

# Risk Management and Mitigation for Building Construction Project in Sangli District

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**ABSTRACT:** Risk analysis as the title suggests this is related to the construction management. Risk analysing technique is used for the purpose of risk management. Which type of risk is occurring and how it is analysed what are various mitigatory methods available. Risk management involves assessing the risk sources and designing strategies and procedures to mitigate those risks to an acceptable level. Measurement of risk factors plays an important role in the assessment of risk. This research proposes to develop risk assessment frameworks and mathematical model to identify the risk factors. Quantification and prioritization of risk factors will help to design controls, resource allocation policies and minimize the total cost. The proposed model can be applied to a complex system that is representative of actual business situations.

**Key words:** Risk Management, Mitigation, Framework.

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## 1.INTRODUCTION

Risk is the subject related with the construction or any project. From the risk analysis phases how, the risk is analyzed by the steps is explained. In India there are many projects they are suffering from risk. Qualitative approaches require expert opinions or a knowledgeable person's views. An expert can be the one who has extensive knowledge about the field related to project or who has worked on similar projects in the past. The major disadvantages of using qualitative approaches are the amount of subjectivity during the project, variation in human judgments, and lack of standardized approach.

There are lots of problems occurring in construction industry such as:

- 1) Unavailability of material.
- 2) Financial problem.
- 3) Land acquirement.
- 4) Unavailability of labours.
- 5) Market risk.
- 6) Construction risk.
- 7) Other unpredictable risks.
- 8) Strike of labour.
- 9) Natural calamities.
- 10) Machine problems.
- 11) Political problems.
- 12) Operating risk.
- 13) Development risk.

## 2.CONCEPTS OF RISK AND RISK MANAGEMENT

Risk is a multi-facet concept. In the context of construction industry, it could be the likelihood of the occurrence of a definite event/factor or combination of

events/factors which occur during the whole process of construction to the detriment of the project (Faber, 1979), a lack of predictability about structure outcome or consequences in a decision or planning situation (Hertz and Thomas, 1983), the uncertainty associated with estimates of outcomes – there is a chance that results could be better than expected as well as worse than expected (Lifson and Shaifer, 1982), etc. This research has adopted the more general and broad definition of risk as presented by Faber (1979).

A systematic approach to risk management in construction industry consists of three main stages: a) risk identification; b) risk analysis and evaluation; and c) risk response. The risk management process begins with the initial identification of the relevant and potential risks associated with the construction project. It is of considerable importance since the process of risk analysis and response management may only be performed on identified potential risks. Risk analysis and evaluation is the intermediate process between risk identification and management. It incorporates uncertainty in a quantitative and qualitative manner to evaluate the potential impact of risk. The combinations thereof which yield a substantial financial impact. Once the risks of a project have been identified and analysed, an appropriate method of treating risk must be adopted. Within a framework of risk management, contractors should decide how to handle or treat each risk and formulate suitable risk treatment strategies or mitigation measures. These mitigation measures are generally based on the nature and potential consequences of the risk. The main objective is to remove as much as possible the potential impact and to increase the level of control of risk. The more control of one mitigation

measure on one risk the more effective the measure is. The process of risk management does evaluation should generally concentrate on risks with high probabilities, high financial consequences not aim to remove completely all risks from a project. Its objective is to develop an organized framework to assist decision makers to manage the risks, especially the critical ones, effectively and efficiently (Perry and Haynes, 1985).

### 3.METHDOLOGY

1)Ninety four risk were identified with the help of thesis, research papers, expert opinions, expert interviews and site visit.

2)Out of ninety four, thirty eight critical risks were selected on the basis of their impact on the project.

### RISKS

On site congestion	Delay in permits licenses
Safety regulations are not followed	Lack of team experience
Complexity of design	Insufficient funds
Large Project size	Bribery and corruption
Unfairness of tendering	Inappropriate time allocation
Improper Planning	Insufficient labours
Unskilled labours	Labour accidents
Low equipment quality	Equipment breakdown
Defective work	Error in design
Labour dispute	Electrical fire occurs
Fluctuation in prices	Low quality construction
Delay in material delivery	Material theft and damage
Quality variation by labours	Wastage of material by workers

3) We have prepared a questionnaire with the help contractor, engineers and builders.

4) We classified risks into three categories. [High risk intensity (3), Medium risk intensity (2) & Low risk intensity (1)]

5)Contractors/experts supposed to mark the severity based on their experties this questionnaire was provided to 30 expert/contractors in the field of construction from Sangli district.

