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Inaugurate Risks Factors in Construction Projects

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Abstract: *The construction industry is widely associated with a high risk and uncertainty due to the nature of its operating environment. This study aims to identify and evaluate key risk factors and their frequency and severity and then their impact in different types of construction projects in India.*

A questionnaire survey was conducted and a total of thirty nine critical factors were identified and categorized into five groups. These are: Administrative Aspect, Financial Aspect, Manpower Aspect, Technical Aspect. The results are presented on the basis of Relative index method and Z-Test.

Keywords: *Risks, Risk Management, Questionnaire Survey, Relative important index, z-test.*

I. INTRODUCTION

The aim of this study is to conclude the prospect factors in industry, allotment of these factors, strategies used to traumatize risks and thus the techniques adopted in analysing these risks. the development project is exposed to a high degree of risk from the start of the project till the highest of the project.

Risk is printed as any event or prevalence which could have an impact on the action of project goals. Risk management in construction comes is to deal effectively with uncertainty and sudden events that might have an impact on palmy and timely completion of the project.

If risks don't seem to be known early throughout a project, it creates tons of exposure and uncertainties to the project life cycle, thereby touching such aspects as value, schedule and quality of the project. additionally, it'd additionally produce exposures within the space of Health, safety and surroundings.

Hence, risk management permits project managers to identify, analyze, respond and manage the risks of the project. this will be the rationale why risk management is extremely necessary for the palmy action for a project.

In drafting the contract, the getting strategy need to clearly outline the responsibilities of the consumer and therefore the contractor and such need to be specific and graspable. this will be to make positive that the prospect is clear for every the contractor and shopper thereby avoid future dispute.

The importance of risk management in construction comes are reportable by many authors.

It had been completed that risk management is crucial to construction activities in minimizing losses and enhancing profitableness.

It had been explicit that risk management might be a way that need to be applied in associate trade to achieve the goals of the trade, thus it is necessary to unfold awareness and build interest amongst individuals to use risk management techniques within the trade.

the prospect might be a measurable a neighborhood of uncertainty and is assumed as a deviation from the specified level, thus the prospect analysis is thus necessary for project choice and coordination of construction work.

II. OBJECTIVES

The main objectives of this study include the following:

- A. Identify risks for construction projects in India and categorize them.
- B. To minimize the effect of risks in construction project..
- C. Ranking of the risk factors in accordance of their

III. LITERATURE REVIEW

TABLE 1

Past	Title of Research
2010	Yasser Abdelghany, A.Samer Ezeidin- This paper focuses on the analysis of the different ICJV risk environments.
2011	Hong-bo Zhou, S.e. M.ASCE and Hui Zhang- This methodology has five main parts: modeling of BNs, determination of occurrence probabilities of risk events, assessment of consequences, calculations of risk value and membership degree of risk rating, and definitions of risk acceptance criteria.
2012	Hariharan Subramanyan, Priyadarshi H. Sawant and Vandana Bhatt - The risk response strategy suggested in this paper will be useful in mitigating the adverse effects of risk in project completion in the Indian construction industry.
2013	Muhammad Saiful Islam - The main attention was paid to the identification of different types of risk and rating the various risks arises in a project and assessing major risk factors. Besides, this research developed a risk management framework for proper management of Bangladeshi construction projects.
2014	Alfredo Federico Serpella et.al. – This paper addresses the problems of risk management in construction projects using a knowledge-based approach, and propose a methodology based on a three-fold arrangement that includes the modeling of the risk management function, its evaluation, and the availability of a best practices model.
2015	Shahid Iqbal et al. - This study is based on findings of a questionnaire-based survey on risk management in construction projects in Pakistan, reporting the significance of different type of risk, ultimate responsibility for them and the effectiveness of some most common risk management techniques practiced in the industry
2016	Greeshma R Krishnan, Minu Anna Johny - Proper management of all these processes is quite challenging for the management team. Risk is nothing but the threats that occur during the project life cycle. Risk may be of various kinds. There are various factors which affects the occurrence of these risks.
2017	Pawel Szymański - The risk is present everywhere, in every area of life. One such area is the construction industry, where risk is ever-present element of a great puzzle. Effective risk management does not apply to the resignation of the risk, which is seemingly the cheapest option activity.
2018	Dr. Chaiwat Pooworakulchai –This article studied the main application to risk management in the construction industry by the sample texts document.
2019	Ahsan Nawaz et al.- Risk management is a comparatively new field and there is no core system of risk management in the construction industries of developing countries

