An Integrated QFD-TOPSIS Approach for Supplier Selection Under Fuzzy Environment: A Case of Detergent Manufacturing Industry

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ABSTRACT

This article describes how supplier selection is a multi-index problem which affects the efficiency of the whole supply chain in both manufacturing and service industries. Considering the importance of selecting effective suppliers, this article aims to integrate two well-known techniques, Quality Function Deployment (QFD) and The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) in order to evaluate suppliers and rank them based on their merits. In order to handle the inherent uncertainty in the process of experts’ judgments, fuzzy logic is involved in the methodology applied in this study. The validity of the utilized integrated approach is demonstrated through conducting a case study in the detergent manufacturing industry in Iran.

KEYWORDS

Detergent Manufacturing Industry, Fuzzy Logic, Quality Function Deployment (QFD), Supplier Selection, Supply Chain Management, TOPSIS

1. INTRODUCTION

Supply chain management is flow management of materials, information and capitals throughout the supply chain, from suppliers to component manufacturers, to final installers, to distribution (warehouses and retailers) and finally to the customers (Govindan et al., 2009; Tavana et al., 2016). The choice of supplier is the most important variable in supply chain management (Talluri & Narasimhan, 2004; Heikkinen, 2012). Inherently, the selection of a supplier is a multi-criteria decision-making problem and it is a strategic decision for companies.

In today’s intensive competitive world, companies focus on developing their core capabilities and outsourcing non-core businesses to supplier with a variety of professional capabilities, to enhance their competitive advantage by utilizing these external resources. On the other hand, consumers’ behavior has been widely changed due to their ideological change; therefore, the product life cycle is shorter and each company has to offer a variety of products to meet customer needs immediately.

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Such procedures would direct modern companies directly to investment in managing the supply chain and in creating strategic partnerships against their rivals (Krause and Ellram 1997).

Considering the fact that manufacturers need to cooperation and interaction with suppliers due to the growing purchasing power and bargaining of their customers so they meet the needs of customers, and increase productivity with minimal cost. The supplier selection is sometimes very complicated, because it includes a large variety of uncontrollable and controllable factors which affects complex decisions. In addition, ratings and ranking on suppliers should be made on a regular basis to ensure that whether the imported product will be meet the relevant quality standards? Therefore, decision making methods should be used to reduce the selection time and develop the result of decision making.

This study aims to propose a QFD-TOPSIS approach by using fuzzy data for supplier selection in a detergent manufacturing company, namely Rokny Company, located in Shiraz, Iran. In this research, the QFD model is used which includes qualitative criteria in order to increasing of decision accuracy. The TOPSIS approach is also one of the most practical decision-making methods and are included both qualitative and quantitative criteria. In this research, the ranking of suppliers is only considered based on quantitative criteria. In classical TOPSIS method, accurate values are used to determine the weight of the criteria and to rank the options. In many cases, when human thinking is associated with uncertainty, it is better to use fuzzy decision-making methods that the fuzzy TOPSIS method is one of these methods. In this research, quantitative criteria are presented in a definite way, not by language variables. Therefore, the use of the fuzzy TOPSIS method is not applicable for quantitative and precise criteria. The model of this research can be considered as a contribution.

Determining the criteria for supplier selection for the Rokny Company suppliers and provide a suitable strategy for selecting and ranking these suppliers in the studied detergent company are two main goals for this study. After introduction, a review of the criteria and methods of supplier selection, followed by methodology of research, introduction of proposed research model, Introduction of analytical methods (including QFD, quality of house, fuzzy logic and TOPSIS technique), The stages of the research, and, finally, conclusions and suggestions for future studies were presented.

2. LITERATURE AND RESEARCH BACKGROUND

In the field of supplier selection and evaluation, several studies have been proposed by the researchers that following are referring to a number of them.

2.1. Supplier Selection Criteria

According to the study by Park et al., (2010), a supplier is evaluated in terms of performance, capability and ability to collaborate. They stated the supplier’s assessment criteria based on Quartz’s Co. buying strategy. There are three evaluation groups in the company: Quality, cost and delivery for performance evaluation; technology and management for capacity assessment; and collaboration to evaluate cooperative relationships.

Awasthi et al., (2010) stated that the selected criteria for assessing the environmental performance of suppliers were as follows: the use of environment friendly technology that conserves energy and consumption of fossil fuel resources. The use of environment friendly goods, packages, recyclable materials, retention of customers with green purchasing habits, collaboration and partnership with green suppliers, environmental organizations, management commitment and support to improve environmental performance, conformance to environmental regulatory standards, green R&D projects on green product and process planning, staff training on environmental targets, design for environment (Recycle, reuse, re-manufacture, disassembly, disposal), environmental certification like ISO 14000 and etc.

Häto nen & Ruokonen (2010) defined the main criteria for selection in Information and communications technology (ICT) industry as follows: Usability; technical competence; price; strategic
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