Employing Fuzzy Logic for Enhancing Administration System Performance

Dr. Yarob Adnan Istitieh

University of Maryland, College Park, MD, USA

Summary
The fuzzy logic adopted in formulating a computer program based on mathematical and logical algorithms. The approved standards were employed in evaluating the performance and determining the competitive priorities of a tangible impact on the decision-making process adopted by the administrative system instead of the traditional currently prevailing treatments. A group of logical rules related to the competitive priority evaluation and the membership functions, connected with each of its variables, were formulated. The results of removing the fuzzy element from the logical comparison results, demonstrated the existence of a notable abstract correlation between the performance attribute and the competitive variables upon which it depends.

Key words:
fuzzy logic, element, correlation, administrative system, decision-making

1. Introduction

The fuzzy logic is considered one of the new concepts family produced by the contemporary scientific knowledge theory to overcome a group of cognitive obstacles facing the mathematical understanding model of the physical phenomena that dominate the traditional physical real situation or formulating advanced mathematical / logical solutions for the complicated systems imposed by the current age spirit depending on techniques more complex and developed than the ones used in the previous decades.
It is observed that there is a wide gap between the high accuracy that characterizes the mathematical treatments of decision-making and the disguised un-absolute variables nature of the world we live in.
In the center of this cognitive gap, we find the truth stating that most of the mathematical principles formal limits have been strictly defined; while the majority of the variables types prevailing the physical realm fall within fuzzy limits wrapped by ambiguity according to the mathematic standard prospect characterized by strict descriptive accuracy.
Owing to the variables overlap, which govern the administrative decision-making, in a world full of the accelerated and overlapped variables and the blurred vision of the optimal decision related to the treatment of systems' inputs suffering from this phenomenon, a revision was effected in employing the traditional systems used in the decision-making process treatment.
There was a trend towards employing the mathematical and logical formulations adopted by the Fuzzy logic. In other words, the process ,adopted during this research, embraces a principle stating that the credibility of an issue (the optimal administrative decision, for example) is not an absolute case, but it has several levels of credibility of divergent ratios (ranging between 0 and 1) in the light of the variables prevailing on the reality ground upon taking the decision .
This process aims to start the first step through the ideological rooting in order to employ this logic / computer technique in more deep future studies for processing the administrative decision-making through concepts closer to the actual reality, generated from.

2. The Mathematical and Logical Bases of the Fuzzy Logic Model

The mathematical and logical bases for the fuzzy logic relies on the principle of processing unclear threshold of the reality variables in order to produce crisp inference from the confusion suffered by these variables.
Generally speaking, the relationship of the truth description for any variable used in describing the administration variables model is formulated as follows:

$$\mathbf{X} = \{x, \mu_x(x)\} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where:
X = the Comprehensive Formula of Variables
x = Any Variable of the Administrative System.
$\mu_x(x)$= the membership function for the variable **x** in the comprehensive formula **X**

The membership function (M.F) can be defined as a curve through which all model the points of the (Input space) model are defined, determined for the membership level values.

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This function value ranges between (0-1). It is calculated in the light of the attribute of the physical change function, a distinctive feature of the variable inside the logical model system.

The Fuzzy Inference Mechanism is adopted as a mathematical and logical approach [3] in order to interpret the values of variables introduced to any natural system through employing a parallel series of the logical / mathematical governing rules and determining their corresponding output values.
The logical rules are composed of the following general formula:

IF **X is A AND Y is B**
THEN H……..(2)

The constants A, B represent logical values defined by the fuzzy set for the variables X, Y, representing the comprehensive formula for the variables targeted in this study.

The first part of the rule or the logical phrase is given the term "premise", while the second part of it is called "consequent".

The mechanism of interpreting the logical rules employed in the fuzzy logic model includes two basic pivots:
The (first): includes the evaluation of the identification of the logical limits used with the inputs under study after adopting the fuzzification.
The (second): is the application of the results extracted from the identification process on issuance of the logical comparison result accordingly. [6]

The logical rules outputs are characterized by being a representative of a fuzzy group that cannot be adopted in taking a dogmatic decision.

