

# “EVALUATION OF GOVERNMENT OFFICER PERFORMANCE USING FUZZYLOGIC TECHNIQUES”

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**Abstract**—Many government departments use seniority as criteria for promotion, not as Performance. But recent 6<sup>th</sup> pay commission recommends, performance based promotion system. In this regard, All Group A Officers of the Central government submits yearly ACR’s (Annual Performance Appraisal Report) system to evaluate the government Officer performance. The Government Officer performance is very important to the government and as well as public, in which usually involves speedy delivery of the government schemes and reaching out to the public expectations. In this paper we proposed to evaluate Government Officers performance on the basis of different factors, applying into fuzzy inference system (FIS), FIS is the process of formulating the mapping from a given input to an output using fuzzy logic. We can consider some of the most relevant factors, and developed rules will be fuzzified. As input fuzzy variable performance will be fuzzified with suitable fuzzy linguistic variable and ultimately FIS will be developed. This paper explains the comparison of two different membership function and getting more or less similar. So to achieve the shape of membership function, which is not playing much role to evaluate the performance in positive or negative direction.

**Keywords**--- Performance Appraisal, Government Officer, public, Cascaded, Fuzzy Inference System, Sensitivity Analysis, Gaussian MF, Fuzzy Rules.

## I. INTRODUCTION

According Government Officer Performance is judge based on the Outcome performance achieved during the past one year as assigned jobs to him. A good Officer delivers job more effately and easily. So that government schemes reaches to public.

Evaluating the performance of a government Officer is very necessary due to many reasons. There are

- a) Improvement of the government functionary.
- b) Monitoring of the government activities.
- c) Betterment to the public
- The feedback form that is being mad to evaluate the performance of government Officer is based an some crisp value (fixed value) which is not at appropriate.

Proposals to use Officer Performance incentives as the basis for government reforms have recently attracted considerable attention and support among researchers and policy makers. The main message is that the most likely way to improve government achievements is to Officers performance incentives, direct monetary rewards (i.e. Increments / next higher grade) for improvements in government schemes outcomes.

To evaluation the Officer performance, I purpose to take the help of public feed back form to apply fuzzy logic. As fuzzy logic is a tool which can be applied in uncertain simulation, must of the factor while evaluate Officer performance are uncertain, Vaguer. Say for example how factor can not be measured with some crisp value, it may be better to have bad, good, better, best etc. which is fuzzy linguistic variable.

“Evaluation of government Officer performance using in fuzzy logic techniques” in this research Officer performance is evaluated. so, first we should survey the Officer duties and public requirements.

Then researcher must interact the Officers and get some knowledge about Officers. Researcher should meet different department Officers. Range from Probationary Officer to Senior Officer like Secretary rank, all have given some ideas about the finding the Officer performance.

Officer performance is very important to the government as well as public. In this research, I just find Officer performance towards the public. Public point of view, Officer must have the

1) Assessment of the work output :

i) planned work ii) quality of output iii) Analytical ability

2) Assessment of Personal attributes :

i)attitude towards work ii) sense of responsibility iii) maintenance of discipline iv) communication skills v) Leadership qualities vi) capacity to work in team spirit vii) Capacity to adhere time schedule viii) Inter-Personal skills ix) Over all bearing & x) personality.

3) Assessment of functional competency:

i) Professional knowledge/ Rules ii) strategic planning ability iii) decision making ability iv) coordination ability. v) ability motivate subordinates vi) Initiative.

## II. METHODOLOGY

Fuzzy Logic introduced by Zadeh (1965) gives us a language, with syntax and local semantics, in which we can translate our qualitative knowledge about the problem to be solved. Fuzzy logic is a powerful problem-solving methodology with a myriad of applications in embedded control and information processing. Fuzzy provides a remarkably simple way to draw definite conclusions from vague, ambiguous or imprecise information. In a sense, fuzzy logic resembles human decision making with its ability to work from approximate data and find precise solutions.

