International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 07 | July 2021 www.irjet.net p-ISSN: 2395-0072

Risk Analysis in Building Construction & Disaster Management

Nehal R. Sawant[1], Ms. Harshita Ambre[2]

[1]*M. Tech. Construction Management, Dept. of Civil Engineering, School of Engineering and Technology, Sandip University, Nashik, Maharashtra, India*
[2]*Assistant Professor, Dept. of Civil Engineering, School of Engineering and Technology, Sandip University, Nashik, Maharashtra, India*

Abstract *- Risks have a giant effect on a construction project's overall performance in phrases of cost, time and quality. As the scale and complexity of the tasks have increased, an ability to control dangers all through the development procedure has turn out to be a principal element preventing undesirable outcomes.*
Project threat evaluation is a powerful tool for making plans and controlling cost, time and reaching the technical overall performance of a building construction assignment. Construction initiatives regularly face numerous uncertainties, which places building construction tasks on the threat of cost, time overruns in addition to bad quality delivery. Considering the restrained sources of growing countries, there is need to finish constructing projects on-time, on-budget, and to fulfil most advantageous high-satisfactory hence, threat control is a crucial part of the decision-making manner in construction enterprise because it determines the fulfilment or failure of construction projects. Disasters have an effect on tens of thousands and thousands of human beings annually, inflicting big numbers of fatalities, damaging financial effect and the displacement of communities. Policymakers, researchers and industry experts are frequently confronted with those outcomes and consequently require equipment to evaluate the capacity influences and offer sustainable solutions, regularly with best very restrained information.
The aim of this research is to boom the information of danger control and mitigation. Deeper information is predicted to contribute to a greater effective danger control and, consequently, a better assignment output and better cost for each customer and contractors.

Key Words: *Risk Management, Mitigation, Construction Project, Disaster Management, cost, time*

1. INTRODUCTION

Risk is described as publicity to loss/benefit or the possibility of incidence of loss/benefit accelerated through its respective magnitude. Events are stated to be sure if the chance in their incidence is 100% or absolutely unsure if the chance of incidence is 0%. Just as the alternative financial activity, construction commercial enterprise is risky. Successes and implementation in housing enterprise relies upon at the quantity of threat. Risk evaluation and control are a essential part of the decision-making method in construction industry. Construction industry and its customers are extensively associated with high degree of dangers due to the character of micro, meso and macro environments unique to production however, production enterprise has terrible popularity in handling dangers as many initiatives fail to fulfil closing dates and rate targets. The clients, contractors and people involved in it have suffered because of above situations.

Any production method is regularly divided into 4 major levels: programme, layout, procurement and manufacturing. In the programme section the customer has an idea approximately the project and analyses situations for its execution. During the making plans section the architects and engineers produce layout and production drawings steady with the customer's requirements. Depending at the procurement option, the making plans section follows both the programme section and the procurement section. In the procurement section the customer chooses the contractor and consequently the events sign the contract. Finally, the contractor executes the project within side the manufacturing section. Traditionally, a production method is sequential; many factors are worried most effective in a few task stages and awareness on their personal part of paintings as opposed to at the complete assignment.

Risks are being identified bellow:

- **Technical Risks**

Technical risks include anything that restricts you from creating the merchandise that your customer wants. this will include uncertainty of resources and availability of materials, inadequate site investigation, or incomplete design. These risks can commonly occur when there are changes in project scope and requirements, and if there are design errors or omissions.

- **Logistical Risks**

There are various logistical risks that require to be addressed before beginning a project. These risks include the unavailability of transportation facilities and availability of equipment like spare parts, fuel, and labour. Without addressing these logistical issues, you risk huge project delays and losses.

- **Financial Risks**

Inflation, local taxes, and availability and fluctuation in foreign exchange are some of the possible financial risks you would possibly incur during a construction project. If you're performing on a project internationally, it's important that you simply understand how the foreign currency are going to be exchanged. Different countries have drastically different taxes in addition, so you would like to take this under consideration before starting a project. Your finances are about to look a lot different if you're working in an exceedingly tax-free city versus a high tax city.

