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CATEGORIZATION AND PRIORITIZATION OF RISK IN RESIDENTIAL PROJECTS IN PUNE

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ABSTRACT

Construction projects are initiated in complex and dynamic environments resulting in circumstances of high uncertainty and risk, which are compounded by demanding time constraints. Construction industry has changed significantly over the past several years. It is an industry driven primarily by private investors; the presence of securitized real estate has increased considerably. The Indian construction industry is value about US$ 376.53 billion investment in infrastructure over a period of three years. The center of attention of the present research is to identify factors that affect the completion of a risk and prepare a prioritization of risk which occurs in residentialconstruction project in Pune. For that total of 22 risk factors were identified and listed .A questionnaire was organized on the basis of a literature review and pilot study. Response of questionnaire gets filled by 22 owners, and 20 project management,22 contractors with high experience in the construction industry in Pune. For prioritizationfuzzy logic in MATLAB is used.

I.INTRODUCTION

Construction industry of India accounts for about 8% of India's GDP. Being the second largest industry after agriculture, it provides direct and indirect employment to the people of India. It is estimated that about 100 million people will get direct employment by the year 2022. Apart from the direct employment, it also provides indirect employment opportunity through other manufacturing industry like cement, iron and steel, bitumen, chemicals, bricks, tiles, paints, construction equipment etc. Construction industry is one of the fastest growing industries in India growing at a compounded annual growth rate (CAGR) of about 11.1% over the last few years**.**

Construction is often the largest employer in any country (Bust et al., 2008). It has been well documented that a large number of accidents occur in the construction industry (Bust et al., 2008; Camino et al., 2008; Gregory and Simon, 2006; Wang et al., 2006). In modern society, the construction industry has been defined as a dangerous profession (Liao and Perng, 2008; Niza et al., 2008).

Under the "Make in India" program launched by the government of India,100 cities are proposed to be developed as smart cities which will open various opportunities in the construction industry. It has been projected that by 2017, US$ 1 trillion will be invested in the infrastructure sector, 40% of which is likely to be funded by the private sector. Out of the total, 45% will be invested into construction activity and 20% for modernization of construction industry. Approximately US$ 650 billion will be required for urban infrastructure over the next 20 years (http://www.makeinindia.com/sector/construction).

Risk is included in each business, and the development business is no special case. The greater part of the risk administration issues that affect a risk emerge from related instabilities. There are a number of issues in the construction business in India are attributed to various factors. One of the generally inquired about points in extend administration is distinguishing factors that impact the smooth completion of project. The author of this paper has made an attempted to categorization and prioritization of risk in residential project for smooth completion of project.

1.1 BACKGROUND AND OBJECTIVE

For development organizations as temporary workers, decreasing business misfortunes caused by chance occasions is the essential worry to expand their business benefit on construction project (Akintoye and MacLeod 1997). Despite the fact that the Indian development industry has increased significantly more significance as of late as a result of the opening up of Indian markets to worldwide and private segment rivalry with the entry ofthearrivalof megaprojects for infrastructure development, the performance ofIndian construction projects has, however, not been very encouraging(Iyer and Jha 2006). The risk events have a number of factors suchas impact on project performance (e.g., cost, schedule, quality, andsafety), probability oflikehood, expenses for controlling riskevents, risk responsible owners, and so forth. Therefore, decomposingthe risk events into the project breakdown structures (e.g., WBS,OBS, and CBS) can benefit construction companies to manage andcontrol the risk events (Hillson 2007).

Christofferson, and Hutchings(2003) utilized an questioner to decide the components prompting the accomplishment of the development associations in the United States by requesting that the respondents organize the five things that contribute most to the achievement of their development associations. The variables with higher rank were: quality workmanship, great representatives, area of the item, client benefit, viable deals and showcasing, organization notoriety, reasonable evaluating and esteem, and cost control exertion. Dikmenet al. (2005) connected the fake neural system (ANN) and various relapse strategy (MR) to rank the elements to accomplish hierarchical viability (OE). They found that the capacity to profit by advertise openings, abilities and culture of an association, joint wandering, and suitable authoritative structure are the best parameters for hierarchical viability. Cheng and Li (2006) connected the explanatory system handle (ANP) to dole out weights to an arrangement of employment execution criteria and proposed that more consideration should be paid by development organizations to the significance of occupation execution assessment.Risk Management is defined as the identification, measurement and economic control of risks. Osama Ahmed Jannadi and Salman Almishari (2003) developed a risk assessor model and computerized the same to determine the risk associated with a particular activity and the justification factor for a proposed remedy. Knowing the value of risk would help contractors in identifying the risk of major construction activities and would enable them to allocate safety precautions in a more efficient manner.