### A. Different Membership function::

a) Straight line: The simplest membership function is formed by straight line. We consider the speed of car fig (1.1), and plot the membership function for high. Where the horizontal represent the speed of the car and vertical axis represent the membership value for high.

b) Trapezoidal: If we consider the case 1.2 and plot the membership function for “less”, we get a trapezoidal membership function. Fig 1.2 shows a graphical representation, where the horizontal axis represent the force applied to the accelerator and the vertical shows membership value for “less”. The function is often represented by “trapmf”.

c) Gaussian:. Let say a fuzzy set Z which represent “number close to zero”. The possible membership function for Z is

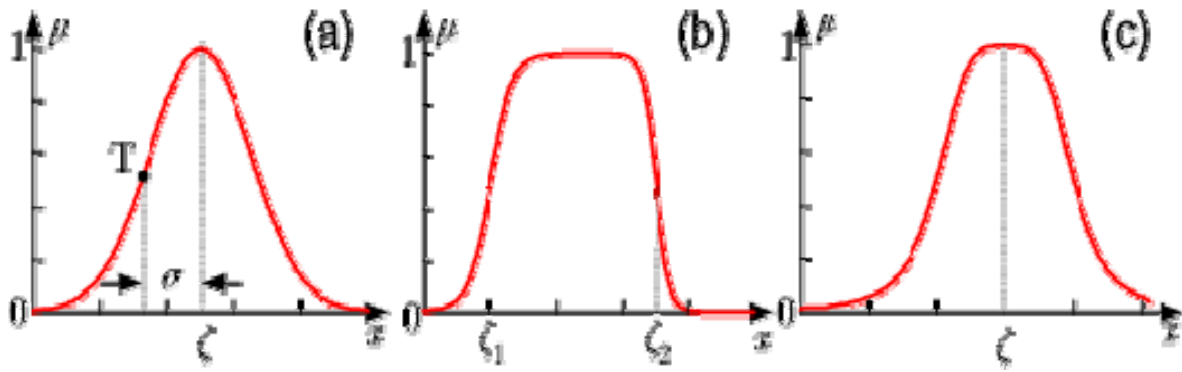
$$\mu_Z(x) = e^{-x^2} \quad (1.3)$$

If we plot this function we get a graph shown in fig 1.3 and are refer as Gaussian membership function.

d)Triangular: This is formed by the combination of straight lines. The function is name as “trimf” .We considers the above case i.e. fuzzy set Z to represent the “number close to zero”. So mathematically we can also represent it as

$$\begin{aligned} & 0 \text{ if } x < -1 \\ \mu_Z(x) &= x + 1 \text{ if } -1 \leq x < 0 \quad (1.4) \\ & 1 - x \text{ if } 0 \leq x < 1 \\ & 0 \text{ if } 1 \leq x \end{aligned}$$

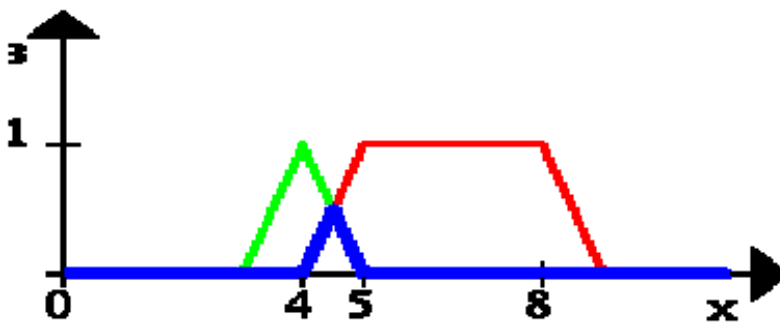
By plotting equation 1.4 we get a triangular graph below figure called “triangular membership function”