- **Management Related Risks**

The most common management related risk is uncertain productivity of resources. Before you start a project, you would like to make sure that you simply have sufficiently skilled staff and that you have adequately defined their roles and responsibilities. Failing to do this may result in disastrous losses.

- **Socio-Political Risks**

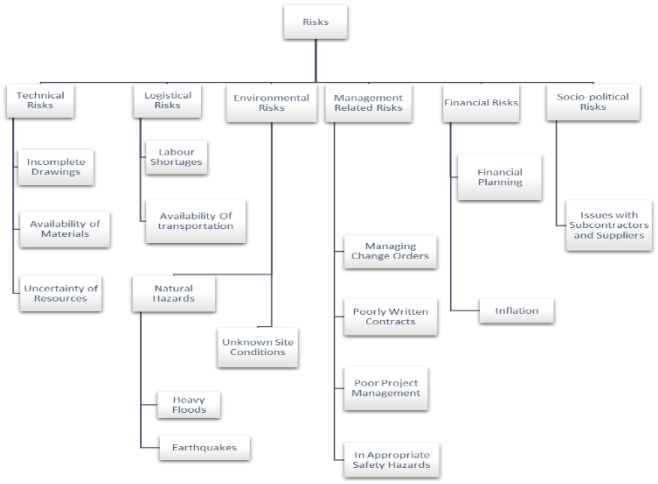
Customs and import restrictions and difficulties eliminating equipment are a couple of the socio-political risks you'll face during a construction project. counting on where your project is, there are getting to vary regulations and codes that you simply must abide by. If you assume that every project goes to possess an equivalent codes and regulations, you'll be in for a rude awakening.

- **Environmental Risks**

Environmental risks consist of natural disasters, weather, and seasonal implications. These risks are normally neglected when people are not familiar with nearby conditions. If you're planning to be performing on a project in a very new city, you would like to become acquainted with that region's weather patterns. If you prepare for possible weather risks, you're way more likely to avoid potential delays and losses.

- **Hazards of Earthquakes**

Most of the hazards to humans come from man-made structures themselves and additionally the shaking they receive from the earthquake. the actual risks to humans are being crushed in a collapsing building, drowning all through a flood as a result of a damaged dam or levee, getting buried below a landslide, or being burned at some point of a fire. Earthquakes are getting increasingly common. Consequently, people that haven't been exposed to them or ever had to believe earthquake safety are now facing a brand-new reality.



2. RESEARCH METHODOLOGY

This study is aimed toward Identifying, Analysing and Limiting the drastic effect of risk/disaster occurring on the building under construction. it's also aimed toward highlighting the main risks that construction projects face, and therefore the risk management techniques used to manage these risks. It describes the perception of professionals regarding the importance of those risks and risk management techniques used for their management.

2.1 Aim of the Study

The primary aim of this research is to establish a system which will help improve the performance of building construction projects in developing countries, without cost and time overruns while achieving optimal quality, through a comprehensive risk and disaster management.

2.2 Objectives of the Study

- To discover and examine risk and important disasters which have huge impact on building through information collection.
- To minimise the impact of disasters on under construction buildings via prediction and preparedness.
- To eliminate the risk via making plans and evaluation.
- To lessen or avoid, the potential losses from hazards.

