Klyuvak O.,
Skrynkovskyy R.

DIAGNOSTICS OF ENTERPRISE SELECTION CRITERIA IN THE PUBLIC E-PROCUREMENT SYSTEM

Удосконалено інтегровану систему із підсистемами електронної логістики, електронного документообігу, електронного бюджетування, електронних платежів та «інвойсів» суб'єктів здійснення публічних електронних закупівель. Представлено класифікацію нецінових критеріїв відбору підприємства-переможця закупівель. Розроблено сутнісну частину економіко-математичної моделі діагностики критеріїв відбору підприємств у системі публічних електронних закупівель на основі визначення балансу інтересів замовника та постачальника.

Ключові слова: *публічні електронні закупівлі, підприємство-переможець, приведена ціна, неціновий критерій відбору, коефіцієнт корекції, економіко-математична модель діагностики.*

1. Introduction

In the context of Ukraine's European integration and the adaptation of domestic legislation to the legislation of the European Union, the effective functioning of the public e-procurement system is an urgent issue not only for public customers, but also for enterprises that supply or will supply goods, work, and services to meet the needs of the state in the future. The procedure for an unbiased, transparent and fair selection of a supplier must balance the interests of all parties to procurement and take into account the European principles and objectives of public procurement. Therefore, special attention deserves research in the field of non-price selection criteria, which are still insufficiently covered in normative legal acts and scientific and methodical literary sources.

2. The object of research and its technological audit

The object of research is the identification of the state, analysis and evaluation of the criteria for selecting enterprises in the system of public e-procurement at the stage of adaptation of Ukrainian legislation to the legislation of the European Union.

3. The aim and objectives of research

The aim of the research is the scientific substantiation of the theoretical and methodological foundations and applied tools for the formation and development of diagnostic criteria for selecting an enterprise for the public e-procurement system.

To achieve this aim, the following objectives are defined:

1. To improve the integrated system of public e-procurement of goods, works and services to consider the place in it of the criteria for selecting enterprises.

2. To submit a classification of non-price criteria for selecting enterprises, which should be displayed in public documents of these procurement entities.

3. To offer recommendations on improving the procedure for selecting enterprises at the stage of adaptation of Ukrainian legislation to the legislation of the European Union.

4. To develop an approach to the construction of the essential part of the economic and mдathematical model for diagnosing the criteria for selecting enterprises in the system of public e-procurement.

4. Research of existing solutions of the problem

Many domestic and foreign scientists and practitioners are engaged in research into the formation and development of the system of public e-procurement [1–19]. In particular, in work [1] the features and difficulties of organizing the process of public procurement are analyzed, proposals are developed to improve the quality of public procurement management, taking into account modern unstable minds. The author [2] substantiates the need for state management at the macro level by the logistical system of public procurement and considers the structure of traffic flow management in resource systems in this system. The essence and mechanism of the functioning of the e-procurement system, e-finance and e-journals are investigated by foreign authors in the works [3]. Research [17] is devoted to the analysis of the stages of the implementation of control and supervision functions by organizational structures of management in the system of public procurement, identification of negative factors in the functioning of this system. The paper [18] highlights current issues for Ukraine today related to the improvement of the modern system of public administration in the sphere of public procurement, in particular, for the needs of the Ministry of Defense of Ukraine.

However, the market for public e-procurement is usually considered from the position of the state, not focusing attention on the balance of interests of all participants in this process, but the criteria for selecting enterprises for the implementation of state orders are not enough research, including in the context of adaptation of Ukrainian legislation to EU legislation and European integration processes in general.

5. Methods of research

To solve the problems, the following methods are used: visual, expert estimates, correlation and factor analysis, logical generalization, economic and mathematical modeling.

6. Research results

The introduction of the system of public e-procurement affects not only the effective functioning of public customers, the level of corruption and the saving of public funds, but also affects the performance of enterprises participating in procurement. In turn, it should be noted that procurement is a complex business process that begins with an analysis of the needs of customers, the possibilities of their satisfaction by suppliers and concludes with the conclusion and execution of the contract of procurement and reporting.