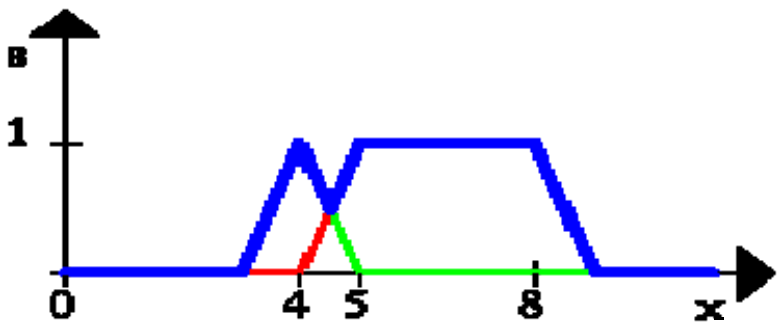
The above Figure : Membership functions with smooth transitions

*B. Fuzzy Set of Operations:*

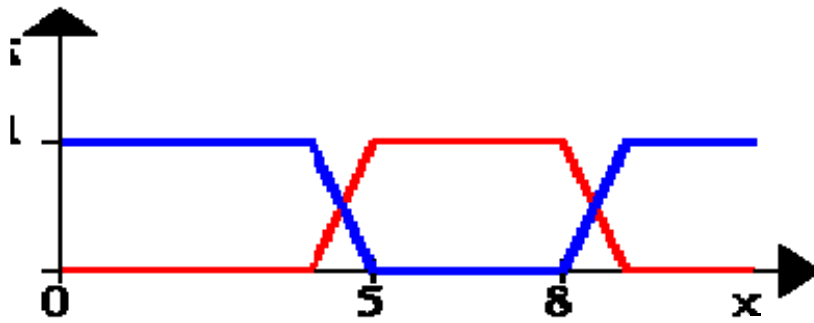
- a) Fuzzy intersection
- b) Fuzzy union
- c) Fuzzy complement



a) Fuzzy intersection



b) Fuzzy union



c) Fuzzy complement

*C. Fuzzy Rule Base:*

a fuzzy rule-based model of human problem solving is described. The model is presented in its general form and then adapted to fit data from a simulated fault diagnosis task. The model was able to match 50% of human subjects' actions exactly while using the same rules approximately 70% of the time. Problem solving rules were selected by the model according to measures of recall, usefulness, applicability, and simplicity. Rules were further discriminated by their use of symptomatic information for pattern recognition or topographic information for information seeking.

A production rule consists of two parts: condition (antecedent) part and conclusion (action, consequent) part, i.e: *IF (conditions) THEN (actions)*

**Rule 1:** *IF (C Score is high) and (C Ratio is good) and (C Credit is good) then (Decision is approve)*

**Rule 2:** *IF (C Score is low) and (C Ratio is bad) or (C Credit is bad) then (Decision is disapprove)*

*D. Fuzzy inference system editor:*

the FIS editor handles the high level issuing for the system such as the number of input and output variables and their names, types of the 'AND' and 'OR' operators, and the aggregation and defuzzification methods.

**a) The membership function editor:**

The membership function editor is used to define the properties of the membership function for the systems variables.

**b) The rule editor:**

The rule editor enables the user to define and edit the of rules that describe the behavior of the system.

**c) The rule viewer:**

The rule viewer is a read only tool that displays the whole fuzzy inference diagram.

**e) The surface viewer:**

The surface viewer is also a read only tool. it is used to display how an output is dependent on any one or two of the inputs.

*E. INPUT PARAMETERS:*

- 1) WELL VERSIED WITH RULES
- 2) STRATEGIC PLANNING
- 3) DECISION MAKING ABILITY
- 4) COORINATION ABILITY
- 5) ABILITY TO MOTIVATE SUBORDINATES.

