
Analysis of the System of Assessment and Selection of Suppliers in Researched Central Europe Enterprises

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Ewa Kulińska¹, Marek Matulewski²

Abstract:

Purpose: This paper presents the methodology of the system of assessment and selection of suppliers on the example of a selected service enterprise. A basic review of literature on multi-criteria methods is presented and phases of the supplier assessment and selection process necessary to develop a model of supplier selection in service industry enterprises are defined.

Design/Methodology/Approach: In order to realize the intended conception, a detailed assessment of suppliers was made according to the selected methods. The first verification method to support the company's supplier selection and assessment process is the local analysis, which includes the arithmetic average method, the weighted average method, and the percentage method. Another scoring-based supplier assessment and selection method is the matching matrix. Graphical verification is another example of multi-criteria verification based on local analysis which is an extension of it. Another example of supplier verification is the method of qualitative variables. The last method used to assess and select suppliers is the AHP analytical hierarchical process. Supplier selection based on this model requires the enterprise to determine the most important criteria that will be used to assess suppliers.

Findings: Of all the verification methods analysed, the analytical hierarchy process model proved to be the most effective and it is on this basis that enterprises should make their supplier selection.

Practical Implications: A thorough analysis of the enterprise's relations with suppliers carried out in the practical part allowed to identify the problem of the company's high dependence on suppliers. Despite constant supervision of cooperation and a restrictive selection process, there are still shortages of supplies and errors in orders resulting from suppliers' inattention.

Originality value: Formulating the right rules of conduct in the process of selecting and assessing a supplier and applying the most optimal method will make it possible to solve many existing problems in the company's procurement logistics.

Keywords: Supplier selection, procurement process, supply chain, multi-criteria methods.

JEL codes: M10, M11, M12.

Paper Type: Research paper.

¹Opole University of Technology, Chairwoman of the Scientific Council of the Discipline of Management and Quality Sciences, Opole, Poland, e.kulinska@po.edu.pl

²Poznan School of Logistics, Chair of Information Systems and Digital Technology, Poznan, Poland, marek.matulewski@wsl.com.pl

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1. Introduction

Selecting the right supplier for many companies is one of the most important aspects of business operations. The quality of purchased goods affects the profitability and efficiency of the company, as well as customer satisfaction. The aim of complex assessment and selection of suppliers is to indicate such errors, as well as an attempt to answer the question how to choose the right supplier.

The aim of the paper is to indicate the most optimal method for assessment and selection of suppliers from among the methods most commonly used in practice. In order to realize the intended conception, a detailed assessment of suppliers was made according to the selected methods.

The procurement process binds all participants in the supply chain together as well as ensures the required quality created by suppliers in the chain area. Procurement is a process that includes all activities related to identifying needs, locating and selecting suppliers, negotiating terms and conditions, and observing the contractor to ensure that he meets performance conditions. In a narrower sense, procurement is all the activities necessary to acquire goods and services that meet the requirements of users. It is, therefore, one of the most important factors in increasing the profitability of the company. To characterize the processes that precede the sphere of production other terms than procurement are also used, namely "material management" and "material procurement".

The procurement process can be defined as the element of the logistics process in which the replenishment of goods takes place. Among the activities that make up the procurement process are: determining or reassessing needs, defining and evaluating user requirements, making a "make or buy" decision, determining the type of purchase, conducting a market analysis, identifying all possible suppliers, pre-selecting all possible sources of supply, evaluating other suppliers, selecting a specific supplier, accepting delivery of a product or service, and assessing delivery performance.

The above presented operations occurring in the procurement process are applied in the case of purchase of goods and services in industrial markets. By carrying out the above activities beneficially, value can be maximized not only for the buying company but also for the selling company while maximizing value in the supply chain. The organization of the procurement process is designed to minimize costs and at the same time maintain proper supply and inventory.

2. Analysis of Research Findings

The research was conducted in 168 companies of restaurant, hotel and leisure industry located in Central Europe. Among the features expected from the suppliers in the majority of entities, the following stand out above all, completeness of delivery, timeliness, quality, price.

Due to the specifications of the goods, companies conduct market research on average every three months in order to find the most optimal supplier and to minimize the delivery time to a maximum of 2 days. Currently, the lead time varies from 1 to 3 days, with occasional deviations from the delivery cycle due to lack of goods or supplier compliance with a predetermined deadline. Stock is maintained at the level of 10-15% and only in the case of goods with a long shelf life, while the remaining stock is ordered in a variable cycle depending on the needs and seasonality of goods.