IV. METHODOLOGY

A questionnaire survey was conducted by construction professionals representing various stakeholders involved in construction projects in India

A. Questionnaire Design

The questionnaire was designed based on critical factors were identified that contributed to the causes of risks. A questionnaire survey was developed to assess the perceptions of various construction professionals of the relative importance of causes and the effects of construction risks. The questionnaire was designed into two sections: Section A; section B. Section A is to obtain the requested background information about the respondents. Section B is to obtain information on the factors that contribute to the causes of risks in construction projects from the perspective of construction professionals. A total sixty seven resources related factors were identified under three broad categories, namely manpower related, material related and equipment related issues. The critical factors are listed in Table 1. A five point Likert scale (1 very low, 2 low, 3 moderate, 4 high, 5 very high) was adopted where respondents were asked to rank the importance and impact of a particular factor on risks in one of their selected projects. Descriptive statistical techniques, namely Relative Importance Index (RII) has been used to highlight the relative importance of critical factors as perceived by the respondents (Assaf et. al, 1995; Faridi and El-Sayegh, 2006; Iyer and Jha, 2005; kmaraswamy and Chan, 1998).

B. Analysis of Data

The data obtained was analyses to determine the relative importance of the various factors that contribute to causes of construction delays.

1) *Relative Importance Index (RII)*: Assess the relative significance among risks, previous literature work study suggests establishing a risk significance index by calculating a significance score for each risk. For Calculating the significance score, multiply the probability of occurrence by the degree of Impact. The significance score for each risk assessed by each respondent can be obtained through the model

$$S_j^i = A_j^i * B_j^i$$

Where S_{ij} = Significance score assessed by respondent j for risk i

A_{ij} = Occurrence of risk i , assessed by respondent j

B_{ij} = degree of impact of risk I , assessed by respondent j .

By averaging scores from every one of the reactions, it is conceivable to get a normal importance score for each hazard, and this normal score is known as the hazard record score and is utilized for positioning the dangers. The model for the figuring of hazard list score can be characterized as

$$R_s^i = \sum_j^T = 1 S_j^i / T$$

Where R_s^i = index score for risk i

S_j^i = Significance score assessed by respondent j for risk i

T = total number of responses

- 2) *Design of The Survey:* The respondents were requested to judge the total risk effect of each risk factor. The approach adopted is to consider two attributes for each risk: the probability level of the risk occurrence denoted by Frequency Index (F.I) and the degree of impact or the level of loss if the risk occurs denoted by Severity Index (S.I). By applying this approach, the respondents were asked to respond to the two attributes for each risk factor. For considering (F.I), the respondents were required to judge the probability level of risk occurrence by selecting one from among five levels, namely: Very small, Small, Normal, large, and Very Large. For considering (S.I) the respondents were asked to judge the degree of impact if the risk concerned occurs by selecting one from among five grades, namely: Very Low, Low, medium, High, and Very high.
- 3) *Analysis of Survey Results:* To assess the relative significance among risks, previous literature study suggests establishing a risk significance index by calculating a significance score for each risk. For calculating the significance score is to multiply the probability of occurrence by the degree of impact. Thus, the significance score for each risk assessed by each respondent can be obtained

V. DATA ANALYSIS

A. Applicability of Test Results to Construction Industry

A z-test is a statistical test used to determine whether two population means are different when the variances are known and the sample size is large. The test statistic is assumed to have a normal distribution, and nuisance parameters such as standard deviation should be known in order for an accurate Z-test to be performed. Z -Tests and t Large Sample Size or Known Variance The first type of test we explore is the most basic: testing the mean of a distribution in which we already know the population variance σ^2 . Later we discuss how to modify these tests to handle the situation where we do not know the population variance Thus, for now, we are assuming that our population is normal with known variance σ^2 . Our test statistic is

