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REVISTA BRASILEIRA DE POLÍTICAS PÚBLICAS
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Managing the procurement activities of the contract department in the education system: optimization of staff time

Gestão das atividades de aquisição do departamento de contratos no sistema de educação: otimização do tempo da equipe

Pavel Pashkov

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Svetlana Sergeeva

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Managing the procurement activities of the contract department in the education system: optimization of staff time*

Gestão das atividades de aquisição do departamento de contratos no sistema de educação: otimização do tempo da equipe

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Abstract

Objective: Improvement of the efficiency of state-funded organizations in times of crisis and the need to reduce costs are popular topics widely discussed among researchers in the field of budgeting. The aim of the study is to improve the efficiency of managing the working time of specialists in procurement. Method: The study was conducted in 2019-2020 on the basis of the State Budgetary Educational Institution School № 1945 (Moscow) using the Program Evaluation Review Technique (PERT) method. Results: The paper reports the results of using criteria for rationing the working time of procurement specialists, which allow reducing the costs associated with the organization of procurement. Conclusions: Transitioning to an efficient procurement system focused on the minimization of labor costs requires the workers to comply with the respective appropriate regulations and labor intensity control.

Keywords: contract department; public procurement; labor rationing; optimization of labor costs.

Resumo

Objetivo: A melhoria da eficiência das organizações estatais em tempos de crise e a necessidade de reduzir custos são temas populares amplamente discutidos entre os pesquisadores da área de orçamento. O objetivo do estudo é melhorar a eficiência da gestão do tempo de trabalho dos especialistas em compras. Método: O estudo foi realizado em 2019-2020 com base na Instituição Educacional Orçamentária do Estado Escola n.º 1945 (Moscou) usando o método da Técnica de Revisão de Avaliação de Programas (PERT). Resultados: O artigo relata os resultados da utilização de critérios de racionamento do tempo de trabalho dos especialistas em compras, que permitem reduzir os custos associados à organização das compras. Conclusões: A transição para um sistema de provisionamento eficiente e centrado

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na minimização dos custos laborais exige que os trabalhadores cumpram as respetivas regulamentações adequadas e controlo da intensidade laboral.

Palavras-chave: departamento de contratos; licitações públicas; racionamento de mão de obra; otimização de custos trabalhistas.

1 Introduction

The primary focus in the organization of an efficient procurement system is optimizing working time and reducing the labor costs of the customer's employees involved in procurement activities, specialists in procurement, administrative and business departments, accounting, etc.¹ In procurement activities, it is possible to use contracts for the supply of goods, works, or services in combination with different methods of determining the supplier, contractor, or executor. To achieve certain goals and resolve tasks, the customer determines the methods of their achievement and realization through procurement activities on their own. For instance, the customer can carry out repair work by economic means, having purchased the materials in advance, and then perform the work with the help of his employees (workers in the building) or conclude an additional contract for the work with them, or may conclude a contract for the work or services with the materials. Each way and method of determining the supplier has its own regulations and labor intensity. Thus, the customer needs to know and understand what labor costs are required for specific tasks performed in specific ways to achieve their goals with minimal labor costs.

The relevance of the described problem is due to particular issues related to the use of labor rationing methods in public organizations, particularly with respect to procurement activities. In their study, Yurchenko and Bykova² indicate among such challenges, first, the difficulty of accounting joint or parallel performance of a job by several employees; second, the lack of typical time standards for individual jobs or the inability to use them to assess the results of individual work; third, the need to collect preliminary data on the types of operations and their duration to calculate the number of staff according to the time standards.

A joint study by scientists from the Fraunhofer IFF (Magdeburg, Germany) and representatives of the Union of Project Managers (Almaty, Kazakhstan) on the example of the European Union, Poland, Germany, the USA, and other regions of the world provides the substantiation of the need to generalize international experience and the study of logistics processes in the regulation of public procurement³.

In developing this study, we proceeded from several objectives to be addressed. First, to conduct a study that would give an opportunity to make procurement management more transparent. Second, to propose an efficient model of public procurement management. Finally, the third objective is to enhance competition and reduce the rate of corruption in this sphere.

The goal of the study is to discover opportunities to improve the efficiency of procurement activities of the contract department in the education system by optimizing the working time of employees.

The present study addresses the following four research questions:

1. What is the rationale for rationing the working hours of contract employees?

¹ ZHILENKO, V. Yu *et al.* The Impact of COVID-19 Pandemic on the Global Economy and Environment. *Journal of Environmental Management and Tourism*, v. 12, n. 5, p. 1236–1241, 2021.

² YURCHENKO, N. V.; BYKOVA, E. A. Methodology of Rationing the Labor of the Personnel of the State Institution-Participant of State Procurement in the Field of Health Care. *Vestnik Eurasicheskoy Nauki*, v. 12, n. 5, p. 1–8, 2020.

³ MUKHTAR, Yernur; TOLUEV, Yuri. Foreign Experience in Regulating the Public Procurement System. *Central Asian Journal of Social Sciences and Humanities*, v. 7, n. 1, 2021.

2. What is the level of labor intensity (labor costs) of various representatives of the contract department for the organization of procurement activities?

3. What is the annual saving of labor resources and the momentary economic effect after the optimization of labor costs and the rationing of the working time of employees in the contract department in the organization of procurement activities?

4. What socio-economic mechanisms allow the executives of customers to balance the workforce, improve procurement activities, avoid inappropriate use of budgetary funds, and increase the efficiency of procurement?

To address the research questions, we examine the procurement process for the supply of goods and services (works) using materials, calculate a project network with a probabilistic time of performance using the Program Evaluation Review Technique method, and determine the task structure for employees involved in procurement activities.

