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Analysis of Vendor's for Machine Tool Manufacturing Industries with Fuzzy Inference Decision Support System: Modelling Tool

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Abstract —*Like many complex supply chain problems, vendor selection problems are not so well defined which can be handed over completely to computers, whereas many human characteristics are also essential to the issues. In this paper attention is given on the fuzzy System helps for Vendor Selection Problem (VSP) with decision support system for machine tool manufacturing industry. It required expert's view, conversion it into fuzzy term, making 8 rule base fuzzy inference system. As a decisive point, conclusions and likely areas of frame work for development present.*

Keywords- Supply Chain Management (SCM), Vendor Selection Problem (VSP), Decision Support System (DSS), Selection Methodology, Supplier Selection Problem (SSP), Fuzzy Inference System, Fuzzy Rule Base

I. INTRODUCTION

The vendor selection process is playing a vital role for smoothly running supply chain. One of the big issues of current problems faced with supply chain management is selection of vendor. The vendor selection process has undergone significant changes during the past thirty years. These include increased quality guidelines, improved computer communications, and increased technical capabilities, essential changes in the purchasing (vendor) selection process. Here, the tabular form of literature survey on Vendor Selection Problem (VSP).

[1] applied Linear weighting method and establish vendor selection decision is the most common way of rating different vendors on the performance criteria for their quota allocations. [2] proposed multiple criteria vendor service factor ratings and an overall supplier performance index. [3] proposed single item LP model to minimize the aggregate price under constraints of quality, service level and lead-time. [4] implemented Mix Integer Programming (MIP) approach with the objective of minimizing purchasing, inventory and transportation related costs without any specific mathematical formulation and demonstrated it through selecting the vendors at IBM. [5, 6] worked and proposed the use of Goal Programming (GP) for price, quality and delivery objectives. [7] by integrating the analytical hierarchy process with linear programming DSS. [8] presented a data envelopment analysis method for a VSP with multiple objectives. [9, 10] used the analytical hierarchical process to generate weights for VSP.

II. DESIGN OF THE FUZZY INFERENCE SYSTEM FOR SELECTING INDUSTRIAL VENDOR/ SUPPLIER

The goal of a Fuzzy System to take in subjective, partially true facts randomly distributed over a sample space and builds a knowledge-based expert system to produce useful decisions [11]. The different steps for the vendor selection are identified as follows.

2.1 Identification and analysis of the problem

In many bids of the vendors in different organizations the winner is selected just by the price factor and other important factors such as "Quality of Material (QOM), Delivery of Material (DOM) are not considered. In the present study, multi-criteria considered for finding out the potential vendor.

2.2 Identification of critical factor and membership functions and conversion in fuzzy range

This survey shows that there are three important criteria for vendor selection which are of great customer consideration are QOM, DOM and price as input variables. linguistic values for QOM are defective, average and non-defective. For DOM values are Late, In-time and Before-time. For price linguistic values are high, medium and low [13]. Here, Net-rating taking as an output variable. Very small, small, rather small, medium, rather large, large and very large are the linguistic variables for output variable net-rating.

Table I. Fuzzy conversion of experts view

Name of the Vendor	Quality of Material				Delivery of Material				Price
	Expert-1	Expert-2	Expert-3	AVG	Exp-1	E-2	E-3	AVG	AVG
V-1	(0.9-1)	(0.7-0.9)	(0.3-0.8)	(0.3-1)	(0.9-1)	(0.7-0.9)	(0.3-0.8)	(0.3-1)	(0.3-1)
V-2	(0.2-0.7)	(0.1-0.3)	(0-0.3)	(0-0.7)	(0.2-0.7)	(0.1-0.3)	(0-0.3)	(0-0.7)	(0-0.7)

2.3 Fuzzy rules construction

Fuzzy Inference DSS makes decisions and generate output values based on knowledge provided by the designer in the form of IF _condition_ THEN _action_ rules. The rule base specifies qualitatively how the output parameter "Net-rating" of the vendor proposal is determined for various instances of the input parameters of "DOM", "QOM" and "Price". As disused earlier; in the present investigation, the efforts have been made for vendor analysis for machine tool's parts [13].

The number of rules in a fuzzy system r is an exponential function of the number of the inputs m and the number of linguistic values k that these inputs can take. In most cases, this exponential function is in the following form [14].