$$Z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$$

where n is the number of observations made when collecting the data for the study, and μ is the true mean when we assume the null hypothesis is true. So to test a hypothesis with given significance level α , we calculate the critical value of z (or critical values, if the test is two-tailed) and then check to see whether or not the value of the test statistic in (2.11) is in our critical region. This is called a z-test. We are most often concerned with tests involving either $\alpha = .05$ or $\alpha = .01$. When we construct our critical region, we need to decide whether or not our hypotheses in question are one-tailed or two-tailed. If one-tailed, we reject the null hypothesis if $z \geq z\alpha$ (if the hypothesis is right-handed) or if $z \leq z\alpha$ (if the hypothesis is left-handed). If two-tailed, we reject the null hypothesis if $|z| \geq z\alpha/2$. So the most common z-values that we use are $z.05 = 1.645$, $z.01 = 2.33$, $z.025 = 1.96$ and $z.005 = 2.575$. These are good number to have memorized when performing hypothesis tests.

- 1) z-test is a statistical test to determine whether two population means are different when the variances are known and the sample size is large.
- 2) It can be used to test hypotheses in which the z-test follows a normal distribution.
- 3) A z-statistic, or z-score, is a number representing the result from the z-test.
- 4) Z-tests are closely related to t-tests, but t-tests are best performed when an experiment has a small sample size.
- 5) Also, t-tests assume the standard deviation is unknown, while z-tests assume it is known.

