

Leadership Evaluation: A Fuzzy Logic based proposed approach

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Abstract

This paper presents a stage-wise fuzzy logic based model for effective evaluation of overall leadership. The study illustrates a model based on emotional, intelligent and spiritual quotient for determining true leadership rating. Various attributes of leader under each quotient has been considered for designing of the proposed model. The paper highlights the applicability of fuzzy reasoning in determining relationship among different attributes and quotients in terms of if-then fuzzy rules. A Matlab-Simulink model can be built based on the proposed model and simulation can be further performed.

Keywords: EQ, IQ, SQ, fuzzy logic, Matlab, Simulink.

1.0 Introduction

Intelligent quotient (IQ), Emotional quotient (EQ) and Spiritual quotient (SQ) represents the complete combination of human intelligence and performance [1]. Past literature showed that there are significant effects of IQ, EQ and SQ on employee behaviour and performance [2]. Various competencies model of IQ, EQ and SQ has been built and applied to working performance of managers/leaders [3-5]. IQ is a term coined by psychologist William stern and it is determined by a number of factors which includes both genetic and non-genetic factors [6]. It is basically a score derived from one of the several different standardisation tests designed to assess relative intelligence [7]. IQ is an ability of a person to solve an objective problem and can be used to make a person competent enough. Yadav and Singh [8] proposed a fuzzy expert system for evaluation of students performance evaluation. The authors discussed a fuzzy inference system and associated rules. Further a practical method has been proposed and

compared with existing statistical method. Pavani et al. [9] evaluated teachers' performance using fuzzy inference system. The authors compared two different membership functions to achieve the shape of membership function which plays more important role in evaluating performance. Haji et al [10] predicted Intelligence, emotional and spiritual quotients (IESQ) to predict personal quality of corporate managers. The study considered data collected from 237 enterprises managers through questionnaires. The paper also showed structural models of personal quality predicted by IESQ.

The subject emotional intelligence was originated in 1980's. In the last decade Emotional intelligence has done significant progress in experimental psychology [11]. EQ is the competency to identify and express emotions, understanding emotions, assimilate emotions in thought and regulate emotions in the self and in others [12]. It seems to have significant impact on individual from view point of cognitive ability. Therefore people with a high level of emotional intelligence may not have high intelligent quotient [13, 14]. It further contributes to a leaders capacity to manage challenges and barriers that the leader may face through the leadership process within organisation. Bouslama et al. [15] proposed a fuzzy based emotional intelligence model and framework to capture uncertainties in surveys of new intakes. The proposed system was expected to help HCT Dubai colleges for better design, prepare orientation and counseling sessions for students. Austin et al [16] performed measure of emotional intelligence on 156 first year medical students. The results showed that females scored significantly higher than males. Structural equation modeling showed direct effects of gender on EQ. The findings provided limited evidence for a link between EQ and academic performance of students. Patel et al [17] explored the use of Artificial Intelligence for enhancing students IQ and EQ levels. The knowledge for the system has been documented which can be easily transferred and can be very useful for measuring mental age correctly.

The spiritual intelligence unit serves to assist people in any context (corporate, community, family) to develop their spiritual awareness, capacity and intelligence, and then to use that intelligence to be more effective as an individual, and thereby expand their capacity to make a greater contribution to the endeavours of others [18]. Covey [19] talks about the spiritual renaissance in the business world, Zohar and Marshall [20] created the concept of spiritual intelligence, Srivastava and Mishra [21] proposed different dimensions of SQ to evaluate, manage and lead people effectively. The study also analysed the relevance of SQ to sustenance and survival of companies in the present world. According to Safara and Bhatia [22], SQ is a capacity for deep understanding of existing questions and insight into multiple levels of consciousness. It also implies awareness of spirit as the ground of being or as the creative life force of evolution. It is characterised by the ability to see the best in seemingly painful circumstances, as well to see the divine beyond the gains of the world [23]. Akhtar et al. [24] studied SQ as a solution to the unethical behaviour of employees and how it can contribute

towards organisational sustainability. The authors concluded that SQ is the ultimate intelligence with which people addressed and solved problems associated with meaning and value. In this paper a fuzzy stage-wise approach for designing of overall leadership evaluation model has been proposed. The study considers different attributes under each quotient which were used to build the proposed model. The procedure for designing of fuzzy controller for proposed system has also been illustrated.

2.0 Designing of proposed stage-wise fuzzy model

Fuzzy logic was initiated by Lotfi A. Zadeh in 1965 [25]. Fuzzy logic is a multi-valued logic that allows intermediate values to be defined between conventional evaluation like true or false, yes or no, high or low etc [26]. Fuzzy logic has emerged as an important tool for controlling complex systems and industrial processes. The most important advantage of fuzzy logic is performing human reasoning in terms of rules defined in natural language. Fuzzy theory is based on the theory of fuzzy sets, which is generalization of classical set theory [27]. This paper proposed a stage-wise fuzzy reasoning model for overall analysis of a Leader [28]. The study considers different attributes under each quotient. A total of 12 such attributes were considered which were combined in three stages which reduced the problem of rule explosion [29]. The first and second stage gives individual quotient analysis whereas the third stage combines the three quotient i.e. IQ, EQ and SQ to give overall analysis.

