Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 05, May-2025

Analysing and Managing Cost Overrun and Risk Analysis in Construction Projects using Python and RII

Anoopa S,
MTech Student, Department of Civil Engineering MIT

Archana Vs
Assistant Professor, Department of Civil Engineering

ABSTRACT
Construction projects are frequently complicated and unpredictable with risk that affects the quality, safety, cost and schedule. Successful project management depends on effective risk management.
This study aims to identify and analyse the severity and likelihood of cost overrun in both residential and commercial construction projects. It examines direct and indirect methods using quantitative and qualitative methods. The analysis ranks major cost overrun and risk factors across different project stages using a questionnaire informed by expert opinions, interviews and literature reviews. Factors are ranked using Relative Importance Index and mean. Additionally a python-based software analysis is used to helps identify and address top cost overrun and risk factors to ensure project success.

***Keywords*: cost overrun, risk factors, relative importance index**

1. INTRODUCTION

1.1 General Background

A nations financial development is greatly impacted by construction industry. Cost overrun and risk management are common in construction and infrastructural projects. Cost is a key factor in the project management life cycle. Budget overrun is a common main challenge in project management but they can be managed and minimized through careful planning and effective management and the use of appropriate tools and technique. Cost overrun occurs when the initial estimated cost of the project exceeds the final budgeted cost. Understanding and managing costoverun is crucial for the successful completion of projects within the allocated cost. Continuously tracking costs and progress to identify any deviations early and take corrective actions. Ineffective use of resources, lack of proper planning, or mismanagement can result in increased expenses. This analysis is done by computational and manual methods. The objective of the study is review and classify literature on cost overrun and risk analysis in both residential and commercial construction projects, to analyse data to determine causes of the factors, to identify cost overrun and risk factors through site observations, questionnaire survey, interviews with industrial experts, literature survey. It is a common issue in project management, especially in large-scale projects, and can occur due to various reasons, ranging from poor planning to unforeseen circumstances. A cost overrun occurs when the actual cost of a project exceeds the budgeted or estimated cost. It is a common issue across various industries, including construction, software development, and infrastructure projects. These overruns can lead to project delays, reduced profitability, and strained stakeholder relationships. Effective project management practices, such as thorough planning, risk management, and clear communication, are essential to minimize the risk of cost overruns and ensure projects are completed within the allocated budget.

A cost overrun occurs when the actual expenses of a project exceed the initially planned or estimated budget. It is a common challenge faced by organizations in a wide range of industries, including construction, software development, government projects, and infrastructure development. Cost overruns can significantly impact the profitability and success of a project, often leading to delays, disputes, and even project cancellations. Understanding cost overrun is critical in project management because it highlights the importance of accurate budgeting, effective risk management, and strong leadership throughout the project lifecycle. Multiple factors can contribute to cost overruns, such as inadequate planning, poor cost estimation, unforeseen circumstances, or scope changes during the execution phase. By identifying the causes and implementing strategies to mitigate cost overruns, organizations can improve their project performance and ensure that projects are delivered on time and within budget.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 05, May-2025

1.2 Scope of the Study

Every project in the construction industry is different and solely dependent on chance. There are daily competitions for work approval from clients, and winning their business means competing against numerous firms. Cost is also a major factor, as many resources are used throughout the course of the project, influencing both the projected cost and completion time. With the use of certain methods and methodologies, this thesis seeks to identify possible risk factors that are related to the job at various phases of construction. It also intends to manage construction projects efficiently, resulting in a significant change in the company's economics.