Analyses were conducted for all subjects studied. A representative example will be presented in the paper.

The first verification method to support the company's supplier selection and assessment process is the local analysis, which includes the arithmetic average method, the weighted average method, and the percentage method. Companies which constantly cooperate with the enterprise are assigned numbers from 1 to 5, where 1 means the lowest quality, the highest price, and 5 is the highest quality and the lowest price. Supporting the selection process with an arithmetic average is the easiest way to make a choice, but it does not take into account the degree of importance of a given criterion for the company. In order to identify the right supplier based on the importance of individual criteria, a weighted average should be used, where the degree of importance is determined by its weight. For the subjects studied, the above method is presented in Table 1.

Table 1. Scoring verification of the supplier assessment and selection process

Criteria	Weight	D1	D2	D3	D4	D5	D6	D7
Quality	0,3	5	3	4	5	4	4	3
Price	0,2	5	3	4	4	4	4	3
Timeliness	0,1	4	5	5	4	4	5	3
Delivery frequency	0,07	5	5	5	4	4	5	5
Flexibility	0,06	5	5	5	3	3	5	2
Distance	0,04	4	5	3	4	2	3	4
Lead time	0,04	5	5	5	3	3	4	4
Discounts	0,02	2	4	5	5	3	5	3
Communication with the supplier	0,04	5	3	5	5	5	5	4
Complaints	0,02	4	5	5	3	4	4	3

Delivery terms	0,06	4	3	5	3	4	5	2
Cooperation to date	0,05	5	5	5	5	4	5	3
Arithmetic mean		4,42	4,25	4,67	4,0	3,67	4,5	3,25
Weighted average		4,52	4,18	4,62	4,23	3,84	4,56	3,14
Percentage value		90,4%	83,6%	92,4%	84,6%	76,8%	91,2%	62,8%

Source: Own elaboration.

In addition to the final evaluation by the arithmetic mean and weighted mean method, Table 1 also shows the percentage value, which is the percentage representation of the weighted mean resulting from the survey. Using the percentage note, the suppliers were divided into three groups, depending on their degree of importance to the company (Table 2).

Table 2. *Scoring verification of the supplier assessment and selection process*

Group name	Percentage
Main suppliers	from 81% to 100%
Alternative suppliers	from 66% to 80%
Backup suppliers	from 50% to 65%

Source: Own elaboration.

This classification provides a simple way to evaluate individual suppliers and illustrate their place and importance to the enterprise.

Based on the results in Table 1 and the breakdown of suppliers in Table 2, the major suppliers include, D1, D2, D3,D4 and D6. While the alternative supplier was found to be supplier D5 and the backup supplier was found to be supplier D7.

Another scoring-based supplier assessment and selection method is the matching matrix. In this case, the process of creating the model began with the selection of the five criteria most important to the enterprise, namely: quality, price, timeliness and frequency of delivery, and flexibility. Then two matrixes were created, in which the first (M1) contains information about the requirements that the company places on suppliers, while the second matrix (M2) contains an assessment of the level of fulfillment of the given criteria. Table 3-5 shows the simplified matching matrix for the main suppliers.

Table 3. *Input factors matrix*

M1: requirements - input factors				
Quality	Price	On-time delivery	Delivery frequency	Flexibility
5	5	4	4	4

Source: Own elaboration.

Table 4. Supplier assessment matrix

	M2: assessment				
	Quality	Price	On-time delivery	Delivery frequency	Flexibility
Supplier 1	5	5	4	5	5
Supplier 2	3	3	5	5	5
Supplier 3	4	4	5	5	5
Supplier 4	5	4	4	4	3
Supplier 5	4	4	4	4	3
Supplier 6	4	4	5	5	5
Supplier 7	3	3	3	5	2

Source: Own elaboration.

