RANKING FACTORS FOR SUPPLIER SELECTION WITH APPLICATION OF THE FTOPSIS METHOD

Adis Puška[1], Sead Šadić[2], Admir I. Beganović[3]

ABSTRACT

The first step in starting each production is the choice of suppliers. The choice of suppliers is influenced by many factors that differ depending on whether it is the first relationship with suppliers or it is about establishing partnerships with suppliers. Factors influencing selection are different and depend on business cooperation with suppliers themselves. Unlike other works, this paper applies expert judgment in the rankings of supplier selection factors. Experts include those scientists who published scientific papers on this subject by the prestigious Elsevier publishing house. Experts were assigned a survey questionnaire containing 39 factors for supplier selection to which they gave their opinion on which of these factors is important for establishing new cooperation or establishing partnerships with suppliers. The answers received were processed and the factors were ranked using the fuzzy TOPSIS method. The results showed that various factors are used in this cooperation with suppliers.

Keywords: supplier selection, expert opinion, fuzzy TOPSIS

JEL: C50, L80

1. INTRODUCTION

In everyday business, the company meets with supplier selection. In order to solve this problem of decision making, it is necessary to select the criteria by which suppliers will be evaluated. What follows is to, by using the available set of solutions, select the supplier and choose the suppliers that best meet the criteria set. When choosing a new supplier, it is not paid great attention as it is when selecting suppliers the company will establish a long-term partnership relationship with. The selection of a new supplier is an operational decision-making problem, and the selection of a supplier with the possibility to establish a long-term partnership relationship is a strategic decision-making problem. When resolving the strategic decision-making problem, group decision-making is usually used, where it is necessary to get as much information as possible from employees who thus contribute to decision-making process.

In practice, the tendency is to pay more attention to customer relationships, and consequently the relationship with suppliers is neglected. Suppliers are being overshadowed by customers without whom there would be no sale and therefore no company profit. However, companies must take into account that their key vendors are the segment on which the business of the company depends. Porter (1980) created a model of five competing powers and stated that the negotiating forces of the supplier were one of them. In this way, it emphasizes the supplier's position in every company. Establishing relationships with suppliers is a key activity because establishing good relationships with suppliers builds all other

[1] *College of Computer Science and Business Communications eMPIRICA, adispuska@yahoo.com*
[2] *PHI Health Center Brčko, sead23@gmail.com*
[3] *The University of Business Studies Banja Luka,admirbeganovic52@gmail.com*

models such as inventory management and production.

This paper explores the most important factors in choosing a new supplier and establishing partnerships with suppliers. In order to investigate the most important factors influencing the selection of suppliers, expert judgment was used in both cases. The authors who published scientific papers from this field by the prestigious publishing house Elsevier were taken as experts. Their answers were then ranked by the fuzzy TOPSIS (FTOPSIS) as the answers were in the form of linguistic values and needed to be transformed into numerical values. The factors for the selection of suppliers were then ranked based on expert grades.

The aim of this paper is to investigate the most important factors influencing the selection of a new supplier and the possibility for establish partnerships with suppliers. The term "new supplier" in this paper is used for those suppliers with which companies are just beginning business cooperation. Building partnerships with suppliers involves raising business cooperation with key suppliers to a higher level so that these suppliers become a backbone of the company. The problem of every company is how to choose one or several suppliers from the total number of suppliers existing on the market . Through the development of cooperation with suppliers after a certain period of time, partnerships with suppliers are established. The selection of the supplier is done by evaluating certain criteria or factors that influence this choice. The task of the experts was to determine which key factors of companies are needed in the selection of the supplier.

2. IMPORTANCE OF THE SUPPLIER SELECTION FOR ENTERPRISES

The selection of suppliers is the first step in the process of product realization, starting from the procurement of materials to the delivery of the product. It is a key factor for the company to be successful on the market (Gencer & Gurpinar, 2007). Hudymáčová et al. (2010) emphasize that the choice of suppliers is one of the most important operations in every company. With the right supplier selection, the company will have a partner to rely on in its business. That is why supplier selection is the key decision for the profitability, growth and survival of enterprises in a competitive global environment. Supplier selection is a strategic decision that affects the overall success of each company (Aguezzoul, 2012).