The complete model with proposed fuzzy logic controllers (FLC's) is shown in Figure 1.0.

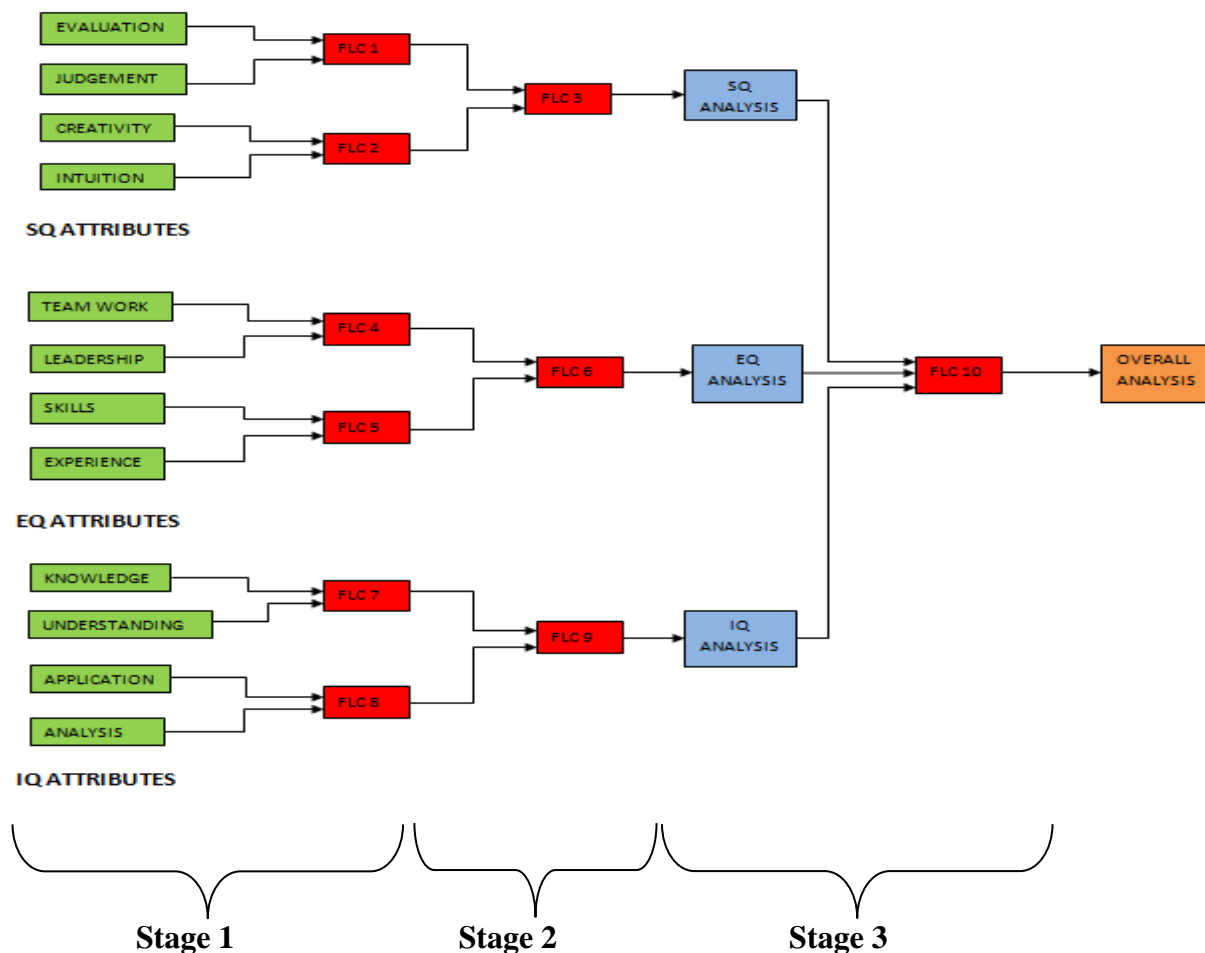


Figure 1.0 Stage-wise fuzzy logic model for Leadership evaluation

3.0 Designing of Membership function's (MF's) and fuzzy rules

Each of the attribute discussed above can be further fuzzified into different grades of MF's having suitable Universe of discourse (UOD). The range of UOD and parameters of MF's were determined by the knowledge and experience of expert depending upon the suitability of particular problem. In this study two different shape MF's i.e. triangular and trapezoidal MF's were proposed for designing of FLC's. A view both MF's for one of the attribute of SQ i.e. evaluation is shown in Figure 2.0 and Figure 3.0 respectively. The UOD considered for 'Evaluation' was in the range of 0 to 10 for both the MF's. A set of five triangular MF's (very low, low, medium, high and very high) were considered for defining of each attribute. Similarly, the UOD and MF's for other attributes can also be defined.