2 Literature review

The mechanism of organizing public procurement is recognized as one of the main aspects of progressive commodity exchange in the economies of various countries. Most of the recent studies on this topic concern various aspects of order placement, and the calculation of the effectiveness of procurement activities is based on the reduction of the contract price. Researchers recognize this as an important guarantee of the effectiveness of contract performance. In most studies, the results of procurement are assessed through timely delivery, cost-effectiveness, and good quality.

V. Khalina, V. Butskiy, and A. Ustilovska⁴ emphasize that the sphere of public procurement is not only one of the most critical in administration but also the most dynamically changing. It is associated with budget spending, the trust of citizens and businesses, and the fulfillment of obligations in an international context. However, the researchers note that “modern requirements for the professionalization of any sphere should concern the introduction of a certain organizational and economic mechanism by which all participants in this process could interact effectively, the relationship between them would be transparent and clear, and the results – specific and measurable”. Hence, the development of an organizational and economic mechanism of professionalization in public procurement, as well as the regulation of relations in this area is a pressing problem that needs to be solved to improve the effectiveness of the entire system of public procurement⁵.

A study by M. C. Matto, A. M. Ame, and P. M. Nsimbila⁶ assessed the impact of contract management on the efficiency of procurement in Tanzania (the ratio of price to quality of procurement). The researchers suggest the use of a quantitative approach and the cross-sectional survey method in the collection and analysis of data. The study concludes that the inconsistency of provisions in the legal acts on public procurement makes the entire mechanism insufficiently effective and reduces the potential for consistent development of this entire sphere⁷. Similar research has been conducted in other countries around the

⁴ KHALINA, V.; BUTSKYI, V.; USTILOVSKA, A. Organizational and Economic Mechanism Professionalization of Public Procurement: the experience of Ukraine. *Sciences of Europe*, v. 3, n. 66, p. 11–26, 2021.

⁵ KHALINA, V.; BUTSKYI, V.; USTILOVSKA, A. Organizational and Economic Mechanism Professionalization of Public Procurement: the experience of Ukraine. *Sciences of Europe*, v. 3, n. 66, p. 11–26, 2021.

⁶ MATTO, Mordecai C.; AME, Ahmed M.; NSIMBILA, Paul M. Influence of contract management on value for money procurement in Tanzania. *International Journal of Procurement Management*, v. 14, n. 6, p. 724, 2021.

⁷ MATTO, Mordecai C.; AME, Ahmed M.; NSIMBILA, Paul M. Influence of contract management on value for money procurement in Tanzania. *International Journal of Procurement Management*, v. 14, n. 6, p. 724, 2021.

world. Norwegian researchers M. Langseth and M. Haddara⁸ stress the importance of a more detailed legal framework to stimulate jobs and create a more innovative and sustainable economy in general. In Norway, high-quality public services depend on well-managed and professional procurement specialists. This demonstrates that this area requires precise rationing⁹.

In general, the optimization of public procurement procedures has been studied from different angles in the context of effective tools for the leading public and private actors. J. Ntsondé and F. Aggeri¹⁰ examine this problem from the point of innovative practices aimed at ensuring sustainability and the creation of new markets for environmentally-friendly products. Investigating the problem of circular public procurement, the authors use a qualitative method, relying on an empirical case related to a public tender in Denmark¹¹. Polish researcher E. Przeszłó¹² analyzes the peculiarities of the current system of public procurement and concludes on the need for uniform regulation of the legal status of economic self-government in Poland. Having analyzed the possibility of active participation of the respective local government at each stage of the state contracting procedure, Przeszłó also assesses the need to optimize the methods of planning and conducting procurements, which are not always properly used by customers.

Studies conducted by R. Aparicio-Arias and J. Moreno¹³ shed light on the negative factors affecting the organization of and response to public procurement during disasters. Specifically, the authors find that public procurement during disasters is negatively affected by several factors: responsiveness and flexibility; market and supplier constraints; pressure on procurement teams; centralized procurement structures; lack of technical knowledge; competition and overlapping agreements; corruption; and price volatility.

In their joint study, Y. Mukhtar and Y. Toluev¹⁴ note that one of the main elements of the progressive process of exchange of goods in the economies of developed countries is a mechanism for the organization of public procurement. The problem of material and technical support of public needs is solved in developed countries by virtue of logistics processes in the system of public procurement through the acquisition and supply of goods, works and services, and material and non-material resources. A. Estevão¹⁵ points out the lack of methods allowing for adequate comparison of the procurement activities of local authorities of various scales, which presents a problem for politicians and scientists. Examining public procurement work among 278 Portuguese municipalities, Estevão concludes that public spending is sublinearly related to population size, indicating savings on the scale of public spending as urban populations increase. T. I. Nzimakwe and A. C. Biyela¹⁶ recognize the factors that hinder the effectiveness of the procurement system: the duration of procurement procedures, late conclusion of contracts, and the lack of a sound basis for the optimization of procedures and digitalization of procurement activities.

⁸ LANGSETH, Marius; HADDARA, Moutaz. Exploring data analytics adoption in public procurement: The case of Norway. In: LANGSETH, M.; SIMILÄ, J. O. (ed.). *Å kjøpe for Norge*. [S.l.]: Cappelen Damm Akademisk/NOASP, 2021. p. 223–256.

⁹ LANGSETH, Marius; HADDARA, Moutaz. Exploring data analytics adoption in public procurement: The case of Norway. In: LANGSETH, M.; SIMILÄ, J. O. (ed.). *Å kjøpe for Norge*. [S.l.]: Cappelen Damm Akademisk/NOASP, 2021. p. 223–256.

¹⁰ NTONDÉ, Joël; AGGERI, Franck. Stimulating innovation and creating new markets: The potential of circular public procurement. *Journal of Cleaner Production*, v. 308, p. 2-35, 2021.

