

Modern Approach to Minimize Risk in Construction Industry

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Registration No: **ANJUMAN-23**

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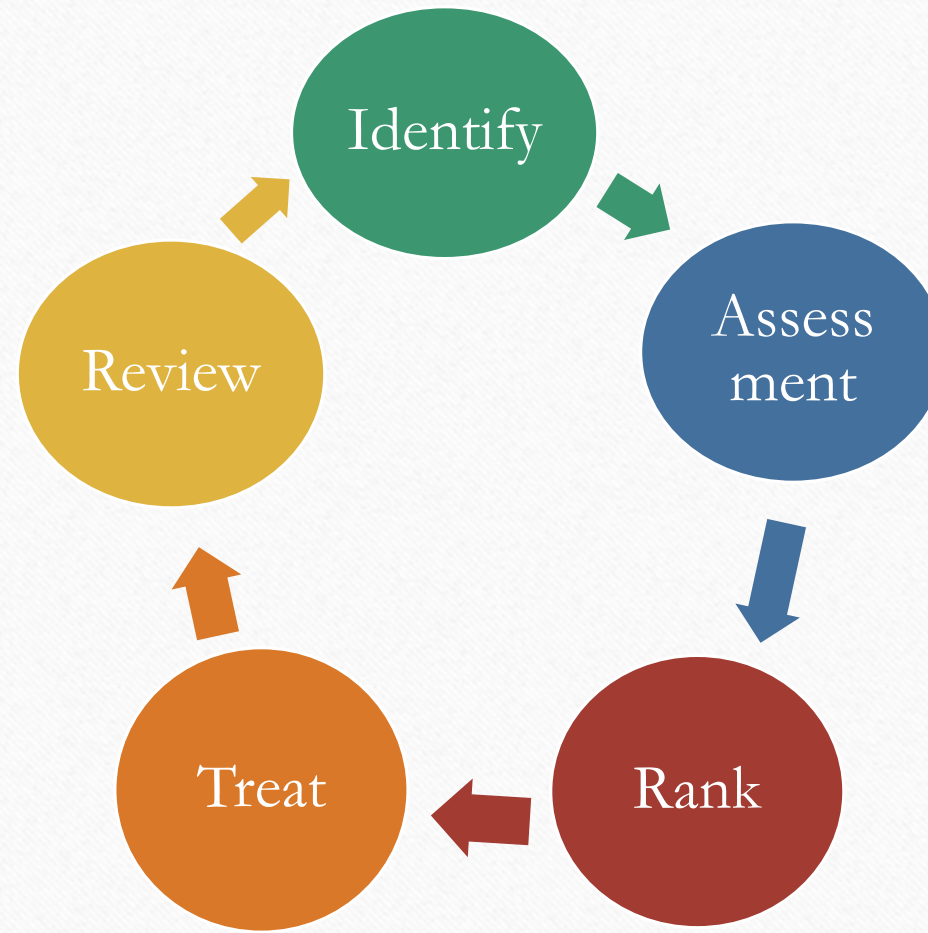
Overview

- Introduction
- Project risk management
- Qualitative and Quantitative techniques
- Objective, motivation and scope of the study
- Literature review
- Risk factors
- Questionnaire design and development
- Result, summary, future scope
- References, List of publications

Introduction

- Risk: According to ISO 31000, risk is the “effect of uncertainty on objectives”
- Project risk: it can be positive risk and negative risk
- Risk Management: Identifying and assessing risk
- Risk and uncertainty

Project Risk Management



Risk identification

- Uncover, recognize and describe risks
- This is not a one time activity
- Different techniques to identify risk:
 1. Brainstorming
 2. Interviewing
 3. Historical data
 4. Assumption analysis etc.

Risk assessment

- Determine which risk needs to be managed first
- Likelihood and consequence of each risk
- Risk assessment matrix
- Quantitative methods can also be used:
 1. Montecarlo technique
 2. Sensitivity analysis
 3. EMV

Ranking

- Rank the risk by determining risk magnitude
- Risk is acceptable or serious

Risk response

- Assess highest ranked risk.
- Risk mitigation strategies, preventive plans.
- Risk treatment measures.
- Different risk response strategies we can choose from.