In this context, it is advisable to consider the system of public procurement as an integrated complex system with subsystems of e-logistics, e-document flow, budgeting, payments and invoices of subjects of procurement of goods, works, services for public funds (Fig. 1, 2) [1–9].
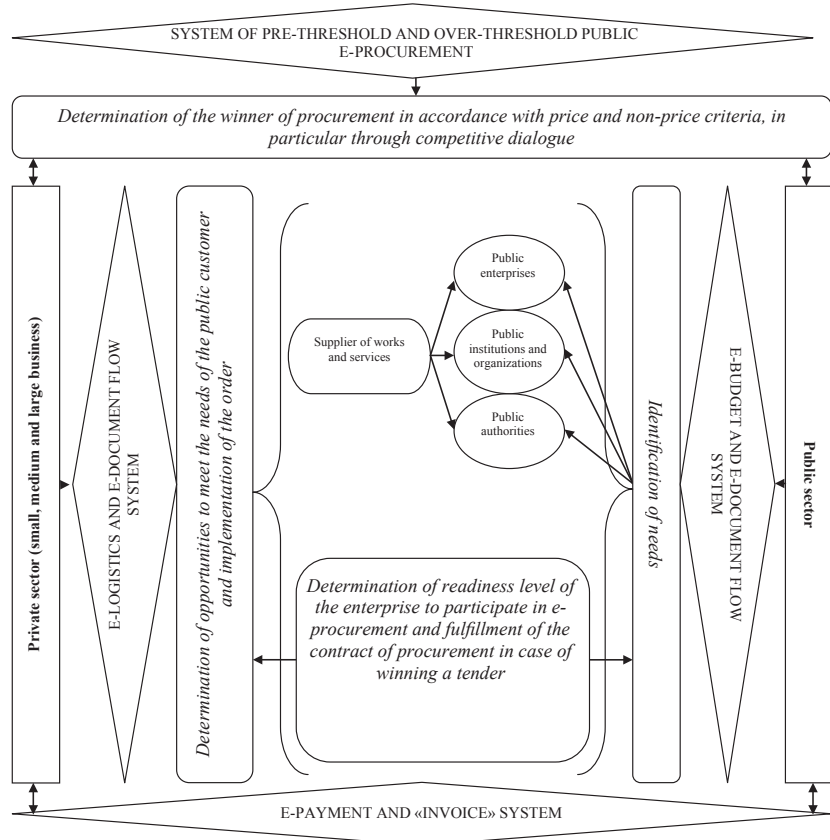
Fig. 2. Integrated system of public e-procurement of works and services. Improved by the authors on the basis of [1–19]
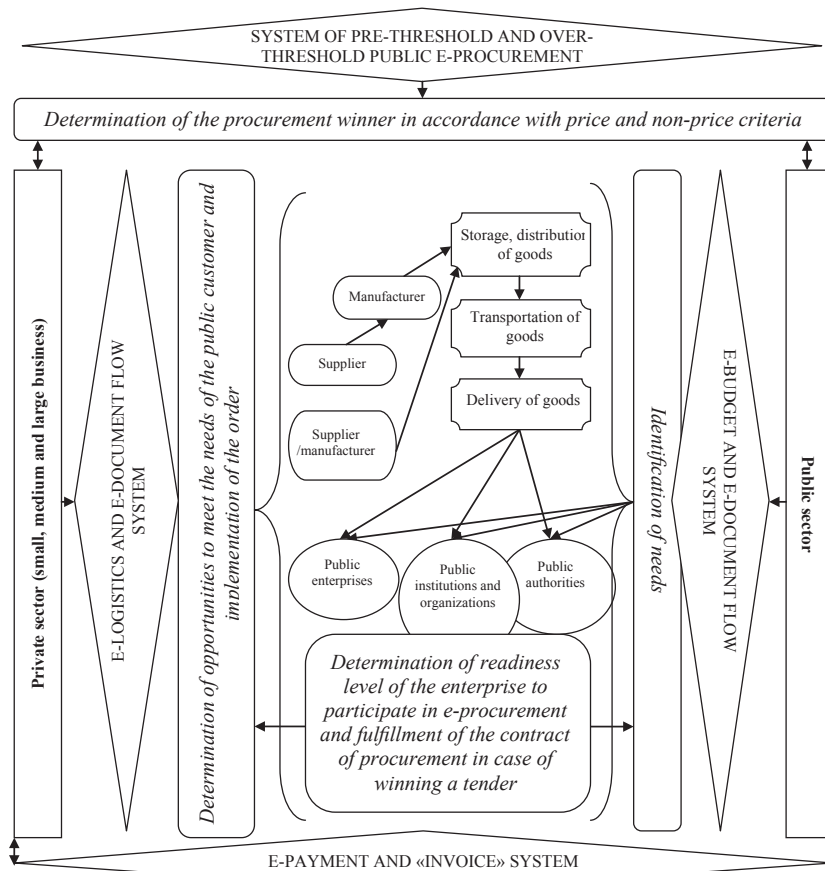
Fig. 1. Integrated system of public e-procurement of goods. Improved by the authors on the basis of [1–19]