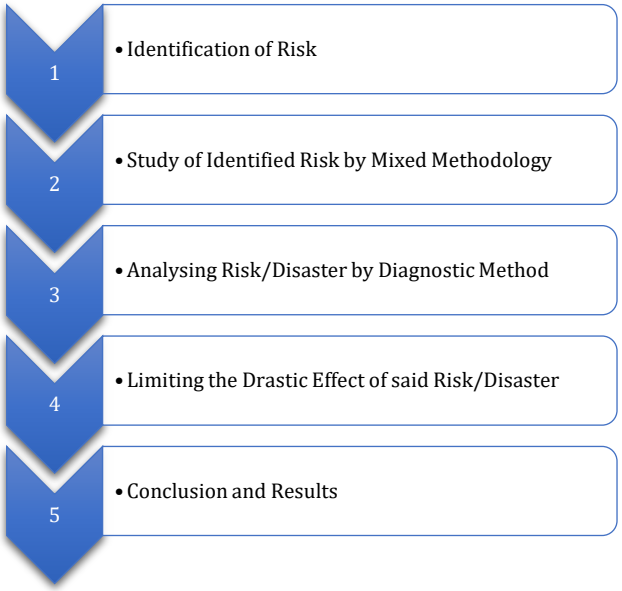
2.3 Advantages of the Project

- It encourages the organization to consider its threats. In particular, risk management encourages it to examine risks that could in any other case be overlooked.

- In clarifying the risks, it encourages the organization to be highly prepared. In different words, it facilitates the organization to control itself better.
- It lets the firm prioritize its funding and decreases inner disputes about how cash need to be spent.
- It reduces duplication of systems. Integration of environmental and fitness and safety systems are one instance.

2.4 Methodology of the Study

The different phases of this project of work are shown in the following diagram. The figure simply describes the experimental strategy of this study step by step.



3. DATA COLLECTION AND ANALYSIS

The following data has been collected by surveying, interview and questionnaire method. I have visited 2 buildings varying in their construction phase.

3.1 Case Study 1:

Fig -1: site visited for case study 1

Sai Ganesh building by New United Enterprises situated in Varose, near Maharaja Hall, Khopoli East.

Purpose: To check what sort of risk may occur during the completion phase is going on.

- **Incomplete or change in Design:**

Reason: New D.C.R.

As the rules are always changing, some builders keep provision to increase the area of building which they do, by not completing the R.C.C. structure. These incomplete structures can pile up really quickly if the new plans are not approved in estimated time frame. So as to hand over the building to customers, builders have to make up alternate provisions for basic commodities. These ill planned designs lead to cost and time over run.

- **Availability of Materials:**

a. Sand

Reason: Law and illegal mining

Due to government-imposed ban on sand mining and underwater blasting because of ecological reasons, the availability of sand (river or otherwise) has become a challenge. Sand being an important major component for concreting, it is highly used in places where concreting is done in-situ. Due to this, Availability of sand being as issue, the time and cost overrun is maximum.

b. Cement

Reason: Closed factories

Due to present conditions of covid 19, the availability of Cement has decreased as the factories are closed. The factories which have been opened since opening of lockdown has been asked to work under 20% of its normal labor capacity leading to incompletion of targets set by factories and over that the dealers are hoarding the Cement. This hoarding leads to inflated price of Cement bags Increasing the overall cost of project. This delay can cause several other issues as a lot of work is being carried out with the help of cement and its mixtures are used for each and every task work increasing the overall time of completion. This inflated pricing and uncertainties of availability causes panic leading to overrun of cost as well as time.

- **Poorly written Contracts:**

In current scenario a lot of contractors and owners are in dispute because of delay in completion of project the same was true for this project. This delay has occurred due to sudden stoppage of everything around the country. A lot of owners are disputing it as they have given an extension of six months after the reopening but are not considering the effects it had on material and labor shortage. This has resulted in disputes because contractors are not finding skilled labors and materials cost has risen due to low supply and high demand. Lot of contractors are leaving

their work or site as it is not only time consuming but also their losing money over it.