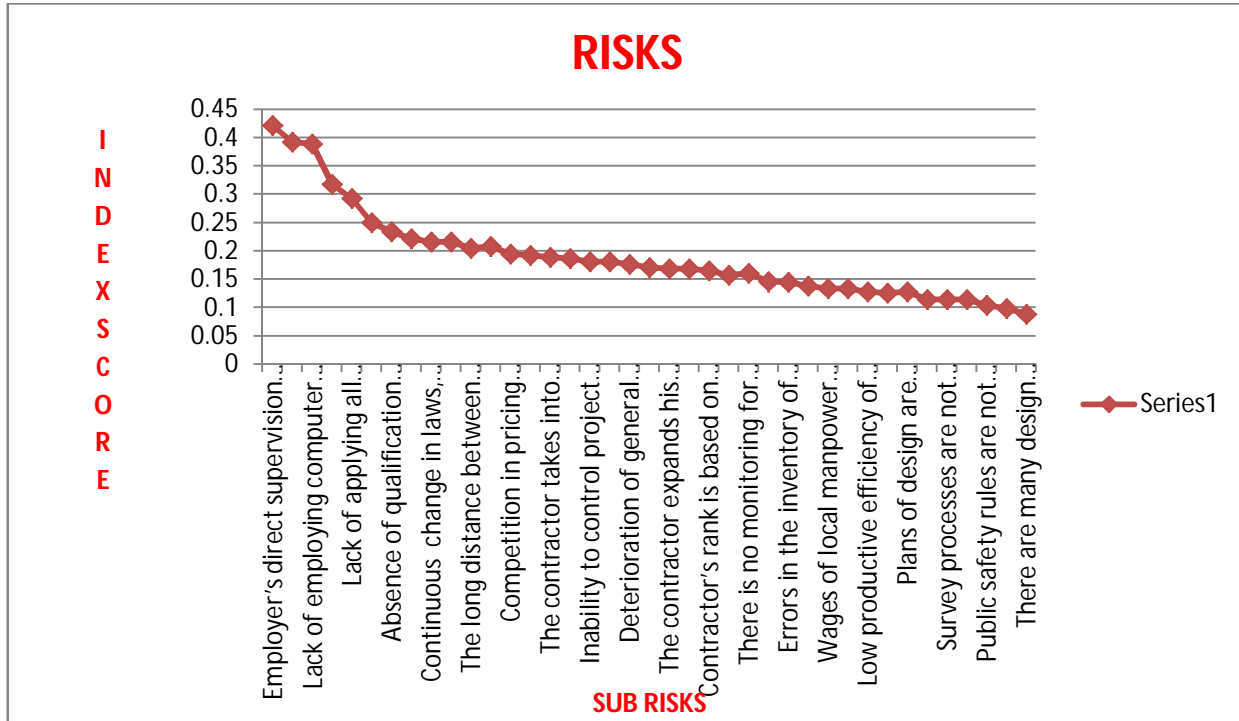
Table 1

INTERVIEW NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Tota l	Mean(m)	SD(s)	C.O.V=(s/ m)
Employer's direct supervision in managing the project	0.48	0.24	0.48	0.48	0.24	0.64	0.64	0.36	0.36	0.48	0.48	0.24	0.32	0.64	0.24	6.32	0.421	0.12	0.284
Lack of employing computer programs in project management	0.48	0.48	0.36	0.24	0.16	0.48	0.64	0.48	0.48	0.36	0.48	0.36	0.12	0.48	0.24	5.84	0.389	0.12	0.3082
Absence of administrative experience in business administration	0.36	0.36	0.24	0.36	0.24	0.48	0.48	0.36	0.64	0.48	0.36	0.48	0.32	0.24	0.48	5.88	0.392	0.06	0.1530
Lack of applying all specifications agreed upon between consultant and contractor.	0.24	0.36	0.36	0.24	0.16	0.48	0.24	0.36	0.36	0.24	0.36	0.36	0.04	0.24	0.36	4.4	0.293	0.06	0.204
Absence of qualification courses for administrators.	0.24	0.12	0.24	0.24	0.16	0.48	0.24	0.24	0.24	0.48	0.24	0.24	0.16	0.16	0.04	3.52	0.234	0.1	0.426
Lack of distinguishing between technical and administrative project aspects.	0.48	0.36	0.36	0.24	0.36	0.24	0.48	0.36	0.36	0.48	0.24	0.36	0.12	0.24	0.08	4.76	0.317	0.2	0.630
Continuous change in laws, particularly income tax law.	0.24	0.16	0.24	0.24	0.24	0.16	0.36	0.16	0.24	0.24	0.16	0.24	0.08	0.16	0.36	3.24	0.216	0.06	0.277
Contractor's rank is based on his company's capital	0.16	0.04	0.16	0.16	0.08	0.24	0.24	0.16	0.24	0.08	0.16	0.24	0.08	0.36	0.08	2.48	0.165	0.04	0.2419
The Company obtains large loans	0.16	0.04	0.36	0.08	0.04	0.16	0.24	0.08	0.08	0.24	0.16	0.08	0.08	0.08	0.04	2	0.133	0.06	0.45
Inability to execute the project within specified time table.	0.48	0.16	0.16	0.16	0.16	0.24	0.48	0.08	0.24	0.24	0.08	0.24	0.24	0.24	0.04	3.24	0.216	0.22	1.018
The contractor expands his work simultaneously in more than one project.	0.24	0.16	0.24	0.08	0.08	0.24	0.24	0.08	0.36	0.16	0.08	0.36	0.08	0.04	0.08	2.52	0.168	0.08	0.476
The contractor does not pay worker wages in due time.	0.16	0.24	0.16	0.16	0.16	0.16	0.48	0.08	0.12	0.24	0.08	0.08	0.24	0.08	0.08	2.52	0.168	0.04	0.238
Construction prices are low	0.16	0.2	0.16	0.08	0.08	0.08	0.08	0.08	0.24	0.48	0.08	0.08	0.04	0.16	0.04	1.88	0.125	0.06	0.478
Competition in pricing projects.	0.16	0.24	0.16	0.08	0.48	0.08	0.24	0.24	0.24	0.36	0.16	0.08	0.32	0.08	0.16	2.92	0.1946	0.02	0.102
Absence of laws governing payment process and protecting contractor's rights.	0.24	0.24	0.36	0.08	0.36	0.08	0.24	0.24	0.24	0.36	0.08	0.24	0.24	0.24	0.16	3.32	0.2213	0.06	0.271
Deterioration of general economic conditions.	0.24	0.08	0.16	0.08	0.24	0.08	0.24	0.16	0.16	0.24	0.16	0.16	0.16	0.16	0.36	2.64	0.176	0.06	0.340
Inability to control project financial affairs.	0.16	0.16	0.16	0.08	0.24	0.08	0.16	0.24	0.24	0.24	0.16	0.16	0.24	0.24	0.16	2.72	0.181	0.02	0.110

