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Strategic supplier selection in the added-value perspective: A CI approach

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Abstract

Supplier selection is one of the most crucial components of the purchasing function, being essential to improve the entity's competitiveness and to increase customer's satisfaction. There are different proposals to perform this task, being the *added-value perspective* one of the most interesting. This approach uses both quantitative and qualitative data for supplier selection, being its main aim to calculate the ability of the supplier to create value for the customer. However, difficulties in the measurement of qualitative items usually avoid its application, reducing the firm's capacity to improve efficiency. To solve this problem, we intend to combine both types of data, using Fuzzy Theory and new emergent paradigms, to obtain an overall ranking of suppliers' suitability.

Keywords: Supplier selection; Added-value perspective; Fuzzy Theory; SOFM

1. Introduction

Supplier selection is one of the most strategic components of the purchasing function of the firm [13], being applied to improve the entity's competitiveness and to increase customer satisfaction. Although criteria used for selecting and retaining suppliers have been examined for decades, the literature documents important changes in these criteria for the last years [19,15,16]. Traditionally, the focus has been on internal logistic measures, like price, lead-time, on time performance, damage, and responsiveness, etc. [4]; thus, many authors identify four broad categories in supplier selection: price, delivery, quality, and service [11,19].

Nevertheless, this internal approach has lost importance in recent decades, being replaced by the added-value perspective, which focuses on the transaction-based theory [2] and the resource-based theory [8]. This new point of view considers that the value-creation concept plays a critical role in the efficiency of the relationships between supplier and buyer [3,20], identifying two groups of variables that affect the supplier's capacity to create value for the client [17]:

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(1) *Direct value variables*, defined in a quantitative way: prices, quality mistakes or delivery items.
(2) *Indirect value variables*, provided by relational factors, such as: cooperation [17]; commitment of resources [1]; trust [22]; customer orientation [18]; communication [17]; responsiveness [11], and customized services and products [12].

This second group has been identified as critical in many studies about business relationships [2,8], being related with the reduction of conflicts among channels and the improvement of firm's performance [15,16].

Despite the merit of added-value proposals, few firms have systematically assessed the value of suppliers, due to the difficulties in the measurement of the second group of qualitative and intangible variables [8,15,16].

The absence of these qualitative attributes in suppliers' selection is not positive for the firm, which "fail to identify where opportunities exist to increase competitiveness, customer value, and shareholder value" [12, p. 1].

We propose a new model of suppliers' selection that allows to combine both quantitative information (first group) and qualitative one (second group), also including the relative importance of each variable, using both 'crisp' and 'fuzzy' attributes [21] (for the first and second group of variables, respectively), combining them through the 2-tuple model proposed by Herrera and Martinez [6]. Thus, we will get an overall ranking of suppliers without losing significant information.

Additionally, in order to get a graphical view of the relative position of sellers, a SOFM model will be developed, including in its construction the particular importance of analysed attributes.

2. The SOFM and the 2-tuple approach

Artificial Neural Networks (ANNs) are Machine Learning models that try to establish mathematical formulas about the structure of the brain, characterised by the learning through the experience and the mining of knowledge from multiple events. The architecture used in ANNs can be divided in different categories; the Self-Organising Feature Map (SOFM) proposed by professor Kohonen belongs to the competitive, unsupervised or self-organising models [9,10], based on competition among neighbouring cells in the net. The model has two layers (Fig. 1):

(1) *Learning or Training Stage*: The ANN establishes the classes which will be used in the operation stage to classify new data. It is achieved through the successive analysis of different patterns: each time an individual $x(t)$ is analysed, the net obtains a 'winner cell' c (the nearest neuron to the pattern); $c = (c_1, c_2)$ will modify its m connections (weights) together to other neighbouring neurons:

$$m_{i,j,k}(t+1) = m_{i,j,k}(t) + \alpha(t)h(|I-c|,t)(x_k(t) - m_{i,j,k}(t)), \quad \text{if } I \in N_c(t)$$
$$m_{i,j,k}(t+1) = m_{i,j,k}(t), \quad \text{if } I \notin N_c(t)$$

where $I = (i,j)$ is a cell, k is the index of the analysed input-variable, $h(|I-c|,t)$ is a function that establishes the 'neighbourhood zone' or $N_c(t)$ and $\alpha(t)$ is a parameter known as 'learning rate' so that $0 < \alpha(t) < 1$. The process is repeated for all patterns, so that weight vectors approach inputs' density function. The training process usually finishes after some pre-fixed steps or epochs (for example 100,000 steps).

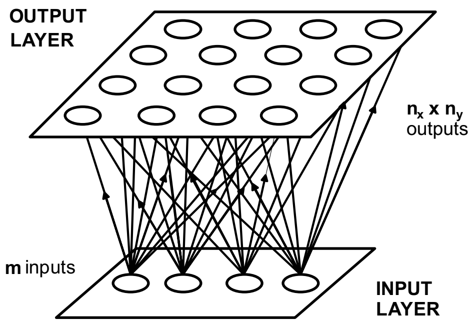

Fig. 1. SOFM model.