Qualitative and Quantitative techniques

Techniques used in Risk Analysis

Qualitative	Quantitative
<ul style="list-style-type: none">• Risk Probability & Impact Assessment• Probability & Impact Matrix• Risk Data Quality Assessment• Risk Categorization• Risk Urgency Assessment• Expert Judgment	<ul style="list-style-type: none">• Data Gathering & Representation Techniques• Quantitative Risk Analysis & Modeling Techniques:<ul style="list-style-type: none">- <i>Sensitivity Analysis</i>- <i>Expected Monetary Value (EMV) Analysis</i>- <i>Decision Tree Analysis</i>- <i>Tornado Diagrams</i>- <i>Monte Carlo Analysis</i>• Expert Judgment

Objective of the study

- To identify and analyze associated risks in the construction industry.
- To simplify and analyze the important risk factors affecting the construction industry according to each company's point of view, using a questionnaire survey.
- To find out the most suitable way of managing the risks to ensure that the project is completed on time and within budget, reduced conflicts and improved profitability

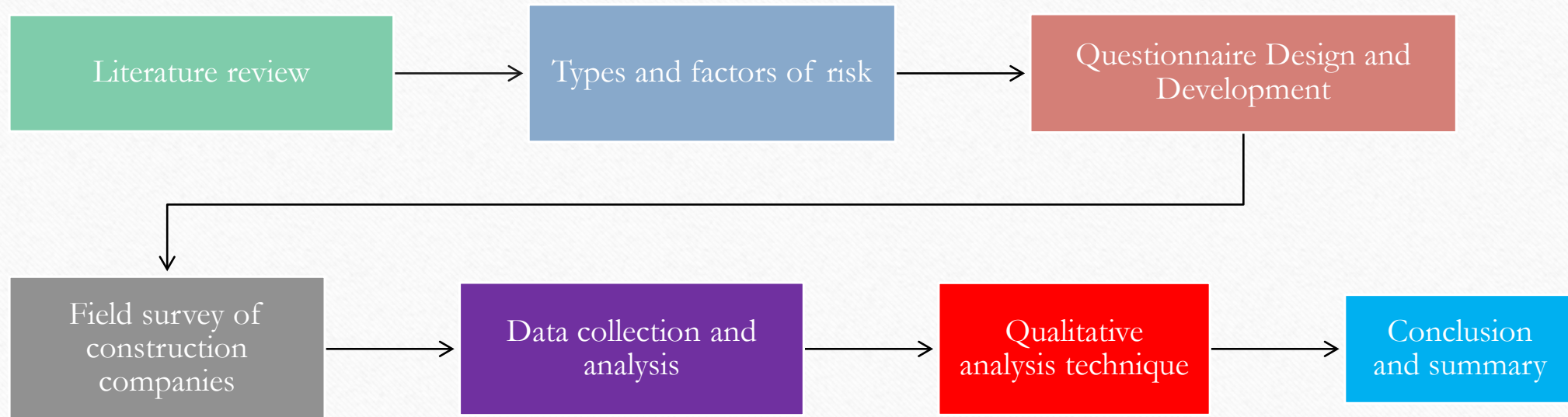
Motivation of the study

- It studies the importance of the risk factors based on their probability and impact.
- This project discusses the risk factors affecting the construction.
- This study has created a list of risk and its impact on the construction industry using survey. These factors are considered to be an important field of study for the future advancement and stabilization of the construction industry and study needs to be done in detail.

Scope of the study

- The scope of this project is to reveal why the construction projects, and generally, all projects, fail due to inadequate risk management and what are the best practices for the recovery. And also discusses the risk factors affecting the construction. It studies the importance of the risk factors based on their probability and impact.
- Importance index more than 25% considered as high and should be mitigated immediately. With respect to the magnitude of risk index, an average Index Score of 25 (likelihood of occurrence 5 × level of impact 5) can be regarded as high as per (ISO 31000)

Study approach diagram



Literature review

Author	Journal/Conference	Year	Findings
Thaheem et al.	Creative Construction Conference, Science direct	2012	The formal risk analysis techniques are not commonly used
Mhetre et al.	International Journal of Engineering Research, Science direct	2016	Most of the studies on quantitative techniques are carried out in developed countries.