2. LITERATURE REVIEW

2.1. General

Cost overrun, particularly in large-scale projects, has been extensively studied across multiple industries. Scholars and professionals have sought to understand its root causes, implications, and solutions in various contexts such as construction, software development, and public infrastructure. The literature on cost overruns provides insight into the systematic, operational, and external factors that lead to exceeding initial project budgets.
An index technique for evaluating the costs of highway development projects Vietnam's overrun risk was created to assess the consequences of these variables in the regression analysis approach. The empirical findings validated Seven essential elements that have exacerbated the likelihood of cost overruns in Infrastructure construction investment management occurs throughout the building phases. land acquisition risk, survey and design scheme risk, system risk, and construction risk associated with unit fiscal and managerial abilities, capital, and contract restriction The macroeconomic climate modifies risk, including moral risk supervision. The Appropriate recommendations have also been made to reduce the project's cost. overrun risk (Sy Hung, Lianxing Min, Jianqiong Wang, and Hong Anh Vu) Mai, Nguyen Hong Phong).
Hyun-Soo Lee et al. (2012) researched risk assessment using a quantitative technique for which different risk variables may be a component of decision-making for safety management in the construction sector. A mathematical language for expressing the risk framework for building projects has been established. The framework is composed of three parts: the "Risk influence factor" component, which consists of a factor extraction procedure, factor weights, and a risk categorization system
Edyta Plebankiewicz (2020) Prediction of cost overrun in construction projects, The paper proposes a cost overrun risks prediction model, the structure of which is based on the fuzzy inference model of Mamdani. It was emphasized in the conclusions that the cost overrun risks prediction model is intended for general contractors who subcontract many stages of works to their subcontractors in accordance with the agreed division into work elements.
Haitham N. S. AL Siyabi (2021) Cost overrun in construction projects in Oman, There are many challenges in construction industry sector, and one of the most important and critical is completion of the project within the original contract value. Risk assessment and Risk Control are crucial to minimize the cost overrun in building construction project in Oman. The study have recommended procedure to cost control in future project such as the Employer should have a proper tender analysis of the Contractor's bid, Detailed design should be finalized before award of work and others. Attada Vivek, C.H. Hanumantha Rao (2022) Identification and analyzing of risk factors affecting cost of construction projects, This article conducts research to identify and analyse significant risk factors that have an impact on the construction industry's budget in India. 42 common risk variables are discovered and grouped into four groups after a thorough study of related literature. The findings reveal high index of risk factors influencing construction project cost overruns.
Tamas Toth and Zoltan Sebestyen researched an integrated risk analysis technique to monitor the likelihood of hazardous events occurring in construction projects from the conceptual stage until the project's conclusion. The traditional risk modeling bases that are integrated with different financial aspects form the foundation of the risk management framework. From these bases, an automated risk management process can be developed to identify the adverse processes that will begin during the project's life and the necessary action plans to counter them. When detrimental patterns are identified in advance, timely implementation of pre-established action measures may be ensured.
Muhammed Siddiq (2024) Risk identification techniques for international contracting projects by construction professionals using factor analysis, This study has investigated the risk identification techniques for International Contracting Professionals in the construction sector. The methodology for conducting this investigation is based on data collection through questionnaires from construction sector professionals in both academia and industry.
Flyvbjerg et al. (2002) further expanded on this by investigating the phenomenon of "optimism bias," where project planners underestimate costs and overestimate the benefits of projects. Their work emphasized that such bias often results in systemic cost overruns, especially in infrastructure megaprojects. They suggested that organizational behavior and political factors also played a significant role in underestimating costs.