The supplier selection process is one of the most important decisions that have a direct impact on the performance of the company (Singh & Rujput, 2012). The right supplier selection can significantly reduce enterprise costs and improve competitiveness (Ghodsypour & O'Brien, 2001). For an enterprise it is not only important to choose a supplier that will supply it with materials and raw materials, but it is important to establish strategic partnerships with key suppliers. The importance of strategic partnerships with suppliers is important for every company. Strategic partnerships with suppliers should be established in order to improve quality, flexibility and reduce production time (Rajesha & Malliga, 2013). With the establishment of partner relations with the supplier, the reliability in purchasing materials and raw materials is improved. A supplier who is a partner with the company has an insight into the company's stock and can permanently act and initiate the procurement process by sending a bid. In this way, production runs smoothly and it is possible to shorten production time, which makes the company react faster to changes on the market.

Supplier selection is influenced by many factors. In the last few years, determining the best supplier has become a key strategic decision. However, this decision usually

involves several goals or criteria, and it is often necessary to make a compromise between possible conflicting criteria (Liao & Kao, 2011). One of the aims of this paper is to show if there is a difference between the supplier selection factor when it comes to selecting a new supplier or choosing suppliers to become potential partners.

Supplier selection is one of the most important aspects that companies need to incorporate into their strategic processes (Taghizadeh & Ershadi, 2013). The problem of selecting suppliers is a challenge not only for scientists, but also for professionals in the procurement department, and for the entire enterprise (Šimunović et al., 2011). The goal of every company is to find an appropriate supplier that best meets the set goals of the company. In modern economic conditions with the possibility to procure raw materials from any part of the world within a reasonable time, the problem of selecting suppliers has become more complex over time. Now, it is possible to find a large number of suppliers, but the underlying problem is who the best suppliers to establish partnerships are.

Dickinson (1966) performed the first complete research of a factor affecting supplier selection. He identified 23 factors that influence supplier selection (Liao & Kao, 2011). Weber et al. (1991) included in the survey 74 papers that considered this topic. Cheraghi, et al. (2004) included 113 papers that deal with the issue of supplier selection. They found that the most frequently used factors are the following: price, delivery and quality. Liao and Kao (2011) identified 29 different factors influencing supplier selection, citing earlier research. Aguezzoul (2012) identified 36 factors, out of which 13 factors appeared after 1990. At the end of the 20th and the beginning of the 21st century, the focus on supplier selection was shifted from quantitative to qualitative factors. De Silva et al. (2009) emphasize that it is

precisely in the 21st century that suppliers selection focused on qualitative rather than on quantitative indicators.

As it can be seen from this overview of works, supplier selection is influenced by many factors. It is extremely important to identify the most important factors that influence the selection of a new supplier and supplier with whom a long-term partnership will be established.

3. BASICS OF FUZZY LOGIC

The concept of the fuzzy set was introduced by Zadeh in 1965. According to his explanation, fuzzy sets have two different meanings: a narrower approach in which the fuzzy logic is an extension of the classical logic and a broader approach where the fuzzy logic is used in sets that do not have clear boundaries. This concept allows us to see the degree of belonging of an element to a particular set, i.e., we associate each element with a real number as an indicator of the degree of belonging of this element to a set (Pavkov & Japundžić, 2012). The fuzzy approach is closer to human thinking because in the real world there are situations that are not completely separated and sometimes it is very difficult to determine the boundary.

When using the fuzzy logic, it is necessary to determine the membership function $\mu_A(x)$, which shows how this function fulfills the condition of belonging to the set A. By applying the classical theory $\mu_A(x)$, it can only receive two values of 1 and 0, while in the fuzzy theory there can be any value in the interval 0 to 1. If a particular claim has "more truth", this assertion will, to a greater degree, fulfill the conditions of belonging to the set A. In this case, the membership function is $0 \leq \mu_A(x) \leq 1$ for each element of the set A.

Each fuzzy set is completely and uniquely determined by its membership function. According to the fuzzy theory, the selection of

the membership function, that is, the form of function and the width of the confidence interval are most often done on the basis of subjective assessment or experience (Božanić & Pamučar, 2010). The use of a triangular approach to fuzzy numbers is the following relation (Chen, 2000):

$$\mu_A(x) = \begin{cases} 0, & x < l \\ (x-l)/(m-l), & l \leq x \leq m \\ (u-x)/(u-m), & m \leq x \leq u \\ 0, & \text{remaining} \end{cases} \quad (1)$$

The membership function is graphically depicted in Figure 1.