¹¹ NTONDÉ, Joël; AGGERI, Franck. Stimulating innovation and creating new markets: The potential of circular public procurement. *Journal of Cleaner Production*, v. 308, p. 2-35, 2021.

¹² PRZESZŁO, Ewa. Economic Self-government and Public Procurement in Poland. *The Lawyer Quarterly*, v. 11, n. 1, p. 19–28, 2021.

¹³ APARICIO-ARIAS, Raúl; MORENO, Jenny. Factors influencing public procurement during disasters: the cases of Chile and New Zealand. *Journal of Public Procurement*, v. 21, n. 2, p. 206–219, 2021.

¹⁴ MUKHTAR, Yernur; TOLUEV, Yuri. Foreign Experience in Regulating the Public Procurement System. *Central Asian Journal of Social Sciences and Humanities*, v. 7, n. 1, 2021.

¹⁵ ESTEVÃO, António Bernardo Curado. *Scaling behavior of public procurement activity*. 2021. Master's Degree (Data Science and Advanced Analytics) - Universidade Nova de Lisboa, Portugal, 2021.

¹⁶ NZIMAKWE, Thokozani Ian; BIYELA, Andile Clifford. Exploring the Procurement Challenges in the South African Public Sector. In: DORASAMY, Nirmala; FAGBADEBO, Omololu (org.). *Public Procurement, Corruption and the Crisis of Governance in Africa*. Cham: Springer International Publishing, 2021. p. 73–92.

By focusing on cost optimization, a business will not only reduce its short-term costs but also gain resources for long-term investments. H. Nguyen¹⁷, having examined this problem, concludes that “cost optimization should come from each individual element of the supply chain, which are linked to each other and contribute to the improvement of the entire chain”. In our previous studies, we also draw attention to the need to develop regulations, as well as recommendations for accounting and rationing the labor of specialists in contract departments. We believe that labor resources in procurement need to be optimized. For example, analysis of the working time costs of procurement specialists and contract managers shows that labor standards also depend on the level of training¹⁸. Y. Stroganova, N. Kadyrov, and A. Prokhorov¹⁹ also believe optimization of the working time of employees in the contract department to be a critical area in the organization of an efficient procurement system. Having studied the possibilities of improving the rationing of the public procurement system, the researchers propose an original method of rationing procurement based on the matrix approach. Similar observations are also made by N. V. Yurchenko and E. A. Bykova²⁰ who note that in modern conditions, labor rationing is one of the tools to optimize the types of work and the number of staff, increasing productivity and efficiency of the organization as a whole. C. N. Cruz-Rubio²¹ in the paper “Citizen Participation and Public Procurement in Latin America: Case Studies” proposes optimizing the working time of employees in contract departments with the use of information support and automation tools. Georgian scientists N. Shonia, Z. Mushkudiani, and S. Makhatadze²² also concluded on the need for a system of rational use of funds allocated for procurement, as well as for a fair and non-discriminatory approach to procurement. Given that procurement procedures take a long time and there are a number of shortcomings associated with administration that hinder the effective functioning of municipalities, the researchers make a suggestion to introduce a system of rationing the time of employees in the contract department.

A. Azamat and R. I. Mardanova²³ demonstrate that in 37 out of 39 developing countries, a price reduction of just 10% in public procurement leads to budgetary savings comparable to the amount of foreign financial aid in the form of loans and credits through international credit organizations. Meanwhile, the stimulating function of public procurement in developed economies addresses several tasks at once. On the one hand, the state gets an opportunity to demand from national companies to use innovative technological and other achievements in the process of fulfillment of the future order, meeting the predetermined technical parameters of the purchased products. On the other hand, the desire of the producers of goods and services themselves to implement the most modern production and management technologies allows them to achieve a higher level of product competitiveness. Thus, a competitive form of procurement allows maximum budget savings. According to experts’ estimates, it reaches an average of 14-16% of the initial product price in developed countries and up to 30% in developing countries. In Italy, the achievement of the European standard, according to which the state must conduct open tenders for the purchase of cars for high-speed trains, led to a 30% reduction in their cost²⁴. The Brazilian government saves up to 20% of

¹⁷ NGUYEN, Huyen. *Cost Optimization in Supply Chain Management*. 2021. Bachelor’s Degree (Business Administration) - Metropolia University of Applied Sciences, Finland, 2021.

¹⁸ PASHKOV, Pavel Aleksandrovich; GORLOV, Viktor Vladimirovich. Optimization of Working Time Professionals in the Field of Procurement of Goods, Works and Services for State and Municipal Needs. *Economic Systems*, v. 14, n. 1, p. 114–127, 2021.

¹⁹ STROGANOVA, Yevgenia; KADYROV, Niyaz; PROKHOROV, Alexander. Matrix approach to managing of rationing in the public procurement. *E3S Web of Conferences*, v. 284, p. 1–9, 2021.

²⁰ YURCHENKO, N. V.; BYKOVA, E. A. Methodology of Rationing the Labor of the Personnel of the State Institution-Participant of State Procurement in the Field of Health Care. *Vestnik Enrasicheskoy Nauk*, v. 12, n. 5, p. 1–8, 2020.

²¹ CRUZ-RUBIO, César Nicandro. Citizen participation and public procurement in Latin America: Case Studies. *Case Studies*, June 2020.

²² SHONIA, Nana; MUSHKUDIANI, Zurab; MAKHATADZE, Sulkhan. Specific of Local Government Procurement Management in Georgia. *European Journal of Economic and Financial Research*, v. 5, n. 2, 2021.

²³ AKRAMOV, Azamat; MARDANOVA, Rano Isakovna. Implementation of Foreign Experience in Government Procurement into the National Economy of the Republic of Uzbekistan. In: KVIIIHIP K. B. et al. *Proceedings of the XXV International Scientific and Practical Conference: Social and Economic Aspects of Education in Modern Society*. Poland: RS Global, 2021. p. 54–59.

