institutions, and organisations included inspections (audits), procurement inspections, joint inspections, and procurement monitoring. Procurement monitoring accounts for the largest share of these activities and is an effective means of control during public procurement procedures. The dynamics of structural changes indicate only a change in their share of the total and confirm that the funds allocated from the state budget for conducting tenders were used in accordance with the requirements of current budget legislation. The violations of public procurement legislation detected constitute negative indicators of economic activity in the field of public procurement. From 2020 to 2024, these violations were characterised by a decrease of 7.2% (1).

$$\left(\sqrt[4]{\frac{9104}{9041} \cdot \frac{8414}{9104} \cdot \frac{8354}{8414} \cdot \frac{6604}{8354}} \right) \cdot 100 - 100 = -7.2. \quad (1)$$

Since 2022, violations of public procurement legislation have shown a downward trend, which has been attributed to the introduction of a moratorium

on inspections during martial law. The calculations performed demonstrate that the role of the State Audit Service of Ukraine in financial control over public procurement is not only confirmed by its necessity but also contributes to improving the effectiveness of explanatory activities, as evidenced by the indicators of the implementation of control results (*Table 2*).

Table 2

Dynamics of Management Decisions Made by the State Audit Service of Ukraine Based on the Results of Audits, Procurement Inspections, and Joint Inspections in 2020–2024

Indicators (index, name)	2020	2021	2022	2023	2024
01. Persons subject to disciplinary action	276	265	208	297	198
02. Persons held financially liable	343	274	179	199	346
03. Persons dismissed from their positions	19	45	21	22	16
04. Warnings issued regarding improper compliance with budget legislation, requiring the violation to be remedied	243	243	105	131	143
05. Budget allocations suspended	23	11	7	3	6
06. Transactions involving budget funds suspended	293	213	94	107	99
07. Budget appropriations / allocations reduced for budget fund administrators	33	17	14	19	7
08. Requirements issued for the return of subsidies and funds provided to budget fund recipients that had been used for purposes other than those intended	33	23	12	7	14
09. Requirements issued for the undisputed recovery of funds into the budget	0	0	0	0	0
10. Amounts recovered into the budget by the state fiscal service on the basis of materials provided by the State Audit Service	1	1	0	0	0
Total	1264	1092	640	785	829

Source: compiled by the authors based on data from the State Audit Service of Ukraine (2020), reports for 2020–2024, State Audit Service of Ukraine (2020).

The results of the analysis indicate that, from 2020 to 2024, the number of management decisions made by the State Audit Service of Ukraine based on the results of inspections, procurement inspections, and joint inspections showed a downward trend, decreasing by an average of 10% annually (2).

$$\left(\sqrt[4]{\frac{1092}{1264} \cdot \frac{640}{1092} \cdot \frac{785}{640} \cdot \frac{829}{785}} \right) \cdot 100 - 100 = -10. \quad (2)$$

The analytical data presented in *Table 2* for each type of management decision made by the State Audit Service of Ukraine based on the results of inspections, procurement inspections, and joint inspections over the period 2020–2024 indicate a significant downward trend. This outcome of the State Audit Service of Ukraine's activities is positive and serves as an instrument of state regulation of public procurement.

Summarising the results of the analysis, the authors of the article have systematised proposals for improving financial control, auditing, and analysis in the context of public procurement (*Figure 1*).