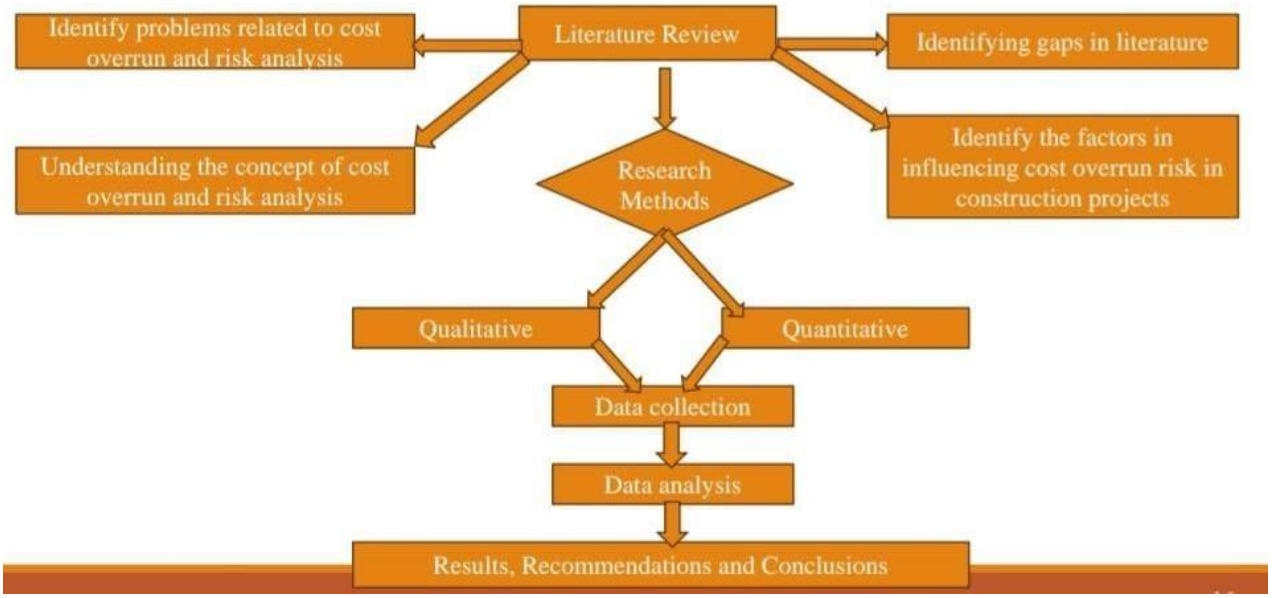
International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 05, May-2025

In construction, Olawale and Sun (2010) conducted a detailed analysis of cost and time overruns, identifying factors such as inaccurate forecasting, poor risk management, and design changes as critical drivers of cost escalation. Their research provided empirical data on how communication breakdowns between stakeholders could lead to cost overruns, especially in projects with international contractors and complex supply chains.

The literature on cost overrun reveals a complex interplay of technical, managerial, and external factors that contribute to budget overruns in projects. Scholars consistently identify inaccurate estimates, scope changes, and poor risk management as central causes. While strategies like improved estimation techniques, agile methodologies, and robust risk management can mitigate some of these issues, organizational and political factors often present deeper challenges. Overall, better governance, transparent decision-making, and continuous stakeholder engagement are necessary to limit cost overruns, particularly in large-scale and high-stakes projects.

3. METHODOLOGY

This section explains the properties of materials involved, work methodology and numerical simulation conducted at work.



3.1 Cost Overrun

3.1.1 Design of Questionnaire of Cost Overrun

A vital stage in ensuring the success of the research is identifying the important features for the study and creating the questionnaire. The reasons for building risks have previously been the subject of much research, and a well-established, peer-reviewed collection of risks characteristics is accessible in the literature. The primary delay characteristics documented in the literature have been included into the questionnaire used for this study. Four main categories were used to identify a total of 24 causes: Material price escalation, Late delivery of materials, Increase in cost of skilled Labour, Adverse effect of weather. In-person interviews with Indian construction professionals were also carried out in order to represent the Indian context and the cross-section of the previously available risks characteristics. Based on these two comments, the final questionnaire survey focused on design. Table 1 enumerates the properties.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 05, May-2025

Factor	Weightage
Neutral	1
Disagree	2
Agree	3
Strongly agree	4

Table 1. Likert scale

3.1.2 Calculating and ranking the Relative Importance Index (RII)

Likert scale of five scales is utilized in the Relative significance Index (RII) technique to indicate the relative significance of the particular causes and consequences based on the probability of occurrence and influence on the project. Moreover, the significant cause or effect component is represented by the larger value of the index of relative significance (RII) (Aibinu & Jigoro, 2002).

$$RII = \sum W / (A \times N)$$

Where:
Relative Importance Index is known as RII.
W is the weight that responders from 1, 2, 3 and 4 assigned to each component, representing low, moderate, high, and very high, respectively. N is the total number of responders, and A is the maximum weightage.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 05, May-2025