²⁴ NGUYEN, Huyen. *Cost Optimization in Supply Chain Management*. 2021. Bachelor’s Degree (Business Administration) - Metropolia

its budget after introducing a Dutch-type procedure for auctions held electronically on the Internet²⁵. In Colombia, the use of open public tenders has reduced government spending on military goods by 47%²⁶.

The literature review has shown that the issue of optimization of working time of contract department employees in the procurement activities for the purpose of improving its performance is an underexplored question. The answer to it will allow organizations to both properly fill the staffing table with new specialists or assign duties to existing employees and determine the effectiveness of a contract specialist, which will undoubtedly improve the efficiency of the procurement process.

3 Methods

The study was conducted in 2019-2020 on the basis of the State Budgetary Educational Institution School № 1945 (Moscow) using the Program Evaluation Review Technique (PERT) method. The method is used to assess the time needed to perform a task in due time. PERT is applied as a tool for managing the analysis and defining and integrating events. In particular, it clearly illustrates the need to optimize the working time of contract department workers and ration their labor. PERT is used to account for the probabilistic nature of the duration of work of contract department staff when calculating time parameters in a network model.

The paper reports the results of the calculation of labor costs for the organization of procurement activities and the implementation of accounting policies based on summarized data from expert reports.

The experts recruited for the study are representatives of contract departments, economists, lawyers, accountants, engineers, heads of supplies, procurement specialists, and contract managers. The obtained materials are used to build a project network of the process of work performance and the delivery of goods using the PERT method. In general, the PERT method can be associated with the concept of benchmarking management of the company. This conclusion about the selected methodology is supported by the research of scholars from the Department of Economics and Business, Islamic University of Bandung I. A. Kartini, T. Aspiranti, and A. M. Rani²⁷. In evaluating the reliability of the PERT method, the researchers note that it has three time estimates that can reveal opportunities during the work on a project. The three estimates are optimistic time, pessimistic time, and most likely time. A. Shah²⁸, comparing PERT to the Critical Path Method (CPM), concludes that one of the advantages of PERT is that it can be used when a project manager plans a large project, and the PERT diagram explicitly defines and illustrates the dependencies (priority relationships) between the elements of the work breakdown structure (WBS). This method also provides for “potential reduction in project duration through a better understanding of dependencies, resulting in improved overlap of activities and tasks where possible”. Among the disadvantages of this method Shah singles out the “inaccuracy of prediction”, explaining this by the fact that PERT has “no past records for the project framework, so prediction comes into play”. Thus, if the hypothesis is inaccurate, there may be negative consequences in the project.

lia University of Applied Sciences, Finland, 2021.

²⁵ KARTINI, I. A.; ASPIRANTI, T.; RANI, A. M. Analisis manajemen proyek dengan menggunakan metode program Evaluation and Review Technique (PERT) Meminimumkan Waktu Kerja (Studi Kasus Pada CV. Sumber Aluminium Pelangi (SAP) di Kota Palembang). *Prosiding Manajemen*, v. 7, n. 1, p. 63–67, 2021.

²⁶ SHAH, Arati. PERT Vs. CPM: A cross review analysis. *International Journal of Social Impact*, v. 6, n. 1, p. 33–43, 2021.

²⁷ KARTINI, I. A.; ASPIRANTI, T.; RANI, A. M. Analisis manajemen proyek dengan menggunakan metode program Evaluation and Review Technique (PERT) Meminimumkan Waktu Kerja (Studi Kasus Pada CV. Sumber Aluminium Pelangi (SAP) di Kota Palembang). *Prosiding Manajemen*, v. 7, n. 1, p. 63–67, 2021.

²⁸ SHAH, Arati. PERT Vs. CPM: A cross review analysis. *International Journal of Social Impact*, v. 6, n. 1, p. 33–43, 2021.

Using the concepts of “contract system”, “rationing of labor”, and “optimization of labor costs” and employing a set of research methods (MMR: comparative analysis, generalization, monitoring, systematization, statistical analysis, typology), we formulate and substantiate theoretical conclusions and recommendations for improving the customer’s professionalism for effective rationing of working hours. The feasibility of such a toolkit is confirmed in the studies of L. Åkerblad, R. Seppänen-Järvelä, and K. Haapakoski²⁹, who note that mixed methods help identify and explain key relationships in research, such as different types of data, data-driven results, theoretical perspectives, etc. Typologies and definitions related to mixed methods research and integration, such as integrative strategy, can help researchers structure their understanding and make informed decisions. American sociologists D. Morgan and A. Perez³⁰ point out that when using MMR, special attention should be paid to two criteria: setting the priority and sequence of actions, which the authors accordingly take into account in determining the problems and trends in rationing working time in the contract department.

In procurement activities, it is possible to use all types of contracts in combination with different methods of determining the supplier, contractor, or executor. To reduce the time for procurement activities, it is necessary to reduce either the cycles of operations or the time of the operations themselves.

In the course of the study, representative statistical analysis based on expert surveys was carried out to determine the labor intensity (labor costs) for the organization of procurement activities and the implementation of accounting policies. The survey sample includes experts proportionally representing a sample of metropolitan schools by administrative districts of the city. All experts have more than one year of job experience.

The experts (10 people) were asked to record in their reports “a picture of the working day”. According to the given parameters, the experts recorded the time limits for employees’ performance of official operations during the working day and then summarized the results of “photographing” in the form of a report table.

4 Results

The data obtained as a result of the study are presented in Tables 1-4.

