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Supplier Selection with Quality Function Deployment

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Abstarct: Supply chain management (SCM) requires many complex decisions to be made while ensuring the movement of products, suppliers, producers, wholesalers, distributors, retailers, and ultimately, customers. Selection and evaluation of supplier is very important in these decisions. In order to complete the product design and production process of the products, the Quality Function Deployment (QFD) is widely used. However, this study can also be used in procurement decisions that are included in the production process, making it possible for managers to make the right decisions. In this study, contribution to the supplier selection process, which is the most important step in the management of the supply chain of Quality Function Deployment was investigated. In an enterprise that produces water treatment devices and water tanks, QFD assessed the supplier characteristics and decided to select the appropriate supplier. The provision of variable components of these suppliers will also be assessed separately. The results have been evaluated in terms of the company.

Keywords: Supplier selection, Quality function deployment QFD), Supplier ranking

Introduction

Supply Chain Management (SCM) is the management of all operations within the chain of business functions, processes and plans of these enterprises in order to enhance the performance of all enterprises within the supply chain. In this definition, it is emphasized that the operator should take into consideration suppliers as well, and the functions, processes and plans of the suppliers should be developed together with the enterprise. Because suppliers have positive or negative effects on the business (Mirmahmutoğulları, 2007).

The selection and valuation of the supplier is an important issue in the TCM. Incorporating customer requests into the development process of new products and services, thus enabling Quality Function Deployment to deliver products or services to the customer, higher quality, faster, and cheaper, can also provide improvements in procurement activities involved in the production process.(Akao, Y., 1990)

Quality Function Propagation (KFY), customer needs and needs; from product design to after-sales service is the best and cheapest way to reflect the method is known. At this point, KFI practitioners are able to provide higher profits by making customers more satisfied.

In this study, in order to improve the characteristics of the suppliers in the supply chain management, the contribution of the Quality Function Propagation method to the supplier selection process has been investigated. An example of how to use the quality function propagation method to improve supplier characteristics is given. It has been researched in the sample which properties of the suppliers to be improved should be improved.

Quality Function Deployment

Quality function deployment is a methot that identifies customer needs, desires and expectations and develops products and services that are compatible with these needs, reducing the cost of product or service development, shortening total production time, increasing productivity and increasing customer satisfaction.

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Stages of Establishing Quality House

The general structure of the quality house consists of 6 main parts.

1. Creation of Customer Parts
2. Creation and analysis of the planning matrix
3. Determination and Analysis of Quality Characteristics
4. Creation and Analysis of Relationship Matrix
5. Determination and Analysis of Technical Correlation
6. Determination of technical benchmarks and targets
7. Planning the Development Project Based on the Results

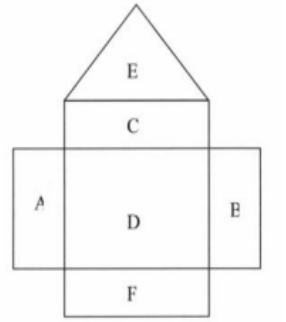

Figure 1. Basic parts of quality house

A: The voice of the consumer
B: Customer satisfaction levels
A: Technical specifications
D: Relationship matrix between the voice of the consumer and technical specifications
E: Correlation between technical specifications (relationship)
F: Comparison between competitive products and target values

Methods

In this study, it was tried to choose suppliers of an operator who produces lightning rod and earthing materials. In the study, "customer" was included as a "producer company" where the supplier company sold the products. It is aimed to examine and improve the supplier characteristics of 4 supplier firms (Cn) in supplying aluminum plates provided by the producer company in customer position. When determining the supplier characteristics, opinions of the 3 different procurement personnel who are working at the client firm and responsible for procuring the same group material were taken about the supplier companies. which features of the currently working suppliers should be improved.

In the first phase of the application, the producer company's purchasing authorities were interviewed and the main characteristics of the supplier's supplier were identified and given in Table 1. Relative importance ratings of supplier characteristics were calculated using 1-9 importance scoring, taking into account interviews with 3 acquirers in need. These values are presented in Table 2.

Table 1. Required features in the supplier

W_1	The amount of returned material
W_2	Price level
W_3	Compliance with agreed delivery time
W_4	Alternative distribution channels
W_5	Term sale possibility
W_6	Distance proximity
W_7	Required certifications and experience

Table 2. Relative importance ratings

	1. buyer		2. buyer		3. buyer		Importance Grade (g_m)	
What is (W_m)	crisp	fuzzy	crisp	fuzzy	crisp	fuzzy	crisp	fuzzy
W_1	9	[8,9,9]	9	[8,9,9]	9	[8,9,9]	9	[8,0, 9,0, 9,0]
W_2	9	[8,9,9]	8	[7,8,9]	8	[7,8,9]	8,3	[7,3, 8,3, 9,0]
W_3	7	[6,7,8]	8	[7,8,9]	7	[6,7,8]	7,3	[6,3, 7,3, 8,3]
W_4	5	[4,5,6]	4	[3,4,5]	6	[5,6,7]	5	[4,0, 5,0, 6,0]
W_5	6	[5,6,7]	7	[6,7,8]	7	[6,7,8]	6,7	[5,6, 6,6, 7,6]
W_6	8	[7,8,9]	6	[5,6,7]	7	[6,7,8]	7	[6,0, 7,0, 8,0]
W_7	7	[6,7,8]	6	[5,6,7]	8	[7,8,9]	7	[6,0, 7,0, 8,0]

The companies and other companies that are frequently working in the present situation and expressed as C are potential suppliers. Opinions on the relational performance of this firm's products from three buyers were also taken according to scale 1-9 and presented in table 3. The C values in the chart indicate the target performance values for the supplier. This is determined by the experts.