Literature review

Author	Journal/Conference	Year	Findings
Hastak, M., Shaked A.	International Journal of Project Management, Research gate	2000	Every project is unlike the earlier one.
Lyons, T., Skitmore, M.,		2004	

Literature review

Author	Journal/Conference	Year	Findings
Wenzhe etal.	Journal of construction Engineering and Management, ASCE	2007	Nature of the risk factor is diverse.
Tabish, S., Jha, K.N.,	International Conference on Construction and Project Management, Science direct	2011	Risk rating system proposed by the government.

Literature review

Author	Journal/conference	Year	Findings
Pawar A., Pagey S.,	International Research Journal of Engineering and Technology (IRJET), , Science direct	2017	Wide gap between theory and practice.

Literature review

Findings:

1. Nature of the risk factor is diverse.
2. Wide gap between theory and practice.
3. Every project is unlike the earlier one.
4. The formal risk analysis techniques are not commonly used.
5. Risk rating system proposed by the government.
6. Most of the studies on quantitative techniques are carried out in developed countries.

Risk factors

1. Financial risk.
2. Legal risk.
3. Management risk
4. Market risk
5. Political risk
6. Technical risk
7. Environmental risk.

Questionnaire Design and Development

The questionnaire consists of two parts:

- A. General information
- B. List of risk factors

General information

1. Name of Your Company?

2. Position :

3. Phone no. And email address :

4. How many of Total years of experience you have working in the field? Less than Five Years From Five to ten Years From ten to Fifteen Years More Than Fifteen Years