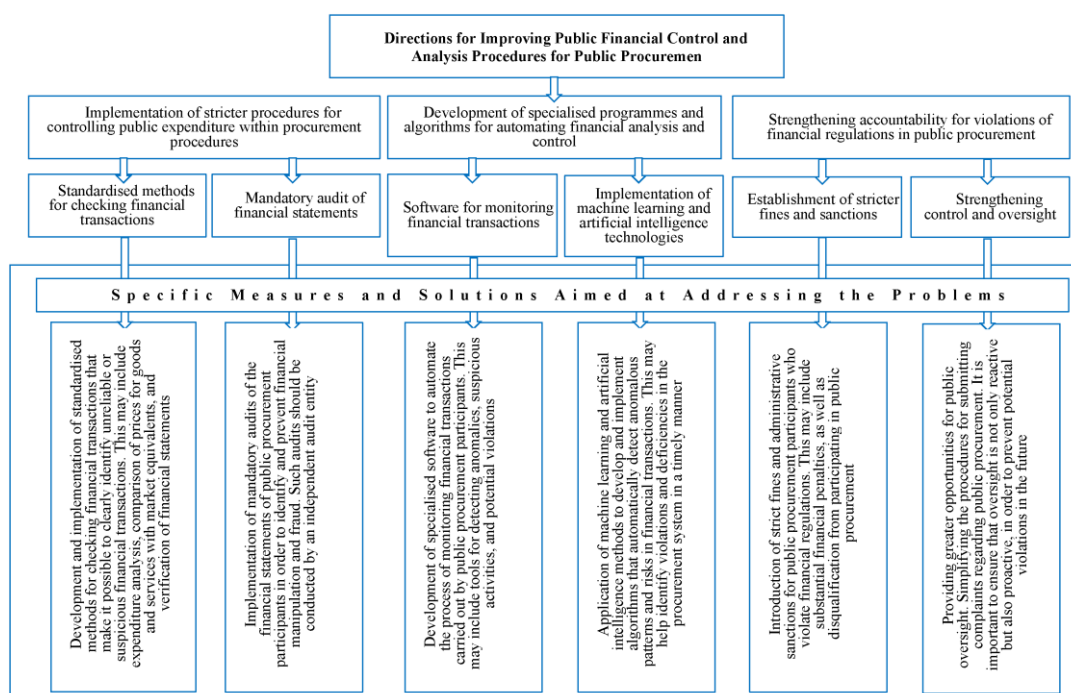


Figure 1. System of Recommended Measures Aimed at Improving Financial Control and Analysis of Public Procurement

Source: developed by the authors.

The results of the analysis should be grouped into three areas:

1) implementation of stricter procedures for controlling the expenditure of public funds within procurement procedures (developing and implementing standardised methods for auditing the financial transactions of participants in procurement procedures; introducing mandatory audits of the financial statements of participants in procurement procedures);

2) development of methodology and the design of specialised programmes and algorithms to automate financial analysis and control (creating software for the automated monitoring of financial transactions and the detection of anomalies in procurement procedures; implementing machine learning algorithms to predict risks and detect fraudsters in the field of public procurement);

3) strengthening accountability for violations of financial regulations in the field of public procurement (establishing stringent fines and administrative sanctions for participants in procurement procedures who violate financial regulations; strengthening oversight of the implementation of decisions and recommendations issued by supervisory authorities in the field of public procurement).

The proposed measures are aimed at ensuring greater transparency, efficiency, and integrity in public procurement by improving the system of financial control and analysis. This will make it possible to prevent losses of public funds resulting from financial violations and to strengthen public confidence, as well as the confidence of other stakeholders, in the public procurement process. Furthermore, these measures will contribute to improved financial resource management and increase the efficiency of budget fund

utilisation. The use of standardised auditing methods will reduce the risk of financial manipulation and abuse in the field of public procurement, thereby helping to ensure integrity and transparency in procurement procedures and reduce public expenditure on unscrupulous participants.

The application of machine learning methods and artificial intelligence technologies will make it possible to automate the process of detecting anomalies and violations in financial transactions, respond more promptly to potential violations, and minimise possible losses resulting from unscrupulous activities.

The introduction of stringent fines and sanctions for violations of financial regulations in public procurement serves as a preventive measure and creates a deterrent effect by discouraging violations of the law, thereby helping to reduce the number of violations and improve compliance with the law. Increasing the number of independent audits, which should be conducted to a high standard of quality, transparency, and impartiality, will contribute to strengthening control and oversight in the field of public procurement. This will make it possible to identify and remedy financial violations in a timely manner, while also creating conditions for more transparent and efficient use of public funds.

