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CASE STUDY ON RISK MANAGEMENT IN CONSTRUCTION PROJECT USING FUZZY APPROACH

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Abstract — *The main object of this study is to review the impact of risk management on success of construction project. The construction industry is subjected to additional risk because of the unique features of construction activities. Risk management aims at distinguishing sources of risk and uncertainty, determinant their impact, and developing acceptable management response. Many corporations usually establish a risk management procedure in their projects for rising the performance and increase the profits. "In this study fuzzy is used method to examine it and provide an appropriate value" A fuzzy set theory is highly subjective and related to inexact and vague information which we deal in construction projects. This study results in finding the Euclidean distance, which reflects the degree of risk.*

Keywords- *Construction project, Risk analysis, Risk management, Effective fuzzy weighted average algorithm, Euclidean distance.*

I. INTRODUCTION

Companies are faced with a lot of risk uncertainty than ever before. Consumer expects a lot of, most significantly; they are doing not need surprises. Risk management has become a very important a part of the management process for any project. Construction project of dynamic nature has seasonal and cyclic ups and down, hence each construction project requires a lot of care in handling. In any successful construction project the contracts should vital as it is important, difficult costly and lengthy proceedings. The contract documents will be used as a tool to manage risk by allocating risks to the various agencies through the various contracts between them. It is uncertainty inherent in plans and risk of one thing happening that may have an effect on prospects of achieving business or projects goals.

Risk is present in all the activities of projects. Risks and uncertainties are more inherent within the construction industry than the other industry. The process of designing, executing and maintaining all project activities is complicated and time consuming.

Risk management within the construction project management content is to be a comprehensive and systematic approach of characteristic, analyzing and responding to risk achieving the project objectives. The benefits risk management method includes identifying and analyzing risks and improvement of construction project management method and effective use of resource.

This paper reports the analysis that aims to look at the risk analysis and risk management practices within the construction industry.

II. OBJECTIVE

- To study on the main cause or risk in construction projects.
- Categorize in likelihood and severity.
- To find out the range, value and category of risk in construction project.

III. SOURCES OF RISK FACTOR

For finding out the factors responsible for risk management in construction project in rcc work, a literature survey is conducted in several works of the researches have been analyzed and the critical factors from the various literature review-

- Plant suitability (Mixture plant).
- Weather (Natural hazards).
- Material availability.

IV. RESEARCH METHODOLOGY

For reaching out the goal of this study two methods are considered for analyzing the numerical value, first one is fuzzy weighted average (FWA) and second is Euclidean distance method which is used to calculate the whole process numerically. This is a hypothetical study on risk management to find out the Euclidean distance which reflects the degree of risk. This hypothetical study is quite depending on random triangular value which was obtained by experts

(researcher). These random values are further analyzed through the both method, Which justify the degree of risk thoroughly.

1.1. FUZZY WEIGHTED AVERAGE

The term fuzzy logic was introduced with the 1965 proposal of fuzzy set theory by Lotfi Zadeh. fuzzy logic has been applied to several fields, from management theory to artificial intelligence.

An operation normally used in risk and decision analysis is that the weighted average operation (C.H. Junag, x.H. Huang, D.J. El ton, 1991) which takes the following form:

$$\bar{W} = \frac{\sum_{i=1}^{n} W_i \, X \, R_i}{\sum_{i=1}^{n} W_i}$$

Where $\underline{W}$ is the weighted average of ratings, R_i is the rating according to criterion *i* and W_i is the weight assigned to criterion When the terms R_i and W_i are represented by fuzzy sets or fuzzy numbers.

V. DATA ANALYSIS

The process of Data analysis includes the six steps, they are:

The basic idea of EFWA algorithm is to sort a 's and b 's in non decreasing order and find two n- tuples $(d_1,\ldots..,d_i\ ,c_{1+i}\ ,\ldots..,c_n)$ with the δ- threshold i and $(c_1\ ,\ldots..,c_j\ ,d_{i+1}\ ,\ldots\ldots d_n)$ with the ξ- threshold j, which are the n-tuples such that,

$f_L\ (d_1\ ,\ldots..,d_i\ ,c_{1+i}\ ,\ldots..,c_n)$ =min $f_L\ (w_1,\ w_2,\ldots\ldots..,w_n)$ and

$f_U\ (c_1\ ,\ldots..,c_j\ ,d_{i+1}\ ,\ldots\ldots d_n)$ = max $f_U\ (w_1,\ w_2,\ldots\ldots..,w_n)$.