It is established that the key stage of procurement is the selection of suppliers by the criterion «price» and non-price criteria, and in most cases the determining criterion is the price. However, although customers aim to purchase goods, services, work at the lowest possible price in order to save public funds, the quality of procurement items should also play a role. Therefore, the quality of procurement items, in spite of electronic selection mainly based on the «price» criterion, should be taken into account by customers in the tender documentation and its suppliers should adhere to the appropriate level. For this, non-price criteria for selecting suppliers are used. Particular attention is paid to non-price conditions, where procurement has a complex or highly specialized nature, in particular when purchasing consulting services, research, development, information technology, strategic, tactical operational management of public enterprises, institutions, organizations or authorities and software etc., as well as there is no formed or constantly operating market for the subject of procurement (Table 1) [10–12].

As shown in Fig. 1, 2 and Table 1, such key business indicator of the enterprise's activity as the level of readiness

for participation in public e-procurement is based on comparison of non-price criteria for selecting the winner of the procurement and the criterion of «price» of the offered goods, works, and services.

Table 1

Displaying the selection criteria in the supplier's public documents

№	Public documents of the supplier enterprise	Criteria for selecting a supplier enterprise	Maximum weights of selection criteria
1	Detailed calculation of the price of the price offer and the price offer itself	Price	70 %
2	General technical description of the offer	Non-price (technical)	30 %
3	Documents confirming the information of participants on their compliance with the following criteria: the availability of equipment and material and technical base, the availability of documented experience in the implementation of a similar contract, the availability of employees of relevant qualifications, etc.	Non-price (resource and qualifying)	
4	Certificate of safety and product quality, in particular environmental labeling of products	Non-price (safety and quality)	
5	Letter of recommendation confirming the reputation and experience of carrying out relevant activities in the market	Non-price (reputation and image)	
6	Copy of the charter and extract from the Unified State Register of Legal Entities, Individual Entrepreneurs and Public Formations; Certificate of the company with bank details	Non-price (basic)	
7	Certificate of absence of debts on taxes, fees, payments controlled by revenue and fee authorities, confirmation of the absence of corruption offenses of bankruptcy proceedings	Non-price (basic)	

Note: compiled by the authors on the basis of [10–16].

On the basis of the analysis [1–19] it is found that it is expedient to take into account the following main recommendations for improving the procedure for selecting enterprises at the stage of adaptation of the legal framework in the field of public e-procurement of the European Union in Ukraine:

– confirmation of environmental friendliness and compliance with European standards of procurement items in the list of public documents that the supplier must provide. Such documents define the security and quality attribute of the tender proposal (Table 1);

– strengthening the role of technical experts in tender committees in cases where the weight of non-price criteria is sufficiently large, the selection is rather complicated, there is no formed or constantly operating market for the subject of procurement and the procedure is carried out through competitive dialogue;

– the inclusion in the Law of Ukraine «On Public Procurements» of the provisions of the general list of public documents and the terms of the procedure for pre-threshold procurement [17, 18].