Table 1 - Results of the analysis of the working day of a procurement specialist (contract manager)

№	Description of a work	Time costs, min									
		E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
1	2	3	4	5	6	7	8	9	10	11	12
1. Procurement planning and supplier identification stage											
1	Verification of the submitted application for compliance with the requirements of the contract system and other regulations, giving comments and recommendations to the initiator of the application, organization of coordination of the application with the economist, deputy director for resources, and director.	52.8	67.2	55.2	73.2	51.6	69.0	53.4	59.4	54.6	58.8

²⁹ ÅKERBLAD, Leena; SEPPÄNEN-JÄRVELÄ, Riitta; HAAPAKOSKI, Kaisa. Integrative Strategies in Mixed Methods Research. *Journal of Mixed Methods Research*, v. 15, n. 2, p. 152–170, 2021.

³⁰ PEREZ, Analay. Media Review: Foundations of Mixed Methods Research: Integrating Quantitative and Qualitative Approaches in the Social and Behavioral Sciences. *Journal of Mixed Methods Research*, v. 15, n. 4, p. 587–589, 2021.

№	Description of a work	Time costs, min									
		E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
1	2	3	4	5	6	7	8	9	10	11	12
2	Preparation of the draft contract and terms of reference for procurement with a single supplier according to p. 5 and p. 4 of Art. 93 of the Federal Law №94.	56.4	75.0	57.6	54.0	54.6	51.6	61.2	53.4	71.4	64.8
3	Searching for or creating an offer(s) and posting a quotation session.	18.5	13.8	13.7	15.8	12.3	18.2	15.6	12.8	15.0	13.8
4	Filling out a draft contract under paragraph 5 and paragraph 4 of Art. 93 of the Federal Law №44.	61.8	55.2	61.8	73.8	66.6	66.0	73.8	49.2	45.0	61.8
5	Verification of the receipt of interim measures in the Automated City Finance Management System (hereinafter referred to as IIS ACFMS).	7.9	9.4	9.2	8.8	9.2	8.5	12.4	11.7	8.8	12.2
6	Entering information into the Unified Automated Information Bidding System (hereinafter UAIBS) and sending it to the winner of the contract.	10.7	10.1	9.5	8.2	11.6	9.5	8.7	8.1	10.7	11.9
7	Drafting an order, including the assignment of responsibility under the contract, and other internal regulations, followed by the familiarization of those responsible.	24.8	19.2	24.4	21.0	15.6	16.2	23.6	17.4	15.0	19.0
8	Saving the concluded contract in the appropriate completed form in the network folder and sending it to the persons responsible for execution by e-mail.	5.9	5.3	5.4	5.4	4.9	5.2	5.9	5.1	6.0	5.1
2. Contract performance stage											
9	Registration of incoming correspondence and primary documentation in the journal and transfer of documents to the initiator of the procurement.	9.3	9.3	11.9	7.7	7.8	11.2	12.2	10.8	8.2	12.4
10	Transfer of documentation for the signature of the manager and putting stamps.	6.2	4.4	5.0	4.3	4.3	4.4	5.5	6.2	5.6	5.5
11	Verification of primary documentation (invoice, bill of lading, act, etc.) for compliance with the requirements.	22.0	24.0	20.0	18.8	24.8	19.8	20.8	23.6	19.4	22.2
12	Verification of the expert conclusion with the decision on the acceptance of the results of the execution of contracts.	12.2	11.3	11.4	7.8	8.8	10.5	11.0	8.3	9.6	10.3
13	Participation in the acceptance of goods, works, and services as a member of the Acceptance Commission.	84.8	70.5	84.8	68.3	75.8	56.3	66.0	93.0	85.5	69.8
14	Determining the payment order number and uploading from IIS ACFMS.	7.8	9.8	9.9	11.8	10.2	8.7	11.2	11.0	10.5	7.9
15	Placement of information on contract performance in the UAIBS.	12.5	7.9	9.4	9.7	11.0	10.4	7.7	10.0	9.7	8.0

№	Description of a work	Time costs, min									
		E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
1	2	3	4	5	6	7	8	9	10	11	12
16	Entering information about the contract in 1C.	7.9	9.8	9.4	9.6	8.2	9.1	10.4	9.3	11.0	11.7
17	Execution of current control over the implementation of contracts by suppliers (contractors, executors).	34.8	27.9	34.5	36.6	34.5	32.7	32.7	23.1	31.8	29.7

Source: prepared by the author.

The time required to create an offer and place a quotation session for contracts for works and services regardless of the amount of work and services requires 15 minutes, and for contracts for the supply of goods, labor time increases in direct proportion to the number of items $t = (n - 1) * T_i$, where n – the number of items according to the specification, T_i – the time required for the operation in minutes.

For example, for a contract with a specification of 5 items, the time required to determine the offers for the five items is 75 minutes, the total labor intensity increases by 60.

Table 2 - Results of the analysis of the working day of a head of supplies and accounting

№	Description of a work	Time costs, min									
		E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
1	2	3	4	5	6	7	8	9	10	11	12
2. Contract performance stage (Accounting of tangible assets)											
1	Determination of the place of deposition and storage of the material by a commission consisting of a manager, an engineer, and a safety specialist.	36.3	33.3	32.7	24.6	24.9	27.9	23.7	31.2	27.3	28.5
2	Acceptance of the material by the commission with the inspection of certificates and transfer to the place of storage.	75.0	64.5	66.0	85.5	65.3	58.5	77.3	88.5	66.8	83.3
3	Preparing an acceptance report for the person in charge based on a document approved by the manager.	69.0	56.3	64.5	90.8	84.0	57.8	84.8	70.5	89.3	85.5
4	Transfer of material to the responsible person with the signing of the act of transfer and acceptance of the approved form.	16.1	14.6	17.3	15.5	17.9	18.3	16.1	17.0	14.6	15.6
5	Scanning and sending the acceptance report to the economist.	20.4	18.8	18.4	16.2	23.6	24.8	25.0	16.0	17.8	24.0
6	The scanned documents are emailed to the accounting officer.	9.0	9.0	8.1	8.9	10.5	10.7	11.5	8.7	9.6	10.8