- **Inflation:**

Reason: Covid 19 Lockdown

Since the start of 2020 and the initiation of nationwide lockdowns the factories are not working in their full capacities. Due to this reason, there is an inflation on various key materials used for construction like cement and steel. As the demand and supply is inversely proportional to each other, the prices of materials are directly proportional to demand so this affects the prices of material, in current scenario for example:

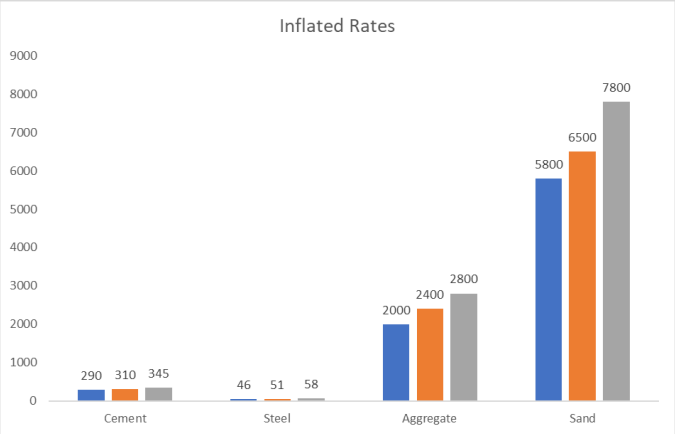


Chart -1: Inflated Rates

3.2 Case Study 2:

Fig -2: Site visited for case study 2

Charms Neptune by Charms Group situated in Khadakpada Circle, Kalyan West.

Purpose: To check what sort of risk may occur during the initiation phase of the building.

- **Uncertainty of Resources:**

Reason: Climate

As the climate changes, the availability of mud decreased due to water percolation. Mud quarries are usually mountains which are away from proper roads, resulting slush on roads due to which transportation is unavailable. Because of this rains the buildings which have completed footing process can't be compacted as mud is the basic component of compacting, resulting in time over run as waterflooding occurs in uncompacted area. As the availability of mud decrease and its demand increase which leads to increase in its costs, for e.g. The cost of mud per brass before rain was Rs. 1800/ brass which increased to Rs. 2400/brass leading to budgeting issues.

Table -1: Mud Prices

Resource	Price in Rs	
	Before Rain	After Rain
Mud	1800	2400

- **Availability of Equipment:**

Reason: Sudden surge in demand

As most of the construction industry was closed during recent times, most of the construction equipment weren't used leading them to go in maintenance mode. Now after sudden permission given for construction there is high demand of this equipment on site leading to temporary unavailability. Over that most of these equipment works on diesel and the increase in price of fuel has impacted the rate hour of this equipment. As the footings which are not compacted is under water due to heavy rains, to remove this water a water pump is required, but due to sudden increase in demand of them it is difficult to get a hold of them.

- **Financial Planning:**

In construction industry a usual planning of finance is done in 30% 30% 40% way. In this 30% belongs to builder which will be used in initiation phase for various purposes such as governmental fees, technical fees, lawyers and CA charges, etc. and also in construction. The 30% which belongs to financial institute is used for construction phase and is usually very hard to be misused as the cheques are cleared by the institute against bills. The remaining 40% usually comes from customers and are used for completion and repayment to institutes as well as have builder profits.

Chart -2: Financial Planning

- **Availability of Transport:**

Reason: Covid 19 and increase in fuel prices

Due to covid 19 the Availability of transportation has been limited making it a challenge for acquisition of materials and on-site Availability of materials. This prolonged non-working has made a lot of equipment to go in maintenance mode. Over that an imposition of lockdown has halted work with little to no movement resulting in sudden increase in prices of various key commodities/materials.

Table –2: Fuel Prices

Fuel Price (in Rs)	
Rate in June 2019	Rate in June 2021
67.40	97.45

The sudden increase in fuel prices has resulted in transportation becoming costlier and over that limited amount of availability has made it difficult for completion under budget.