Table 5. Simplified matching matrix

Matching matrix (M2-M1)					
Supplier 1	0	0	0	1	1
Supplier 2	-2	-2	1	1	1
Supplier 3	-1	-1	1	1	1
Supplier 4	0	-1	0	0	-1
Supplier 5	-1	-1	0	0	-1
Supplier 6	-1	-1	1	1	1
Supplier 7	-2	-2	-1	1	-2

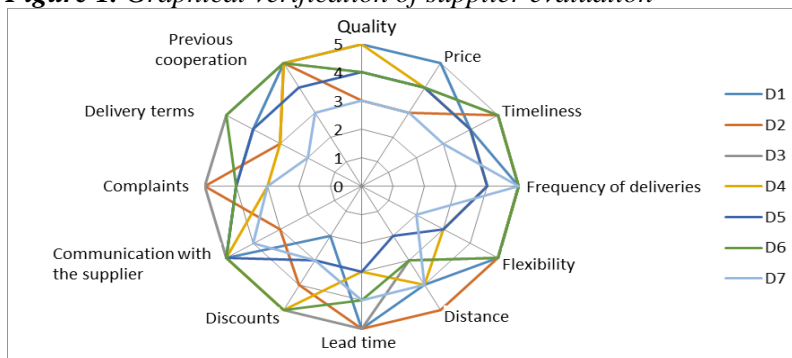
Note:

	- Assessment that meets the requirements
	- Assessment exceeding requirements
	- Non-compliant assessment

Source: Own elaboration.

A comparison of the matrixes allows any gaps or excesses in the individual criteria to be highlighted. The resulting supplier assessment indicates with which suppliers you can continue to cooperate and which suppliers you should give up in order to maintain a sufficiently high level of company reputation.

Figure 1. Graphical verification of supplier evaluation



Source: Own elaboration.

Graphical verification is another example of multi-criteria verification based on local analysis which is an extension of it. The results obtained in Table 1 can be clearly visualized in graphical form. For this purpose, a radar chart is used. The linking of points whose values increase from the center of the circle shows the ratings given to each of the company's suppliers, while the circle-shaped model depicts the ideal supplier.

With this method, it is possible to visually see which suppliers meet only the minimum requirements and differ significantly from the others and among which suppliers there is potential for development. It is therefore a factual representation of the degree of competitiveness of suppliers.

Another example of supplier verification is the method of qualitative variables. Among the criteria analyzed, the four most important ones for the enterprise are selected, which the supplying enterprises absolutely have to meet if they want to continue working with the subject.

Table 6. *Assessment of suppliers using the qualitative variables method*

	Price	Quality	On-time delivery	Flexibility	Result
Supplier 1	+	+	0	+	+
Supplier 2	-	-	+	+	0
Supplier 3	0	0	+	+	+
Supplier 4	0	+	0	-	0
Supplier 5	0	0	0	-	-
Supplier 6	0	0	+	+	+
Supplier 7	-	-	-	-	-

Source: *Own elaboration.*

Suppliers were rated in three categories, good (+), neutral (0) and unsatisfactory (-), and the final phase of the process was a score representing the overall supplier rating. Suppliers who actively cooperate with the company and have a significant impact on the company's development received a value of (+) in the final summary.

The last method used to assess and select suppliers is the AHP analytical hierarchical process. Supplier selection based on this model requires the enterprise to determine the most important criteria that will be used to assess suppliers. The first step is to create a hierarchy model in graphical form, which allows a simple depiction of the decision structure of the problem of selecting the right supplier. The next step is the decomposition of the decision problem in the form of a hierarchy tree, which is shown in Figure 2.

At this stage, the overarching objective, i.e. supplier selection, is indicated, as well as the sub-factors, which are the individual criteria formulated by the decision

K2	0,5	1	2,0	7,0	7,0	8,0	5,0	7,0	7,0	5,0	7,0	8,0
K3	0,5	0,5	1	2,0	7,0	7,0	3,0	2,0	6,0	7,0	6,0	7,0
K4	0,11	0,1	0,5	1	1,0	5,0	1,0	6,0	5,0	3,0	3,0	6,0
K5	0,11	0,1	0,1	1,0	1	1,0	1,0	5,0	3,0	5,0	5,0	3,0
K6	0,11	0,1	0,1	0,2	1,0	1	0,5	1,0	2,0	2,0	2,0	1,0
K7	0,11	0,2	0,3	1,0	1,0	2,0	1	3,0	9,0	9,0	9,0	9,0
K8	0,11	0,1	0,5	0,2	0,2	1,0	0,3	1	2,0	2,0	3,0	4,0
K9	0,11	0,1	0,2	0,2	0,3	0,5	0,1	0,5	1	2,0	2,0	2,0
K10	0,11	0,2	0,1	0,3	0,2	0,5	0,1	0,5	0,5	1	2,0	3,0
K11	0,11	0,1	0,2	0,3	0,2	0,5	0,1	0,3	0,5	0,5	1	1,0
K12	0,11	0,1	0,1	0,2	0,3	1,0	0,1	0,3	0,5	0,3	1,0	1
Total	2,99	4,84	7,23	22,4	28,26	36,5	21,27	35,58	45,5	45,83	50	54

Source: Own elaboration.