Figure 1. Membership functions of triangular fuzzy numbers
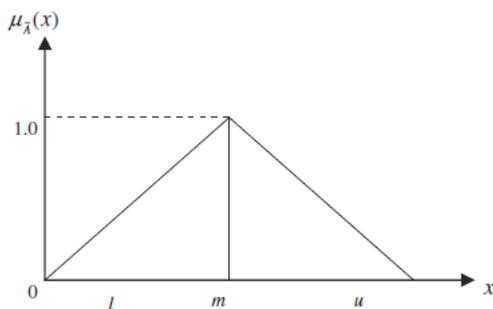
Source: Chen, C.T. (2000). Extensions of the TOPSIS for group decision-maging under fuzzy environment. Fuzzy Sets and Systems. 114(1), p 4

If we observe the two fuzzy sets $\tilde{A}_1 = (l_1, m_1, u_1)$ and $\tilde{A}_2 (l_2, m_2, u_2)$ then the basic algebraic operations on these numbers can be performed as follows:

Multiplication of fuzzy numbers:

$\tilde{A}_1 \cdot \tilde{A}_2 = (l_1,m_1,u_1)\cdot(l_2,m_2,u_2) = (l_1 l_2, m_1 m_2, u_1 u_2)$ for $l_1,l_2>0$; $m_1,m_2>0$; $u_1,u_2>0$ (2)

Subtracting fuzzy numbers:

$\tilde{A}_1 - \tilde{A}_2 = (l_1,m_1,u_1)-(l_2,m_2,u_2) = (l_1-l_2, m_1-m_2, u_1-u_2)$ for $l_1,l_2>0$; $m_1,m_2>0$; $u_1,u_2>0$ (3)

Division fuzzy numbers:

$\tilde{A}_1/\tilde{A}_2 = (l_1,m_1,u_1)/(l_2,m_2,u_2) = (l_1/l_2, m_1/m_2, u_1/u_2)$ for $l_1,l_2>0$; $m_1,m_2>0$; $u_1,u_2>0$ (4)

Reciprocity of fuzzy numbers:

$\tilde{A}^{-1} = (l_1,m_1,u_1)^{-1} = (1/l_1, 1/m_1, 1/u_1)$ for $l_1,l_2>0$; $m_1,m_2>0$; $u_1,u_2>0$ (5)

When using fuzzy logic, it is possible to use a fuzzy numbers and linguistic expressions. In this paper, linguistic expressions will be used, where linguistic value will be used to determine the importance of individual factors according to the importance of these factors. This research will use linguistic values in the form of a Likert scale with seven levels of belonging. These degrees of belonging range from very little importance to very high importance. The use of linguistic variables according to Zadeh (1975) gives a value that is less general than the numerical value. This will leave space for experts to assess the importance of individual factors for selecting suppliers. In this way values are formed so that the two endpoints are very close to zero and one, while the mean values are evenly distributed between these endpoints. On the basis of this membership, the linguistic values of fuzzy numbers shown in Table 1 are formed.

Table 1. Linguistic values of fuzzy numbers

Linguistic variables	Fuzzy number
Very Low Importance (VLI)	0, 0, 0.1
Low Importance (LI)	0, 0.1, 0.3
Medium Low Importance (MLI)	0.1, 0.3, 0.5
Middle Importance (MII)	0.3, 0.5, 0.7
Medium Importance (MEI)	0.5, 0.7, 0.9
High Importance (HI)	0.7, 0.9, 1
Very High Importance (VHI)	0.9, 1, 1

Source: Authors of the research

4. FTOPSIS METHOD

In 1981, Hwang and Yoon developed the TOPSIS method. It is based on the concept that the alternative should have the shortest distance from the positive ideal solution and the longest distance from the negative ideal solution (Lu et al., 2007).

The basic logic of the FTOPSIS method is to first define an ideal positive solution and an ideal negative solution. The best one is the alternative, which is in the geometric sense closest to the ideal positive solution, that is, the longest of the ideal negative solution.

The ideal solution is defined using the best value alternatives for each individual criterion, and the negative ideal solution represents the worst value of the alternative rating. The terms "best" and "worst" are interpreted for each criterion separately, according to whether it is maximizing or minimizing the criteria" (Srđević et al., 2002).

For most decision-making models, human thinking is vague and influences decision-making, so it is better to use the FTOPSIS method at that time." (Farzami & Vafaei, 2013).

The steps in implementing the FTOPSIS method are:

Step 1 Identification criteria for evaluating alternatives.