6) Out of 30 contractors we got 15 valid responses. Even though we got response of 50% people most of them had experience of more than 8 years and some of them having experience of more than 20 years.

7) On the basis of questionnaires we ranked top 15 risks as explained below

For example :

Average = Sum of all risk intensity / No.of responses

Higher the average higher the rank.

### 7.1 STATISTICAL RESULTS ON THE CRITICALITY OF RISKS FROM FIRST QUESTIONARY.

(Where A,B,C are the notification given to the response sheet obtained from the contractors)

Table No-1

RISK	A	B	C	D	E	F	G	H	I	J	K	L	SUM	AVG.	RANK
1	2	2	2	2	1	2	2	2	2	2	1	2	22	2	-
2	2	2	2	2	2	2	3	3	3	1	3	3	24	2.19	12
3	2	2	2	3	1	2	1	3	2	3	3	3	24	2.18	13
4	3	3	3	3	1	2	1	3	3	1	3	3	26	2.36	7
5	3	2	3	2	2	3	2	2	2	2	1	2	24	2.	-
6	2	2	2	3	2	2	1	3	1	3	2	1	24	2.16	
7	3	3	3	1	2	2	1	3	1	2	3	3	24	2.17	14
8	1	2	1	3	2	1	2	2	2	1	3	3	19	1.72	-
9	3	3	3	3	3	3	1	2	3	1	2	1	28	2.54	1

10	2	1	2	2	2	2	1	3	2	1	2	1	19	1.72	-
11	3	2	3	1	2	2	1	3	3	2	3	3	25	2.27	8
12	3	2	3	2	3	2	3	2	3	1	3	3	27	2.45	4
13	2	2	2	3	2	2	1	2	2	3	2	2	23	2.09	-
14	2	2	2	2	2	2	2	1	3	1	2	1	22	2	-
15	1	2	2	3	2	2	1	1	3	2	1	2	22	2	-
16	2	2	2	2	2	2	1	3	2	1	2	2	21	1.9	-
17	3	3	3	2	1	3	1	2	3	3	3	3	27	2.45	5
18	3	3	3	3	2	3	1	2	3	3	3	3	28	2.54	2
19	2	3	2	2	3	2	1	3	2	3	3	3	25	2.27	9
20	2	2	2	2	2	2	1	3	2	1	1	2	22	2	-
21	2	2	2	3	2	2	1	3	3	3	3	3	25	2.27	10
22	2	2	2	2	1	2	1	3	2	3	1	2	21	1.9	-
23	2	2	2	3	2	2	1	2	3	3	2	1	23	2.09	-
24	2	2	3	3	2	3	2	2	2	3	3	3	26	2.36	6
25	2	1	2	1	2	1	1	2	3	2	1	2	19	1.72	-
26	2	2	2	3	2	2	2	1	2	2	3	3	24	2.18	15
27	3	2	2	2	3	2	1	2	2	2	1	2	26	2.36	-
28	3	3	2	3	3	2	1	2	3	2	3	3	27	2.45	3
29	2	2	3	2	3	2	1	1	3	3	1	2	24	2.18	-
30	1	1	2	2	3	1	1	1	2	2	1	2	19	1.72	-
31	3	2	2	2	1	2	1	3	3	3	3	3	25	2.27	11
32	2	2	2	3	3	2	3	1	2	2	2	1	24	2.18	-
33	2	2	2	2	2	2	1	2	1	3	1	2	20	1.81	-
34	2	2	3	2	1	2	1	2	1	2	1	2	19	1.72	-
35	3	3	2	2	2	2	1	1	3	2	2	1	24	2.18	-
36	2	2	2	3	1	3	1	1	2	3	1	2	22	2	-
37	2	2	2	3	1	2	1	1	2	1	2	1	19	1.72	-
38	3	3	3	2	1	3	1	1	2	1	2	1	22	2	-

8) For those top 15 risks we provided mitigatory measures based on experts opinion and literature review and we prepared second questionnaire which include these top 15 risks and mitigatory measures for all those risks. Every risk has more than 3 mitigatory measures. Second questionnaire was again sent to above 15 experts/contractors. Experts/contractors has to rank those mitigatory measures based on their expertise.