The proposed package of measures is aimed at addressing the need to improve financial management in the field of public procurement and ensure the efficient use of public resources. These measures will help strengthen public confidence in the procurement system and ensure more efficient and transparent implementation of government programmes and projects, particularly, at the current stage, those aimed at enhancing Ukraine's defence capabilities and its capacity to resist Russia's military aggression against Ukraine.

3. Analysis of risks in public procurement under martial law and generalisation of audit results

Scientific studies indicate that risks are always present among participants in public procurement procedures during tendering. Timely identification and scientifically grounded, effective risk management are essential conditions for successful and transparent procedures. Under martial law, public procurement is characterised by constant changes in the regulatory framework. Furthermore, martial law has simultaneously created both advantages and disadvantages for public procurement, contributing to the emergence of risks. Timely risk analysis and auditing should not only identify negative factors but also help prevent them in order to enhance the transparency of public procurement.

At the same time, not all risks arising during the organisation of public procurement are associated with corruption (fraudulent) activities or non-compliance with current legislation. In some cases, the main causes include technical requirements, inadequate assessment of systemic performance, and other factors. *Figure 2* summarises a model illustrating how risks may arise in public procurement depending on their types. Meanwhile, *Table 3* groups typical violations identified through the results of operational audits (monitoring) of public procurement that give rise to practical risks.