*F. OUTPUT PARAMETERS:*

- 1)POOR
- 2)GOOD
- 3)EXCELLENT

INPUT	INPUTNAME	LINGUISTIC	RANGE
INPUT1	WELL VERISED WITH RULES	ABSTRACT	1-50
		BETTER	25-75
		RELEVANT	50-100
INPUT2	STRATEGIC PLANNING	ERATIC	1-50
		MANAGEBLE	25-75
		OPTIMUM	50-100
INPUT3	DECISION MAKING ABILITY	BAD	1-50
		GOOD	25-75
		VERY GOOD	50-100
INPUT4	COORINATION ABILITY	VERY UNIMPRESSON	1-50
		IMPRESSON	25-75
		VERY IMPRESSON	50-100
INPUT5	MOTIVATE SUBORIDNATES	BELOW	1-59
		NORMAL	50-75
		ABOVE	50-100

OUTPUT	OUTPUTNAME	LINGUISTIC	RANGE
OUTPUT1	STRATEGIC PLANNING	POOR	1-40
		GOOD	40-80
		EXCELLENT	90-100

iii. FUZZIRIFICATION:

Fuzzification comprises the process of transforming crisp value into grade of membership for linguistic terms of fuzzy sets. The membership function is used to associate a grade to each linguistic term

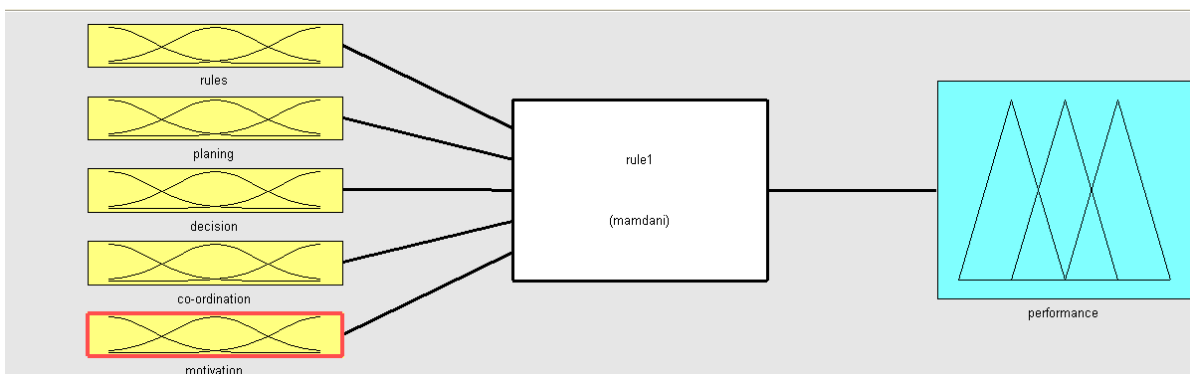


FIGURE-1

Figure-1 describes the we select the five parameters and one output of the Officer activities and apply to the FIS and arrange the rules then we evaluate the Officer performance.

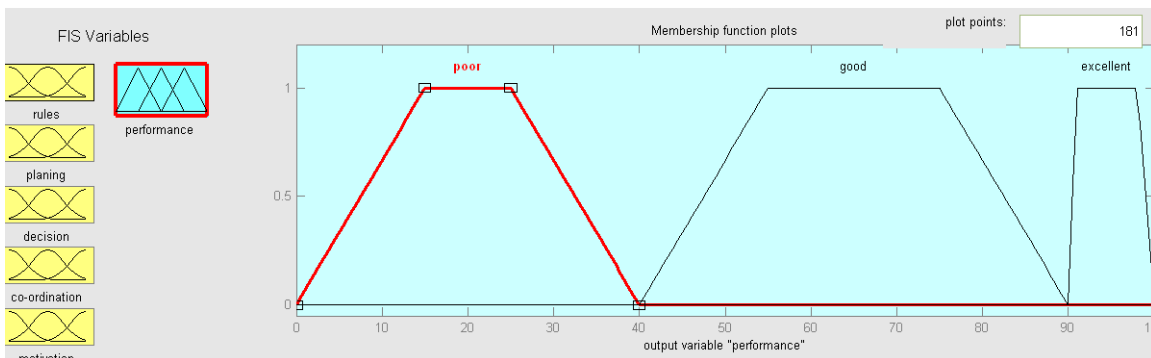
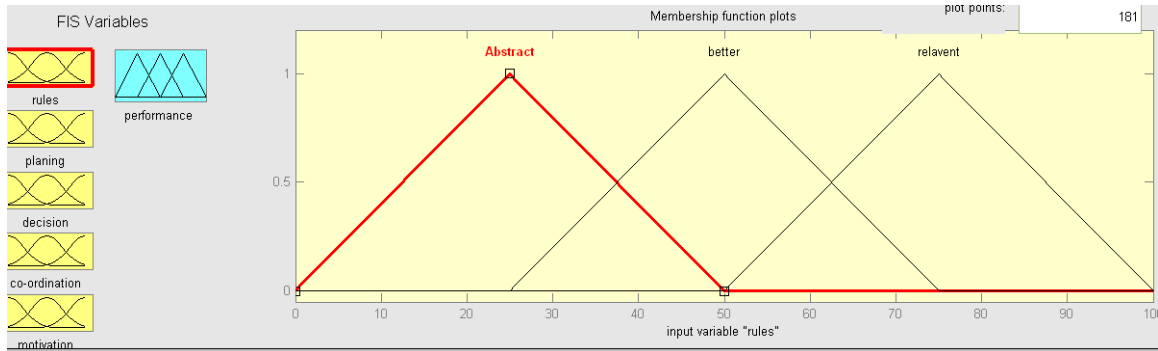