Step 2 Generating alternatives.

Step 3 Evaluation of the alternative.

Step 4 Identifying the weight of the criterion. (Jahanshahloo et al., 2006).

Step 5 Evaluation of preference through fuzzy sets and forming decision matrix.

Step 6 A linguistic transformations of the preferences using the above transformation represented by Table 1.

Step 7 Normalization using linear transformation, by using the following relation for the criteria which need to be maximized:

$$r_{ij} = \left(\frac{l_{ij}}{u_j^+}, \frac{m_{ij}}{u_j^+}, \frac{u_{ij}}{u_j^+} \right), \ u_j^+ = \max_i \left\{ u_{ij} \text{ for } i=1,2,...n \right\} \ (6)$$

or the following relationship when the criteria need to be minimized:

$$r_{ij} = \left(\frac{l_j^+}{l_{ij}}, \frac{l_j^+}{m_{ij}}, \frac{l_j^+}{u_{ij}} \right), \ u_j^+ = \min_i \left\{ l_{ij} \text{ for } i=1,2,...n \right\} \ (7)$$

Where u_j^+ is the maximum value of the criteria elements for the third fuzzy number and l_j^+ is the minimum value of the criteria elements for the first fuzzy number. Due to the nature of the fuzzy numbers that the first fuzzy is the smallest number and the third fuzzy is the biggest number, only these numbers are taken (Chan, 2000).

Step 8 Multiplication of the obtained normalized values with the corresponding weight coefficients.

Step 9 Determine the distance of alternatives from ideal solutions. In this step the n-dimensional Euclidean distances of all alternatives of an ideally positive and ideally negative solution are calculated by means of relations.

$$A^* = (v_1^*, v_2^*,...,v_n^*) \ v_j^* = (1,1,1) \qquad (8)$$

$$A^- = (v_1^-, v_2^-,...,v_n^-) \ v_j^- = (0,0,0) \qquad (9)$$

$$d_i^* = \sum_{j=1}^n d(\tilde{v}_{ij}, \tilde{v}_j^*), \ i=1,2,...,m \qquad (10)$$

$$d_i^- = \sum_{j=1}^n d(\tilde{v}_{ij}, \tilde{v}_j^-), \ i=1,2,...,m \qquad (11)$$

Where A^* is an ideal positive solution, and A^- is an ideal negative solution. d_i^* represents the value of the deviation of the weighted elements of particular criteria from an ideal positive solution, while d_i^- represents the deviation of certain criteria from an ideal negative solution. On the basis of these relations, it is calculated how many alternatives are there in a particular criterion regarding an ideal solution.

Step 10 Determine the relative proximity of the alternative to the ideal solution. For each

alternative, a relative distance is determined based on the following formula:

$$CC_i = \frac{d_i^-}{d_i^* + d_i^-}, \; i = 1, 2, ..., m \; (12)$$

The result of the FTOPSIS method is in the interval: $0 \leq CC_i \leq 1$. When the alternative Ai is closer to the ideal solution then the CC_i value is closer to 1. Alternative Ai will take the value 1 if its values are identical to the positive ideal solution, and the value is 0 if its values are identical to the negative ideal solution.

5. RANKING FACTORS FOR SUPPLIER SELECTION

Different approaches have been used in determining the importance of certain factors affecting supplier selection. In order to determine which factors influenced supplier selection, a survey of experts was made who published relevant papers on this topic.

The scientific portal www.sciencedirect.com was taken to determine the basic set of this research. It has about 4,000 magazines. In order to identify the experts or scientific workers who dealt with the topic of supplier selection, the search of this portal was used according to the keywords: supplier selection and long-term relationships with suppliers. A total of 66,917 and 68,390 papers were found. Because of the excessive number of works, a further search focused on key words and summary was made. After that 375 papers

related to the key phrase 'supplier selection' and 241 papers related to key phrase 'long-term relationships with the suppliers' was found. Since some of the papers appear in both searches, the total sample was 543 papers with 977 emails of authors who wrote these works. An e-mail was sent to all authors with a request to respond to a questionnaire that consisted of two parts: the first part was for the selection of a new supplier within short-term relationships and the second part for the selection of suppliers with which the company should establish long-term business cooperation.

In both of these parts, 39 factors which are used in supplier selection were used. The experts were required to evaluate these factors in order to determine which factors are most important for the selection of the new supplier and which factors are the most important for establishing long-term partnerships with the supplier.