#### 8.1.Mitigation measures for top 15 risks

##### 1)Bribery and corruption

A) Establish JV with renowned local partners, especially the central local government agencies or state owned enterprises.

B) Enter into contract with local government authorities to prevent corruption.

C) Set aside a budget for unavoidable spending

D) have to deal with corrupt officials Cultural and commercial awareness training to management and key personal who may

E) Try to work directly with the business connections, i.e. do not hire broker or middleman

F) Obtain all necessary approvals in timely manner to minimize chance for corrupt individual to obstruct work

G) Maintain good relations with concerned local government officials and concerned authorities.

##### 2)Unskilled labours

A) Arranging training programmes or seminars.

B) Conducting annual survey to find out number of available skilled labour.

C) Employing permanent skilled labours and train them through the company.

D) Conducting awareness programmes to contractors to recruit sufficient numbers of skilled labours and illustrating the advantages and high profit associated with.

##### 3>Error in design

A)Undertake pre-project planning to minimize design errors

- B) Adopt Design & Build option which enables contractor to design in harmony with site conditions thus minimizing design/drawing disputes
- C) Introduce adjustment clauses in contract to review plan and constructability
- D) Get Design liability insurance
- E) Arrange and undertake comprehensive site investigation before construction phase
- F) Specify construction extension clause in contract
- G) Organize for appraisal/vetting of drawings and design criteria by at least one independent engineering/architect consultant
- 4) Excessive approval procedure in administrative govt departments
  - A) Ensure the project is complying with local planning commission's development plan
  - B) Ensure the feasibility study report and contract depict local government, local
  - C) Prepare and submit all necessary documents and feasibility study report in a timely manner to local government departments
  - D) Establish JV with renowned local partners, especially the central government agencies or state owned enterprises
  - E) Maintain good relationship with local government and higher officials
  - F) Ask local government to establish one stop agency for all approvals
  - G) Pre-package all approvals when signing contract with project client
- 5) Transportation facilities are not available
  - A) Adequate access facilities should be made to the site
  - B) Good quality transportation equipment should be used
  - C) Procurement of material before the end of stock
  - D) High capacity transportation vehicles should be adopted
- 6) Delay in material delivery
  - A) Adequate Transportation facilities Should be developed
  - B) Locally available material should be preferred
  - C) Proper material procurement
  - D) Good relationship should be maintained with authorized dealer
- 7) Lack of team experience
  - A) Hire competent project management team
  - B) Employ local staff with bilingual ability
  - C) Appoint experienced person for critical cases
- D) Arraigning guest lecture by specialist person
- 8) Improper Planning
  - A) Hire competent project management team
  - B) Employ local staff with bilingual ability
  - C) Conflict resolution clause in contract and specify construction extension clause in contract if client causes the delay
  - D) Provide notice provision and notice period in contract
  - E) Provide clauses on schedule delay and additional payment if caused by client
- 9) Insufficient labours
  - A) Good wages.
  - B) Healthy working conditions.
  - C) Fixed working hours
  - D) Minimizing the use of manpower wherever is necessary (promoting automation)
- 10) Low equipment quality
  - A) Repair and maintenance of equipment should be done instantaneously
  - B) Skilled labour should be appointed on critical equipment
  - C) Avoid use of low quality equipment
  - D) Stand-by equipment should be available
- 11) Low quality construction
  - A) Adopt proper quality control procedures
  - B) Adopt proper safety control programme
  - C) Apply innovative production concepts/philosophies like Lean Construction, Just In Time and Total Quality
  - D) Management, to decrease variability and rework during construction
  - E) Benchmark and monitor construction activities properly
  - F) Good quality material should be used
- 12) Delay in permits/licenses
  - A) Ensure the project is complying with local planning commission's development plan
  - B) Ensure the feasibility study report and contract depict local government, local partner and foreign party's actual
  - C) intentions (like anticipated profits, risk sharing)
  - D) Prepare and submit all necessary documents and feasibility study report in a timely manner to local government
  - E) Departments

F) Establish JV with renowned local partners, especially the central government agencies or state owned enterprises

G) Maintain good relationship with local government and higher officials

H) Ask local government to establish one stop agency for all approvals

I) Pre-package all approvals when signing contract with project client

13) Safety regulations are not followed

A) Ensure that construction and operation are as per examination and concerned approving authority's expectation

B) Get Third Party Insurance for compensation to general public and staff

C) Study and implement the local accident regulations stringently and effectively

D) Adopt proper safety control programme, management system, supervision, incentives and preventive measures

14) Insufficient funds

A) The clarity about source of funding.