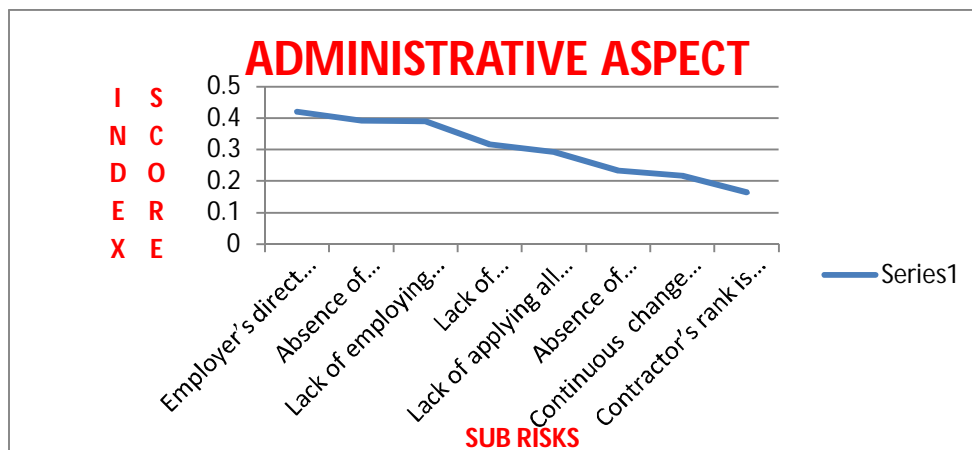
Taxes and tax burdens.	0.16	0.08	0.16	0.04	0.24	0.04	0.16	0.08	0.24	0.16	0.04	0.08	0.12	0.04	0.08	1.72	0.114	0.04	0.348
There is no standing guideline of the numerous resources in India.	0.24		0.16	0.04	0.24	0.16	0.24	0.08	0.12	0.48	0.08	0.24	0.48	0.24	0.08	3.12	0.208	0.08	0.384
The long distance between the project and resources	0.24	0.24	0.24	0.04	0.04	0.24	0.16	0.24	0.24	0.48	0.12	0.24	0.36	0.04	0.16	3.08	0.205	0.04	0.194
There are no regular tests for materials used in projects.	0.16		0.16	0.04	0.08	0.08	0.24	0.08	0.36	0.24	0.08	0.08	0.24	0.08	0.16	2.2	0.1466	0.02	0.136
The contractor takes into account the resource of lowest price.	0.24	0.36	0.04	0.08	0.24	0.16	0.36	0.08	0.24	0.36	0.06	0.04	0.04	0.16	0.16	2.84	0.1893	0.06	0.316
Fluctuating prices of materials.	0.24	0.24	0.08	0.24	0.12	0.48	0.24	0.24	0.24	0.48	0.4	0.12	0.24	0.24	0.3	3.76	0.250	0.04	0.159
Some materials do not arrive at the assigned site	0.16		0.04	0.08	0.08	0.16	0.48	0.08	0.16	0.24	0.24	0.08	0.08	0.08	0.04	2.08	0.1386	0.06	0.432
There is no monitoring for high quality	0.08	0.08	0.24	0.08	0.24	0.16	0.24	0.08	0.36	0.24	0.08	0.24	0.04	0.04	0.16	2.4	0.16	0.04	0.25
Absence of trained local manpower.	0.48	0.24	0.24	0.16	0.08	0.24	0.24	0.08	0.24	0.24	0.04	0.24	0.08	0.08	0.16	2.8	0.186	0.18	0.964
Wages of local manpower are high	0.24	0.16	0.08	0.04	0.08	0.08	0.16	0.04	0.24	0.16	0.16	0.08	0.16	0.16	0.16	2	0.133	0.04	0.3
Absence of training centers for local manpower.	0.16	0.24	0.24	0.04	0.24	0.16	0.16	0.08	0.16	0.36	0.08	0.24	0.08	0.24	0.24	2.72	0.181	0.04	0.220
Necessary technical skills are not available.	0.24	0.24	0.16	0.04	0.04	0.08	0.36	0.24	0.08	0.24	0.08	0.24	0.12	0.12	0.16	2.36	0.157	0.06	0.381
Public safety rules are not abided by	0.16	0.08	0.04	0.04	0.16	0.16	0.24	0.08	0.04	0.08	0.16	0.08	0.16	0.08	0.16	1.56	0.104	0.02	0.1923
Absence of health insurance.	0.16	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.12	0.04	0.08	0.08	0.08	0.16	1.48	0.098	0.02	0.202
Low productive efficiency of the worker	0.16	0.08	0.16	0.04	0.08	0.16	0.04	0.08	0.08	0.12	0.04	0.16	0.24	0.16	0.16	1.92	0.128	0.08	0.625
There are many design bureaus	0.16	0.08	0.08	0.08	0.04	0.24	0.08	0.08	0.08	0.04	0.04	0.04	0.08	0.04	0.04	1.32	0.088	0.06	0.681
The designer does not follow up designs and changes made on them.	0.24	0.24	0.16	0.08	0.04	0.24	0.24	0.24	0.16	0.08	0.16	0.24	0.24	0.08	0.16	2.56	0.1706	0.06	0.351
Recurring design errors.	0.08	0.24	0.16	0.04	0.08	0.24	0.16	0.24	0.08	0.04	0.08	0.16	0.24	0.16	0.16	2.88	0.192	0.04	0.208
Errors in the inventory of quantities.	0.04	0.08	0.08	0.08	0.16	0.24	0.24	0.08	0.12	0.08	0.16	0.24	0.24	0.16	0.16	2.16	0.144	0.06	0.416
Supervising the project is not abided by.	0.04	0.24	0.08	0.08	0.08	0.24	0.04	0.08	0.08	0.16	0.06	0.04	0.16	0.08	0.16	1.72	0.114	0.06	0.523
Plans of design are incompatible with execution.	0.08	0.08	0.08	0.04	0.16	0.24	0.08	0.08	0.24	0.24	0.04	0.24	0.12	0.04	0.16	1.92	0.128	0.04	0.3125
Survey processes are not precise.	0.04	0.24	0.08	0.04	0.04	0.08	0.08	0.16	0.36	0.08	0.04	0.04	0.16	0.04	0.16	1.72	0.114	0.1	0.872