№	Description of a work	Time costs, min									
		E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
1	2	3	4	5	6	7	8	9	10	11	12
7	An employee of the accounting department generates documents for acceptance for accounting in the program.	4.8	6.3	3.9	5.3	6.2	5.6	5.1	4.0	6.0	4.5
8	Preparation of the document to be signed by the commission and entered into 1C.	73.8	59.4	66.0	63.6	66.6	71.4	75.0	67.8	58.2	64.8
9	Approval of a local document for the withdrawal of inventory.	127.2	142.8	144.0	139.2	134.4	138.0	112.8	128.4	109.2	116.4
10	The responsible material person submits a memo, an order, and a protocol (statement) for the withdrawal of one item.	5.0	5.7	6.2	4.1	3.9	4.7	5.7	6.3	6.1	5.0
11	The documents are submitted to the accounting department, the employee generates documents for withdrawal in 1C.	17.7	18.2	18.0	13.5	13.7	11.6	13.4	13.1	17.1	15.6
12	The person responsible prints the document, it is signed by the commission, and a scan of the document is placed in 1C (one position).	4.9	5.0	6.1	5.0	3.8	4.9	4.7	3.9	5.4	4.2
13	Based on the signed document, an employee of the accounting department performs the withdrawal (one item).	3.8	4.2	6.1	5.5	4.1	4.5	5.8	5.9	6.1	4.0

Source: prepared by the author.

Table 3 - Results of the analysis of the working day of an engineer

№	Description of a work	Time costs, min									
		E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
1	2	3	4	5	6	7	8	9	10	11	12
1. Procurement planning and supplier identification stage											
1	Forming a job plan (Per item)	3.9	5.0	6.2	5.8	5.1	4.6	4.5	5.4	5.4	5.9
2	Performing measurements on a per-item basis	3.8	5.4	4.7	6.2	4.3	6.0	5.2	4.7	4.6	3.8
3	Preparation of a request for the procurement of goods, works, services for one item	16.7	14.4	14.4	15.9	18.8	16.2	11.9	12.8	15.5	14.4
4	Approval of the terms of reference to the contract	13.8	13.7	11.4	12.0	14.3	18.5	13.4	17.9	18.0	16.1

№	Description of a work	Time costs, min									
		E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
1	2	3	4	5	6	7	8	9	10	11	12
2. Contract performance stage											
5	Preparation of an application to a supplier, contractor, or executor for the supply of materials, works, or services	74.4	49.2	67.8	49.8	49.2	53.4	49.2	64.2	48.6	46.2
6	Acceptance of the material by the commission with the inspection of certificates and transfer to the place of storage	77.3	91.5	64.5	74.3	81.8	59.3	75.8	78.0	57.0	70.5
7	Daily control of contract performance	64.8	45.0	65.4	53.4	64.8	71.4	54.6	55.8	75.0	50.4

Source: prepared by the author.

Operations of an auxiliary nature are combined with the main operations (Table 4).

Table 4 - Aggregated list of works and events

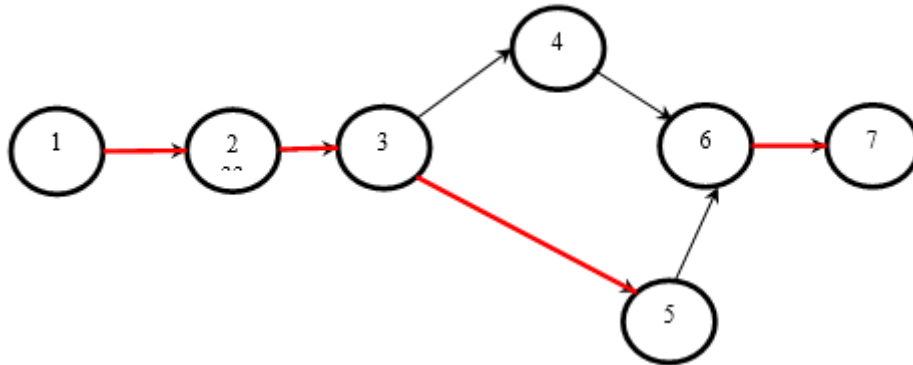
№	Event (executor)	Title of the work	Code of the work
1	Emergence of the need		-
1. Procurement planning and supplier identification stage			
2	Formation of application, preparation of documentation, contract conclusion (engineer, procurement specialist)	Forming a job plan (for 15 items).	1-2
		Performing measurements for 15 positions.	
		Preparation of a request for the procurement of goods, works, and services for 15 items.	
		Checking the submitted application for compliance with the requirements of the contract system and other regulations, giving comments and recommendations to the initiator of the application, organizing the coordination of the application with the economist, deputy director for resources, and director.	
		Drafting the contract and terms of reference for purchases with a single supplier under paragraph 5 and paragraph 4 of Art. 93 of the Federal Law №44.	
		Approval of the terms of reference.	
		Filling out the draft contract under paragraph 5 and paragraph 4 of Art. 93 of the Federal Law №44.	
		Verification of the receipt of interim measures in the IIS ACFMS.	
		Entering information into the UAIBS and sending it to the winner of the contract.	
		Drafting an order, including the assignment of responsibility under the contract, and other internal regulations, followed by the familiarization of those responsible.	
Saving the concluded contract in the appropriate completed form in the network folder and sending it to the persons responsible for execution by e-mail.			
2. Contract performance stage			