Table 3. Relational comparison matrix

	1. buyer				2. buyer				3. buyer				Customer Comparison Matrix (X)				
What is (W_m)	C_1	C_2	C_3	C_4	C_1	C_2	C_3	C_4	C_1	C_2	C_3	C_4	C_1	C_2	C_3	C_4	e_j
W_1	5	9	8	4	6	9	9	3	6	8	9	4	5,67	8,67	8,67	3,67	0,1423
W_2	8	5	5	9	8	6	4	8	8	5	6	9	8,00	5,33	5,00	8,67	0,145
W_3	6	8	9	5	5	8	8	4	6	9	8	3	5,67	8,33	8,33	4,00	0,1437
W_4	3	8	8	3	4	7	7	2	5	8	7	3	4,00	7,67	7,33	2,67	0,1393
W_5	8	7	8	6	9	6	6	4	7	7	7	5	8,00	6,67	7,00	5,00	0,1466
W_6	9	8	9	3	9	8	8	2	8	9	8	1	8,67	8,33	8,33	2,00	0,1367
W_7	7	8	8	6	8	9	8	5	6	9	8	5	7,00	8,67	8,00	5,33	0,1464

The final degree of importance for each supplier characteristic is calculated and normalized as shown in Table 4 below.

Table 4. Final importance ratings

	Latest Importance Ratings		Scheduled Last Importance Ratings	
What is (W_m)	crisp	fuzzy	crisp	fuzzy
W_1	3,1445	[2,7951, 3,1445, 3,1445]	0,8216	[0,9390, 0,7189, 0,7189]
W_2	1,9337	[1,6939, 1,9259, 2,0884]	0,5052	[0,3872, 0,4403, 0,4774]
W_3	2,3704	[2,0364, 2,3596, 2,6828]	0,6193	[0,4655, 0,5394, 0,6133]
W_4	1,828	[1,4624, 1,8280, 2,1936]	0,4776	[0,3343, 0,4179, 0,5015]
W_5	1,3684	[1,1495, 1,3547, 1,5600]	0,3575	[0,2628, 0,3097, 0,3566]
W_6	3,8274	[3,2807, 3,8274, 4,3742]	1,0000	[0,7500, 0,8750, 1,0000]
W_7	1,7299	[1,4828, 1,7299, 1,9770]	0,4520	[0,3390, 0,3955, 0,4520]

Based on these values, according to their importance, they are listed as follows:
$W_6 > W_1 > W_3 > W_2 > W_4 > W_7 > W_5$

In this case, the sixth supplier feature should be the top priority.Subsequently, customer needs for supplier characteristics have been turned into engineering properties. Seven technical requirements have been identified by the client company in order to meet customer needs, taking into consideration the characteristics of the existing and potential supplier companies, and the increase or decrease of these values is specified in Table 5.

Table 5. First technical ratings for how to

how are (H_m)	First Technical Ratings (t_n)	Scheduled First Technical Ratings
H_1	67,73	0,55
H_2	122,11	1,00
H_3	93,47	0,77
H_4	94,03	0,77
H_5	71,86	0,59
H_6	88,58	0,73
H_7	54,59	0,45

Based on these values, a sequence as follows according to importance ratings is obtained.
H2> H4> H3> H6> H5> H1> H7

in order to be able to conduct competitive analysis in technical terms, the values of how all the supplier companies are evaluated are determined. These are presented in Table 6.

Table 6. Values and priorities

how are (H_m)	Measurement Unit	Technical Competitiveness Priority Rating (zn)
H_1	%	0,150
H_2	$	0,149
H_3	gün	0,150
H_4	%	0,150
H_5	$	0,132
H_6	km	0,124
H_7	yıl	0,145

The appropriate order has been determined considering the Technical Competition Priority Grade, Target Value and Growth Rate.

H6> H2> H3> H4> H5> H1> H7

In this case, it is understood that the first factor to be improved and given importance is the distance of the supplier company to the manufacturer. This will greatly assist transport costs, which increase the procurement cost in the supply chain, to reduce other delayed costs. Another important factor is the cost of purchasing the material. For this reason, the supplier firm must first take precautions to reduce the cost of product sales.

Results and Discussion

In this study, the purpose of supplier selection, contribution of quality spread function to supplier selection process was investigated. Work has also been supported by an application example that includes improving the

characteristics of existing suppliers to carry ongoing and regular material and information. It has been determined that the first factor that needs to be improved from the factors considered in the study is the distance of the supplier firm to the manufacturer and the other important factor is the purchase cost of the material.

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