5. Who is responsible for handling risks in the company?

Senior Manager

Site Engineers

General Contractors

Risk Manager

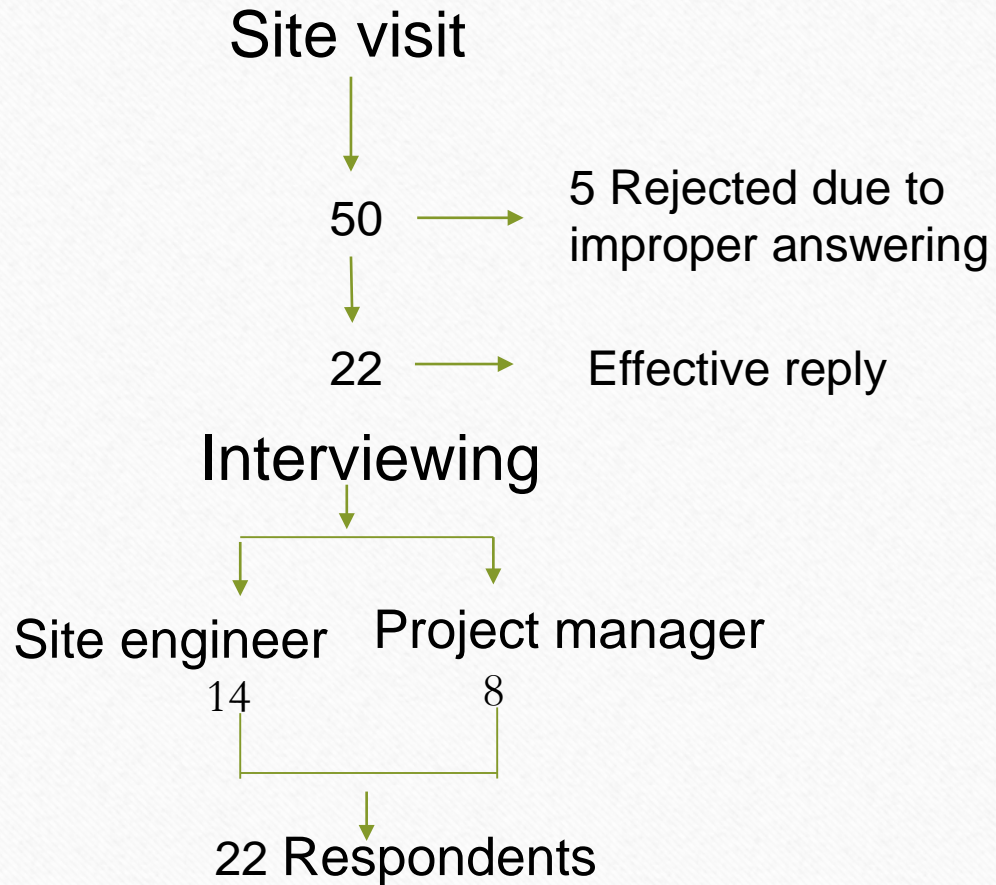
All Staff

Risk Assessment Questionnaire: **General Information**

Characteristic	Low risk	Medium risk	High risk
Organisation			
A. Scope			
1. Scope of the project is :	<input type="checkbox"/> Well-defined and understood	<input type="checkbox"/> Somewhat defined, but subject to change	<input type="checkbox"/> Poorly defined and likely to change
2. The business requirements of the project are :	<input type="checkbox"/> Understood and straightforward	<input type="checkbox"/> Understood but very complex	<input type="checkbox"/> Very complex
3. The quality of current data is :	<input type="checkbox"/> well-defined and simple to convert	<input type="checkbox"/> well-defined but complex	<input type="checkbox"/> Poor or complex to convert
B. Budget			
1. The project budget is based upon use of a proven successful cost estimation process by personnel with estimation experience :	<input type="checkbox"/> yes personnel with experience	<input type="checkbox"/> Some experience or process	<input type="checkbox"/> No
2. Project funding matches or exceeds the estimated cost and is stable :	<input type="checkbox"/> funding is greater than estimated and is expected to be stable	<input type="checkbox"/> Funding is marginally adequate	<input type="checkbox"/> Funding less than estimated and stability is uncertain

C. Schedule			
1 Project duration is estimated at :	<input type="checkbox"/> Less than 3 months	<input type="checkbox"/> 3 to 12 months	<input type="checkbox"/> Greater than 12 months
D. Human Resources			
1. The project managers experience and training is	<input type="checkbox"/> Recent success in managing a project	<input type="checkbox"/> No actual experience	<input type="checkbox"/> No recent experience
2. Experience of personnel with tools and techniques to be used	<input type="checkbox"/> Experienced in use of tools and techniques	<input type="checkbox"/> Formal training in use of tools and techniques but no experience	<input type="checkbox"/> No training and no experience
3. How would you rate the readiness level within the project recipient for changes this project will create	<input type="checkbox"/> High	<input type="checkbox"/> Moderate	<input type="checkbox"/> Low

Data collection



Sr. no	Experience	No. of respondent
1	Less than 5 year	6
2	From 5 to 10 years	10
3	More than 10 to 15 years	3
4	More than 15 year	3
	Total	22

Methodology

- Risk = Probability of occurrence X degree of impact (Tabish & jha 2011)
- A Likert scale of 1-5 was used in the questionnaire. A Likert scale is a type of psychometric response scale questionnaire, and is the most widely used scale in survey research. When responding to a Likert questionnaire item, respondents specify their level of agreement to a statement

Sr.no	Types of risks	Probability level of the risk occurrence (a)					Degree of impact (b)					Risk
		very small(1)	Small (2)	Normal (3)	Large (4)	very large(5)	very small (1)	Small (2)	Normal (3)	Large (4)	very large (5)	
1.	Increase in material cost			3						4		12

Risk Score

Impact

Risk matrix	Low (1)	Very low (2)	Medium (3)	High (4)	Very high (5)
Very large(5)	5	10	15	20	25
Large (4)	4	8	12	16	20
Normal (3)	3	6	9	12	15
Small (2)	2	4	6	8	10
Very small(1)	1	2	3	4	5