FIGURE-2

Figure-2 shows fuzzification of input parameters knowledge with there membership function and its corresponding range as explain in table1, the membership function are overlapping with each other for achieving better results



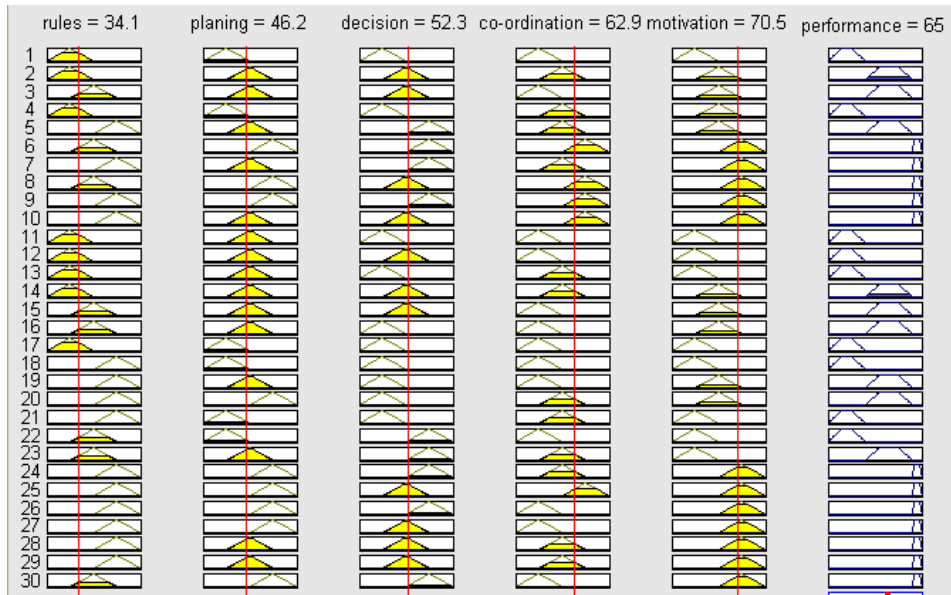
**FIGURE-3**

Figure-3 shows fuzzification of output parameter performance with there membership function and its corresponding range as explain in table 2, the membership function are touching with each other for achieving better results.

