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Analytic network process in supplier selection: A case study in an electronic firm

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Abstract

Supplier selection, which is the first step of the activities in the product realization process starting from the purchasing of material till to the end of delivering the products, is evaluated as a critical factor for the companies desiring to be successful in nowadays competition conditions. With the scope of this paper, supplier selection was considered as a multi criteria decision problem. A model aiming the usage of analytic network process (ANP) in supplier selection is developed owning to the evaluation of the relations between supplier selection criterias in a feedback systematic. The proposed model is implemented in a company of electronic.

Keywords: Supplier selection; Analytic network process; Multi criteria decision making; Purchasing

1. Introduction

Purchasing decisions have a major impact on companies, because of this fact systematic methods must be followed up. There are two main reasons for this [1]:

- First in many companies, the cost of the purchased goods and services accounts for more then 60% of the cost of goods sold.
- Second, over 50% of all quality defects can be traced back to purchase material.

Since 1960s, supplier selection criterias and suppliers performance have been a focal point of many researchers.

While the traditional vendor evaluation methods primarily considered financial measures in the decision making process, more recent emphasis on the incorporation of multiple vendor criteria into evaluation process [2].

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The studies about supplier selection are based on the years of 1960s. Dickson identified 23 criteria for supplier selection based on a survey of 273 purchasing manager. He showed that quality was perceived to be most important criteria followed by delivery and performance history [2].

It is never expected from a supplier being perfect, according to all supplier selection criterias. For example, a supplier product may have a high quality, but cost of the products may not be the lowest. On the other hand, another suppliers' products cost may be the lowest, this is very good for a company, but on the same time delivery performance may be the worst. As it seen from the example, for making good decisions, supplier selection process must be handled systematically.

There are many methods used in supplier selection such as cluster analysis [3], case based reasoning systems [4], statistical models [3], decision support systems [4,3], data envelopment analysis [3,1,5,6], analytic hierarchy process [7–9,3] total cost of ownership models [3,10], activity based costing [11], artificial intelligence [4,3], mathematical programming [12,6,13,2,14].

The methods used in supplier selection are intending the effectively of the purchasing decisions and implementing decision-making mechanism systematically.

Gaballa [14] is the first author who applied mathematical programming to supplier selection in a real case in 1974. He used a mixed integer-programming model to formulate this decision-making problem for the Australian Post Office.

There are many papers in literature about supplier selection. Some of them are: Ghodsypour and O'Brien [12,14], Zhu [13], Talluri [6], Talluri and Narasimhan [2], Boer et al. [3], Weber et al. [5], Barbarosoğlu and Yazgaç [7], Tam and Tummala [8], Dağdeviren and Eren [9], Degraeve et al. [10].

2. Analytic network process

Many decision problems cannot be building as hierarchical because of dependencies (inner/outer), influences between and within clusters (criterias, alternatives). ANP is very useful to solve this kind of problems.

ANP provides a general framework to deal with decisions without making assumptions about the independence of higher-level elements from lower level elements and about the independence of the elements within a level. In fact ANP uses a network without the need to specify levels as in a hierarchy [15].

ANP is firstly introduced by Saaty, which is based on 1-9 scale, in his book named "The Analytic Hierarchy Process" (1980). After that, Thomas L. Saaty developed this issue in his published book named "The Analytic Network Process" (1996).

Saaty suggested the usage of AHP to solve the problem of independence on alternatives or criteria and the usage of AHP to solve the problem of dependence among alternatives or criteria. The structural difference between AHP (hierarchy) and ANP (network) is also shown in Fig. 1. As it seen from the figure a hierarchy is the simple and special case of a network.

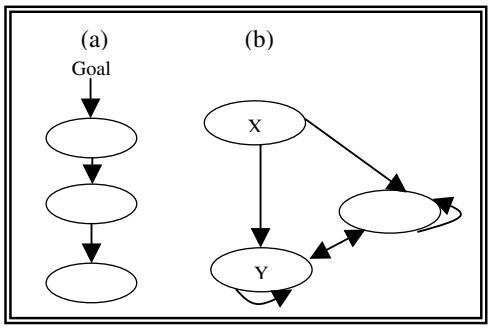

Fig. 1. (a) Structure of AHP, (b) Structure of ANP.