In the public procurement market, customers are interested in buying goods, works and services honestly and at an optimal price. The optimal price of the subject of procurement must balance the interests of customers and suppliers (1).

$$K_{pp} \approx K_{op} \approx K_{cp}, \qquad (1)$$

where K_{op} – the coefficient of the optimal price of the subject of e-procurement; K_{pp} – the coefficient of the proposed price of the subject of e-procurement by the supplier;

K_{cp} – the price coefficient of the subject of e-procurement of the customer.

The Law of Ukraine «On Public Procurements» includes the concepts «adjusted price» and «correction coefficient», which are related to non-price selection criteria and the «price» criterion. The adjusted price (P_r) is calculated on the basis of the price (P_p), which is indicated by the supplier in the tender proposal, and the indicators of non-price criteria. The economic-mathematical model of the adjusted price is entered by the customer in the tender documentation (2).

$$P_r = \frac{P_p}{K_k}, \qquad (2)$$

where K_k – price correction coefficient of the subject of procurement of the customer.

To calculate the price correction coefficient for the customer, let's use formula (3) and the data in Table 1.

$$K_k = 1 + \frac{\sum (C_t; C_{rk}; C_{sq}; C_i; C_b)}{P_v}, \qquad (3)$$

where $C_1...C_n$ – the value of non-price criteria (technical (C_t), resource and qualifying (C_{rk}), security and quality (C_{sq}), reputation and image (C_i), basic (C_b)); P_V – share of the «price» criterion.

The price coefficient of the subject of e-procurement of the supplier is defined as the result of the business process, it forms economic and social effects (functioning and development).

$$K_{pp} \in f\left(\sum_1^n BP_1; \sum_1^n BP_2; \sum_1^n BP_3; \sum_1^n BP_4 \right), \qquad (4)$$

where $\sum_1^n BP_1$ – a set of business processes of the supplier that lead to the emergence of economic effects of functioning; $\sum_1^n BP_2$ – a set of business processes of the supplier that lead to the emergence of economic development effects; $\sum_1^n BP_3$ – a set of business processes of the supplier that lead to the emergence of social effects of functioning; $\sum_1^n BP_4$ – a set of business processes of the supplier that lead to the emergence of social development effects.

In [19] such classification of the enterprise resources is given: labor, material, financial and energy. According to the above classification, the following business indicators are proposed:

1) an indicator of the level of use of labor resources (index of the use of labor resources, index of production per worker in a year, the labor productivity index, the labor output index, index of the use of the working time fund, index of production safety, index of the level of wages, etc.);

2) an indicator of the level of use of the material resources of the enterprise (index of the cost of material resources, index of the provision of the enterprise with material resources, material output, material intensity, index of the turnover of the enterprise's reserves, the share of materials in the cost of production, etc.);

3) an indicator of the level of use of financial resources of the enterprise (index of the cost of resources attracted by the enterprise, index of the term of resource mobilization by the enterprise, the share of resources occupied by the enterprise, the share of the company's own financial resources, the share of the company's irredundant financial resources, the share of the enterprise's need for financial resources, own financial resources, etc.);

4) an indicator of the level of use of the energy resources of the enterprise (the energy intensity of products, index of energy output, energy security of the enterprise, index of equipment energy efficiency, the cost of fuel and lubricants, the price and tariffs for electricity).

In this context, it is advisable to extend the classification described above with information, time and innovative resources.