**IV. RULE BASED:**

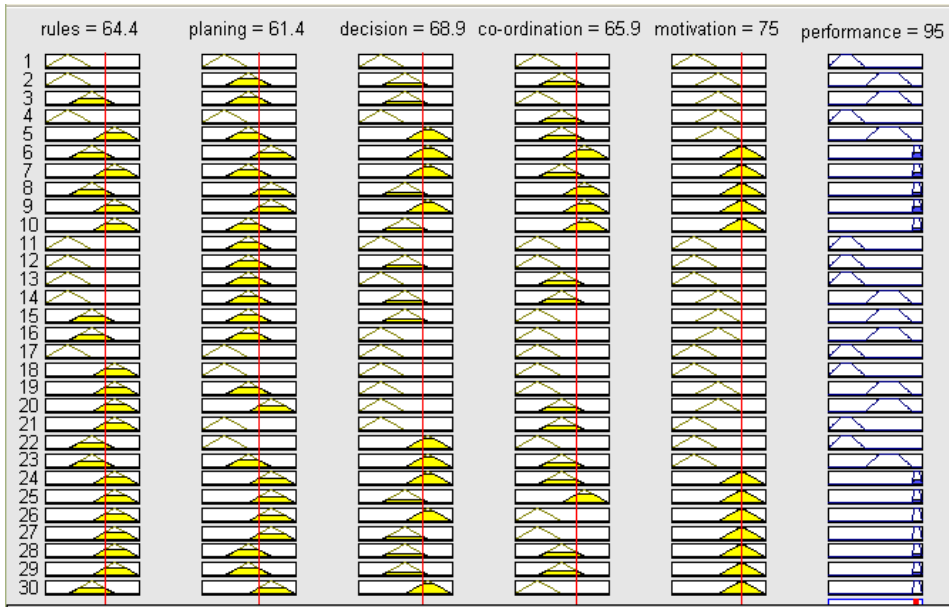
As per the input and output parameters fuzzified as shows in fig 1 to fig 7 rule base is generated by applying my own reasoning as an expert person to observe or taking decision to Evaluate the performance of a Officer. There are 34 numbers of rules generated using ‘AND’ and ‘OR’ operator. The overall rules are written below

- 1 .If (well versed with rules is abstract ) then (performance is poor).
- 11. If (well versed with rules is better) and (strategic planning is manageable) and (decision making ability is good) then (performance is good).
- 20. If (well versed with rules is relevant) and (strategic planning is manageable) and (decision making ability is very good)and (coordination is un impression) then (performance is good).
- 34. If (well versed with rules is relevant) and (strategic planning is optimum) and (decision making ability is very good)and (coordination is impression)and (ability to motivate is satisfy) then (performance is excellent).



**FIGURE-4**

The above Figure-4 : Rules 34.1 planning 46.2 decision 52.3 co-ordination 62.9 motivation70.5 and performance=65

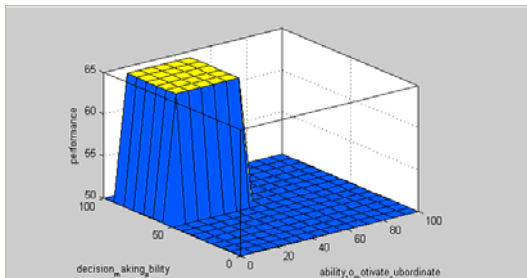


**FIGURE-5**

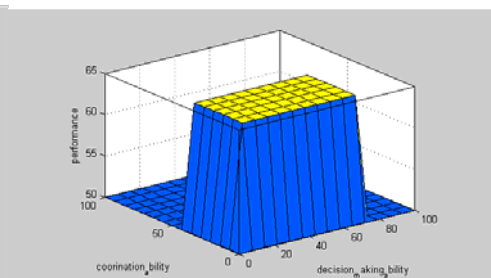
The above Figure-5: Rules 64.4 planning 61.4 decision 68.9 coordination 65.8 motivation 75 and performance=95

INPUT						OUTPUT
SNO	Well versed with rules	Strategic planning	Decision making	coordination	Motive subordinates	Triangular
1	6	12.9	18	15.9	20.5	20.4
2	7	12.2	24.5	9.85	22	33.7
3	32.6	35.6	28	37	31.1	40.4
4	44.7	38.6	40.2	31.1	38.6	56.2
5	40.2	47.7	52.2	41.1	55	67.2
6	53.8	41.7	53.5	55.2	61.4	68.3
7	64.4	58.3	62.8	64.4	64.4	70.4
8	68.8	76.5	70.5	75	72	76.1
9	78.5	81.1	70.5	70	84.1	83.8
10	97.7	87.6	97.7	96.2	96.2	95