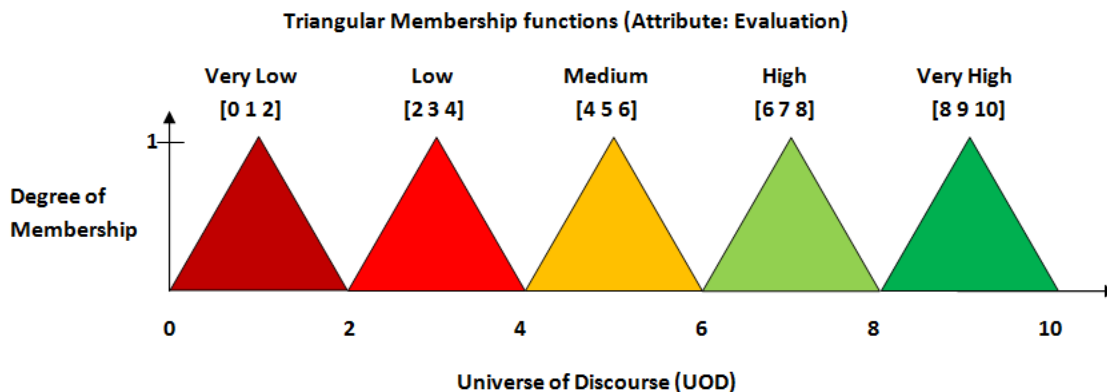


Figure 2.0 Triangular MF's for attribute: Evaluation

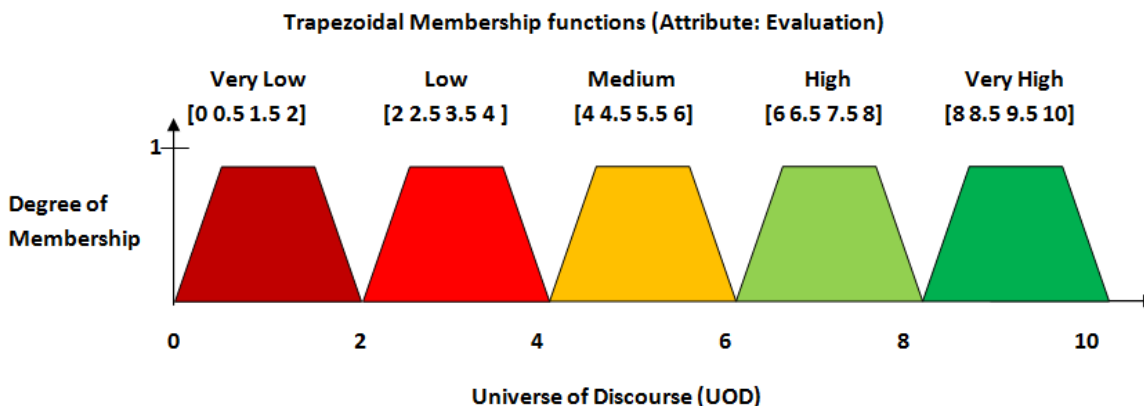


Figure 3.0 Trapezoidal MF's for attribute: Evaluation

In stage-wise process two or more of input attributes were combined and analysed in the form of if-then fuzzy rules. The fuzzy rules were designed based on knowledge and experience of expert and varies from one expert to another. The if-then fuzzy rules for 'FLC-1' i.e. evaluation and judgment analysis are shown in Table 1.0. Similarly the rule base for other controllers can also be defined.

Judgment	Evaluation					
		Very low	Low	Medium	High	Very high
Very low		Very low	Very low	Low	Medium	Medium
Low		Very low	Low	Low	Medium	Medium
Medium		Low	Low	Medium	Medium	High
High		Medium	Medium	Medium	High	Very high
Very high		Medium	Medium	High	Very high	Very high

Table 1.0 If-then fuzzy rules for 'FLC-1'

4.0 Conclusion

This paper proposed a stage-wise fuzzy reasoning model for overall leadership evaluation. The study showed how three quotients i.e. Intelligent Quotient (IQ), Emotional Quotient (EQ) and Spiritual Quotient (SQ) can be combined effectively using proposed approach. A 3-Stage fuzzy reasoning model has been proposed which can be used to avoid problem of fuzzy rule explosion. The paper illustrated linguistic application of fuzzy logic in determining human decisions in terms of if-then fuzzy rules. The study also proposed two different shape MF's i.e. triangular and trapezoidal which can be analysed to built the proposed model. As an extension to future work the proposed model is being implemented to run on Matlab/Simulink environment for practical simulations.

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