



# **DEALING UNCERTAINTY: SCALING UNCERTAINTY USING LINGUISTIC VARIABLES FOR PROJECT SCHEDULING**

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## **ABSTRACT**

There are myriads of uncertain factors or uncertainties which crop up in project scheduling. Many times they lead to delay in completion, failures and even collapse. Although consistency index pinpoints uncertainty and in statistics coefficient of variation gives measure of uncertainty, standard uncertainty logic is used to deal with it yet fuzzy set theory is used to quantify linguistic variables. Today, Fuzzy set theory and theory of probability are established tools to deal with uncertainty. This paper describes scaling of uncertainties which are linguistic in nature and proposes a model based on integrated research methodology using fuzzy set and probability theory.

**KEYWORDS - Fuzzy set theory , Linguistic variables , Model , Project scheduling , Uncertainties ,Uncertainty scales**

## **I. INTRODUCTION**

There are numerous activities ongoing during life span of project . They may be regular , leading and following , concurrent , repetitive , parallel and cyclic in nature. A sphere of uncertainties zoom over the project domain. Uncertainties crop up any time. They cannot be predicted. Once they occur they cause immense loss to resources . Their frequency of occurrence magnifies the loss and results in delay in completion of project beyond expectations.

Qualitative or linguistic variables are used in project scheduling. They describe uncertain factors. When they occur in combination together they add to overall and final outcome of the decision. Fuzzy set theory is a tool for translating linguistic variables mathematically.

## **II. UNCERTAINTY SCALING**

**2.1 Time resource is probabilistic in nature . In PERT the three time estimates are :**

1.Optimistic

2.Most Likely

3.Pessimistic



## 2.2 Uncertainties or uncertain factors :

2.2.1 Based upon frequency of occurrence the uncertainties are:

1. Very Rare                                      2. Rare                                      3. Quite Often                                      4. Frequent

2.2.2 Uncertainties have consequences on project cycle:

1. Insignificant                                      2. Medium                                      3. Large                                      4. Very Large

2.2.3 Uncertainties effect completion time of project that is :

1. Small                                      2. Large                                      3. Very Large

Scaling of uncertainties is done on an appropriate scale having base values say 0 to 1 in steps of 0.1 .

## III. EXAMPLE

Experience effects accidents and consequently project duration

3.1 Consider scaling of experience of a person ranging from no experience to excellent. Choose experience scale from 0 to 40 years.

0	10	20	30	40
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### Experience Scale in Years

In some cases no experience is from 0 to 3 years and excellent experience is from 25 to 30 years'

3.2 Consider effects of experience on accidents.

They may be minor, major, severe and fatal.

The frequency of occurrence of major accident is

Daily	Weekly	Fortnightly	Monthly	Half yearly	Yearly
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### 3.3 The accidents have consequences like

Damage to machine and property	Injury to others	Injury to self	Legal issues	Fatality
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They also result in capital loss. It may be minimum , considerable , great and enormous. This may be scaled as

Minimum	Considerable	Great	Enormous	Catastrophic
0	10	50	100	1000

Capital loss in Thousand of Rupees

### 3.4 Project Delay Time

Out come on project delay is scaled as :

Week/s	Month/s	3-months	6-months	9 -months	Year/s
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## IV. REMEDIAL MEASURES

In order to complete the project in time, handing it over and to ensure minimum overrun in time and cost persons with adequate experience are to be deployed in handling situations of complexities and site should have safety devices and security measures installed.

## V. INTEGRATED MODEL

Obtain a fuzzy set of Frequency and Consequence and a fuzzy set of Consequence and Duration. Compose a fuzzy set of Frequency and Duration. Obtain horizontal sum of row. For maximum sum of members in a row find probability mass function, pmf.

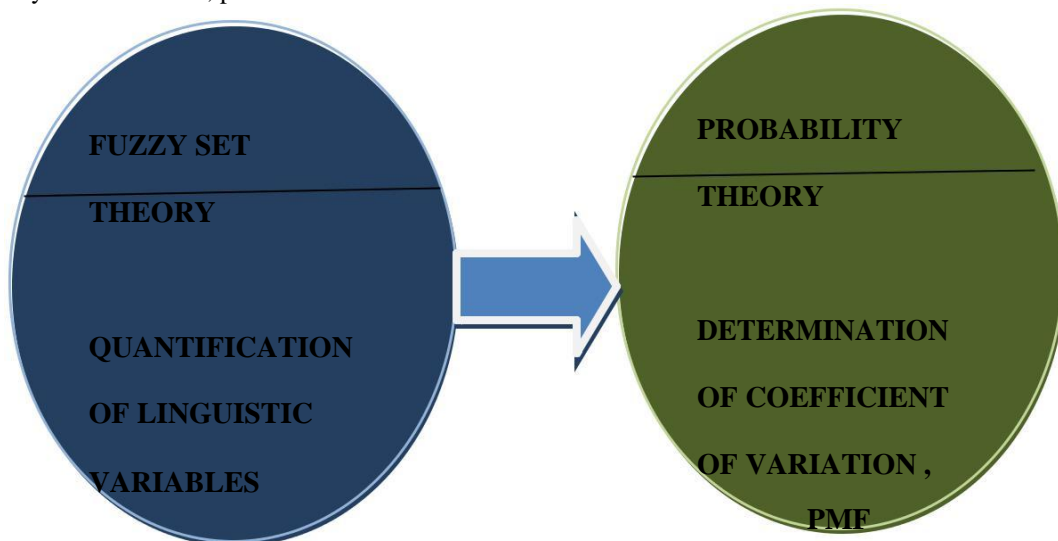


Fig. 1. Integrated Model: Fuzzy set + Probability

## VI. CONCLUSION

The pmf is extensively used to study phenomenon where random variables are involved. Sample space and probability measures fade into the background.

Fuzzy set theory deals with complexities and also do projects have many complexities and uncertainties. It is an ideal tool to deal with them and can be successfully applied in their domain.

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