Table 2

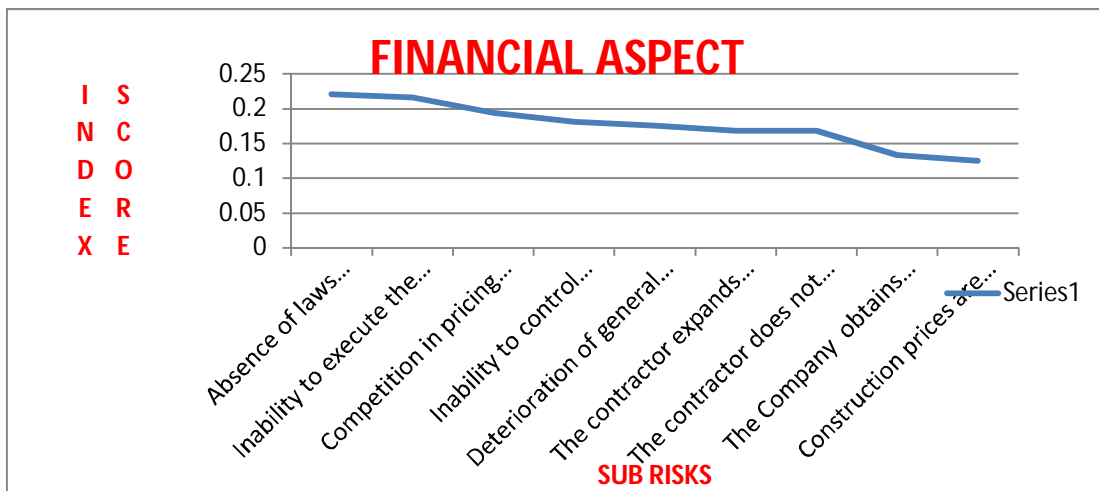
Ranking of Risk			
S.No	Risks	Index Score	Rank order
1	Employer's direct supervision in managing the project	0.421	1
2	Absence of administrative experience in business administration	0.392	2
3	Lack of employing computer programs in project management	0.389	3
4	Lack of distinguishing between technical and administrative project aspects.	0.317	4
5	Lack of applying all specifications agreed upon between consultant and contractor.	0.293	5
6	Fluctuating prices of materials.	0.25	6
7	Absence of qualification courses for administrators.	0.234	7
8	Absence of laws governing payment process and protecting contractor's rights.	0.221	8
9	Continuous change in laws, particularly income tax law.	0.216	9
10	Inability to execute the project within specified time table.	0.216	10
11	The long distance between the project and resources	0.205	11
12	There is no standing guideline of the numerous resources in India.	0.208	12
13	Competition in pricing projects.	0.194	13
14	Recurring design errors.	0.192	14
15	The contractor takes into account the resource of lowest price.	0.189	15
16	Absence of trained local manpower.	0.186	16
17	Inability to control project financial affairs.	0.181	17
18	Absence of training centers for local manpower.	0.181	18
19	Deterioration of general economic conditions.	0.176	19
20	The designer does not follow up designs and changes made on them.	0.17	20
21	The contractor expands his work simultaneously in more than one project.	0.168	21
22	The contractor does not pay worker wages in due time.	0.168	22
23	Contractor's rank is based on his company's capital	0.165	23
24	Necessary technical skills are not available.	0.157	24
25	There is no monitoring for high quality	0.16	25
26	There are no regular tests for materials used in projects.	0.146	26
27	Errors in the inventory of quantities.	0.144	27
28	Some materials do not arrive at the assigned site	0.138	28
29	Wages of local manpower are high	0.133	29
30	The Company obtains large loans	0.133	30
31	Low productive efficiency of the worker	0.128	31
32	Construction prices are low	0.125	32
33	Plans of design are incompatible with execution.	0.128	33
34	Supervising the project is not abided by.	0.114	34
35	Survey processes are not precise.	0.114	35
36	Taxes and tax burdens.	0.114	36
37	Public safety rules are not abided by	0.104	37
38	Absence of health insurance.	0.098	38
39	There are many design bureaus	0.088	39