3.1.3 Experience of responders in construction sector of cost overrun

NO	DATA	RII	RANK
1.	Material price escalation	0.725	1
2.	Late delivery of materials	0.697	2
3.	Improper planning and scheduling	0.678	5
4.	Fluctuations in price of labour	0.677	7
5.	Adverse effect of weather	0.613	13
6.	Poor contract documentation and management	0.609	14
7.	Lack of experience	0.497	23
8.	Frequent design charges	0.519	18
9.	Inadequate labour / Skill availability	0.499	21
10.	Change in scope of the project	0.676	8
11.	Mode of financing and payment for completed works	0.566	17
12.	Contractors poor procurement process	0.578	16
13.	Inappropriate government policies	0.622	10
14.	Rework due to poor materials by the contractors	0.518	19
15.	Changes in material specification and types	0.600	15
16.	Insufficient numbers of equipments and tools	0.616	12
17.	Mistakes during construction	0.622	11
18.	Work suspension during litigation	0.631	9
19.	Delay in inspection and approval of completed works	0.691	4
20.	Disputes/Accidents/Strikes on site	0.496	24
24.	Additional work/Direct change orders by client	0.678	6
21.	Increase in cost of skilled labour	0.694	3
22.	Inadequate monitoring and control	0.498	21
23.	Political interference	0.501	20

Table 2. Cost overrun using RII method

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 05, May-2025

3.1.4 Cost Overrun Factors

a) Material price escalation: Material price escalation is a common cause of cost overruns in construction projects, driven by fluctuations in the market prices of construction materials such as steel, concrete, lumber, asphalt, and other raw materials. Material price escalation is a significant risk factor that can lead to cost overruns in construction projects. Managing this risk requires proactive measures, including strategic procurement, contract provisions, market monitoring, and flexible project management.

b) Late delivery of materials: A late delivery of materials can cause various issues depending on the context. It can affect construction projects, manufacturing processes, supply chains, or even customer satisfaction. Late deliveries can push back entire project timelines, causing delays subsequent tasks, which may lead to missed deadlines and penalties. Delays might increase costs due to the need for overtime work, hiring additional labour, or finding alternative suppliers to avoid downtime.

c) Improper planning and scheduling: Improper planning and scheduling in construction projects can lead to numerous problems, including delays, cost overruns, and even project failure. Poor scheduling can result in tasks being completed out of sequence, causing critical phases of construction to be delayed. This affects the overall timeline and can lead to contract breaches.

d) Fluctuation in price of labour: Fluctuations in the price of labour can significantly impact construction projects, as well as other industries, leading to budget uncertainties, project delays, and changes in profitability. These fluctuations can be influenced by various factors, and managing them requires strategic planning. Below is a detailed look at the causes, effects, and strategies to mitigate labour price fluctuations in construction projects.

e) Adverse effect of weather: Weather can have significant adverse effects on construction projects, causing delays, cost overruns, safety risks, and quality issues. Since construction projects often involve outdoor work, they are especially vulnerable to weather fluctuations.

f) Poor contract documentation and management: Poor contract documentation and management in construction projects can lead to significant challenges, risks, and financial losses. If the contract lacks clarity or precision, it can lead to different interpretations by stakeholders. Vague language can result in disputes over responsibilities, timelines, or payment terms. Poorly drafted contracts often fail to properly assign risks to the party best suited to manage them. This can result in disputes over who is responsible for unforeseen issues such as delays, cost overruns, or accidents. Contracts might omit provisions for unforeseen circumstances like weather delays or supply chain disruptions, leading to arguments and project delays.