Reducing both project cost and time duration is critical in a competitive environment. However, a trade-off between project time and cost is required. This in turn requires contracting organizations to carefully evaluate various approaches to attain an optimal time-cost equilibrium.

Daisy X. M. Zheng et al.(2004) proposed model that integrates adaptive weights derived from previous generations, and induces a search pressure toward an ideal point. The concept of the GA-based multi objective Time Cost Optimisation model is illustrated through a simple manual simulation.

Hyun-Ho Choi et al.(2004) suggested risk assessment procedure that is composed of four steps of identifying, analyzing, evaluating, and managing the risks inherent in construction projects. The work was related to a risk assessment methodology for underground construction projects. The main tool of their risk assessment methodology is the risk analysis software which is built upon an uncertainty model based on fuzzy concept. Other tools developed in the study include the survey sheets for collecting risk-related information and the detail check sheets for risk identification and analysis.

Owners also should have a decision-making mechanism that will free them from automatically taking the typical “transfer the risk to a surety” option and will allow them to make intelligent and economical decisions that include retaining or avoiding the risk of contractor default.

ObaidSaad Al-Sobiei et al.(2005) introduced a methodology that involves using artificial neural network (ANN) and a genetic algorithm (GA) training strategies to predict the risk of contractor default. Prediction rates of 75% and 88% were obtained with the ANN and GA training strategies, respectively. The model is of relevance to owners because once the likelihood of contractor default is predicted and the owner’s risk behavior is established, the owner can make a decision to retain, transfer, or avoid the risk of contractordefault.

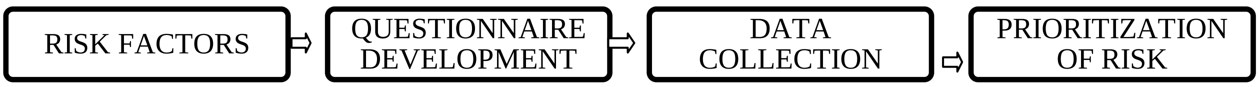
M. Pilar de la Cruz etal.Cruz (2006) included a list of 96 risk events, categorized and prioritized first by impact, then by frequency. The most relevant ones are related to issues such as an inadequate prequalification system, insufficient training of public servants, or political considerations prevailing over real needs, among others. A total of 117 potential risk responses were identified, categorized, and prioritized by potential efficiency and difficulty of implementation. Each risk event was associated to a set of potential responses. A survey was carried out among Spanish public servants working in construction projects, to validate risk identification and to obtain a qualitative assessment. Moreover, a Delphi analysis was developed to validate the risk response identification and obtain a qualitative assessment.

Ashraf M. Elazouni (2006) classified a group of 245 contractors into classes of small numbers. This involves screening of contractors based on many attributes. A neural network model was applied to aid in the prequalification process by classifying contractors into groups based on similarity in performance using the financial ratios of liquidity, activity, profitability, and leverage.

D. Singh and Robert L. K. Tiong (2006) conducted a questionnaire survey for accruing the data required to identify the important contractor selection criteria (CSC) and the importance of the same in assessing the capabilities of the candidate contractors during the selection process. The developed contractor selection system is capable of assessing multiple attributes of the candidate contractors so that the risk of the project failure due to the selection of an inappropriate contractor is minimized. D. Singh and Robert L. K. Tiong(2006) presented a systematic procedure based on fuzzy set theory to evaluate the capability of a contractor to deliver the project as per the owner's requirements. The proposed model is not intended to supplant the work of decision-making teams in the contractor selection process, but rather to help them make quality evaluations of the available candidate contractors. One major advantage of the method is that it makes the selection process more systematic and realistic as the use of fuzzy set theory allows the Decision makers to express their assessment of contractors' performance on decision criteria in linguistic terms rather than as crisp values.

J. Li et al.(2006) described a forecasting method for predicting potential cost overruns and schedule delays on construction projects. The method is intended for use by members of project teams in performing integrated time and cost control of construction projects. The output of the forecasting method is useful in evaluating the project status at different time horizons and in quantifying the impact of the performance indicators on the profitability of the job.