[15] investigated Equation (i) that for a fuzzy system with 2 inputs which can take 3 linguistic values the number of rules will be 8.

$$r = k^m \quad \text{.....(i)}$$

Figure 1 and 2 show the fuzzification of QOM and Net- Rating respectively. This same procedure is repeated for other two inputs variable "DOM and Price".

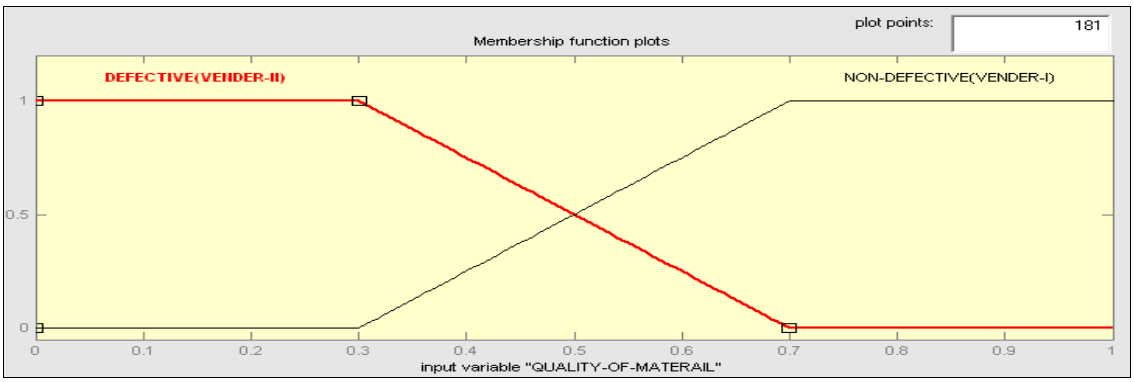

Fig. 1 Fuzzification of QOM

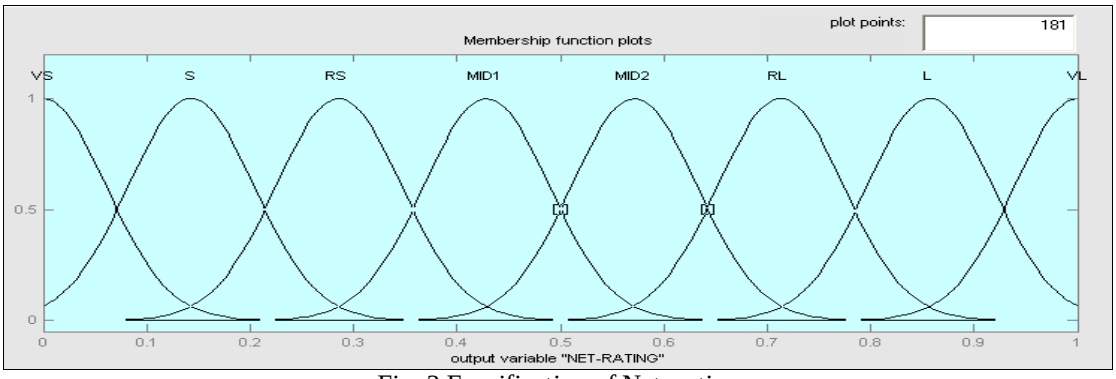

Fig. 2 Fuzzification of Net- rating

2.4 The Rule viewer

As shown in Figure 3, the Rule viewer displays the fuzzy process. Each row of plots corresponds to one rule and each column of plots corresponds to either an input variable (Yellow) or an output variable (Blue). Here, putting the input (0.5, 0.5 0.2).