B) Sanctioning the loan from bank

C) Raise the funds from crowd funding

D) Introduce new scheme to attract source of funds

15) Labours are not Familiar with new technology

A) Arranging the seminar

B) Recruit labours which are capable of handle new technology

C) Hire specialized to educate about new technology

9) We obtained priority of mitigatory measures from the respondents as per their opinion, knowledge and expertises.

10) If 1<sup>st</sup> rank is given to a mitigation, the weightage given to that mitigation is 9. On similar lines the weightage given to remaining mitigations is as follows.

Table No – 2

Mitigation No.	1	2	3	4	5	6	7	8	9
Weightage	9	8	7	6	5	4	3	2	1

11) Average is obtained from the following formula

$Avg = \text{Sum of all weightages} / \text{No. of responds.}$

12) The mitigation which has higher average should be given priority.

**Sample example –**

**2) Unskilled labours**

A) Arranging training programmes or seminars.

B) Conducting annual survey to find out number of available skilled labour.

C) Employing permanent skilled labours and train them through the company.

D) Conducting awareness programmes to contractors to recruit sufficient numbers of skilled labours and illustrating the advantages and high profit associated with.

Table No - 3

Risk 131 Mitigation for 2 <sup>nd</sup> risk	Experts/Contractors												sum	Avg
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII		
A	7	7	7	7	7	7	6	7	6	7	6	6	80	6.666667
B	6	8	6	8	6	6	9	6	9	6	9	9	88	7.333333
C	8	9	8	9	9	8	8	9	7	9	8	8	100	8.333333
D	9	6	9	6	8	9	7	8	8	8	5	5	88	7.333333

Procedure to find out the most effective mitigation for given risks

- 1) Suppose we are finding the most effective mitigation for risk no 2 that is “Unskilled labours”
- 2) Then go to frame work table( table no - 4 )

- 3) Find the highest value.
- 4) For risk number 2, it is 8.33, that is for risk number2, “C” is the most effective mitigation.

#### 4.FINAL RESULTS

Table No - 4

MITIGATION	A	B	C	D	E	F	G	H	I
RISKS									
1	5.42	5	4.58	6	7.08	<b>8.08</b>	5.83		
2	6.67	7.33	<b>8.33</b>	7.33					
3	6.08	<b>7.83</b>	5.33	4.42	6.42	4.92	7		
4	5.58	6.25	6.5	6.42	<b>6.83</b>	5.58	4.5		
5	7.33	7.33	7.16	<b>8.16</b>					
6	7.25	<b>7.92</b>	7.58	7.25					
7	7.75	7.08	<b>8.17</b>	7					
8	7	7	7	<b>7.41</b>	6.58				
9	7.25	6.83	7.4	<b>8.5</b>					
10	7.66	7.33	<b>8</b>	7					
11	6.08	6.17	<b>7.83</b>	7	5.92	6.5			
12	6.33	<b>6.5</b>	4.17	6.17	2.75	4.83	6	4.25	3.75
13	<b>8</b>	7.17	7.33	7.5					
14	7.58	7.92	<b>8.08</b>	6.42					
15	7.33	<b>8.58</b>	8.08						

#### 5. CONCLUSIONS

Thirty eight critical risks associated with local construction projects in local areas were identified and categorized into into three phases. (Pre-construction, construction, post-construction). For each of the identified risk, practical mitigation measures were provided and evaluated. All of the mitigation measures were perceived by the response from the survey. It is suggested that whenever we want to mitigate a risk then the mitigation with higher value should be given higher priority.

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#### 6. REFERENCES

- [1]. Loosemore, M., Raftery, J., Reilly, C. & Higgon, D. (2006). Risk Management in Projects. 2
- [2]. Akintoye, A., Beck, M. & Hardcastle, C. (2003). Public Private Partnership: Managing Risks & Opportunities.
- [3]. Fewings, P. (2005). Construction Project Management: An Integrated Approach. Abingdon: Taylor And Francis.
- [4]. Mudau, R. And Pretorius, L. (2009). Project Control and Risk Management for Project Success: A South African Case Study. Proceeding Of The Portland International Conference, 1409-1414, Portland
- [5]. Text book of project management by Kumar Niraj Jha.
- [6]. Risk management framework for construction projects in developing countries