

# Improving the supplier evaluation technique in the company's procurement logistics

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**Abstract.** The article explores the issues of supplier evaluation and selection in the organization's procurement management, which is particularly important in the context of the dynamics of logistics networks under the influence of modern market trends. The selection of suitable suppliers affects the performance of the logistics system and, consequently, the results of the company's activities. As a result of the study the algorithm and the technique were developed which enable to increase the objectivity and comprehensiveness of supplier evaluation through the use of several methods and selection of key criteria that correspond to the goals, objectives, and needs of the organization. The results of testing the technique are presented on the example of the company engaged in the production of warehouse equipment. To ensure the required level of flexibility, achieve goals and improve company's performance, it is recommended to evaluate suppliers using the proposed technique cyclically, considering changing factors of the external and internal environment.

## 1 Introduction

In the conditions of increasing dynamics of the business environment and the expansion of logistics networks, the number of participants in the processes of supply, production, and distribution of products is growing. Increasing flexibility and getting the ability to quickly respond to market changes is often associated with the transformation of business processes, including supplier selection in accordance with the evolving needs of the organization and market (Barmuta et al., 2020). Procurement logistics is one of the most important areas of company activities, as it plays a fundamental role in shaping the relationship between the supply chain participants. Procurement management involves a set of actions necessary to purchase raw materials and products to keep the business running, using marketing, logistics and other tools (Savina et al., 2021; Zekhnini et al., 2021). Currently, procurement logistics is also viewed through the prism of supply chain management and relationships with suppliers. The key tasks of procurement logistics include defining the number of suppliers, evaluating and selecting best-qualified suppliers.

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Supplier selection is the process of finding partners that meet certain criteria, provide the right level of product or service quality at the right price, in the right quantity, and at the right time (Lechner, 2019; Min et al., 2019). Supplier evaluation involves identifying the organization's needs and then determining the extent to which potential suppliers are capable of meeting those needs. The choice of suppliers affects not only the competitiveness and performance of the organization's supply chain management, but also the effectiveness of implementing modern management methods and techniques at the enterprise (including lean management, total quality management and so on).

The analysis of scientific literature on this issue shows that supplier evaluation is a topical research subject. The studies are characterized by the prevailing tendency towards using multiple evaluation criteria instead of traditional models, mostly based on the analysis of financial aspects (Naqvi, Amin, 2021; Mwadulo, 2019). At the same time, the ongoing discussion about methods for supplier evaluating, as well as the logistics evolution under the influence of new economic, technological and other trends, indicate the need for further research in this area. The purpose of this study is to improve the technique for evaluating suppliers using a comprehensive multi-criteria approach based on application of several methods and selection of key evaluation criteria that correspond to the goals and needs of the organization.

## **2 Materials and methods**

The research methodology is based on the use of logical methods, including analysis, analogy, etc., economic and mathematical methods, expert judgement. The theoretical basis of the study includes research papers in the area of analysis, evaluation, and selection of suppliers in procurement logistics.

It should be mentioned that the standard procedure for evaluating suppliers includes the analysis of data available and calculation of indicators characterizing the benefits of cooperation with certain suppliers. One of the barriers to the development of procurement logistics is the lack of a comprehensive technique for evaluating and selecting suppliers, which often leads to inefficient management decisions in organizations. The problem of supplier selection in the current economic conditions creates the need for a multi-criteria analysis carried out using supplier evaluation criteria, which can be based on both quantitative and qualitative parameters (Taherdoorst, Brard, 2019; Medvedeva, 2020). According to the research hypothesis, in order to increase the flexibility and efficiency of a company's supply chain, supplier evaluation should be carried out cyclically, considering the corresponding changes in the internal and external environment; therefore, this process involves the selection of criteria for analysis that best meet the goals, challenges, and needs of the company at the time of the evaluation. The developed supplier evaluation algorithm is shown in Fig. 1.

It should be mentioned that one of the most important stages of the evaluation process involves the selection of criteria, including technical, logistical, financial, assessing the interaction between the supplier and the consumer, and others. When selecting criteria and defining their weighting values, it seems important to consider the operational and strategic policy of the enterprise, including in the field of risk management, and therefore the list of potential criteria can be expanded depending on the needs of a particular company (Alukhanyan et al., 2019). The algorithm shown in Fig. 1 includes application of the scoring method for evaluating suppliers according to certain criteria, with the calculation of the final rating index of each supplier based on the weighted average, accounting for the significance of the criteria defined, and standard deviation. The next step consists in

calculating selected evaluation indicators for the analysis and adjustment of the supplier ranking obtained as a result of using the scoring method.