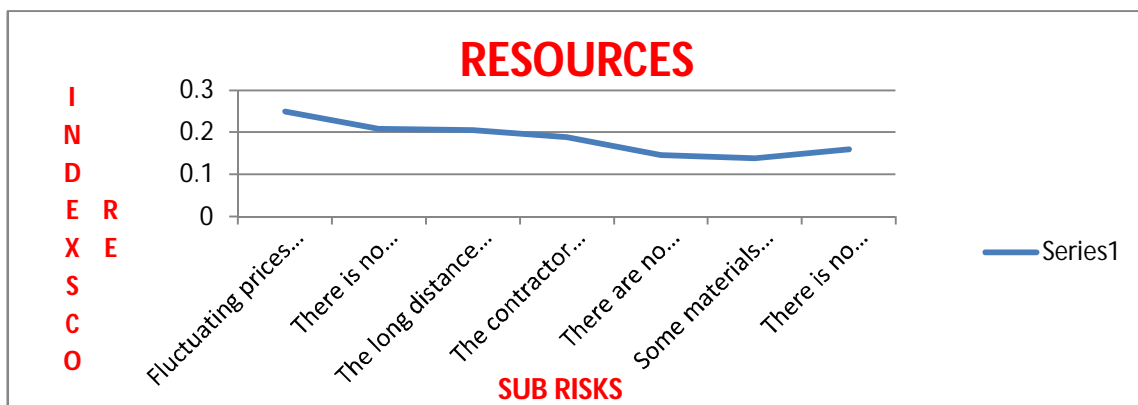
ADMINISTRATIVE ASPECT	Index Score(□)
Employer's direct supervision in managing the project	0.421
Absence of administrative experience in business administration	0.392
Lack of employing computer programs in project management	0.389
Lack of distinguishing between technical and administrative project aspects.	0.317
Lack of applying all specifications agreed upon between consultant and contractor.	0.293
Absence of qualification courses for administrators.	0.234
Continuous change in laws, particularly income tax law.	0.216
Contractor's rank is based on his company's capital	0.165