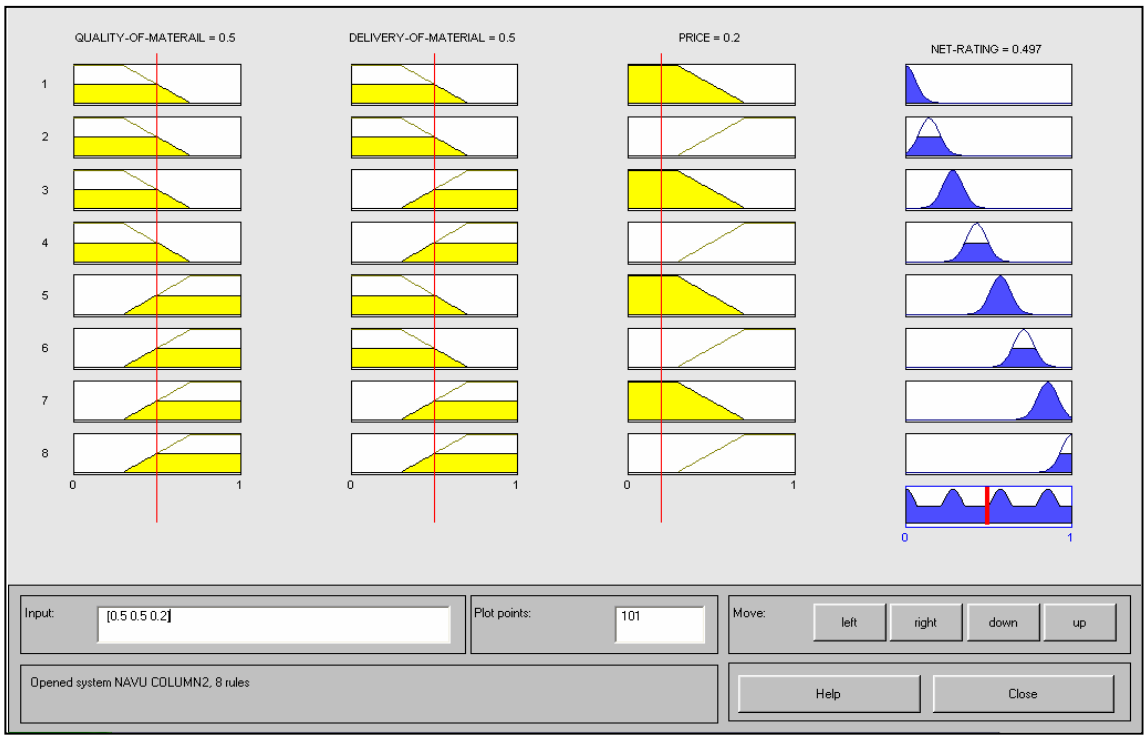

Fig. 3 Rule Viewer -Input [0.5 0.5 0.2]

2.4 The Surface viewer

The surface view of DOM v/s QOM v/s Net- rating (Price= 0.8), QOM v/s Price v/s Net- rating (DOM= 0.5) and DOM v/s Price v/s Net- rating (QOM= 0.5) are in figure. 4, 5, 6 respectively.