Out of the total number of e-mails sent, 43 were invalid, because e-mail addresses were not active anymore, and so the number of experts who received the e-mail was 934. Out of that number, 56 completed the questionnaire. In order to determine the importance of certain factors that influence the selection of the supplier, the FTOPSIS method and the MS Excel program was used in which all the calculations necessary for this work were made. The results obtained by the experts' responses are presented in Table 2.

Table 2. Answers of experts on the importance of the factor for selecting a new supplier.

Factors for supplier selection	1	2	3	4	...	56
Ethic codes of the company	HI	MLI	LI	MEI	...	MLI
Desk side service price	MEI	VLI	LI	HI	...	VHI
Procedural compliance delivery	MII	MLI	MII	MEI	...	HI
Social responsibility of the company	MEI	MII	MEI	MEI	...	MLI
Warranty	VHI	MEI	HI	MEI	...	HI
...	...	...	...	...	...	...
Support provision speed	MEI	HI	HI	MEI	...	MEI

Sources: research results

When completing the second part of the survey questionnaire, two experts did not answer one question, and they were excluded from the analysis, so 54 experts in total were included in this analysis.

Table 3. Answers of experts on the importance of factors for long-term cooperation with suppliers

Factors for supplier selection	1	2	3	4	...	54
Ethic codes of the company	HI	HI	MII	VHI	...	MEI
Desk side service price	MEI	MEI	MII	HI	...	MEI
Procedural compliance delivery	MEI	MII	HI	MII	...	VHI
Social responsibility of the company	MEI	VHI	HI	MEI	...	MII
Warranty	HI	HI	MII	VHI	...	MEI
...	...	...	...	...	...	...
Support provision speed	HI	VHI	VHI	HI	...	HI

Sources: research results

The next step in ranking and computing the FTOPSIS method consisted of transforming linguistic values into fuzzy numbers (Table 4, Table 5).

Table 4. Fuzzy values of the experts' answers to the importance of individual factors for selecting a new supplier

Factors for supplier selection	1	2	3	4		56
Ethic codes of the company	0.7,0.9,1	0.1,0.3,0.5	0.1,0.3,0.5	0.5,0.7,0.9	...	0.1,0.3,0.5
Desk side service price	0.5,0.7,0.9	0, 0.1,0.3	0.1,0.3,0.5	0.7,0.9,1	...	0.9,1,1
Procedural compliance delivery	0.3,0.5,0.7	0.1,0.3,0.5	0.3,0.5,0.7	0.5,0.7,0.9	...	0.7,0.9,1
Social responsibility of the company	0.5,0.7,0.9	0.3,0.5,0.7	0.5,0.7,0.9	0.5,0.7,0.9	...	0.1,0.3,0.5
Warranty	0.9,1,1	0.5,0.7,0.9	0.7,0.9,1	0.5,0.7,0.9	...	0.7,0.9,1
...	...	...	...	...	...	...
Support provision speed	0.5,0.7,0.9	0.7,0.9,1	0.7,0.9,1	0.5,0.7,0.9	...	0.5,0.7,0.9

Sources: research results

Table 5. Fuzzy values of the experts' answers to the importance of certain factors for long-term cooperation with suppliers

Factors for supplier selection	1	2	3	4		54
Ethic codes of the company	0.7,0.9,1	0.7,0.9,1	0.3,0.5,0.7	0.9,1,1	...	0.5,0.7,0.9
Desk side service price	0.5,0.7,0.9	0.5,0.7,0.9	0.3,0.5,0.7	0.7,0.9,1	...	0.5,0.7,0.9
Procedural compliance delivery	0.5,0.7,0.9	0.3,0.5,0.7	0.7,0.9,1	0.3,0.5,0.7	...	0.9,1,1
Social responsibility of the company	0.5,0.7,0.9	0.9,1,1	0.7,0.9,1	0.5,0.7,0.9	...	0.3,0.5,0.7
Warranty	0.7,0.9,1	0.7,0.9,1	0.3,0.5,0.7	0.9,1,1	...	0.5,0.7,0.9
...	...	...	...	...	...	
Support provision speed	0.7,0.9,1	0.9,1,1	0.9,1,1	0.7,0.9,1	...	0.7,0.9,1

Sources: research results

After the transformation of the linguistic value into a numerical phase, the numbers need to be normalized (6). The next step in implementing the FTOPSIS method was to assign weight coefficients to certain values of marks. Since every expert's opinion is equally valued, the same value is assigned. Then value of the distance alternatives from the ideal

solutions followed the calculation based on the relations (10) and (11). Based on distance, the value of the FTOPSIS method was calculated and a ranking order of factors influencing the selection of a new supplier or the selection of the key supplier with which the long-term business cooperation will be established, was formed. This is presented in Table 6.