Probability

Legend:

- Low
- Medium
- High

Probability and impact scale

Sr. no.	Option	Probability Scale	Impact Scale
1	Very High	5	5
2	High	4	4
3	Moderate	3	3
4	Low	2	2
5	Very Low	1	1

Methodology

- Qualitative risk analysis
- The method used to rank the risk factor

$$\mathbf{P.I} = [\sum (P_s * XPs) / (Pmax)] * 100 \quad \text{Eq. 1}$$

$$\mathbf{I.I} = [\sum (I_s * XI_s) / (Imax)] * 100 \quad \text{Eq. 2}$$

Then the importance index (IMP.IND.) will be calculated by the following formula:

$$\mathbf{IMP.IND. \% = (P.I * I.I.) * 100} \quad \text{Eq. 3 (Ghalfy 1995)}$$

Methodology

- **Total Respondents = 22**
- **Calculations of Important Index**

$$P.I = [\sum (P_s * XPs) / (Pmax)] * 100$$

$$= [(4 * 8 + 3 * 14) / (22 * 5)] = 67.27\%$$

$$I.I = [\sum (I_s * XI_s) / (I_{max})] * 100$$

$$= [(11*5 + 4*8 + 3*3) / (22*5)] = 87.27\%$$

$$IMP.IND. \% = (P.I * I.I) * 100 = 67.27 * 87.27 = 58.70 \%$$

Scale	Option	Respondents (Probability of occurrence)	Respondents (Degree of Impact)
5	Very High	0	11
4	High	8	8
3	Moderate	14	3
2	Low	0	0
1	Very Low	0	0
	Total	22	22

Importance Index

Sr.no.	Risk factors	Imp index(%)	Rank					
				11	Equipment failure	54.73	11	
1	Loss due to corruption	82.6	1	12	Poor relation and disputes with partner	51.72	12	
2	Competition from other companies	82.5	2	13	Increase of labour cost	48.58	13	
3	Increase of material price	78.18	3	14	Time constraint	48.16	14	
4	Impact on project due to climatic conditions	77.34	4	15	Design changes	42.8	15	
5	Cost increase due to changes of govt policies	68.02	5	16	Uncertainty and unfairness of court justice	39.13	16	
6	Bankruptcy of project partner	66.86	6	17	Lack of knowledge	36.09	17	
7	Site accidents	63.95	7	18	Industrial disputes	33.44	18	
8	Project delay	63.58	8	19	Errors in design drawings	30.14	19	
9	Improper project planning and budgeting	61.12	9	20	No past experience in similar project	28.11	20	
10	Loss due to fluctuation of inflation rate	58.7	10	21	Team work	8.38	21	30