№	Event (executor)	Title of the work	Code of the work
3	Preparatory stage of contract performance (engineer)	Preparation of an application to a supplier, contractor, or executor for the supply of materials, works, or services.	2-3
4	Acceptance of goods used in work	Acceptance of the materials (needed for work) by the commission with the inspection of certificates and transfer to the place of storage.	3-4
5	Stage of contract performance, accounting of material assets (head of supplies, accountant)	Determination of the place of deposition and storage of the material by a commission consisting of a manager, an engineer, and a safety specialist.	3-5
		Acceptance of the material by the commission with the inspection of certificates and transfer to the place of storage.	
		Preparing an acceptance report for the person in charge based on a document approved by the manager.	
		Transfer of material to the responsible person with the signing of the act of transfer and acceptance of the approved form.	
		Scanning and sending the acceptance report to the economist.	
		The scanned documents are emailed to an employee in the accounting department or the financial responsibility center.	
		An employee of the accounting department generates documents for acceptance for accounting in the program.	
		Preparation of the document to be signed by the commission and entered into 1C.	
		Approval of a local document for the withdrawal of inventory.	
		The responsible material person submits a memo, an order, and a protocol (statement) for the withdrawal of one item.	
		The documents are submitted to the accounting department, an employee generates documents for withdrawal in 1C.	
The person responsible prints the document, it is signed by the commission, and a scan of the document is placed in 1C (one position).			
Based on the signed document, an employee of the accounting department performs the withdrawal (one item).			
6	Control	Control over the progress of work.	4-6 5-6
7	Acceptance of work, verification of documents, execution of payment, and entering information into electronic systems (procurement specialist)	Registration of incoming correspondence and primary documentation in the journal and transfer of documents to the initiator of the procurement.	6-7
		Transfer of documentation for the signature of the manager and putting stamps.	
		Verification of primary documentation (invoice, bill of lading, act, etc.) for compliance with the requirements.	
		Verification of the expert conclusion with the decision on the acceptance of the results of the execution of contracts.	
		Participation in the acceptance of goods, works, and services as a member of the Acceptance Commission.	
		Determining the payment order number and uploading from IIS ACFMS.	
		Placement of information on contract performance in the UAIBS.	
		Entering information about the contract in 1C.	
Execution of current control over the implementation of contracts by suppliers (contractors, executors).			

Source: prepared by the author.

The network based on these dependencies takes the following form (Figure 1).

Figure 1 - Project network of the process of work performance and the delivery of goods



Source: prepared by the author.

The required time for an employee to perform work per year is defined as the sum of the time for each operation by the number of cycles N per year.

$$T_j = \sum_{n=1}^{i=1} t_i * N_i.$$

The total time spent by employees for a given period can be represented in mathematical form: $T = \sum_{n=1}^{i=1} T_i$, the labor intensity of all employees.

The expected time for the critical paths 1-2, 2-3, 3-5, and 6-7 is calculated by the formula:

$$\bar{t}(i, j) = \frac{2t_o(i, j) + 3t_n(i, j)}{5}$$

where t_o – optimistic time,

t_p – pessimistic time;

Variance:
$$\sigma^2(i, j) = \left[\frac{t_n(i, j) - t_o(i, j)}{6} \right]^2$$

Table 5 - Mathematical expectation and variance

№	Works on the critical path	t_o , min	t_p , min	min		Specific weight, %
1	2	3	4	5	6	7
1	1-2.	16,116.75	19,643.15	18,232.59	345,430.47	40%
2	2-3.	1339.80	2157.60	1830.48	18577.69	4%
3	3-5.	16,869.30	20,230.40	18,885.96	313,805.37	41%
4	5-6.	1,305.00	2,175.00	1,827.00	21,025.00	4%
5	6-7.	4,728.45	5,726.05	5,327.01	27,644.60	12%

Source: prepared by the author.

Under normal work organization conditions, the expected critical time is 768.38 hours. The variance of the critical path = 726,483.13. The standard deviation of the critical path $\sigma_{cr}=852.34$. The interval of the guaranteed project execution time: $3\sigma_{cr} = 3*852.34 = 2,557.02 \approx 2,557$, i.e. guaranteed performance of the work in $46,103 \pm 2,557$ minutes (768.38 ± 42.62 hours)

$$P(43,546 \leq cr \leq 48,660) = P(\leq 2,557) = 2\Phi(2,557/852.34) = 2\Phi(3) = 2*0.49865 = 0.9973$$

$$P(cr \leq T) = 0.5 + \Phi = 0.5 + \Phi\left(\frac{48,660 - 46,103}{852.34}\right) = 0.5 + \Phi(3) = 0.5 + 0.49865 = 0.99865$$

Maximum project time will not exceed 811 hours.

Let us perform a calculation for performing work or providing services using a product (1-2, 2-3, 3-4, 6-7).

Table 6 - Mathematical expectation and variance for the paths 1-2, 2-3, 3-4, 6-7

№	Works on the critical path	to, min	tp, min	min		Specific weight, %
1	2	3	4	5	6	7
1	1-2.	10,316.75	13,843.15	12,432.59	345,430.47	53%
2	2-3.	13,39.80	2,157.60	1,830.48	18,577.69	8%
3	3-4.	1,653.00	2,370.75	2,083.65	14,310.141	9%
4	5-6.	1,305.00	2,175.00	1,827.00	21,025.00	8%
5	6-7.	4,728.45	5,726.05	5,327.01	27,644.60	23%

Source: prepared by the author.

The expected critical time to organize and conduct work is 391.68 hours. The variance of the path is 426,987.91. Root-mean-square deviation of the path $\sigma_{cr} = 653.44$. Interval of guaranteed project completion time (three-sigma rule): $3\sigma_{cr} = 3*653.44 = 1,960.32$, i.e. a guaranteed completion of the project in $23,500 \pm 1,960$ minutes (391.67 ± 32.67 hours)

$$P(21,540 \leq cr \leq 25,460) = P(\leq 19,600) = 2\Phi(1,960/653.44) = 2\Phi(3) = 2*0.49865 = 0.9973$$

$$P(cr \leq T) = 0.5 + \Phi = 0.5 + \Phi\left(\frac{25,460 - 23,500}{653.44}\right) = 0.5 + \Phi(3) = 0.5 + 0.49865 = 0.99865$$

The maximum duration of the project will not exceed 424 hours and 20 minutes.

