Scientific Journal of Impact Factor(SJIF): 3.134

e-ISSN(O): 2348-4470
p-ISSN(P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 2,Issue 5, May -2015

Ranking of "Risk Factors" and "Risk Management Actions" Affecting Building Construction Projects in Gujarat

Patel Kishan[1], Dr. Rajiv Bhatt[2], Prof. J. J. Bhavsar[3]

[1]*Student of final year, M.E (Construction Engineering& Management), B.V.M Engineering College, Vallabh Vidyanagar, Gujarat, India,*
[2] *Associate Professor, Civil Engineering Department, A.D.I.T Engineering College, Vallabh Vidhyanagar, Gujarat, India,*
[3]*Associate Professor and PG Coordinator (Construction Engineering& Management), Civil Engineering Department, B.V.M. Engineering College, Vallabh Vidyanagar, Gujarat, India,*

Abstract *- Presently India is in the developing phase which brings tremendous growth of construction industry. Construction industry is witnessing all kinds of projects across the country. Construction projects are initiated in complex and dynamic environments resulting in circumstances of high uncertainty and risk. Risks always exist in construction projects and often cause schedule delay or cost overrun. Risk management is a process which consists of identification of risks, assessment of risks, response with a suitable method for handling and control risks. This study focuses on ranking of factors which contributes as "Frequency of occurrence and Degree of severity of Risk factors", "Importance of Risk factors" and "Use of Risk management methods". During this study, 70 feedbacks were collected from Architects, Contractors and Developers from Ahmedabad, Anand and Nadiad city of Gujarat state of India. Responses were analyzed by Importance Index (IMPI) Method, Weighted Average Method and Relative Importance Index method (RII). It was found that "High competition in bids", "Resource management", "Delayed payments on contract" and "Financial failure of the contractor" are the four major risks in building construction projects*

Keywords*: Construction Industry, Risk factors, Importance Index (IMPI), Weighted Average Index, Relative Importance Index (RII).*

I. INTRODUCTION

The track record of construction industry is very poor in terms of managing with risks, resulting in the failure of many projects to meet time schedules, targets of budget and sometimes even the scope of work. As a result, a lot of suffering is inflicted to the clients and contractors of such projects and also to the general public. Risk in the construction adversely affects the project objectives of time, cost, scope and quality. Some risks in construction processes can be easily predicted or readily identified; still some can be totally unforeseen. Construction risks can be related to design, physical, logistics, legal, environmental, management, financial, construction and political. Compared with many other industries, the construction industry is subject to more risks due to the unique features of construction activities, such as long period, complicated processes, terrible environment, financial intensity and dynamic organization structures (Flanagan and Norman, 1993; Akintoye and MacLeod, 1997; Smith, 2003).

Risk management may be described as "a systematic way of looking at areas of risk and consciously determining how each should be treated. It is a management tool that aims at identifying sources of risk and uncertainty, determining their impact, and developing appropriate management responses" (Uher,2003).

II. OBJECTIVE

The objective of this study is to measure the importance of Risk factors from the different points of view of project practitioners (contractor, owner and consultant). The main objectives of this research is to identify and rank out the common Risk Factors in Building construction projects in Gujarat state of INDIA, as well as to study the preventive and remedial steps to avoid or to minimize the number of Risks in building construction to save the time and cost.

III. PILOT SURVEY

Before distributing and finalizing the questionnaire, a pilot survey was conducted where the questionnaire was discussed with experts of construction industry like Architect, Contractor, Consultant, Developer Professors etc. and total 10 experts reviewed the questionnaire for clarity, simplicity, ambiguity and practicality. After consulting these experts and

after correcting the questionnaire as per their suggestion the finalized questionnaire was distributed among the respondents like Architect, Contractor and Developer.