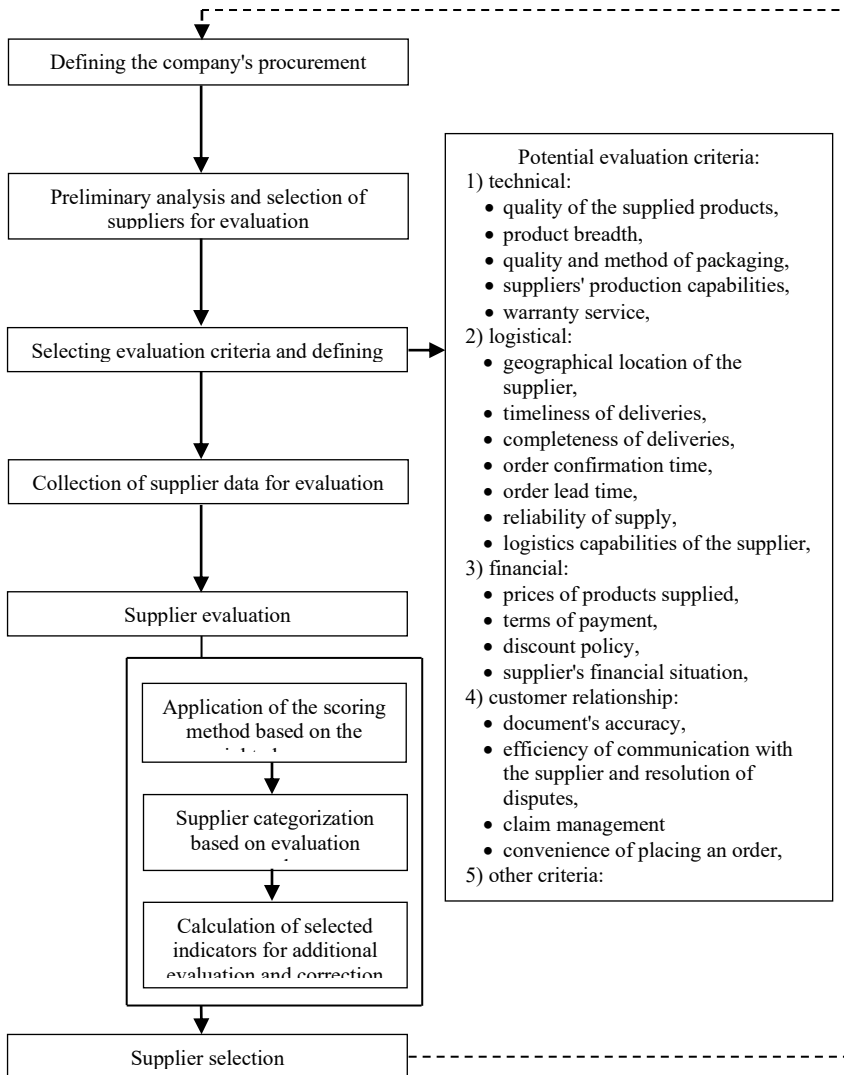


Fig. 1. Developed algorithm for evaluation and selection of suppliers

The technique developed was tested, using the case of the enterprise engaged in the production of warehouse equipment. Based on the specific needs of the company, criteria were selected, the description, weighting values, and rating scale of which are given in Table 1.

**Table 1.** Supplier evaluation criteria selected for the company under study.

<b>Evaluation criterion</b>	<b>Weighting value</b>	<b>Rating scale</b>
Product quality (compliance with standards, guarantees, quality control system)	0.165	5 – very high level 4 – high level 3 – medium level 2 – low level 1 – very low level
Pricing policy (price of products, price stability, delivery costs, types of discounts available)	0.152	
Reliability of deliveries (timeliness, completeness of deliveries, compliance of the delivered products with the placed orders)	0.118	
Flexibility (possibility to change orders, agree on delivery terms, customization opportunities)	0.114	
Geographical location (distance from the supplier, transport connections, country of origin, routes)	0.106	
Environmental policy (environmental friendliness of products, modes of transport used, ecological safety of packaging, route optimization)	0.102	
Service level (communication with the supplier, convenience of placing an order, claim management)	0.078	
Innovativeness (readiness to introduce innovative solutions, new product development policy)	0.062	
Reputation (opinions and recommendations of customers)	0.053	
Potential (production, logistics capabilities)	0.050	

To evaluate the suppliers of the company under consideration, 10 criteria are defined (Table 1). The selected criteria are assigned weighting values according to its significance, which in total are equal to 1. Criteria are evaluated by experts on a 5-point scale. The final score is calculated as a weighted average of the assigned scores for all criteria for each supplier. The proposed technique allows categorizing the analyzed suppliers based on the calculated score as follows:

- category 1 - 4.1-5.0 points - high compliance with the criteria (recommended suppliers),
- category 2 - 3.1-4.0 points - medium compliance with the criteria (suitable suppliers),
- category 3 - 2.1-3.0 points - low compliance with the criteria (potential standby suppliers),
- category 4 - less than 2.1 points - insufficient compliance with the criteria (non-recommended suppliers).