II. METHODOLOGY OF WORK



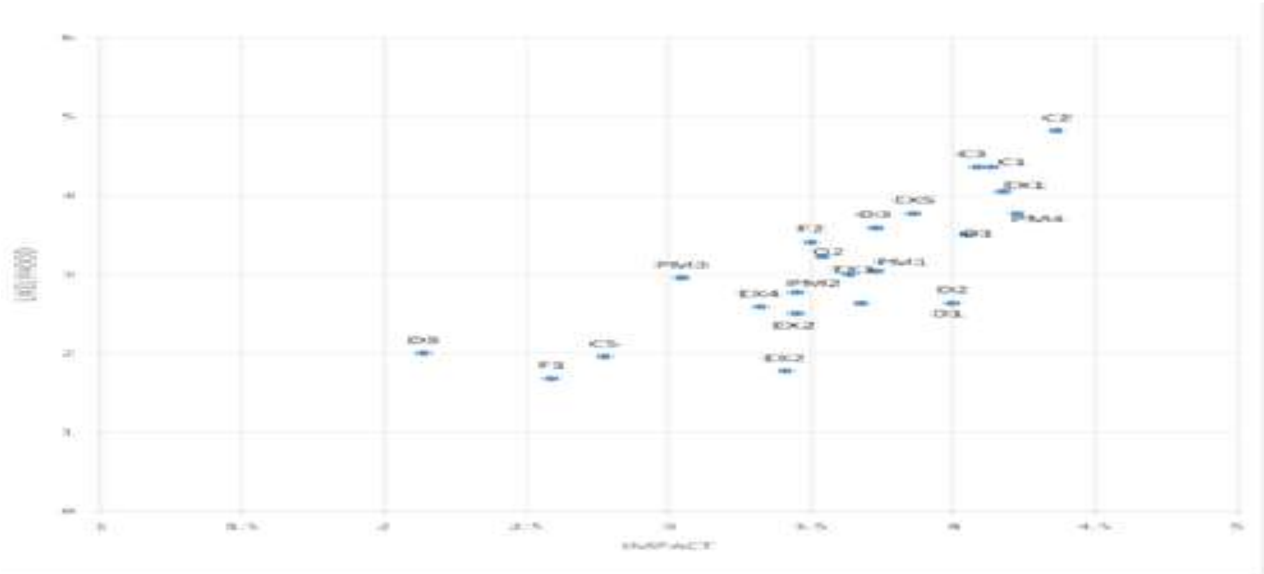
In this paper, based on literature review and interviews with residential project experts, project manager, owner and contractor risks that arises in RMC plants were identified. Total 22 risk factors relating to Design risks, External risks, Organizational risks ,Project Management risks, Force Majeure risks, Constructionrisks were identified. From the identified risk factors, 5 point likert scale questionnaire was prepared for impact and like hood of occurrence. Impact was classified into 5 categories negligible, low, moderate, very high, extreme for ratings of 1, 2, 3, 4 and 5 respectively. Similarly, like hood of occurrence was classified into Rare,Unlikely,occasional,Likelyand Almost certain1, 2, 3, 4 and 5 respectively. A total 64 respondents from 30residential project in Pune rated these questionnaire based on their knowledge and experience. A risk matrix as shown in figure.1 was made for impact vs. like hood.

Table 2. Classification of Risk

Range	Impact	Like hood
1-3	Low	Low
3-4	Medium	Medium
4-5	High	High

According to contractor- Construction time overruns (C1)Construction cost overruns (C2)Labor problems (C3)Public objections, political events (EX1) are having high impact and high likehood.

Figure 1Risk matrix by contractor



According to owner-Construction time overruns (C1)Construction cost overruns (C2) are having high impact and high likehood.