EFWA Algorithm

1. Sort a's in nnon-decreasing order. Let $(a_1,\ a2,\ldots..,\ an)$ be the resulting sequence. Let first: =1 and last: =n.
2. Let δ- threshold: =[(first+last)/2]. For each I =1,2,….., δ- threshold, let $e_i := d_i$ and for each I = δ-threshold+1,……,n, let $e_i := c_i$. For an n-tuples S =$(e_1,\ e_2,\ldots\ldots..,\ e_n)$, evaluate $\delta_{S\ \delta\text{- threshold}}$ and $\delta_{S\ (\delta\text{- threshold+1})}$.
3. If $\delta_{S\ \delta\text{- threshold}} > 0$ and $\delta_{S\ (\delta\text{- threshold+1})} \leq 0$ then L =$f_L\ (e_1,\ e_2,\ldots..,\ e_n)$ and go to step 4; otherwise execute the following step.
   3.1 If $\delta_{S\ \delta\text{- threshold}} > 0$, then first := δ- threshold+1 ; otherwise last := δ- threshold, and go to step .
4. Sort b 's in non- decreasing order. Let $(b_1,\ b_2,\ldots..,\ b_n)$ be the resulting sequence. Let first :=1 and last :=n.
5. Let ξ –threshold := [(first+last)/2]. For each i =1,2,….., ξ –threshold, let $e_i := c_i$ and for each i = ξ –threshold+1 ,….., n, let $e_i := d_i$. For an n- tuples S =$(e_1,e_2,\ldots\ldots..,\ e_n)$, evaluate $\xi_{S\ \xi\text{–threshold}}$ and $\xi_{S\ \xi\text{–threshold+1}}$.
6. If $\xi_{S\ \xi\text{–threshold}} > 0$ and $\xi_{S\ \xi\text{–threshold+1}} \leq 0$ then U =$f_U\ (e_1,e_2,\ldots\ldots..,\ e_n)$ and stop; otherwise execute the following step.
   6.1 If $\xi_{S\ \xi\text{–threshold}} > 0$, then first := ξ –threshold+1; otherwise last := ξ –threshold, and go to step 5.

Where,

$$\xi_{S1} = \frac{(a_1 - a_i)e_1 + (a_2 - a_i)e_2 + \ldots + (a_n - a_i)e_n}{e_1 + e_2 + \ldots + e_n}$$

$$\delta_{S1} = \frac{(b_1 - b_i)e_1 + (b_2 - b_i)e_2 + \ldots + (b_n - b_i)e_n}{e_1 + e_2 + \ldots + e_n}$$

The fuzzy weighted average is:

$$\bar{W} = \frac{W_1 R_1 + \ldots + W_n R_n}{W_1 + \ldots + W_n}$$

Following are the Euclidean distance measurement:

d(X, Minimal) = 0.734

d(X, Low) = 0.509

d(X, Moderate) = 0.377

d(X, High) = 0.509

d(X, Critical) = 0.791

The closet Euclidean distance is 0.377 which means that the risk of plant productivity is considered as Moderate.

VI. CONCLUSION

An effective risk management process encourages the development company to identify and quantify risks and to consider risk containment and risk reduction policies. Construction companies that manage risk effectively and with efficiency get pleasure from financial savings, and bigger productivity, improved success rates of recent projects and better decision making.

As early I have explained that risk is that which could arise from that lack of information. Risks are gaps in information that we expect represent a threat to the project. So in my research I have taken 3 factors against risk to find out that which type of risk is that in construction.

In this study we tried to propose the degree of risk in rcc construction project whether it is minimal, low, moderate, high or critical for the plant productivity. Plant productivity is divided in three phases: Plant suitability, natural hazard, material availability. The values are taken hypothetically for this calculation. The data has been calculated through fuzzy weighted average method. The smallest value has been opt. for this study. The data after calculation is respectively: 0.734 (Minimal), 0.509 (Low), 0.377 (Moderate), 0.509 (High), 0.791 (Critical). As we have mentioned before the smallest value is taken for the final result of the study. So the smallest value amongst all is 0.377.

The closet Euclidean distance is 0.377 which means tha the risk of plant productivity is considered as moderate.

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