Table 6. Ranking factors for supplier selection

Factors for supplier selection	Selection of new suppliers				Selection of partnership suppliers			
	d^*	d^-	CC	Rank	d^*	d^-	CC	Rank
Ethic codes of the company	9.31	16.81	0.6435	19	8.48	18.25	0.6828	15
Desk side service price	8.90	15.98	0.6423	20	10.18	15.64	0.6057	34
Procedural compliance delivery	8.13	17.35	0.6809	12	8.14	17.78	0.6860	12
Social responsibility of the company	10.97	15.05	0.5784	35	9.47	16.91	0.6409	24
Warranty	7.07	18.30	0.7213	5	7.93	18.23	0.6968	9
Flexibility of delivery	6.11	18.04	0.7470	2	7.05	18.77	0.7270	4
Financial and credit position of the company	7.38	17.79	0.7069	8	7.39	18.44	0.7139	7
ISO standards	10.14	15.53	0.6050	31	10.01	16.28	0.6193	30
Flexibility of the product	8.49	16.52	0.6604	17	8.34	17.49	0.6773	17
JIT delivery	8.10	17.65	0.6853	9	8.37	17.98	0.6824	16
Distance of the company	10.04	15.83	0.6118	29	10.46	15.73	0.6006	35
Company experience	8.52	16.69	0.6621	16	8.23	17.80	0.6839	14
Communication skills	9.70	15.93	0.6215	25	9.73	16.92	0.6349	26
Aesthetics and practicality of the packaging	11.77	13.38	0.5320	38	12.25	13.95	0.5324	39
Production capacity	9.13	15.67	0.6320	23	9.42	16.29	0.6336	27
Company competence	7.95	16.76	0.6782	13	8.39	17.47	0.6756	18
Product quality	4.13	19.94	0.8285	1	6.92	19.45	0.7376	2
Consistency of the delivery	6.82	18.34	0.7291	3	6.42	19.16	0.7490	1
Recycling possibilities of the product	11.09	14.42	0.5653	36	10.47	15.58	0.5981	36
Environment preservation	9.76	15.57	0.6146	28	8.89	17.02	0.6568	22
Company organization and management	9.09	16.03	0.6382	21	7.98	17.64	0.6885	11
Net Price	6.85	17.89	0.7232	4	9.21	16.95	0.6480	23
Deferred payment	10.00	14.79	0.5965	33	9.87	15.81	0.6155	32
Sustainable development companies	10.20	15.03	0.5958	34	9.81	16.17	0.6224	29
Possibility of on-line support	10.37	15.40	0.5977	32	10.40	16.26	0.6099	33
Price discounts	9.62	16.25	0.6281	24	10.06	16.71	0.6242	28
Insurance and risk cover during the delivery	9.83	16.01	0.6196	27	10.10	16.20	0.6160	31
Conspicuous products	11.21	13.73	0.5506	37	11.78	14.10	0.5449	38
After sale services of the supplier	8.42	17.44	0.6744	14	7.38	18.54	0.7153	6
Continual improvement of the products	8.40	16.86	0.6675	15	7.04	18.84	0.7279	3
Company position on the market	10.13	15.80	0.6093	30	8.48	17.22	0.6700	19
Delivery expenses	9.69	15.89	0.6214	26	9.44	16.78	0.6400	25
Company size	12.47	13.39	0.5177	39	11.29	14.68	0.5651	37
Modern equipment and technology	9.07	15.99	0.6381	22	8.72	16.73	0.6574	21
Reducing cost of delivery	8.60	16.70	0.6600	18	7.61	17.93	0.7019	8
Claims solving	7.90	17.19	0.6850	10	8.63	17.28	0.6669	20
Performance of delivery history	8.00	17.09	0.6812	11	8.19	17.73	0.6841	13
Quality orientation of the company	6.96	17.73	0.7181	6	7.19	18.55	0.7206	5
Support provision speed	6.95	17.37	0.7142	7	7.88	18.08	0.6965	10