IV. SCOPE OF THIS STUDY

1. This research is carried out for building projects only.

2. The study is focuses on three cities of Gujarat state i.e. Ahmedabad, Anand and Nadiad

V. RESEARCH METHODOLOGY

In this paper authors have tried to work out ranking of Risk Factors in construction industry along with ranking of frequency and impact of these Risks. Further this work includes the ranking of various preventive and remedial methods used by construction industry for Risk resolution. The survey questionnaire was designed to get the ranking of above three issues by suitable technique. The risk factors are given in appendix 1. The survey questionnaire is made of four parts. Part 1 includes demographic information of respondents. Part 2A includes Frequency of occurrence and Degree of severity of Risk factors. Part 2AA includes Importance of Risk factors and Part 2B & Part 2C includes Preventive and Remedial methods respectively. Respondents have to tick mark any one option for each raw under the category of Always (5), Often (4), Sometimes (3), Rarely (2), Never (1)

It was planned to collect the feedbacks from various stakeholders of construction industry from Ahmedabad, Anand and Nadiad city of Gujarat state of India. The survey has included Architects, Contractors and Developers. This research work includes use of Importance Index Method, Weighted Average Method and Relative Importance Index method.

VI. DATA COLLECTION

The total population data was collected from different sources of the city which is as given below:

Number of Builder / Developers, Contractors / Engineers and Architects in Ahmedabad according to Ahmedabad Urban Development Authority (AUDA) and Number of Builder, Contractors and Architects in Anand and Nadiaad are taken from reference of local construction practitioners and from yellow pages. Total numbers of stakeholders are 2015

Table 1: Number of builder, contractor and architect

CITY	BUILDER	CONTRACTOR	ARCHITECT
Ahmedabad (a)	859	663	192
Anand (b)	64	98	23
Nadiad (c)	45	55	16
Total	968	816	231
Total (a+b+c)	**2015**		

Sample size required for the present study was calculated as given below.

Below given formula was used to determine the sample size of unlimited population (Creative Research Systems, 2001):

$$SS = [Z^2 \times P \times (1\text{-}P)] / C^2$$

Where,

SS = Sample Size.

Z = Z Value (e.g. 1.96 for 95% confidence interval).

P = Percentage picking a choice, expressed as decimal, (0.50 used for sample size needed).

C = Confidence interval (0.1)

POP is the Population = 2015

$$SS = [1.96^2 \times 0.5 \times (1\text{-}\ 0.5)] / .1^2 = 96.04$$

Correction for finite population:

$$SS_{new} = \frac{SS}{1 + \frac{SS - 1}{POP}} \qquad SS_{new} = \frac{96.04}{1 + \frac{96.04 - 1}{2015}} = 92$$

So, sample size is 92. During the data collection stage, total 113 questionnaires were distributed out of which 70 feedbacks were received back. Out of the total responses, 38 were from Contractors, 21 from Builders, and 11 were from Architects.

Table 2: Questionnaire Distributed and Responses Received

Sr. No	Respondent	Questionnaire Distributed	Responses Received	Percentage of Responses
1	Contractor	52	38	73.07%
2	Builder	38	21	55.26%
3	Architect	23	11	47.82%
	Total	113	70	61.94%
4	By mail	38	0	0%

VII. DATA ANALYSIS

This research work has used following two methods for carrying out ranking work.

A. **Importance index as a function of severity and frequency indices:**

Abdullah Albogamy(2012) used this same technique to rank the causes of delay of large construction projects of Saudi Arabia.

i. **Severity index**: A formula is used to rank risk factors based on severity as indicated by the participants.

$$\text{Severity Index (S.I.) (\%)} = \sum a\,(n/N) * 100/5$$

Where,

▪a = constant expressing weighting given to each response (ranges from I for negligible to 5 for severe),

▪n = frequency of the responses,

▪N = total number of responses.

ii. **Frequency index**: A formula is used to rank risk factors based on frequency of occurrence as identified by the participants.

$$\text{Frequency Index (F.I.) (\%)} = \sum a\,(n/N) * 100/5$$

Where,

▪a = constant expressing weighting given to each response (ranges from 1 for never up to 5 for always),

▪n = frequency of the responses,

▪N = total number of responses

Importance index: The importance index of each risk is calculated as a function of both severity and frequency indices, as follows:

$$\text{Importance Index (IMP.I.)(\%)} = [\text{S.I. (\%)} * \text{F.I. (\%)}]/100$$

B. WEIGHTED AVERAGE METHOD: Data of all these table were analyzed by a weighted average was calculated for each type of claims as follows:

$$\text{Weighted Average Index} = (W_i * X_i)/N;$$

where W_i is the weight assigned to the i^{th} option; X_i is the number of respondents who selected the i^{th} option; and N is the total number of respondents (70 in this study).