The indicator K_{pp} is suggested to be defined as the ratio of non-price parameters to the parameter «price» (P). The key non-price parameters are: information (I), time (T), opportunities/threats (OTH), resources (R):

$$K_{pp} = 1 + \frac{I + T + OTH + \sum_{1}^{n} R}{P}, \qquad (5)$$

where $\sum_{1}^{n} R$ – the sum of spent labor, material, technical, financial, energy, information, time and innovative resources.

In the context of this, let's propose an approach to analyzing the existence and tightness of the relationship between the costs of ensuring the optimal level of non-price criteria for selecting the winner of procurement and indicators of the effectiveness of participation in public e-procurement (6), (7).

$$\begin{aligned} \mathrm{Cov}(E, R) &= M(E - \mu_e)(R - \mu_r) = \\ &= M(ER) - \mu_e \mu_r = \mu_{er} - \mu_e \mu_r, \end{aligned} \qquad (6)$$

where $\mathrm{Cov}(E, R)$ is the covariance between the sample values of the array of expenditure indicators for ensuring the optimal level of non-price criteria for selecting the winner of procurement and indicators of the effectiveness of participation in public e-procurement; E, R – selective values of the array of expenditure indicators for ensuring the optimal level of non-price criteria for selecting the winner of procurement and indicators of the effectiveness of participation in public e-procurement, respectively; M – the mathematical expectation operator; $M(ER)$ – the mathematical expectation of the product of quantities; μ_{er} – the average value of the product of quantities; μ_e – the average value of E; μ_r – the average value of C.

To the main expenses aimed at ensuring the optimal level of non-price criteria for selecting the winner of the procurement, let's refer:

$$E \in \sum(E_{mt}; E_p; E_{sq}; E_{in}), \qquad (7)$$

where E_{mt} – costs of material and technical equipment of production; E_p – costs for training, advanced training and retraining of personnel; E_{sq} – costs aimed at improving the safety and quality characteristics of products and the production process; E_{in} – innovative costs for providing competitive advantages (development of new types of products, introduction of new technological processes).

The formula of the balance of interests of the supplier and the customer (1) is supplemented with the ratios that reflect the customer price correction coefficient, taking into account technical, resource and qualification, safety and quality, reputation and image and basic non-price selection criteria (2), (3), price coefficient of the subject of e-procurement of the supplier, taking into account the business processes leading to economic and social effects (4), and the input parameters «information-time-opportunities/threats-resources» (5), covariance between the values of the expenditure indicators to ensure an optimal level of non-price criteria for selecting the winner of the procurement and performance indicators of participation in public e-procurement (6), (7) is the basis of economic and mathematical model of diagnosis criteria for selecting the winner of the public e-procurement. The essential portion of diagnostics economic and mathematical models (1)–(7) is recommended to use in case of a final customer, excluding mediators and contact groups.

7. SWOT analysis of research results

Strengths. The strength of research is a new approach to the classification of non-price criteria for selection of the winner of e-procurement in accordance with the European Union Directives for public procurement in 2014, and the fact that an essential part of the economic and mathematical model for diagnosing criteria for selecting the winner of public e-procurement balances the interests both the customer and the supplier, takes into account a wide range of input and output economic and social indicators.

Weaknesses. The weakness is that the system of non-price criteria for selecting enterprises is fundamental and is not considered in the context of certain features of the functioning of enterprises, in particular the type and specifics of economic activity, the organizational and legal form of ownership, organizational structure, size, as well as any changes in legislation, Policy and political instability affect the quality of information and the level of effectiveness and effectiveness of management decisions in environment of this system.

Opportunities. The opportunities for further research are the public e-procurement system entering the international market, its integration with the European Union systems, the use of innovative methods and tools to attract investment (external, internal) to the procurement system of Ukraine.

Threats. The threats to the results of conducted research are from the information security field that may arise at the stages of collecting, analyzing and processing the personal data of suppliers, transferring and modifying financial information, making payments in the system of public e-procurement, and the like.

8. Conclusions

1. The integrated complex system of public e-procurement is improved, based on the subsystems of e-logistics, e-document flow, budgeting, payments and invoices of subjects of procurement of goods, works, services for public funds, and in which the selection criteria for enterprises.