Sources: research results

The results obtained by this survey show that the selection of a new supplier is the most important factor in the quality of the product, and then follows the flexibility of delivery, i.e., adjusting the supplier to the needs of the company and the consistency of the delivery. The price of the product is at the fourth place. Based on this order of factors for choosing a new supplier, it can be seen that the most important factors for the company are the quality of materials and raw materials and the delivery. In addition to the factors that are related to these groups, in the top ten factors are the financial and credit position of the company and the net price. The financial and credit position is important for businesses, since it is the goal of every company to ensure that its supplier is consistent and delivers quality products. Companies that are struggling to survive on the market have numerous problems and it is difficult in such cases to enable continuous delivery and the quality of these products. Based on this, this factor is one of the most important for the selecting new supplier.

When choosing suppliers with whom a company needs to establish long-term partnerships, it was shown that the most important factor is the consistency of the delivery while the second factor is the importance of product quality. In this case, when it is necessary to build long-term partnerships, the most important factors influencing supplier selection are those related to the delivery and quality of materials and raw materials, because the third most important factor in this selection is precisely the continuous improvement of the products by suppliers. In addition to these factors, the fourth most important factor is the flexibility of delivery, the fifth focuses on product quality, followed by the post-sales service of the supplier, etc.

Based on these results, it can be concluded that there are differences when it comes to selecting a new supplier and selecting a

supplier with which a long-term partnership will be established. The factors such as continuous product improvement, post-sales service from providers, and reduction in procurement costs are more important when selecting a supplier as a long-term partner than selecting a new supplier. These differences exist because when selecting a supplier as a long-term partner, assessment of their past delivery is made, involving many factors and only after a certain period of time to the decision is made to enter partnerships with suppliers.

The obtained results show that certain factors are equally significant in the selection of new suppliers and suppliers with which a long-term partnership will be established, such as product quality or consistency and flexibility of deliveries that are very well ranked in both variants. It should be noted that the net price has experienced the biggest difference in importance since it does not influence the establishment of long-term partnership relationships, as it is at the 23th place, while it is very important when selecting a new supplier.

By comparing this rank order with the rank order made by Dickson (1966), it can be concluded that quality and delivery have taken on the primacy of the most important factors for choosing a supplier from a price factor. These results were confirmed by Weber et al. (1991) as well as Cheraghi, et al. (2004).

5. CONCLUSION

When selecting a supplier, companies have a number of factors at their disposal to help them evaluate and select a supplier. These factors are diverse and depend on the very nature of supplier selection. This work contributed to understanding which factors are most important in selecting a supplier. Unlike other works, this research did not target companies but experts in the field of

supplier selection. In this way, this research did not focus on one territory in relation to one branch of economy, but experts from several countries of the world and from different branches of economy were involved, so that the results of this research are applicable to any branch of economy or any country.

The conducted research focused on two segments of supplier selection, namely the selection of a new supplier (the establishment of short-term cooperation with suppliers) and selection of suppliers with which the company will establish long-term cooperation. Based on the conducted research involving 39 factors that influence supplier selection, the results were obtained which showed that some factors equally influence the choice of suppliers in both cases, while some factors are significant for just one case.

By comparing this rank order with the rank order made by Dickson (1966), it can be concluded that quality and delivery have taken on the primacy of the most important factors for selecting a supplier from a price factor. These results were confirmed by Weber et al. (1991) and Cheraghi, et al. (2004). On the basis of the obtained results it can be concluded that the focus of the selection of the supplier has shifted from quantitative factors to qualitative factors.

In the future research of this topic, it is necessary to remove the limitations present in this research. A list of experts should be defined from this region and it should include more than one scientific portal. An evaluation of factors should be made with the addition of new factors that influence supplier selection, and the research should be conducted on several occasions. A wide range of factors that influence the choice of suppliers should be determined and along with experts the number of these factors should be reduced. Then, an expanded questionnaire should be made and filled in by a smaller number of

experts, which should also reduce the same factors. When the final list of factors is formed, it is necessary to include as many experts as possible in order to get more complete data. In this way, more credible data will be obtained than by this research.

However, the aim of this paper was to show that there is a difference in the selection of new suppliers and suppliers with which the partnership will be established, which was proved with the results obtained. The results obtained by this research and the application of the FTOPSIS method, which enabled factors for selecting suppliers to be ranked, have shown that the supplier selection is a very complex task for each enterprise and that many factors influence it.

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