The cost per hour on the example of the costs of the State Budgetary Educational Institution School № 1945 (Moscow) is 580.31 rubles³¹.

Productivity of the second option is 1.9 times higher, the saving of labor resources is 386.8 man * h per year, the economic effect in monetary terms is 224,463 rubles 91 kopecks.

Thus, the conducted study provides the values of mathematical expectation and variance (Tables 5 and 6), the savings of labor resources per year, and the economic effect in monetary terms. The data we recommend to be used for the improvement of work are the results of the analysis of the working day of the procurement specialist, engineer, head of supplies, and accounting department (Tables 1-3); data on an aggregated list of works and events (Table 3); project network of the process of performance of works and delivery of goods (Figure 1).

5 Discussion

The use of the PERT method in calculating labor costs demonstrates the need to optimize the working time of contract employees and ration their labor to ensure the efficiency of the entire procurement system. Network planning is a widely known method that should be put into practice. In the present case, the PERT

³¹ NZIMAKWE, Thokozani Ian; BIYELA, Andile Clifford. Exploring the Procurement Challenges in the South African Public Sector. *In: DORASAMY, Nirmala; FAGBADEBO, Omololu (org.). Public Procurement, Corruption and the Crisis of Governance in Africa.* Cham: Springer International Publishing, 2021. p. 73–92.

method (the method of uncertainty) is more fitting for procurement, where the variability of events is high and various operations take different time (for example, writing a statement of claim can take 60 minutes for one contract, while for another, it may be 30 or 120 minutes). The study demonstrates the challenges in balancing the workforce, improving procurement activities, and improving the efficiency of procurement in today's environment. This paper proves that the main task of conducting effective procurement activities is to ensure the smooth and quality work of all employees of the organization. At the same time, it is taken into account that the development of customer professionalism in the field of procurement is the key to improving the contracting system. Previous studies on this issue³² indicate that the published normative, scientific, and practical data do not contain the methodology of labor rationing defined by us that meets the principles of comprehensiveness, objectivity, specificity, and efficiency³³. The PERT method for calculating labor costs and rationing the working time of contract department employees in procurement details, structures, and specifies the requirements of regulatory documentation without contradicting them. Meanwhile, we concur with the argument of H. Nguyen³⁴ that cost optimization improves competitive advantage, and the ultimate goal of cost optimization is to achieve efficiency, not just cost savings.

The presented calculation of the time intervals of specific actions in the procurement procedures on the parameters of the rate of time spent by the respondent per transaction, the number of respondents, and the average time for each item per transaction will allow the heads of customers to balance the labor force, as well as to avoid negative consequences. For example, the reduction of working time depends significantly on the professionalism of employees and the characteristics of the workplace. Thus, we conclude on the need for control in procurement, the importance of collecting data on requirements and prices, the importance of preparing procurement documentation, the urgency of processing the results of procurement, and the need for justification of procurement. The present study draws attention to the total time spent by procurement specialists (time to prepare for work, time to complete work, time to prepare the workplace, lunch break time, physiological breaks, main and auxiliary working time). In this respect, it is recommended to keep track of the working time of procurement specialists and contract managers in order to develop reasonable measures to optimize their labor costs. The required number of procurement specialists should be calculated on the basis of and accounting for the analysis of the resources of their working time.

The key to organizing an efficient procurement system lies in optimizing the working time of the contract department employees, organizing project networking, and labor rationing. To improve the work of the contracting system, the development of customer professionalism needs to be made a key area.

The theory of effective procurement offers a solution to the paramount task of ensuring the smooth and quality work of all employees of the country's economic complex. The approach focused on the professionalism of employees of the contract department when performing the task at hand has at its core a typical scheme of labor functions: control in procurement; collection of data on needs, prices; preparation of procurement documentation; processing of procurement results; preparation of plans and justification of procurement.

The main issue of the effectiveness of the contract department in the procurement activities is rationing the working time of procurement specialists in the stages of procurement planning, supplier identification, and contract performance.

³² YURCHENKO, N. V.; BYKOVA, E. A. Methodology of Rationing the Labor of the Personnel of the State Institution-Participant of State Procurement in the Field of Health Care. *Vestnik Eurasicheskoy Nauk*, v. 12, n. 5, p. 1–8, 2020.

³³ ESTEVÃO, António Bernardo Curado. *Scaling behavior of public procurement activity*. 2021. Master's Degree (Data Science and Advanced Analytics) - Universidade Nova de Lisboa, Portugal, 2021.

³⁴ NGUYEN, Huyen. *Cost Optimization in Supply Chain Management*. 2021. Bachelor's Degree (Business Administration) - Metropolia University of Applied Sciences, Finland, 2021.

6 Final conclusions

The conducted study will allow the heads of customers to balance the workforce, improve procurement activities, avoid inappropriate use of budgetary funds, and improve the efficiency of procurement in general.

Such research promotes the socio-economic efficiency of the state contract system and the implementation within its framework of state and municipal procurement. In general, the sustainability of budget policy and the system of public administration depends on the efficiency and transparency of procurement procedures. In this respect, it seems advisable to develop a special local normative act providing for the procedure of forming a plan-assignment for different periods of time from a day to a year for specialists of the contract department, taking into account the optimization of the labor process.

In general, it is recommended to ration the working time of contract department employees of state and municipal institutions both in the field of supply and procurement and in other spheres using the PERT method. The results of the present study are of interest to the scientific community that studies the problems of labor rationing, as well as rationing specialists in organizations.

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