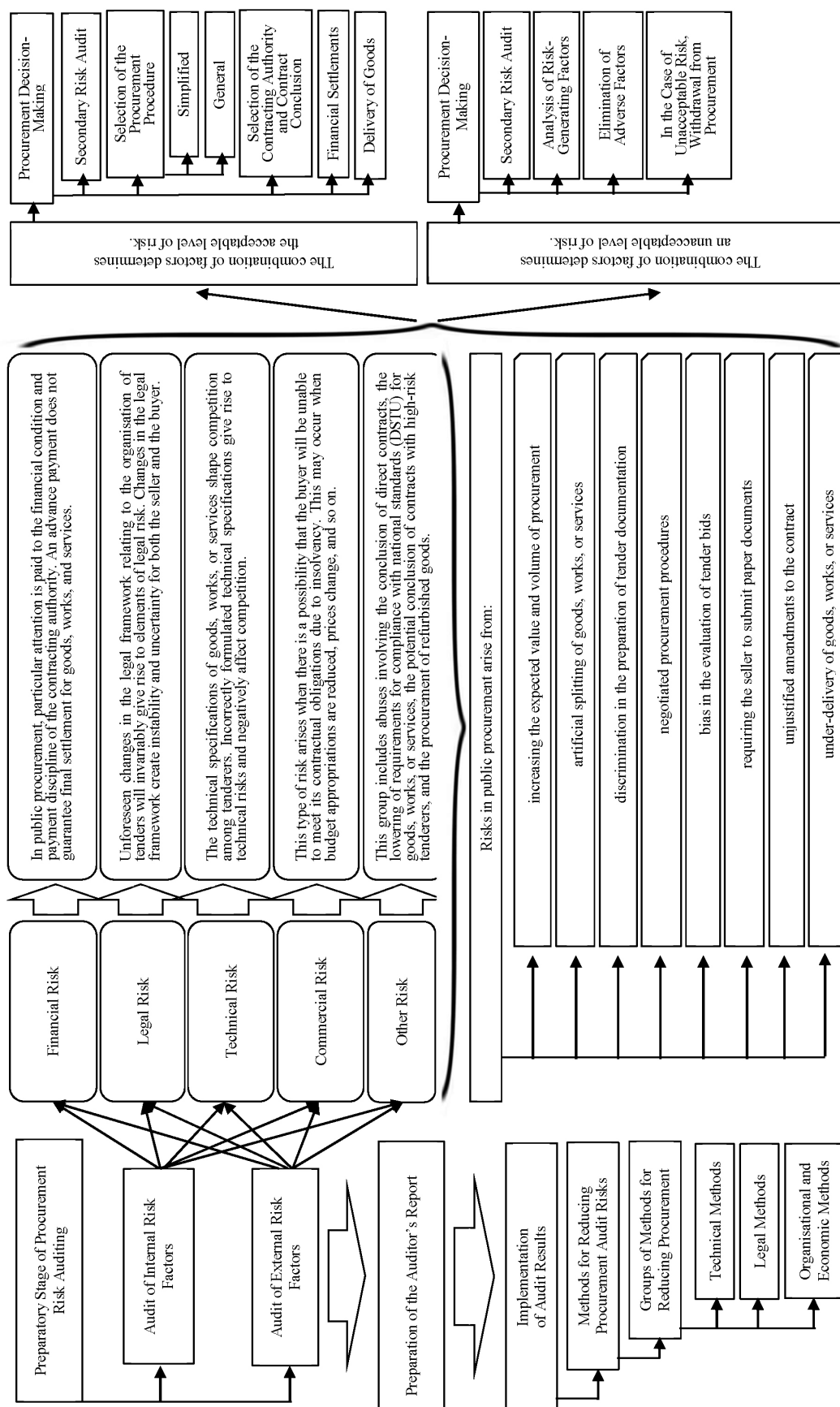


Figure 2. Model for Organising Risk Auditing and Decision-Making in Public Procurement

Source: (developed by the authors)

Table 3

Typical violations identified as a result of public procurement audits

Violation Group (Type)	Primary Documents Subject to Audit	Interpretation of the Violation
Unjustified planning of public procurement	Contracts; tender participation applications; documents confirming the tenderer's compliance	Absence of regulatory legal documents that are mandatory for use in determining the expected cost of a good, work, or service.
Exceeding the average market purchase price	Price quotations; cost estimates	Excessive pricing of goods, works, or services in public procurement may indicate corruption or fraud.
Failure to fulfil contractual obligations	Contracts; bank statements	Various types of risks may arise during the performance of contractual obligations, potentially prompting the contracting authority (seller) to fail to fulfil the terms of the contract.
Significant overestimation of procurement volumes	Contracts; bank statements	In this case, a corruption risk arises, consisting in the improper determination of procurement volumes and the receipt of an undue benefit.

Source: grouped by the authors.

Thus, public procurement auditing serves to determine the justification, feasibility, and efficiency of procurement, analyse tender results, and assess the compliance and reliability of the objectives stated in the Law of Ukraine "On Public Procurement". Public procurement auditing will be effective if it is conducted through a systematic combination of audit procedures, namely: documentary examination, which involves analysing documents relating to procurement procedures in order to verify compliance with current legislation and the proper organisation of procurement; and on-site inspection, which is carried out to ensure that tendering is conducted in accordance with the specified documents and the requirements of current legislation.

Since October 2022, the public procurement system in Ukraine has operated in accordance with Resolution No. 1178 of the Cabinet of Ministers of Ukraine (12 October 2022). In July 2024, Resolution No. 782 of the Cabinet of Ministers of Ukraine (4 July 2024) came into force. Accordingly, when procuring goods (works or services), the localisation requirement must currently be applied when an individual item included in the list of goods subject to localisation, which the contracting authority acquires, costs UAH 200 000 or more. Where several different items of goods are procured, the cost of each item must be considered separately. In addition, Clause 13 of the Special Provisions, which concerns the conclusion of a procurement contract without conducting open tendering and/or using an electronic catalogue, has been expanded. Specifically, it covers the procurement by contracting authorities of goods and services (except for routine repair services) valued at UAH 100 000 or more, routine repair services valued at UAH 200 000 or more, and works valued at UAH 1.5 million or more.

According to the Ministry of Economy of Ukraine, in 2023, the number of procurements completed in the Prozorro system increased by 28% compared with 2022, reaching 3.6 million lots. The expected value of

procurement increased by almost 70% compared with the previous period, reaching UAH 622 billion. Despite the full-scale war, the public procurement sector is currently developing more dynamically than ever. The year 2025 demonstrated that approximately 80% of all public procurement funds are spent through Prozorro. Thus, not only the number of procurements but also their success rate and the level of competition have increased. In 2022, successful procurements accounted for 60%, while in 2023, this figure reached 68%. The level of competition in 2022 was 1.8, representing the average number of bids per procurement (Bihun, 2024).