So, in order to reach to a final decision through which the approved rules are employed in formulating the model, all results extracted from all rules (together) are treated by defuzzification in order to reach to a decisive result in respect of the variables handled by the study .

In general, centroid is considered one of the ways to be used most in the field of defuzzification from the results extracted from the fuzzy logic model which adopts the principle of calculating the value of the cross area center existed under the variable curve, and in the calculations used for the approved model outputs [6].

3. The Competitive Priorities through a Contemporary Prospect

The performance of the operations function, during the conversion processes, is measured by adopting a group of standards called "The competitive priorities" as it was handled by the specialist literatures.

The competitive priority type selection means taking a group of decisions pertinent to the selected priority such as the selection of the cost leadership position, the commodity variation or the marketing consent ratio.

The features, which characterized the last decade of the past century and the beginning of this century, point out to a startling growth in the companies' number, accompanied by a wide variation in products with rapid technological changes [5], and that put the companies in front of a strategic option summarized in the question about the manner which enables them to penetrate the market through a competitive feature which enhances its position in the competition circle.

When responding this question, the role and contribution of the operations' strategy appear in determining the manner through which the operations' function can express the group of basic decisions connected to the competitive priorities. That is to say, the research will be in the manner through which the production system will insure specific features to achieve a competitive advantage. This practically means the determination of the competitive priorities as the first step in developing and explaining the competitive company strategy for achieving its goals.

The duty of the competitive priorities determination starts through a condensed study for the strengths of the company operation which enable it to use them as a competitive weapon [2], as follows:

1. The experience in the product / operations
2. The capability of fast delivery
3. A product of a short life circle
4. The production flexibility
5. Operations of low cost
6. The work and facilities locations
7. Variation of product and the facilities volume
8. The quality

The substantial matter, which represents the range in which the company can manoeuvre, is the access to a sequence of the competitive priorities.
This matter is not governed by a described rule suitable for all companies. Some people do not consider determination of the priorities sequence as a final decision, but consider them as objectives recurring continually instead of considering them as conflicting objectives. This is the majority of Japanese companies' point of view, which could – through this track- achieve suitable levels of quality and effective cost. Accordingly, they are now working towards achieving the utmost flexibility and fast delivery [1].

4. Methodology

The most important measures approved in evaluating the performance and determination of the competitive priorities for a product in the department of the operations management [4] is:

- Cost
- Quality
- Delivery
- Service
- Flexibility

These measurements, in addition to the creativity measurement, were adopted in preparing the computer fuzzy logic program for the performance measurement model.
In order to deepen the mathematical description of these measurements, according to the change of the values possessed by each, the Membership Function (M.F.) was formulated to determine the effectiveness of each measurement as shown in table No.1.

Table 1: The Levels of the Membership Function Description of the Performance Measurements

Variable	**The suggested levels for the description of the variables' membership function**				
Cost	Low	Fair	High	Very high	----------
Quality	Bad	Fair	Good	Very good	Excellent
Delivery	Slow	Immediate	In time	----------	----------
Service	Low	Fair	Good	Very good	Excellent
Flexibility	Low	Fair	High	--------	----------
Creation	Creative	Classic	--------	--------	----------

The performance measurements formulated in fuzzy logic rules exploited from the academic scientific reserve and the field experience of specialists in Business Administration field in order to conclude to the outcome of the final judgment in respect of a case selected for study purposes.