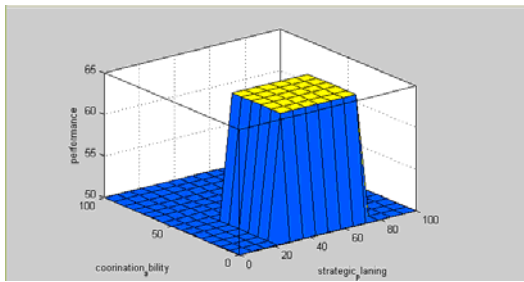
The above Table : Inference process when Well versed with Rules =97.7, Strategic planning =97.7, Decision making =97.7,Coordination ability =97.7, Motivate subordinates=97.7 then performance =95.



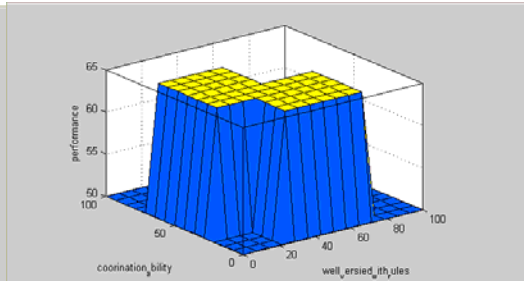
**FIGURE-6**



**FIGURE-7**



**FIGURE-8**



**FIGURE-9**

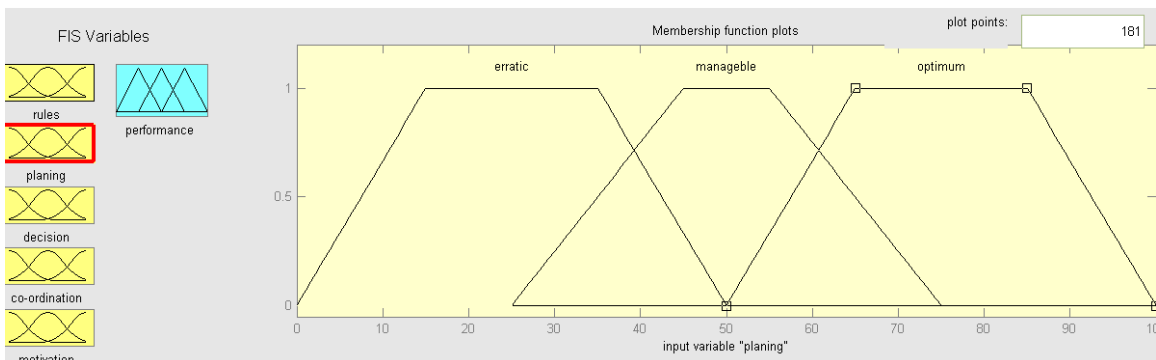
Three dimensional of surface viewer of rule base explains the Rules is on X-axis and Strategic planning is Y-axis with respective to performance on Z-axis.