2. The classification of non-price criteria for selection of enterprises in the system of public e-procurement is presented, which should be reflected in the relevant public documents of the supplier and normative legal acts of the European model, namely: technical, resource and qualifying, safety and quality, reputation and image, basic criteria.

3. Recommendations to adapt EU legislation and procedures in the field of public procurement in Ukraine, which are as follows: introduction of environmental and confirmation of compliance with European standards, procurement items in the list of public documents to be provided by the supplier; strengthening the role of technical experts in tender committees in cases where the weight of the non-price criteria is large enough, the selection is quite complex, there is formed or a permanent subject of procurement market and the procedure is performed by a competitive dialogue, the establishment of an exhaustive list of public documents, and the timing of the pre-threshold procurement procedures.

4. The essential part of the economic and mathematical model of diagnosis criteria is developed for selecting the winner of the public e-procurement on the basis of balance of interests of both the customer and the supplier, and relationships that reflect customer price correction coefficient taking into account technical, resource and qualifying, safety and quality, reputation and image and basic non-price criteria, price coefficient of the subject of e-procurement of the supplier, taking into account the business processes that lead to economic and social effects, and output parameters «information-time opportunities/threats of resources», the covariance between the values to ensure optimal levels of non-price criteria for selecting the winner of procurement performance and participation rates of expenditure indicators in public e-procurement.