3.3 Risk Analysis:

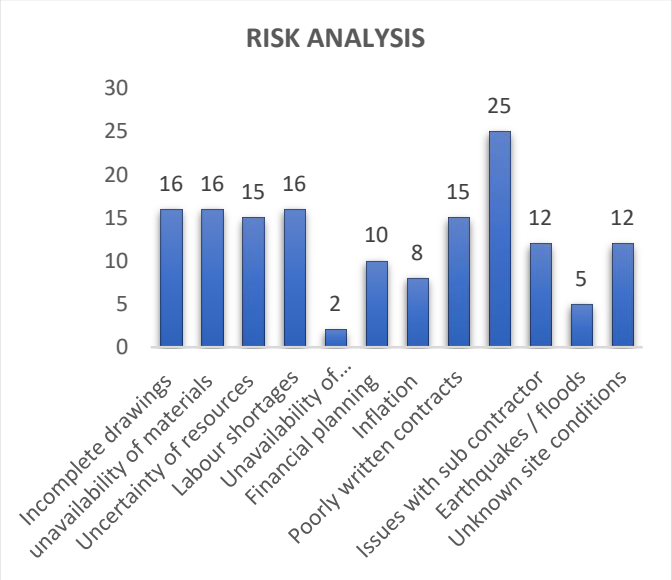


Chart -3: Risk Analysis

This are the various risks associated in my project which I have classified and given them the risk factor (number) on its occurrence and impact on a particular project.

4. RESULTS AND DISCUSSION

In the table below I have classified various risk according to its occurrence and impact and given them a risk factor corresponding to their severity and the consequence they can have on the overall project.

Table –3: Severity of Risks

Description	Occurrence	Impact	Risk	Remark
Incomplete drawings	4	4	16	STOP
unavailability of materials	4	4	16	STOP
Uncertainty of resources	3	5	15	URGENT ACTION
Labour shortages	4	4	16	STOP
Unavailability of transportation	2	3	6	OK
Financial planning	2	5	10	ACTION
Inflation	2	4	8	ACTION
Poorly written contracts	3	5	15	URGENT ACTION
In appropriate Safety hazards	5	5	25	STOP
Issues with sub-contractor	3	4	12	ACTION
Earthquakes / floods	1	5	5	NO ACTION
Unknown site conditions	3	4	12	ACTION

I have categories the risk in the following way with the help of various builders and contractors.

Likelihood						
	Frequent	5	10	15	20	25
	Occasional	4	8	12	16	20
	Seldom	3	6	9	12	15
	Remote	2	4	6	8	10
	Unlikely	1	2	3	4	5
Risk		Incidental	Minor	Serious	Major	Catastrophic
		Consequences/Severity				

5. CONCLUSIONS

In this study we have found multiple risk associated with building construction at different phase along with its percentage of impact and how to take precautionary actions or mitigation of the said risk.

I have concluded that for the **case study 1** where the building was about to be completed the following preventive measures work as mitigation:

- **Incomplete or Change in Design: (64%)**

New Designs to be only considered until the R.C.C is not finished, no new Designs to be considered once completion of overhead water tank.

- **Availability of Materials: (64%)**

For Sand: Use of mix design, use of grit powder are the basic alternative for river sand and are cost effective.

For Cement: Proper Planning, Batching Storing and Ordering of Cement through authorized dealers well in advance can help to decrease the delay.

- **Poorly written Contracts: (60%)**

A contract should be made in a way that it secures both the parties. In above case, contract should have the clause of rise in cost and supply constraint happening after a natural calamity is struck.

- **Inflation: (32%)**

Inflation can't be prevented but smart planning can help to lower the prices accordingly.

For **case study 2** where the building was at its initiate state, the following mitigation/prevention work best for the risk associated:

- **Uncertainty of Resources: (60%)**

Builders and contractors should use mixture of demolished building materials and mud hoarded while excavation for refilling which can help to maintain and decrease overall budget of the construction.

- **Financial Planning: (40%)**

Securing of bank loans with pre sanctions for whole project. securing of finance and knowledge about short comings. use of various schemes to make selling attractive.