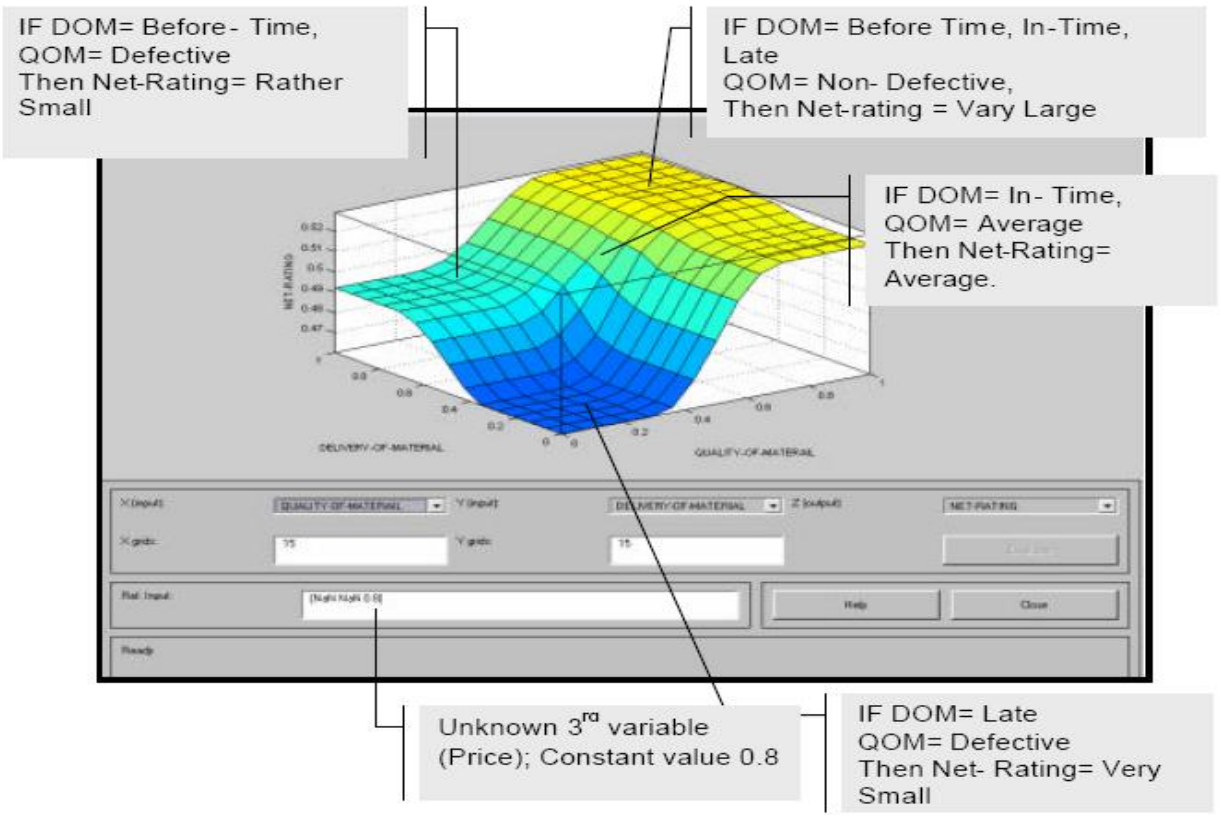

Fig. 4 3D- Surface for DOM v/s QOM v/s Net- rating with Price = 0.8

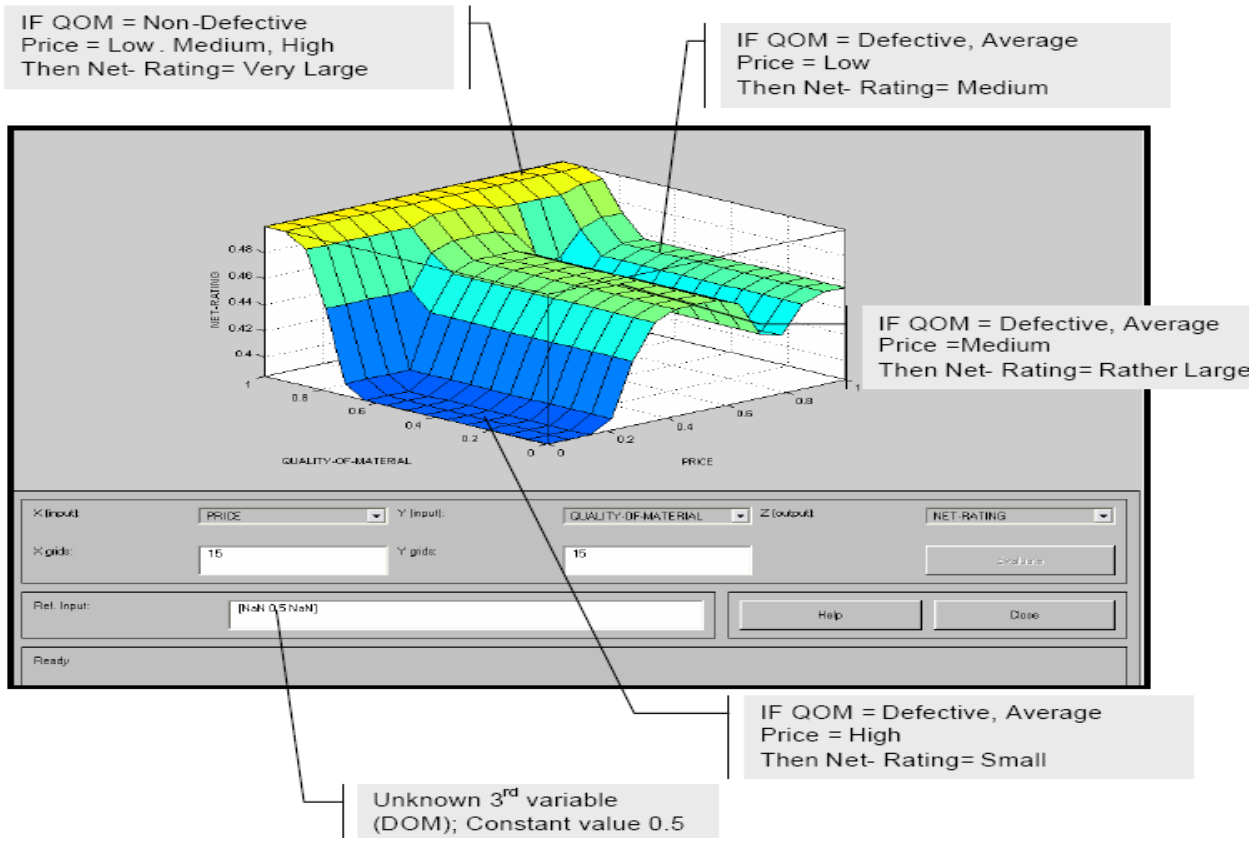

Fig.5 3D- Surface for QOM v/s Price v/s Net- rating with DOM= 0.5

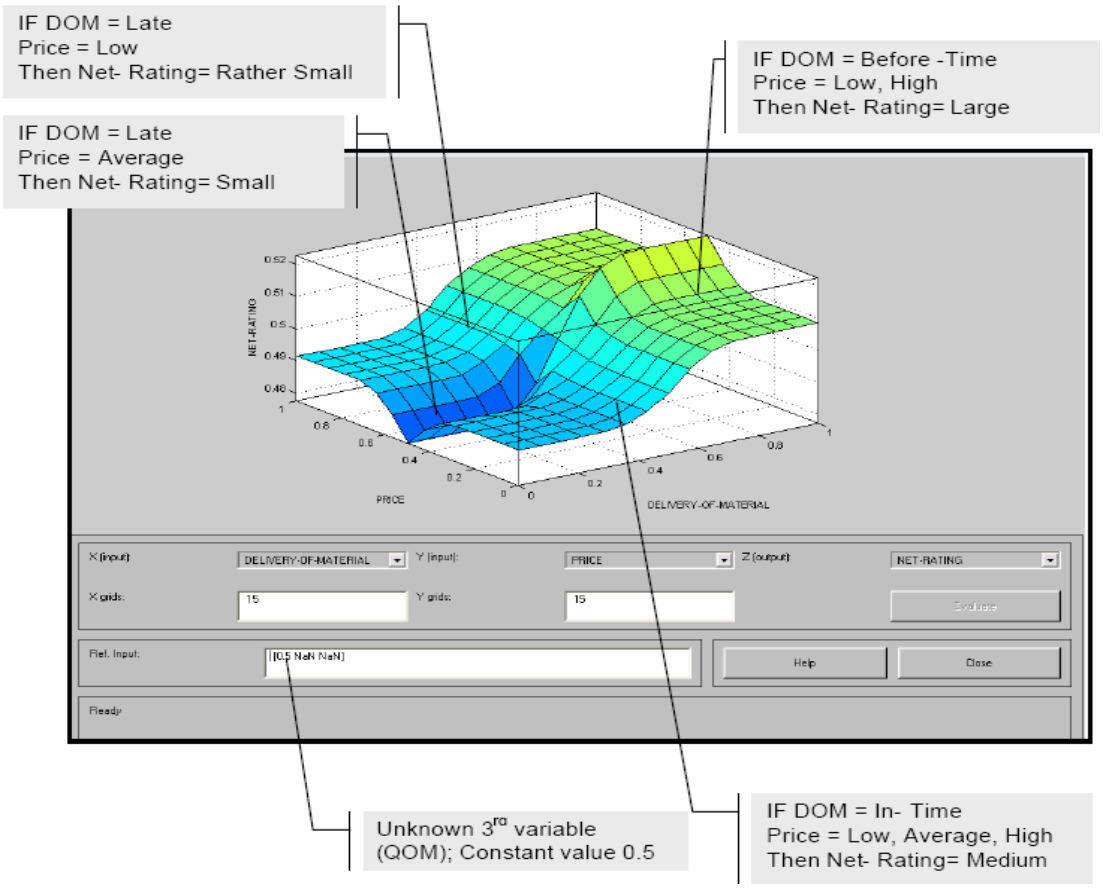

Fig. 6. 3D- Surface for DOM v/s Price v/s Net- rating with QOM = 0.5

III. CONCLUSION & DISCUSSION

Based on the existing work has been carried on the vendor analysis problem with implementing fuzzy infererence decision support system for machine tool parts selection. For selecting the potential vendor one can consider at least three analysis criteria Delivery of Material, Quality of Material, Price as input variables to a Fuzzy Inference System (FIS). Experts' view plays an important role hence they must be considered before Fuzzification in FIS modeling. Many factors as suggested by experts may be considered in arriving at a final decision for a particular vendor. Fuzzy Inference System may be easily incorporated in decision making by involving input variables, membership function to obtain subsequent net-rating after diffuzzification. FIS offers 3D-Surface view, which distinguishes potential vendor from with comparison with different linguistic variables, may be incorporated in selection mechanism.

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