The criteria in Table 1 were assigned the labels K1 to K12 and a pairwise comparison was made. The next step is to normalise all priority matrixes by summing the notes in each column and then dividing each value by the sum of each column.

The third and final stage is to determine the relative priority index of each criterion. The obtained values from the division are summed up line by line for each criterion, and then divided by the number of all criteria. With the help of the index, which is the weight of particular criteria, a table of evaluation of particular suppliers is created, as presented in Table 9.

Table 9. *Verification of suppliers using the AHP method*

Criteria	Weight	D1	D2	D3	D4	D5	D6	D7
Quality	0,284	1,42	0,852	1,136	1,42	1,136	1,136	0,852
Price	0,201	1,005	0,603	0,804	0,804	0,804	0,804	0,603
Timeliness	0,139	0,556	0,695	0,695	0,556	0,556	0,695	0,417
Delivery frequency	0,076	0,38	0,38	0,38	0,304	0,304	0,38	0,38
Flexibility	0,059	0,295	0,295	0,295	0,177	0,177	0,295	0,118
Distance	0,029	0,116	0,145	0,087	0,116	0,058	0,087	0,116
Lead time	0,094	0,47	0,47	0,47	0,282	0,282	0,376	0,376
Discounts	0,037	0,074	0,148	0,185	0,185	0,111	0,185	0,111
Communication with the supplier	0,024	0,12	0,072	0,12	0,12	0,12	0,12	0,096
Complaints	0,023	0,092	0,115	0,115	0,069	0,092	0,092	0,069
Delivery terms	0,017	0,068	0,051	0,085	0,051	0,068	0,085	0,034
Cooperation to date	0,016	0,08	0,08	0,08	0,08	0,064	0,08	0,048
Total		4,68	3,91	4,45	4,16	3,77	4,34	3,22

Source: Own elaboration.

After summing up the results for each supplier, a comparison of the results obtained with the results of Table 1 is made for the weighted average in descending form presented in Table 10.

Table 10. Comparison of the results of supplier assessment based on two methods

Local method			AHP method		
D3	4,62	92,4 %	D1	4,68	93,6 %
D6	4,56	91,2 %	D3	4,45	89 %
D1	4,52	90,4 %	D6	4,34	86,8 %
D4	4,23	84,6 %	D4	4,16	83,2 %
D2	4,18	83,6 %	D2	3,91	78,2 %
D5	3,84	76,8 %	D5	3,77	75,4 %
D7	3,14	62,8 %	D7	3,22	64,4 %

Source: Own elaboration.

The method of the analytical hierarchy process made it possible to determine the most important suppliers for the enterprise. After the comparison, it can be seen that in the AHP method, supplier D1 turned out to be the most important supplier, while in the local method it took third place. Supplier D3 ranked second after detailed AHP analysis, indicating that despite receiving more points in the local method, the most important criteria indicated by the company were rated lower than in the case of supplier D1.

A similar situation occurs for supplier D6, which ranked third in the analytical hierarchy process method. The other suppliers, despite the difference in final scores, occupy the same positions. As in the case of the other methods, supplier D7 turned out to be the weakest supplier, so the company should consider its desire for further cooperation, as it may have a negative impact on the enterprise.

Of all the verification methods analysed, the analytical hierarchy process model proved to be the most effective and it is on this basis that enterprises should make their supplier selection.

3. Conclusions and Summary

A thorough analysis of the enterprise's relations with suppliers carried out in the practical part allowed to identify the problem of the company's high dependence on suppliers. Despite constant supervision of cooperation and a restrictive selection process, there are still shortages of supplies and errors in orders resulting from suppliers' inattention.

This paper demonstrates that the most effective selection method is the analytical hierarchy process model, and that its proper application makes it possible to mitigate such problems by identifying suppliers that do not meet the enterprise's requirements and also negatively affect the company's profitability.

Furthermore, the use of multi-criteria methods makes it possible to identify suppliers who have a positive impact on the growth of the enterprise's value, as well as to distinguish those who are constantly developing. Formulating the right rules of conduct in the process of selecting and assessing a supplier and applying the most optimal method will make it possible to solve many existing problems in the company's procurement logistics.

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