The increase in the number of completed procurements leads to an increase in the number of violations detected. The following violations were identified as a result of procurement procedures:

- violations of tender documentation requirements;
- violations of procedures for reviewing tender documentation;
- failure to publish official information, among others.

In its reports, the State Audit Service of Ukraine provides statistics on the main types of violations identified during public procurement audits (Figure 3). All violations identified by auditors in Prozorro should be grouped into nine categories, with a tenth additional category entitled "Other Violations".

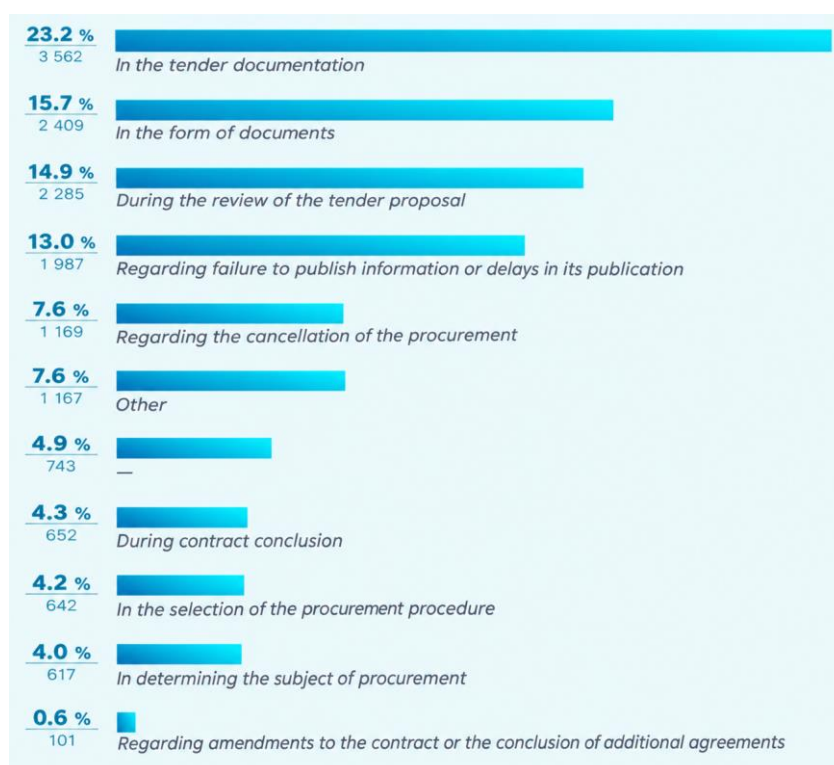


Figure 3. Classification of Violations Identified by the State Audit Service of Ukraine in the Audit of Public Procurement in 2023.

Source: State Audit Service of Ukraine. Reports (2020); Statistical Reports (2023).

Almost every fourth violation identified by the State Audit Service of Ukraine during public procurement procedures concerns "Violations in Tender Documentation"; every sixth violation concerns "Violations in the Tender Bid Evaluation Procedure" and "Violations in Document Formats." Together, these account for half of all violations identified during monitoring. There were 743 cases in which either no violations were found or the monitoring process was still marked as "Monitoring in Progress."

Conclusions

This study focuses on enriching the scientific understanding of contemporary organisational, economic, and legal processes and procedures involved in state regulation of public procurement through the use of appropriate control and analytical instruments. Given the wide range of instruments available to the state for influencing public procurement processes and procedures, financial control and analysis should be considered in the context of the state's task of selecting the most effective combination of regulatory instruments in view of the specific circumstances prevailing in a particular country. From this perspective, financial control and financial analysis are among the priority instruments within this framework, as they are characterised by their effectiveness and potential to influence processes and procedures, as well as by a sufficient degree of legal, procedural, and organisational development and systematic application.

The article establishes that improving the system of financial control and analysis will contribute to greater efficiency and transparency in public procurement, enhance the effectiveness of the state regulation system in this field, and help prevent abuse and corruption.