C. RII INDEX METHOD: Data of all these table were analyzed by a RII Index was calculated for each type of claims as follows:

$$\text{RII Index} = \Sigma W/(A*N)$$

Where, W = weighting given to each factor by the respondents which ranges from 1 to 5,

A = highest weight (i.e. 5 in this case) and

N = total number of respondents.

Table 3: Top 10 risk factors according to importance index method

Rank	RISK FACTORS	Frequency Index	Severity Index	Importance Index
1	High competition in bids	72.571	76.286	55.362
2	Resource management	58.286	83.714	48.793
3	Delayed payments on contract	64	71.429	45.714
4	Financial failure of the contractor	50.571	86.000	43.491
5	Defective design (incorrect)	52.286	81.143	42.426
6	Improper planning	50.857	79.714	40.540
7	Poor communication between involved Parties	51.429	77.429	39.820
8	Occurrence of accidents because of poor safety procedures	56.571	67.143	37.984
9	Inaccurate quantities	60.857	62.000	37.731
10	Unmanaged cash flow	51.714	72.000	37.234

Table 4: Top ten risk factors according to Weighted Average Index and RII method

RANK	RISK FACTORS	Wei. Avg. Index	RII
1	Financial failure of the contractor	4.10	0.820
2	Delayed payments on contract	4.06	0.811
3	Resource management	3.99	0.797
4	Defective design (incorrect)	3.93	0.786

5	High competition in bids	3.83	0.766
5	Improper planning	3.83	0.766
6	Poor communication between involved Parties	3.80	0.760
7	Environmental factors (floods, earthquakes, etc.)	3.79	0.757
8	Awarding the design to inexperience Designer	3.66	0.731
9	Supplies of defective materials	3.46	0.691
10	Disputes among the parties of contract	3.41	0.683

Table 5: Use of preventive methods and remedial methods

Wei. Avg. Index	USE OF METHOD
0-1	Never
1-2	Rarely
2-3	Sometime
3-4	Often
4-5	Always