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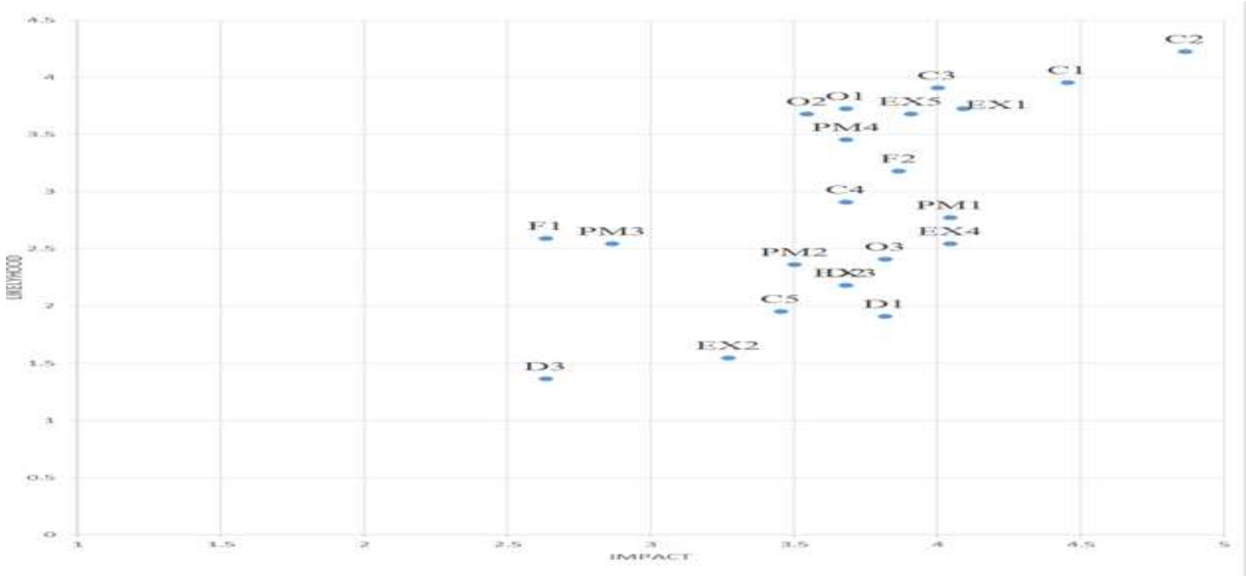
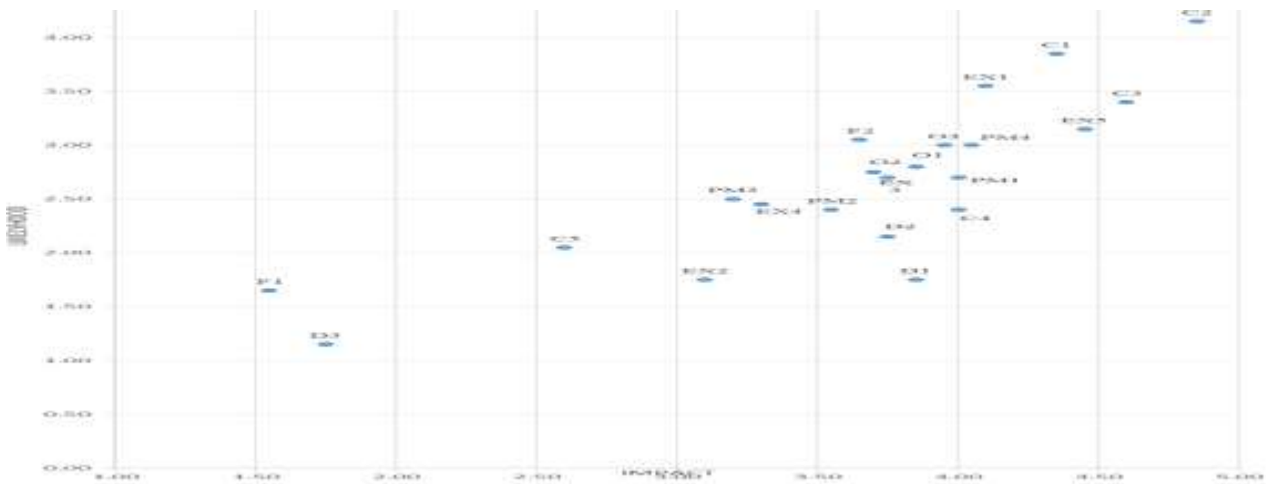
Figure 2 Risk Matrix by owner



According to project manager-Only Construction cost overruns (C2) has high impact and high likehood.