A synthesis of the research findings indicates an increase in the number of violations in the procurement system under martial law, as confirmed by official reports of the State Audit Service of Ukraine. Procurement monitoring has identified the main types of violations, including violations in the preparation of tender documentation; violations of procedures for reviewing tender documentation; violations relating to the publication of official information; violations in contract conclusion; and violations in the selection of procurement procedures, among others. Further synthesis and classification of these types of violations will make it possible to identify relationships between the areas in which budget funds are used and the types of fraudulent and corrupt schemes.

In July 2024, the Government of Ukraine amended the procedure for conducting public procurement in order to enhance the security of tenderers and protect procurement data from the enemy. Thus, it became permissible not to publish information about procurement for the country's defence needs and not to disclose the locations of supplier enterprises. The confidentiality of information during procurement for defence purposes at the monitoring stage may have a negative impact on tenders, particularly by creating opportunities for shadow schemes involving the expenditure of budget funds. An analysis of violations related to public procurement, based on data from the State Audit Service of Ukraine, makes it possible to identify the causes

of their occurrence. The authors suggest that such violations may stem from corrupt and fraudulent schemes involving the expenditure of budget funds, which can be detected through documentary cross-checks.

It is proposed that a system of measures aimed at improving financial control and analysis of public procurement at the procurement monitoring stage be developed. These measures should aim to ensure greater transparency, efficiency, and integrity in public procurement by improving the system of financial control and analysis. This will make it possible to prevent the loss of public funds due to financial violations and strengthen public confidence, as well as that of other stakeholders, in the public procurement process.

The results of the study are of scientific value, as they expand the range of theoretical foundations of financial control and analysis within the system of state regulation of public procurement, diagnose problems and shortcomings in the existing system of financial control and analysis, and provide specific proposals for improving this system. These results are also of practical significance, as they can be used to optimise the work of supervisory authorities, enhance the efficiency and transparency of public procurement, and improve legislation and the regulatory framework in the field of public procurement. The findings of this study are expected to contribute to a deeper understanding of the importance of financial control and analysis in ensuring the efficiency and transparency of public procurement.

Further research on this topic involves improving audit procedures for public procurement audits based on documentary cross-checks and analysing the dynamics of violations identified by state supervisory authorities. The latter will make it possible to identify the overall trends in the structure of abuses and assess their impact on certain macroeconomic indicators of the country. Further research should include an analysis of the results of control measures in the field of public procurement during the post-war period and their impact on the scale of the misuse of budget funds. Another promising area of research is the study of opportunities for implementing NATO standards and principles in Ukraine's public procurement system, particularly with regard to transparency, accountability, competition, and control over the use of resources. An important task is to identify mechanisms for adapting the relevant approaches to the national system of financial control and procurement auditing. This will help enhance the reliability of procurement procedures, strengthen control over the use of public funds, and bring Ukraine's public procurement system closer to the practices of NATO member states.

REFERENCES / СПИСОК ВИКОРИСТАНИХ ДЖЕРЕЛ

Bihun, N. (2024). Despite the full-scale war, the public procurement sector is developing as dynamically as ever. *Ministry of Economy of Ukraine*. <https://me.gov.ua/News/Detail?lang=uk-UA&id=eae84bc3-8355-497f-a96a-911e4b23dfa7-&title=PopriPovnomasshtabnuViinu>

Бігун, Н. (2024). *Попри повномасштабну війну, сфера публічних закупівель як ніколи динамічно розвивається. Міністерство економіки України*. <https://me.gov.ua/News/Detail?lang=uk-UA&id=eae84bc3-8355-497f-a96a-911e4b23dfa7&title=PopriPovnomasshtabnuViinu>