To improve the analysis objectivity, it is suggested to additionally use the evaluation indicators corresponding to the criteria specified in Table 1, characterizing the performance of suppliers. The results of calculating these indicators are compared with the score obtained at the previous stage, after which, if necessary, the supplier ranking is adjusted and applied to select suppliers for cooperation.

### 3 Results

The proposed technique was applied to evaluate the suppliers of the selected enterprise that is engaged in the production of warehouse equipment. Currently, the company is

implementing measures aimed at building a sustainable supply chain that implies the use of environmentally friendly resources and their processing in order to improve their properties or reuse without harming the environment (Fu et al., 2022). In this regard, the environmental and innovation policy of suppliers is of particular importance for the enterprise under study. In addition, due to market dynamics and internal transformations of the company, one of the key criterion for evaluating suppliers is their flexibility, ability to quickly respond to changes, considering the needs and requirements of the customer. It should be noted that the most significant criteria include product quality, pricing policy, and reliability of supplies. Supplier geographical location is also selected as an evaluation parameter, since the company is working with partners throughout Russia, as well as foreign firms. Other criteria include service level, reputation, and potential of the supplier. As part of the evaluation, an in-depth analysis of the procurement activities of the company under study was carried out. The evaluation was conducted by a team of eight experts, including the authors of the article and the company's employees. Table 2 shows expert assessments of the selected criteria.

**Table 2.** Rating score of suppliers of the organization under study in accordance with defined criteria.

Criteria for evaluation	Supplier 1	Supplier 2	Supplier 3	Supplier 4	Supplier 5	Supplier 6	Supplier 7
Product quality	4	4	3	5	2	3	5
Pricing policy	3	5	3	3	4	5	2
Reliability of deliveries	5	4	5	5	3	3	4
Flexibility	3	3	4	3	2	3	4
Geographical location	5	4	2	1	5	4	4
Environmental policy	4	3	1	4	2	4	5
Service level	3	5	2	3	4	5	4
Innovativeness	4	5	3	3	3	5	5
Reputation	5	4	3	4	2	3	4
Potential	4	5	3	3	2	3	5

The scores of suppliers are shown in Table 3, including the sum of the scores for all criteria, the weighted average to account for the significance of the criteria, and the standard deviation to show the spread between the scores.

**Table 3.** Rating score of suppliers under consideration

Rating score	Supplier 1	Supplier 2	Supplier 3	Supplier 4	Supplier 5	Supplier 6	Supplier 7
Sum of scores for all criteria	40	42	29	34	29	38	42
Weighted average	3.933	4.126	2.962	3.509	2.958	3.792	4.075
Standard deviation	0.775	0.749	1.044	1.114	1.044	0.872	0.873

The calculated results (Table 3) make it possible to rank the suppliers under study as follows:

- category 1 - suppliers 2 and 7 - recommended suppliers,
- category 2 - suppliers 1, 4 and 6 - suitable suppliers,
- category 3 - suppliers 3 and 5 - potential standby suppliers.

In terms of weighted average and standard deviation, supplier 2 best meets the criteria. To verify the results obtained, the selected indicators for evaluating the performance of suppliers are calculated and presented in Table 4.

**Table 4.** The values of the selected indicators for evaluating the effectiveness of the company's interaction with the suppliers under study.

