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Supplier Selection: Integrated Theory using DEMATEL and Quality Function Deployment methodology

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Abstract

In modern management, a company tries to establish a long-term relationship with its supplier to ensure its stable source and therefore evaluating supplier has become even more critical than ever in gaining strategic advantage in supply chain management. The suppliers should fulfill certain basic conditions provided by the company like: health and safety, finance, environmental responsibilities etc. Therefore, supplier evaluation and selection is a complex multi criteria decision-making problem involving various tangible and intangible factors in the supply chain management system. In this paper, we have tried to explain how using the various weights from DEMATEL approach is integrated with Quality Function Deployment(QFD) to select the most suitable supplier

Keywords: Dematel; Quality function Deployment; Selection Index; Supplier Selection

1. Introduction

In today's world and day to day life, Supplier evaluation and selection is a complex multi criteria decision-making(MCDM) problem involving various factors in the supply chain management system.

The quality of the products not only depends on the organization but also the raw materials supplied from the suppliers. In this paper, firstly an algorithm is proposed to find the various weights given to each customer criteria with respect to each supplier using the Decision Making Trial and Evaluation Laboratory (DEMATEL) approach. Secondly taking the closeness values from the DEATEL approach it is integrated with the Quality Function Deployment (QFD) methodology to evaluate and select the best supplier.. A numerical example is proposed to illustrate an application of the proposed method.

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1.1. Proposed DEMATEL Method

The Battelle Memorial Institute developed the DEMATEL Method Project through its Geneva Research Centre (Gabus and Fontela 1973). The original DEMATEL method was aimed at the fragmented and antagonistic phenomena of world societies and searched for integrated solutions. By using DEMATEL we could quantitatively extract the interrelationship between multiple factors that were contained in the problem. In this case, not only are the direct influences taken into account, but also the indirect influences among multiple factors**.** The steps for the methods are explained below:

1.2 Proposed Quality Function Deployment method

In the QFD process, a matrix called the house of quality (Hauser and Clausing 1988) is used to display the relationship between the voice of customers and the quality characteristics.These are basically the customer and technical requirements, respectively. The HOQ is developed during the QFD transformation. Basically, the HOQ demonstrates how the technical requirements satisfy the customer requirements.

2. Methodology

- The various customer criteria taken into considerations are :Price, Quality, Delivery, Flexibility, Service.
- The various technical criteria taken into consideration are : Reliability, Resources, Social Responsibility, IT Technology, Just-In-Time System.

2.1 The DEMATEL method

Step 1: Using Dematel Approach, the comparison scale is designed as five levels:0 (no influence), 1(low influence), 2(medium influence), 3(high influence), and 4(very high influence) based on expert's judgement pair-wise comparisons in terms of influence and direction between criteria.
Step 2: Generating the direct-relation matrix. As the result of the above analysis, the initial data can be obtained as the direct-relation matrix, n*n matrix A, in which a_{ij} is denoted as the degree of the criterion i affects the criterion j.

$$A = \begin{bmatrix} 0 & a_{1,2} & \cdots & a_{1,n} \\ a_{2,1} & 0 & \cdots & a_{2,n} \\ \vdots & \vdots & \vdots & \vdots \\ a_{n,1} & a_{n,2} & \cdots & 0 \end{bmatrix} \quad (1)$$

Step 3: Normalizing the direct-relation matrix. On the base of the direct-relation matrix A, the normalized direct-relation matrix E can be obtained through formulas:

$$k = \min\left[\frac{1}{\max\sum_{i=1}^{n} a_{ij}}, \frac{1}{\max\sum_{j=1}^{n} a_{ij}}\right] \quad (2)$$