Carpinetti L., Piga G., Zanza M. (2006). The Variety of Procurement Practice: Evidence from Public Procurement. <i>Handbook of Procurement</i> . Cambridge University Press. https://www.cambridge.org/core/books/abs/handbook-of-procurement/variety-of-procurement-practice-evidence-from-public-procurement/43792A6-1F209C2794237DC6157CC17EF	
Horbatiuk, Ya. V. (2016). Analysis of the Powers of Public Authorities in the Field of Public Procurement Control. <i>Legal Bulletin. Series: Air and Space Law</i> , (4), 132–136. https://nbuv.gov.ua/UJRN/Npnau_2016_4_23	Горбатюк Я. В. (2016). Аналіз повноважень органів державної влади у сфері контролю публічних закупівель. <i>Юридичний вісник. Серія: Повітряне і космічне право</i> , (4), С. 132–136. https://nbuv.gov.ua/UJRN/Npnau_2016_4_23
Ivanova, O., & Sevostianova, H. (2018). Organization of public procurement in Ukraine and the countries of the European Union. <i>Business Inform</i> , (9), 41–47. https://surl.lu/oldedg	Іванова, О., & Севостьянова, Г. (2018). Організація публічних закупівель в Україні та країнах Європейського Союзу. <i>Бізнес-Інформ</i> , (9), 41–47. https://surl.lu/oldedg
Nazarova, K. O., & Kopotienko, T. Yu. (2017). Public procurement control as a state priority for economic development. <i>Business Inform</i> , (11), 96–101. http://nbuv.gov.ua/UJRN/binf_2017_11_16	Назарова, К. О. & Копотієнко, Т. Ю. (2017). Контроль публічних закупівель як державний пріоритет розвитку економіки. <i>Бізнес-Інформ</i> , (11), 96–101. http://nbuv.gov.ua/UJRN/binf_2017_11_16
Okulich-Kozarin, V., & Melnyk, K. (2021). Public procurement as an object of audit and management of united rural territorial communities under decentralization. <i>Accounting and Finance</i> , (3), 142–148. http://nbuv.gov.ua/UJRN/Oif_apk_2021_3_19	Окулич-Козарін, В. & Мельник, К. (2021). Публічні закупівлі як об'єкт аудиту та управління об'єднаними сільськими територіальними громадами в умовах децентралізації. <i>Облік і фінанси</i> , (3), 142–148. http://nbuv.gov.ua/UJRN/Oif_apk_2021_3_19
<i>On Public Procurement. Law of Ukraine No. 922-VIII</i> . (2026, August 24). Published on the official website of the Verkhovna Rada of Ukraine. https://surl.cc/xmfmye	<i>Про публічні закупівлі. Закон України № 922-VIII</i> . (2026, 24 серпня). Опублікований на офіційному порталі Верховної Ради України. https://surl.cc/xmfmye
Pedchenko, N. S., Kudatskyi, O. M., & Pedchenko, M. H. (2023). Public procurement in Ukraine: Advantages and disadvantages. <i>Scientific Bulletin of Poltava University of Economics and Trade. Series: Economic Sciences</i> , (2), 31–35. http://nbuv.gov.ua/UJRN/Nvpushk_2023_2_6	Педченко, Н. С., Кудаський, О. М., & Педченко, М. Г. (2023). Публічні закупівлі в Україні: переваги на недоліки. <i>Науковий вісник Полтавського університету економіки і торгівлі. Серія: Економічні науки</i> , (2), 31–35. http://nbuv.gov.ua/UJRN/Nvpushk_2023_2_6
<i>ProZorro</i> . (n. d.). Official portal for the publication of information on public procurement in Ukraine. https://prozorro.gov.ua/	<i>ProZorro</i> . (б. д.). Офіційний портал оприлюднення інформації про публічні закупівлі України. https://prozorro.gov.ua/
<i>Resolution of the Cabinet of Ministers of Ukraine No. 1178</i> . (2022, October 12). On approval of the special procedure for the public procurement of goods, works, and services for customers covered by the Law of Ukraine "On Public Procurement" for the period of the legal regime of martial law in Ukraine and for 90 days from the date of its termination or cancellation. https://surl.li/pkojac	<i>Постанова Кабінету Міністрів України № 1178</i> . (2022, 12 жовтня). Про затвердження особливостей здійснення публічних закупівель товарів, робіт і послуг для замовників, передбачених Законом України "Про публічні закупівлі", на період дії правового режиму воєнного стану в Україні та протягом 90 днів з дня його припинення або скасування. https://surl.li/pkojac
<i>Resolution of the Cabinet of Ministers of Ukraine No. 782</i> . (2024, July 4). On amendments to the special procedure for the public procurement of goods, works, and services for customers covered by the Law of Ukraine "On Public Procurement" for the period of the legal regime of martial law in Ukraine and for 90 days from the date of its termination or cancellation. https://surl.li/lbtved	<i>Постанова Кабінету Міністрів України № 782</i> . (2024, 4 липня). Про внесення змін до особливостей здійснення публічних закупівель товарів, робіт і послуг для замовників, передбачених Законом України "Про публічні закупівлі", на період дії правового режиму воєнного стану в Україні та протягом 90 днів з дня його припинення або скасування. https://surl.li/lbtved
Rusin, V. M. (2019). Development of the public procurement system in Ukraine. <i>Bulletin of TNEU</i> ,	Русін, В. М. (2019). Розвиток системи публічних закупівель в Україні. <i>Вісник THEV</i> , (12), 99–103.