**V. DEVELOPMENT OF FUZZYSYSTEM USING TRAPEZOIDAL:**

**Trapezoidal Fuzzifiers:**

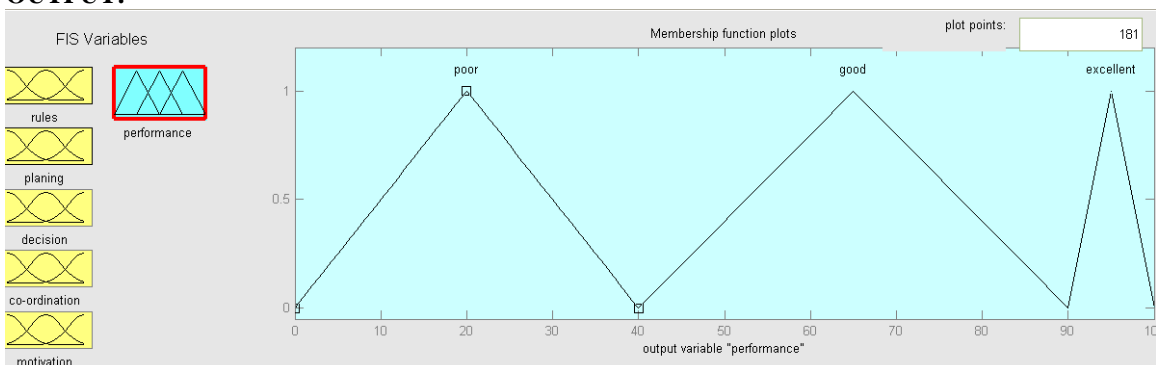
For the simplicity of discussion only the trapezoidal fuzzifiers are presented here Fuzzification of a real-valued variable is done with intuition, experience and analysis of the set of rules and conditions associated with the input data variables. There is no fixed set of procedures for the fuzzification.

**INPUT:**



**FIGURE-10**

**OUTPUT:**



**FIGURE-11**



INPUT						OUTPUT
SNO	Well versed with rules	Strategic planning	Decision making	coordination	Motive subordinates	Trapezoidal
1	15.9	15.9	15.9	15.9	15.9	20.3
2	25	25	25	25	25	20.4
3	33	35	35	35	35	48
4	44.7	44.7	44.6	44.7	44.7	55.6
5	55.3	55	55.3	55.3	55	67.2
6	65.9	65.5	65	65.7	65.8	71
7	68.8	76.5	70.5	75	72	76.1
8	87.1	83.3	84.4	78	70.5	80.8
9	73.5	81.1	70.5	82.8	84.1	87.8
10	97.7	97.6	97.7	97.7	97.7	95

The following table shows that how inference engine works for different input values .if we observe this table minimally then one can say that for different values of a input parameters the output (performance) that is produced by FIS more or less current.

**COMPARISION TABLE:**

INPUT						OUTPUT	
SNO	Well versed with rules	Strategic planning	Decision making	coordination	Motive subordinates	Triangular	Trapezoidal
1	9.85	12.9	18	15.9	20.4	20.4	20.3
2	29.5	12.2	23.5	9.85	22	33.7	20.4
3	32.6	35.6	28	37	38.1	40.4	48
4	44.7	38.6	40.2	38.1	38.6	56.2	55.6
5	40.2	47.7	53.3	48.1	55	67.2	67.2
6	53.8	41.7	53.3	55.2	61.4	68.3	71
7	64.4	58.3	62.8	64.4	64.4	70.4	76.1
8	68.8	76.5	76.5	75	72	76.1	80.8
9	73.5	81.1	70.5	70	84.1	87.8	87.8
10	97.7	97.6	97.7	96.2	96.2	95	95

In the above table an example is demonstrated by and my point of view is taking arranging input values for getting the output as Officer performance in shape triangular and trapezoidal membership functions.

Suppose Sno.1: Well versed with Rules range is 15.9, Strategic planning is also 15.9, Decision making range is also 15.9, Coordination range also 15.9, Motivate subordinates range is 15.9 then performance in triangular shape we get 20.4 and also trapezoidal shape we get 20.3.

Sno.10: Suppose Well versed with Rules range is 97.7, Strategic planning range is also 97.7, Decision making range is also 97.7, Coordination range also 97.7, Motivate subordinates is 97.7 then performance in triangular shape we get 95 and also trapezoidal shape we get 95.

**VI. CONCLUSION**

So far we have developed FIS with different input parameters to evaluate the performance of Officer using two different membership functions triangular and trapezoidal and compared the performance. Result shows that in both the cases the performance in percentage we are getting is more or less similar,

So we can conclude that the shape of membership function is not playing much rule to evaluate the performance in positive or negative direction.

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