Figure 3 Risk matrix by project manager



Risk is classified into five categories in fuzzy tool, according to impact and like hoodof occurrence of risk factor as shown in table1. Impact, likehoodof occurrence and risk are converted to membership set with trapezoidal distributions as shown in figure 4, 5 & 6.After assigning membership function to input and output variables, the resulting fuzzy inputs are evaluated using a linguistic rule base and fuzzy logic operations to yield a classification of the'riskiness' of the failure. Rules for impact, like hood of occurrence and risk is shown in table 2.After rules are assigned to membership function, the fuzzy outputs are defuzzified. The formula to calculate the crisp value of output is given as follows:

Value of Output Component=∑ (Input Degree of membership * Output Set value)

The Surface graph in figure 7proves that the membership function and rules assigned to input and output variables are accurate.

Figure 4Membership function for impact in MATLAB

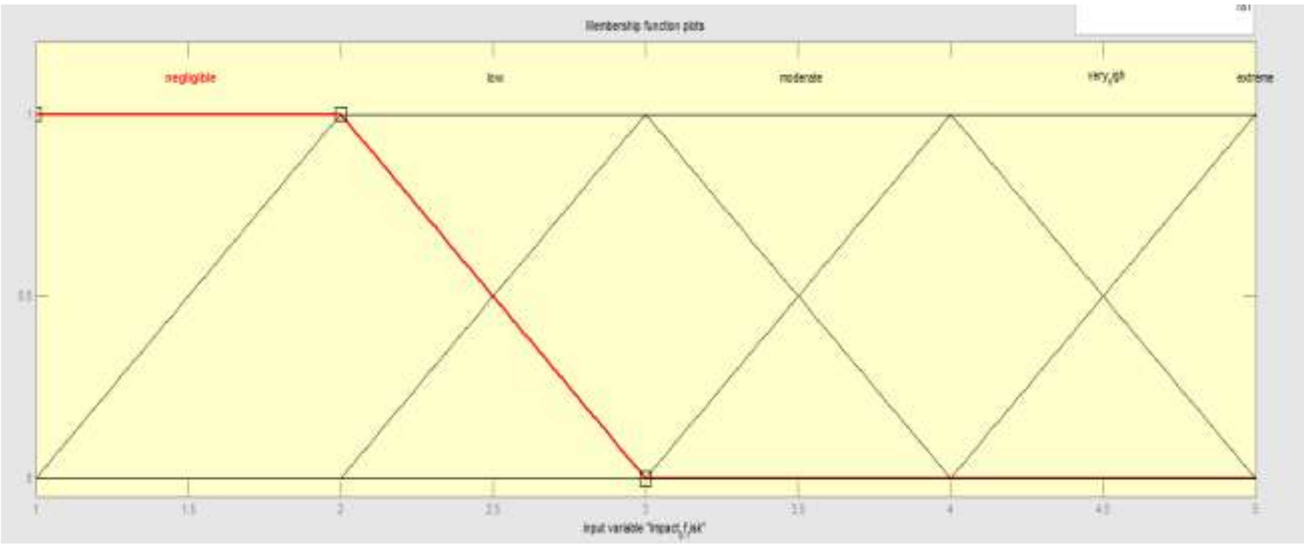


Figure 5 Membership function for probability of occurrence in MATLAB

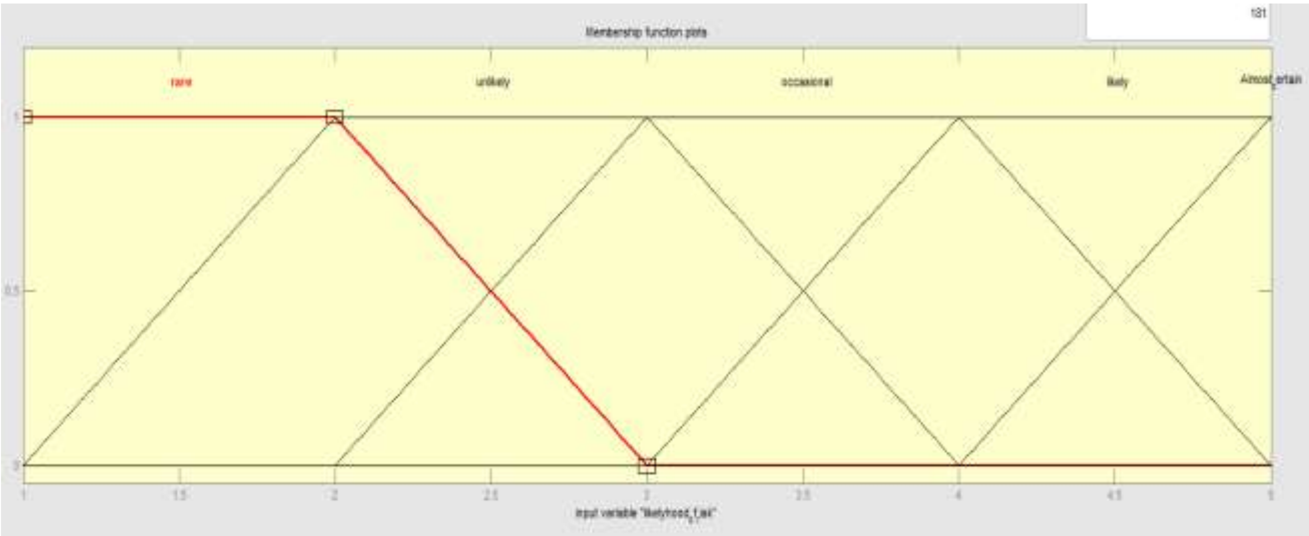


Figure 6:- Membership function for risk in MATLAB

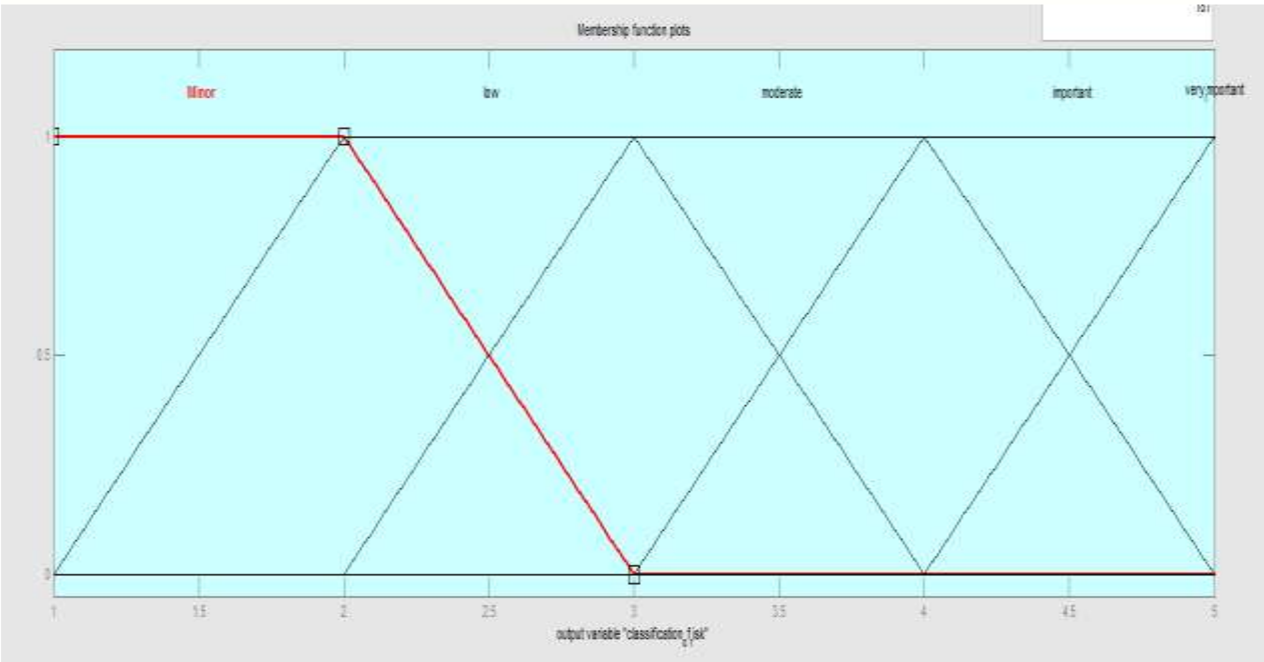


Figure 7:- Surface graph for impact, like hoodof occurrence and risk in MATLAB

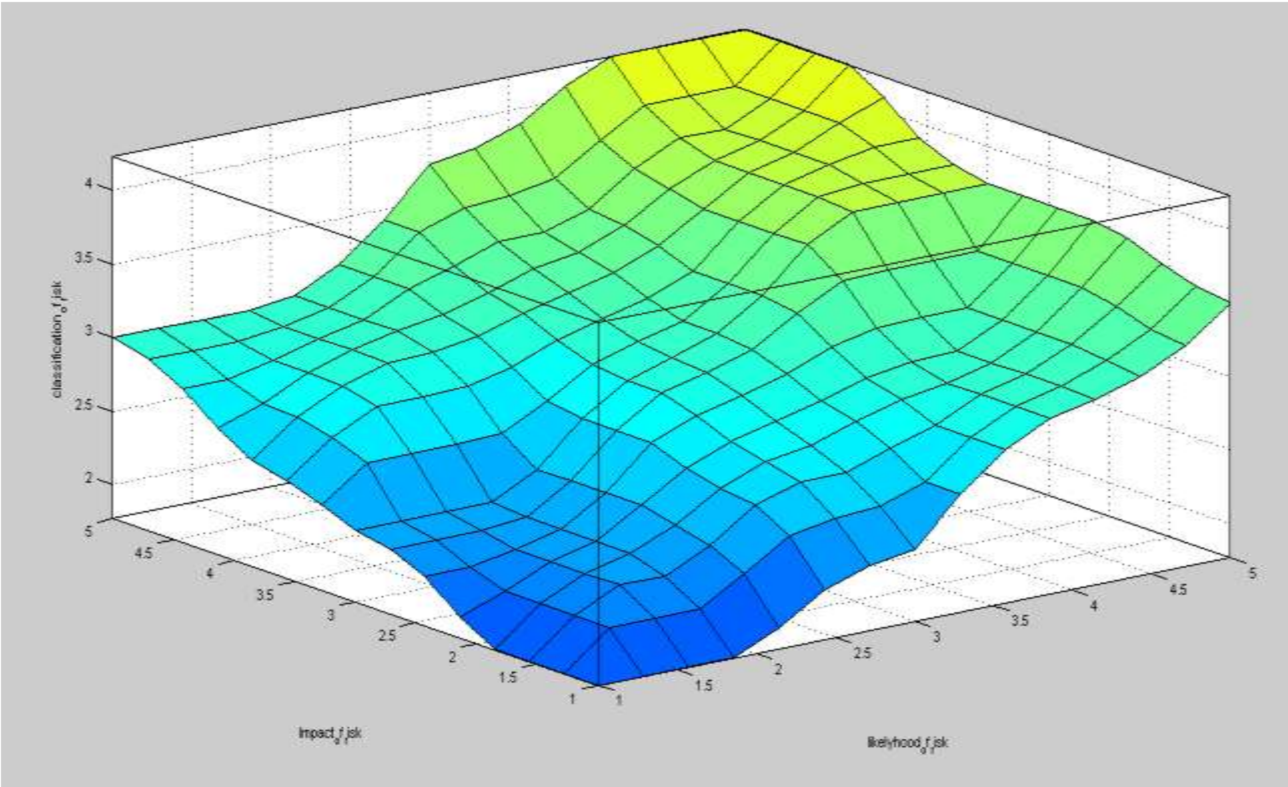


Table 2 Rules for impact, probability of occurrence and risk

Sr no.	Like hood	Impact	Risk
1	Rare	Negligible	Minor
2		Low	Minor
3		Moderate	Low
4		Very High	Low
5		Extreme	Moderate
6	Unlikely	Negligible	Minor
7		Low	Low
8		Moderate	Low
9		Very High	Moderate
10		Extreme	Moderate
11	occasional	Negligible	Low
12		Low	Moderate
13		Moderate	Moderate
14		Very High	Important
15		Extreme	Important
16	Likely	Negligible	Moderate
17		Low	Moderate
18		Moderate	Important
19		Very High	Important
20		Extreme	Important
21	Almost certain	Negligible	Moderate
22		Low	Important
23		Moderate	Important
24		Very High	Very important
25		Extreme	Very important

III.CONCLUSION

In this study a successful attempt is made to combine qualitative analysis of risk and fuzzy logic tool to identify the risk factors that arise in Residential construction and to prioritize the identified risk. From the RPN the most critical risk that affect the residential project is ,construction time overruns (C1), construction cost overruns (C2)which leads to huge loss. foe that proper planning of time management should be done due to which cost of construction can be reduced. This study helps to reduce the losses in residential construction byprioritization of risk**.** This would give more realistic outcomes. Thus integrated study can help in achieving better and realistic results. This will help the management and parties involved to be prepared more properly. Thus not wasting time on not so important or lesser important risks and instead focusing on more dangerous risks which could hamper the project objectives more dominantly.

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