(12), 99–103. URL: https://doi.org/10.32702/2306-6806.2019.12.99	https://doi.org/10.32702/2306-6806.2019.12.99
<i>State Audit Service in Public Procurement. (2020). Are Monitoring Procedures Effective? https://ti-ukraine.org/wp-content/uploads/2020/07/Derzhau-dytsluzhba-v-publichnyh-zakupivlyah-chy-efek-tyvni-monitoryngy-1.pdf</i>	<i>Держаудитслужба в публічних закупівлях. (2020). Чи ефективні моніторинги. https://ti-ukraine.org/wp-content/uploads/2020/07/Derzhau-dytsluzhba-v-publichnyh-zakupivlyah-chy-efek-tyvni-monitoryngy-1.pdf</i>
<i>State Audit Service of Ukraine. Reports. (2020). Statistical Reports. https://dasu.gov.ua/ua/plugins/userPages/53</i>	<i>Державна аудиторська служба України. Звіти. (2020). Статистичні звіти. https://dasu.gov.ua/ua/plugins/userPages/53</i>
Vorovska, L. A., & Kolesnyk, N. V. (2020). Public procurement as a system for the efficient use of budget funds in local self-government bodies. <i>Visnyk of Berdyansk University of Management and Business</i> , 2(48), 89–92. ISSN 1997-4167.	Воровська, Л. А., & Колесник, Н. В. (2020). Публічні закупівлі як система ефективного використання бюджетних коштів в органах місцевого самоврядування. <i>Вісник Бердянського університету менеджменту і бізнесу</i> , 2(48), 89–92. ISSN 1997-4167
Zaiets, N. M. (2016). Control in the field of public procurement and the impact of its results on the efficiency of procurement procedures. <i>Scientific Works of Kirovohrad National Technical University. Series: Economic Sciences</i> , (30), 216–223. https://surl.li/orcngh	Засць, Н. М. (2016). Контроль у сфері державних закупівель та вплив його результатів на ефективність здійснення процедур закупівель. <i>Наукові праці Кіровоградського національного технічного університету. Сер.: Економічні науки</i> , (30), 216–223. https://surl.li/orcngh
Zdyrko, N. H. (2019). Public procurement: Types and procedures for implementation. <i>Agrosvit</i> , (18), 51–62. https://surl.li/mnekmy	Здирко, Н. Г. (2019). Публічні закупівлі: типи та процедури здійснення. <i>Агросвіт</i> , (18), 51–62. https://surl.li/mnekmy

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The authors received no direct funding for this study

Usenko, A., Kopotiienko, T., & Ovcharyk, R. (2026). Financial control and analysis of public procurement. *Scientia fructuosa*, 5(169), 156–177. [http://doi.org/10.31617/1.2026\(169\)10](http://doi.org/10.31617/1.2026(169)10)

Received by the editorial office 15.05.2026.

The article has been revised 01.06.2026.

Accepted for printing 13.07.2026.

Published online 21.10.2026.