Indicators	Supplier 1	Supplier 2	Supplier 3	Supplier 4	Supplier 5	Supplier 6	Supplier 7
Share of error-free deliveries in the total number of orders	0.94	0.92	0.94	0.93	0.84	0.9	0.92
Share of orders delivered without damage and losses in the total number of orders placed	0.93	0.94	0.91	0.91	0.93	0.93	0.95
Share of orders delivered in the total number of orders placed	0.95	0.94	0.96	0.95	0.91	0.9	0.95
Share of orders delivered on time in the total number of orders	0.9	0.95	0.88	0.92	0.9	0.92	0.92
Share of employees who received training over the past two years	0.28	0.51	0.18	0.3	0.25	0.48	0.46
Share of rail transport in the total volume of supplies	0.37	0.4	0.22	0.35	0.2	0.42	0.54
Order picking accuracy	0.9	0.98	0.93	0.93	0.88	0.92	0.94

Share of new services provided to customers in the last two years	0.15	0.33	0.19	0.24	0.19	0.42	0.38
Share of products purchased from the supplier at a discount	0.65	0.77	0.72	0.52	0.43	0.7	0.72
Recycled materials utilization rate	0.18	0.32	0.15	0.24	0.2	0.27	0.3

The calculation of the indicators was carried out based on the data received from supplier companies, as well as on the experience of cooperation between the enterprise under study and suppliers considered. The analysis of the data in Table 4 reveals three clear leaders in terms of selected indicators, including suppliers 2, 6, and 7. As a result of applying the scoring method, suppliers 2 and 7 are classified as recommended, while supplier 6 is classified as suitable. For the rest the values of the calculated indicators (Table 4) correspond to the rating scores of suppliers (Table 3), therefore, the ranking of suppliers should be adjusted as follows:

- category 1 - suppliers 2, 6 and 7 - recommended suppliers,
- category 2 - suppliers 1 and 4 - suitable suppliers,
- category 3 - suppliers 3 and 5 - potential standby suppliers.

The results of the evaluation can be used to analyze the interaction of the organization under consideration with suppliers and select the most suitable of them for further cooperation. It is recommended to carry out such supplier evaluation procedure from time to time, considering changing internal and external factors.

## 4 Discussion

There are many studies on supply logistics, which are focused on the issue of supplier evaluation and selection. For the most part, discussions encompass the problems of choosing criteria and methods for supplier evaluating, caused by the lack of an efficient comprehensive assessment procedure, business transformation under the influence of new trends, lack of efficiency of existing evaluation methods (Konys, 2019; Muratova et al., 2021; Pató, Kiss, 2019). In particular, it is highlighted that the existing supplier evaluation methods might be associated with high complexity and limitations by quantitative parameters (mathematical modeling methods), lack of balance and inconsistency (analytic hierarchy process, analytic network process), subjectivity and high dependence on expert opinion (scoring method, matrix approach) and other restrictions (Giannakis et al., 2020; Lopes, Rodriguez-Lopez, 2021; Su, Zhan, 2020; Naqvi, Amin, 2021). Such criticism indicates the difficulty of developing a universal method for effectively evaluating suppliers of any company. Furthermore, it should also be mentioned that the choice of suitable criteria that determine the procedure for evaluating suppliers and subsequent analysis of cooperation with them affects supplier selection, quality of products, as well as the

efficiency of procurement logistics and enterprise performance as a whole. Accordingly, the assumption that it is necessary to adjust the evaluation criteria as a result of changes in the needs of the company and/or other significant factors seems logical. In addition, the technique proposed in this study makes it possible to increase the objectivity of supplier evaluation due to expanding the scoring method by calculating the weighted average and standard deviation for supplier ranking purposes, as well as calculating and analyzing selected indicators for evaluating the organization's interaction with suppliers in order to compare and consider the evaluation results obtained using different ways.

## **5 Conclusion**

Under current conditions, the supplier selection seem to be a key element of any company's activity, since it affects its performance. To improve the efficiency of the company's procurement management, it is necessary to evaluate suppliers and select the most relevant ones for cooperation. One of the most common mistakes organizations make is choosing a supplier based on assumptions, subjective opinion, or analysis without considering supplier evaluation criteria which are significant for the organization. Existing methods for evaluating suppliers are criticized by the authors of research papers due to various limitations (high complexity, subjectivity, lack of comprehensiveness, inconsistency of analysis, etc.). It seems that the methods and models of supplier evaluation used by enterprises should be as simple as possible, practical and adapted to the specific needs of the company. In this context, proposed in the article algorithm for supplier evaluation helps overcome identified barriers. It is based on the assumption, that to increase the flexibility and improve performance of the company, supplier evaluation should be carried out cyclically, considering relevant changes in the internal and external environment. Therefore, this process involves the selection of criteria for analysis, which best meet the needs and goals of the company at the time of evaluation, instead of using the same set of criteria for every evaluation. The developed technique helps increase the comprehensiveness and objectivity of the evaluation by calculating the weighted average and standard deviation for supplier ranking, and by analyzing the selected indicators for evaluating the effectiveness of the organization's interaction with suppliers.

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