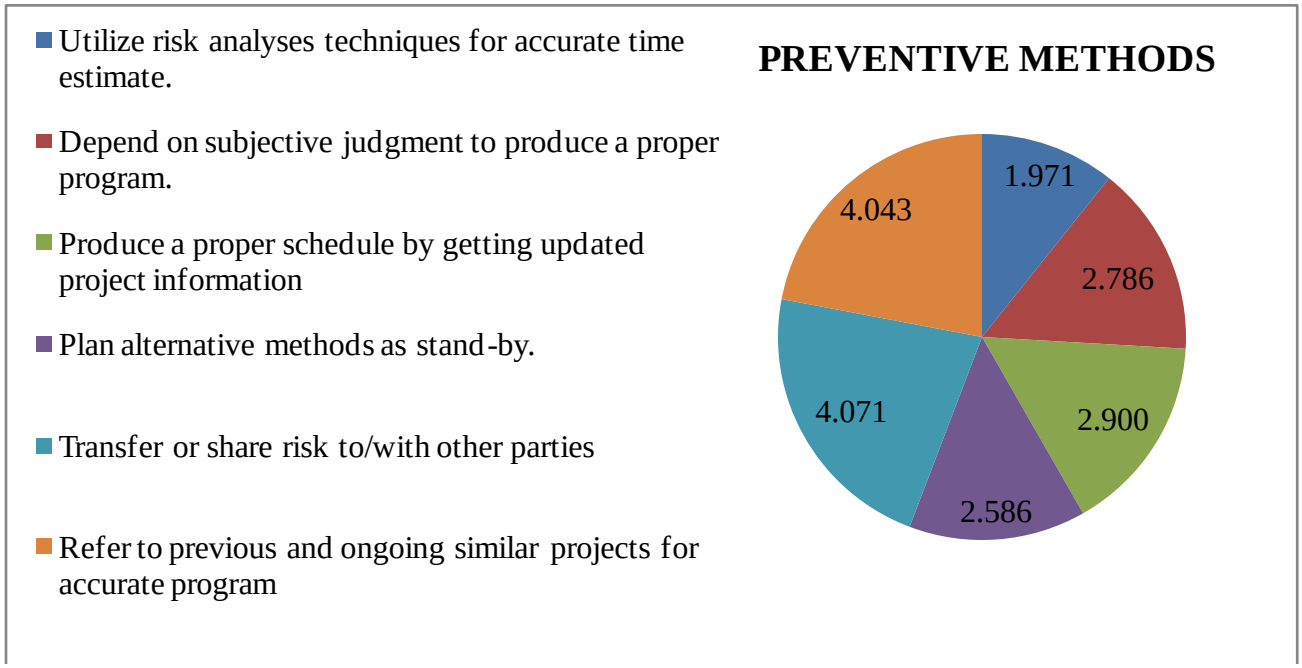

Figure 1: use of preventive methods

Table 6: Ranking of Preventive Methods by Respondents

No	Preventive Methods	Rank by Owner	Rank by Contractor	Rank by Architect
1	Utilize risk analyses techniques for accurate time estimate.	6	6	6
2	Depend on subjective judgment to produce a proper program.	5	4	4
3	Produce a proper schedule by getting updated project information	3	3	3
4	Plan alternative methods as stand-by.	4	5	5
5	Transfer or share risk to/with other parties	2	1	1
6	Refer to previous and ongoing similar projects for accurate program	1	2	2

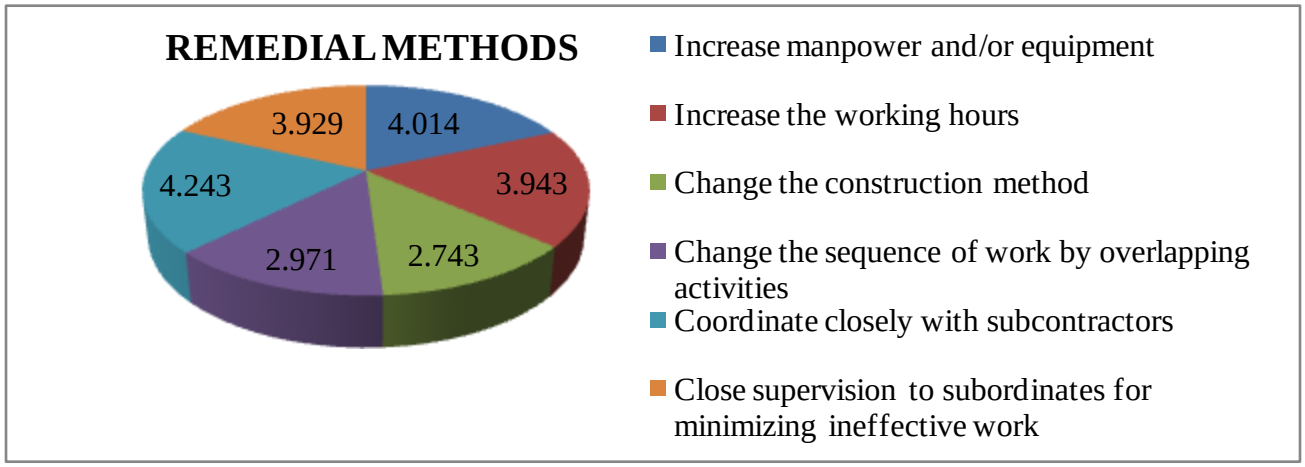

Figure 2: use of remedial methods

Table 7: Ranking of Remedial Methods by Respondents

No.	Remedial Methods	Rank by Owner	Rank by Contractor	Rank by Architect
1	Increase manpower and/or equipment	2	4	4
2	Increase the working hours	4	3	2
3	Change the construction method	6	6	6
4	Change the sequence of work by overlapping activities	5	5	5
5	Coordinate closely with subcontractors	1	1	1
6	Close supervision to subordinates for minimizing ineffective work	3	2	3