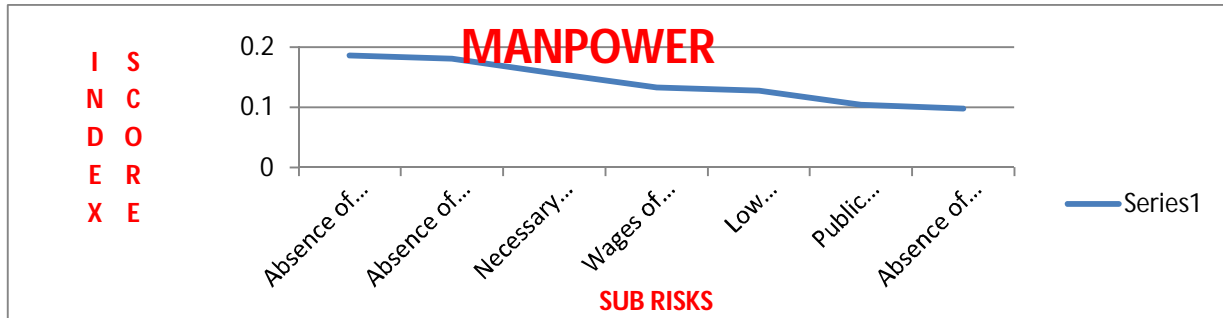
FINANCIAL ASPECT	Index Score(□)
Absence of laws governing payment process and protecting contractor's rights.	0.221
Inability to execute the project within specified time table.	0.216
Competition in pricing projects.	0.194
Inability to control project financial affairs.	0.181
Deterioration of general economic conditions.	0.176
The contractor expands his work simultaneously in more than one project.	0.168
The contractor does not pay worker wages in due time.	0.168
The Company obtains large loans	0.133
Construction prices are low	0.125



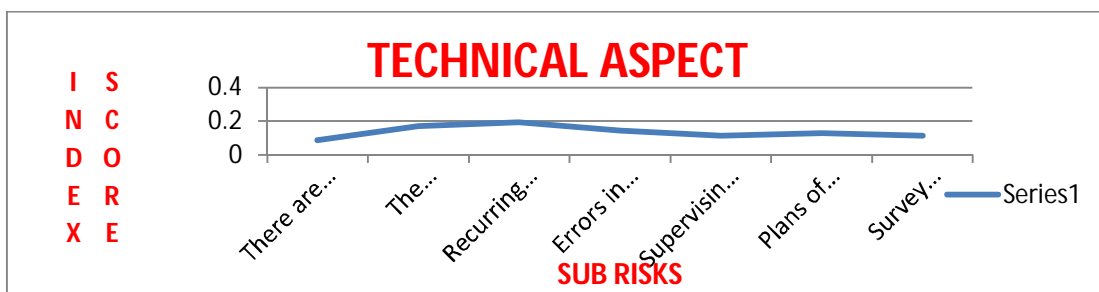
RESOURCES	Index Score(□)
Fluctuating prices of materials.	0.25
There is no standing guideline of the numerous resources in India.	0.208
The long distance between the project and resources	0.205
The contractor takes into account the resource of lowest price.	0.189
There are no regular tests for materials used in projects.	0.146
Some materials do not arrive at the assigned site	0.138
There is no monitoring for high quality	0.16



MANPOWER	Index Score(□)
Absence of trained local manpower.	0.186
Absence of training centers for local manpower.	0.181
Necessary technical skills are not available.	0.157
Wages of local manpower are high	0.133
Low productive efficiency of the worker	0.128
Public safety rules are not abided by	0.104
Absence of health insurance.	0.098



TECHNICAL ASPECT	Index Score(□)
There are many design bureaus	0.088
The designer does not follow up designs and changes made on them.	0.17
Recurring design errors.	0.192
Errors in the inventory of quantities.	0.144
Supervising the project is not abided by.	0.114
Plans of design are incompatible with execution.	0.128
Survey processes are not precise.	0.114



VI. CONCLUSION

In this study, identifying the risk factors faced by the construction industry is based on collecting information about construction risks, their consequences and corrective actions that may be done to prevent or mitigate the risk effects. The main point which was considered this research is to explore the key risk factors and identify these factors that could be faced in construction projects in India. The main point which was considered this research is to explore the key risk factors and identify these factors that could be faced in construction projects in India The study suggested that factors with stronger impact on risk in construction sites are those with importance index above the average importance index calculated for the 39 factors identified in this study.

The ten most important factors are:

- A. Employer's direct supervision in managing the project.
- B. Absence of administrative experience in business administration.
- C. Lack of employing computer programs in project management.
- D. Lack of distinguishing between technical and administrative project aspects.
- E. Lack of applying all specifications agreed upon between consultant and contractor.
- F. Fluctuating prices of materials.
- G. Absence of qualification courses for administrators.
- H. Absence of laws governing payment process and protecting contractor's rights.
- I. Continuous change in laws, particularly income tax law.
- J. Inability to execute the project within specified time table.

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