Result

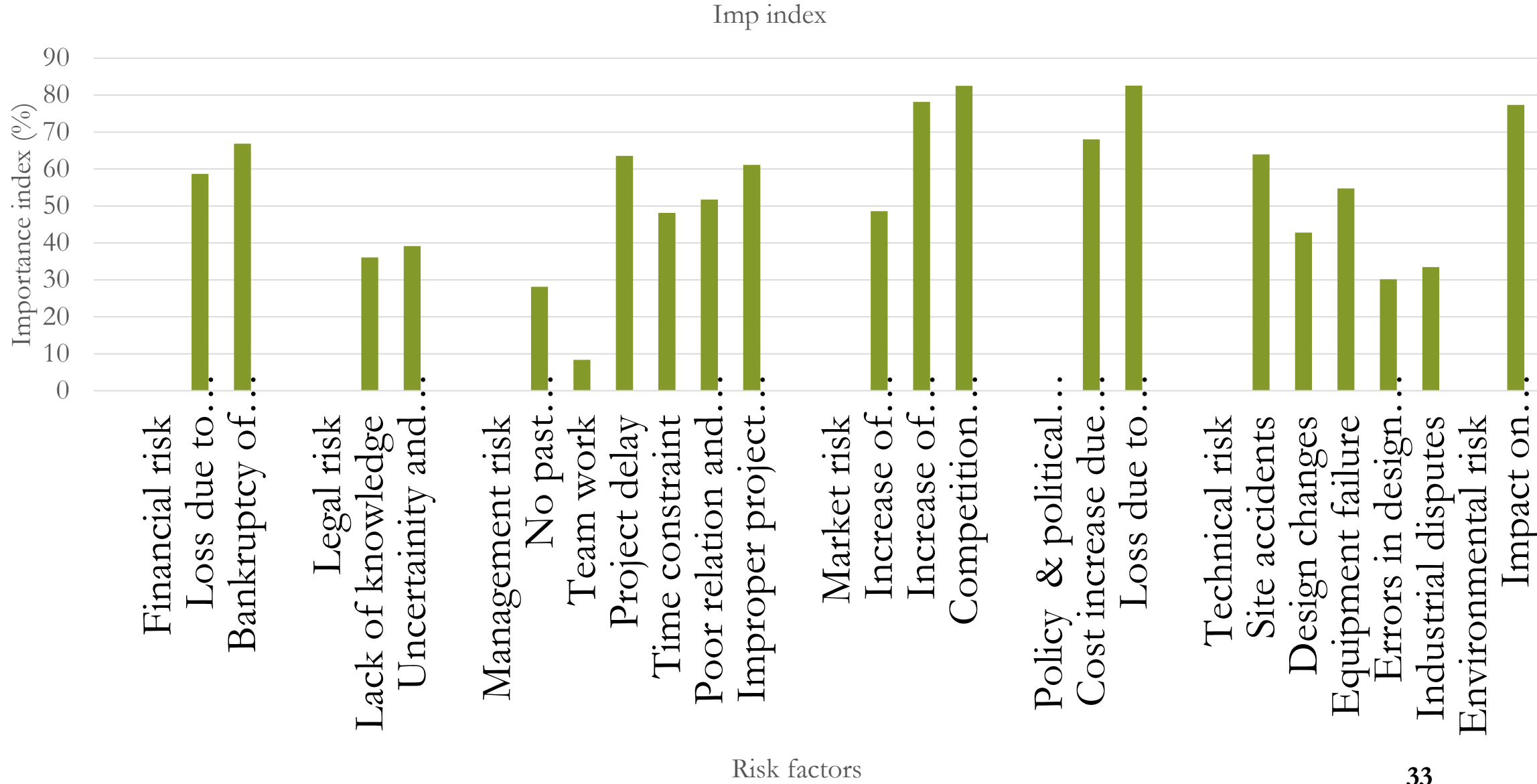


Response from Selected companies about Different Risk Analysis Techniques

Result

1. Lack of familiarity of risk analysis techniques.
2. This is followed by the claim that the amount of calculations involved using the techniques are unnecessary in order to meet the project objectives of cost, time and quality.
3. Lack of confidence on the applicability of these techniques
4. lack of formal training in risk analysis and management techniques by most of the respondents.

Result



Conclusion

- Risk Factors: Analysis indicated that there are top 20 risk factors
- Risk analysis techniques: Top 3 analysis techniques used in most of the companies:
 - Direct judgment
 - Expert system
 - Probability analysis

Recommendations

- Experienced construction team
- Risk management should be considered a primary tool to assess the project.
- The contractor should be familiar with the changes of the material prices
- Contract terms and conditions

Future scope

- Future research will also look in more detail at risk management processes, such as
 1. Risk management planning
 2. Identification
 3. Measurement
 4. Prioritisation
 5. Monitoring and control.

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List of Publications

1. “Factors affecting Project Success in Construction Industry: A Review”, ***International Conference on Construction, Real Estate, Infrastructure and Projects(CRIP) Management-ICCRIP-2017*** by NICMAR, Pune. (Under Review, Paper Communicated)
2. “Modern approach to minimize risk in construction industry”, ***Journal of Construction Engineering and Project Management, Korea Institute of Construction Engineering and Management.*** (Under Review, Paper Communicated)

Thank you