- **Availability of Transport: (24%)**

Have contacts with multiple people providing the same service, so when the down time occurs or your reliable resource is not available or is cost prohibitive, you can get your work done without facing time overrun.

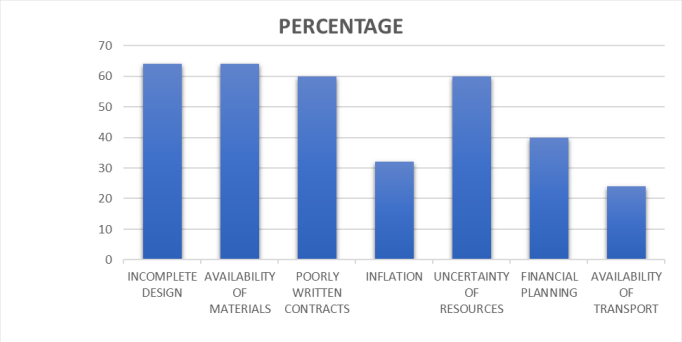


Chart -5: Percentage of damage due to Risk

ACKNOWLEDGEMENT

At the end of my dissertation, it's far a pleasing task to explicit my way to all people who contributed in various ways to the success of this study and made it an unforgettable experience for me.
I would really like to explicit my honest gratitude to Ms. Harshita Ambre for her incredible guidance and non-stop encouragement throughout course of my work. I genuinely respect for her large information and satisfaction supervision and advice.
My special thanks to Prof. Dr. P. L. Naktode, Head of Civil Engineering Department, for his regular suggestion and all of the facilities furnished to effectively complete this work.
I would additionally like to thank Prof. Dr. A. S. Maheshwari, Associate Dean of the Institute who has supplied me this possibility to provide this dissertation.
I could additionally want to thank to all of the faculty contributors of the branch for his or her precious guidance and assist throughout the direction of my work. Also, I would really like to thank all my friends who've directly or indirectly helped me in my assignment work at some stage in the path.
Finally, I would love to thank my parents from whom I learnt the value of hard work and its fruitful results.

REFERENCES

[1] Daniel Baloi, (2012), "Risk Analysis Techniques in Construction Engineering Projects", Journal of Risk Analysis and Crisis Response, Vol. 2, No. 2.

[2] Patel Kishan, (2014), "Study of Risk Factors Affecting Building Construction Projects", International Journal of Engineering Research and Technology (IJERT) Vol. 3, Issue 12.

[3] Shahid Iqbal, Rafiq M. Choudhry, (2014), "Risk Management in Construction Projects", Technological and Economic Development of Economy, VOL. 21.

[4] J. Shah, (2011)," An Overview of Disaster Management in India", Disaster Management and Human Health Risk II.

[5] C. Davis, V. Keilis-Borok; G. Molchan; P. Shebalin; P. Lahr, C. Plumb, (2010), "Earthquake Prediction and Disaster Preparedness: Interactive Analysis", Natural Hazards Review, NH.1527-6996.

[6] Terje Aven, (2016), "Risk assessment and risk management: Review of recent advances on their foundation", European Journal of Operational Research, 1–1.

[7] Agnieszka Dziadosz, Mariusz Rejment (2015), "Risk Analysis in Construction Project - Chosen Methods", Procedia Engineering 122 (2015) 258 – 265.

[8] Peter Stringfellow, (2017), "Construction Contractors Involvement in Disaster Management Planning", Australasian Journal of Construction Economics and Building, p 243.

[9] Ms. M sivagami, mr. Sarath I P, (2018)," Risk Management in Construction: A Literature Review", International Research Journal of Engineering and Technology (IRJET), vol. 5, issue 11.

[10] V. Rathna Devi, (2018), "Study on Risk Analysis in Construction Project", International Research Journal of Engineering and Technology (IRJET), vol.5, Issue 5.