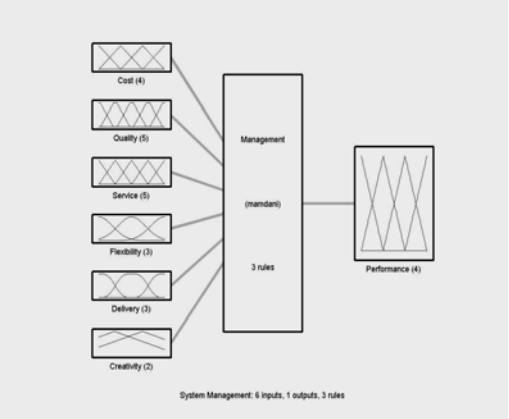
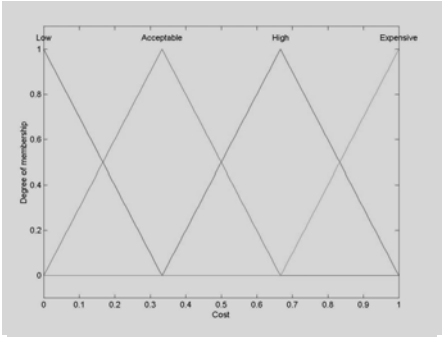
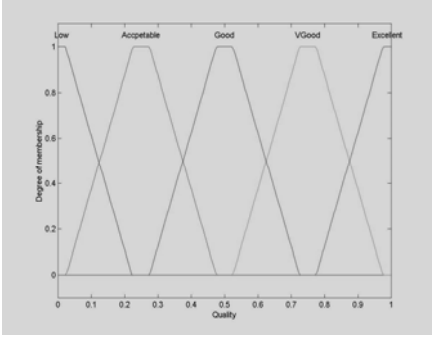


Fig. 1 The Suggested Structure for the Model Inputs and Outputs





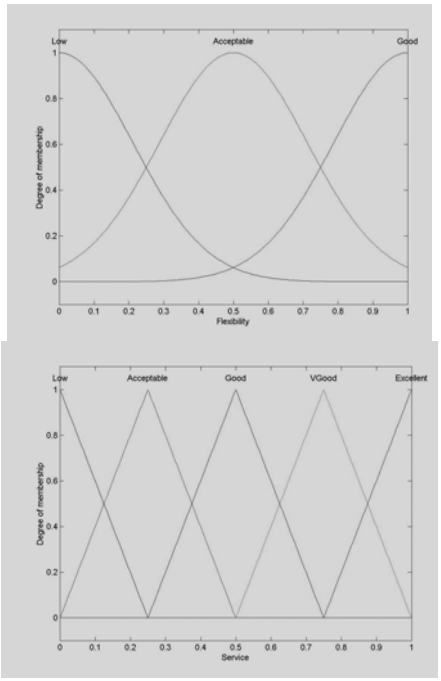


Fig. 2 The Suggested Structure for the Fuzzy Model

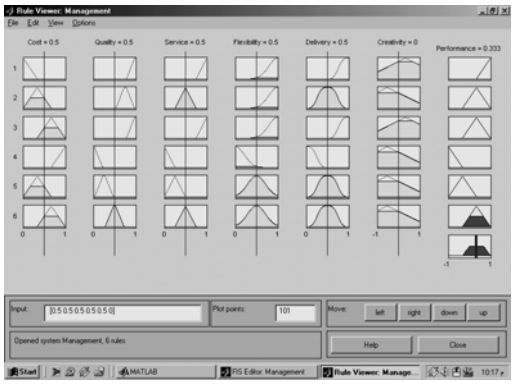


Fig. 3 The Results of Defuzzification Process from the Suggested Logical Model Bases

5. Results

The computer treatment for the system inputs (figure1) - through the approved rules series and the membership functions of each variable of them - see Figure (3), showed an abstract tangible relationship between the performance under the competitive standards and the potential of employing the model in computing the expected results for each case of those facing the establishments during the execution of their different activities.

6. Conclusions and Recommendations

The fuzzy features which the competitive priorities are characterized by , adopted by the institutions in order to meet the needs of the market, in which they plan to enter the yard of the competition prevailing therein, obliged us to reconsider the traditional ways used in treating the items of this vital issue. So, adoption of the fuzzy logic model which keeps up with the changes that spread all over the world we are living in and in which environment, our decisions are made, became the model representing one of the recent ways of treating the mechanisms of taking decisions within an environment full of changes.

The initial treatment of the suggested model revealed the possibility of adopting the extracted results in building a strategic decision, through which a group of variables relating to the competitive priorities are invested.

Therefore, we suggest starting a series of condensed researches, which employ these techniques in more detailed studies for each factor of the competitive priorities in order to increase the solidity of the ground, on which our organizational decision relies, for the time being.

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Dr. **Istitieh yarob A.M**
Ph.D. (2004): Azerbaijan State academy; January 2004. Member of staff at Jerash Private University, Computer Science Department, Jordan