References

1. Bakaiev, L. The study of project management problems of the public procurement organization in Ukraine [Text] / L. Bakaiev, O. Kosolapova // Zbirnyk naukovykh prats Derzhavnoho ekonomiko-tekhnolohichnoho universytetu transportu. Ser.: Ekonomika i upravlinnia. – 2014. – Vol. 29. – P. 182–188.
2. Smyrychynskyi, V. V. Logistic conception of state purchases management [Text] / V. V. Smyrychynskyi, V. S. Zdrenyk // Problems of Theory and Methodology of Accounting, Control and Analysis. – 2012. – № 1 (19). – P. 339–345.
3. Gansler, J. S. Digitally Integrating the Government Supply Chain: E-procurement, E-finance, and E-logistics [Electronic resource] / J. S. Gansler, W. Lucyshyn, M. Kimberly. – Arlington: IBM Endowment for The Business of Government, 2003. – 74 p. – Available at: \www/URL: https://www.academia.edu/3247855/Digitally_integrating_the_government_supply_chain_E-procurement_e-finance_and_e-logistics
4. Yuzevych, V. Diagnostics of the system of interaction between the government and business in terms of public e-procurement [Text] / V. Yuzevych, O. Klyuvak, R. Skrynkovskyy // Economic Annals-XXI. – 2016. – Vol. 160, № 7–8. – P. 39–44. doi:10.21003/ea.v160-08
5. Directive 2014/55/EU of the European Parliament and of the Council of 16 April 2014 on electronic invoicing in public procurement Text with EEA relevance [Electronic resource] // Official Journal of the European Union. – 6.5.2014. – OJ L 133. – P. 1–11. – Available at: \www/URL: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014L0055
6. Pro publichni zakupivli [Electronic resource]: Law of Ukraine from 25.12.2015 № 922. – Available at: \www/URL: http://zakon2.rada.gov.ua/laws/show/922-19
7. Pro zatverdzhennia form dokumentiv u sferi publichnykh zakupivel [Electronic resource]: Order of the Ministry of Economic Development and Trade of Ukraine from 03.22.2016 № 490. – Available at: \www/URL: http://zakon3.rada.gov.ua/laws/show/z0449-16
8. Pro elektronnu komertsiiu [Electronic resource]: Law of Ukraine from 03.09.2015 № 675-VIII. – Available at: \www/URL: http://zakon2.rada.gov.ua/laws/show/675-19
9. Pro elektronni dokumenty ta elektronnyi dokumentoobih [Electronic resource]: Law of Ukraine from 22.05.2003 № 851-IV. – Available at: \www/URL: http://zakon4.rada.gov.ua/laws/show/851-15
10. Non-price criteria [Electronic resource] // OpenProcurement. Development of Open Procurement system. – Available at: \www/URL: http://openprocurement.org/ua/nonprice-criteria.html
11. Yeshchenko, I. ProZorro: prozora pravda pro systemu [Electronic resource] / I. Yeshchenko // Biznes. – 14.09.2016. – Available at: \www/URL: https://www.business.ua/sunflower/prozorro_prozora_pravda_pro_sistemu-351528/$
12. Melnyk, I. Publichni zakupivli: porady dlia uchasnykiv [Electronic resource] / I. Melnyk // Bukhhalter&Zakon. – October 2016. – № 41-42. – Available at: \www/URL: http://bz.ligazakon.ua/ua/magazine_article/BZ009446
13. Miniailo, V. P. Analiz i kontrol protsedur derzhavnykh zakupivel [Text] / V. P. Miniailo // Visnyk Natsionalnoho universytetu «Lvivska politekhnika». Menedzhment ta pidpryiemnytstvo v Ukraini: etapy stanovlennia i problemy rozvytku. – 2009. – № 647. – P. 125–129.
14. Miniailo, V. P. Do pytannia otsinky efektyvnosti derzhavnykh zakupivel [Text] / V. P. Miniailo // Ekonomichni nauky. Seriia: Oblik i finansy. – 2010. – Vol. 7 (25), Part 2. – P. 295–303.
15. ProZorro is a public e-procurement system [Electronic resource]. – Available at: \www/URL: https://prozorro.gov.ua/en
16. Analysis Module ProZorro [Electronic resource]. – Available at: \www/URL: http://bi.prozorro.org/
17. Krytenko, O. Organizational structure of management in public procurement services [Electronic resource] / O. Krytenko // Democratic Governance. – 2013. – № 11. – Available at: \www/URL: http://nbuv.gov.ua/UJRN/DeVr_2013_11_19
18. Nahornichevskyi, O. Basic directions for improving public administration in the public procurement sphere in Ukraine in the context of national security [Text] / O. Nahornichevskyi // Efficacy Public Administration. – 2015. – № 43. – P. 184–192.
19. Skrynkovskyy, R. M. Diagnostics of Utilization of the Human, Material, Financial, and Energy Resources of the Enterprise as a Tool for Management of the Elements of Its Production and Commercial Operations [Text] / R. M. Skrynkovskyy // The problems of economy. – 2015. – № 1. – P. 249–254.

ДИАГНОСТИКА КРИТЕРИЕВ ОТБОРА ПРЕДПРИЯТИЙ В СИСТЕМЕ ПУБЛИЧНЫХ ЭЛЕКТРОННЫХ ЗАКУПОК

Усовершенствовано интегрированную систему с подсистемами электронной логистики, электронного документооборота, электронного бюджетирования, электронных платежей и «инвойсов» субъектов осуществления публичных электронных закупок. Представлено классификацию неценовых критериев отбора предприятия-победителя закупок. Разработано сущностную часть экономико-математической модели диагностики критериев отбора предприятий в системе публичных электронных закупок на основе определения баланса интересов заказчика и поставщика.

Ключевые слова: публичные электронные закупки, предприятие-победитель, приведенная цена, неценовой критерий отбора, коэффициент коррекции, экономико-математическая модель диагностики.

Klyuvak Oksana, PhD, Lecturer, Department of Business Economy and Information Technology, Lviv University of Business and Law, Ukraine, e-mail: oksana_klyuvak@ukr.net, ORCID: http://orcid.org/0000-0003-3383-926X

Skrynkovskyy Ruslan, PhD, Associate Professor, Department of Business Economy and Information Technology, Lviv University of Business and Law, Ukraine, e-mail: uan_lviv@ukr.net, ORCID: http://orcid.org/0000-0002-2180-8055