VIII. RESULTS AND DISCUSSION

From present study it is found that "High competition in bids" is having first rank among all Risk factors. Second rank was given to "Resource management" by the respondents. "Delayed payments on contract" is having third rank and "Financial failure of the contractor" is having fourth rank in Risk factors.

IX. CONCLUSION

According to above analysis of collected data it is concluded that FINANCIAL, MANAGEMENT AND LOGISTIC risks are most important risk in building construction projects. Most of construction practitioners are not using risk management techniques. According to preventive method analysis it is concluded that generally risk is transferred to other party or they Refer previous and ongoing similar projects. Whenever project objectives are suffer they closely coordinate with their subcontractors, increase manpower and working hours

X. ACKNOWLEDGEMENT

Authors are highly grateful to all participating construction professionals for spending their valuable time and giving their feedbacks on survey questionnaire.

XI. REFERENCES

[1] Akintoye, A.S. and MacLeod, M.J. "Risk Analysis and Management in Construction," International Journal of Project Management, 1997, 15(1), 31-38.
[2] Flanagan, R. and Norman, G. "Risk Management and Construction", Victoria: Blackwell Science Pty Ltd, Australia, 1993.
[3] Patel Kinnaresh, "A study on risk assessment and its management in India" American Journal of Civil Engineering, 2013, 1(2): 64-67
[4] Smith, N.J. "Appraisal, Risk and Uncertainty (Construction Management Series)", London: Thomas Telford Ltd, UK, 2003.
[5] Uher, T. "Programming and Scheduling Techniques", UNSW Press, Sydney, 2003.
[6] Zenghua kuang "risk management in construction projects", Via University College Horsens Campus, Denmark 2011.

Websites:

http://auda.org.in/

http://www.surveysystem.com/sample-size-formula.htm

Appendix – 1 Risk factors affecting building construction projects

A. DESIGN	A1. Defective design (incorrect)
	A2. Inaccurate quantities
	A3. Design Changes
	A4. Awarding the design to inexperience Designer
	A5. Lack of consistency between bill of quantities, drawings and specifications
B. PHYSICAL	B1. Occurrence of accidents because of poor safety procedures
	B2. Supplies of defective materials
	B3. Security of material and equipment

	B4. Varied labor and equipment productivity
C. LOGISTICS	C1. Improper site investigation
	C2. High competition in bids
	C3. Poor communications between the site and head offices (contractor side)
D. LEGAL	D1. Ambiguity of work legislations
	D2. Difficulty to get permits
	D3. Disputes among the parties of contract
E. ENVIRONMENTAL	E1. Adverse weather conditions
	E2. Difficulty to access the site (very far)
	E3. Environmental factors (floods, earthquakes, etc.)
F. MANAGEMENT	F1. Poor communication between involved Parties
	F2. Improper planning
	F3. Changes in management ways
	F4. Information unavailability (include uncertainty)
	F5. Resource management
G. CULTURAL	G1. Religion
	G2. Cultural custom
H. FINANCIAL	H1. Delayed payments on contract

	H2. Unmanaged cash flow
	H3. Inflation
	H4. Financial failure of the contractor
I. CONSTRUCTION	I1. Gaps between the Implementation and the specifications due to misunderstanding of drawings and specifications
	I2. Actual quantities differ from the contract Quantities
	I3. Lower work quality in presence of time Constraints
	I4. Undocumented change orders
J. POLITICAL	J1. New governmental acts or legislations