g) Lack of experience: A lack of experience in construction projects can lead to a range of issues that can negatively impact the project's quality, timelines, and costs. Inexperienced project managers may struggle to create accurate project schedules, leading to delays, conflicts, or unrealistic deadlines. Without experience, project managers may fail to allocate sufficient resources (materials, labour, equipment), causing shortages or inefficient use of available resources. An inexperienced team may underestimate how long tasks will take or fail to account for complexities, such as unforeseen site conditions or coordination challenges with subcontractors. Inexperience in estimating can result in under-pricing bids, causing the project to run over budget when costs escalate during construction. Inexperienced teams may not set aside enough contingency funds for unexpected expenses, leading to financial difficulties. Without experience, teams may base decisions on assumptions rather than realistic assessments of cost drivers, including materials, labour rates, and market fluctuations.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 05, May-2025

h) Frequent design changes: Cost overruns due to frequent design changes in construction projects are a common problem and can significantly impact project budgets, schedules, and overall success. Poorly thought-out or rushed designs often lead to changes during the construction phase when issues with the original design become apparent. This is often due to insufficient time spent in the planning stage. Clients may request changes to the design after construction has started, often due to changes in preferences, expectations, or project objectives. This leads to scope creep, requiring adjustments to materials, construction techniques, and timelines.

i) Inadequate labour /skill availability: Cost overruns due to inadequate labour usually arise from insufficient labour planning, skill gaps, or unexpected absenteeism, and they can significantly impact a project's timeline and budget. Not enough workers are assigned to meet the project's needs, leading to extended timelines. Increased labour costs as more hours are needed to complete the project, often at overtime rates. Labor force lacks the necessary skills or experience, which can lead to slower work, errors, or rework. Rework and extended timelines raise material and labour costs, affecting the overall budget.

j) Change in scope of project: Cost overruns due to changes in the scope of a project, often known as *scope creep*, can occur when new features, requirements, or changes are introduced after project planning. These additions can disrupt schedules, require more resources, and increase the complexity of the project, resulting in significant budget impacts. An incomplete or ambiguous project scope at the outset often leads to unforeseen changes as the project progresses. Additional work is required to clarify and meet the evolving requirements, increasing Labour, materials, and time costs.

k) Mode of financing and payment for completed works: Cost overruns in construction projects can often result from issues related to the mode of financing and payment for completed works. Projects financed through loans or debt may incur high-interest rates, especially if delays occur. As interest accrues over time, projects may face unexpected cost increases. Projects that rely on variable-interest financing may see cost increases due to interest rate fluctuations. If financing terms change during the project, it can lead to adjustments in budgets that were not initially planned. Delays or gaps in funding can interrupt project progress, leading to inefficiencies.

l) Contactors poor procurement process: Cost overruns in construction projects can also stem from a contractor's poor procurement process. Contractors who don't order materials on time may face delays in receiving them, disrupting the project schedule. Delays often mean workers and equipment are idled, leading to extra costs. When materials are ordered late, contractors may need to expedite shipping to meet deadlines, which often comes at a high premium. If contractors select suppliers based on cost alone, they might procure lower-quality materials that may not meet project specifications. This can lead to rework or early failure, both of which increase project costs.

m) Inappropriate government policies: Improper or poorly implemented government policies can significantly contribute to cost overruns in construction projects. Construction projects often require multiple permits and clearances. When government policies impose lengthy, complex approval procedures, projects may face delays that lead to extended timelines and increased labor and material costs. Sudden changes in regulations or compliance requirements can disrupt ongoing projects, requiring adjustments that may involve costly rework or additional documentation. Different government agencies may interpret regulations differently, causing confusion and delays for contractors. This often results in repeated submissions or corrections, adding administrative costs and extending project timelines.

n) Rework due to poor materials by the contractors: Cost overruns in construction projects often result from rework necessitated by the use of poor-quality materials, typically due to contractor procurement issues or poor quality control. When materials fail quality checks or are identified as unsuitable during construction, rework is required. This increases labour hours, equipment use, and overall expenses, as workers need to remove, replace, or repair substandard materials. Poor- quality materials may be wasted and require replacement, leading to a direct increase in material costs.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 05, May-2025

o) Changes in material specification and types: Cost overruns due to changes in material specifications and types are common in construction projects and can result from evolving project needs, regulatory requirements, or stakeholder preferences. Switching to materials with enhanced quality or durability often comes at a premium. For example, upgrading from regular concrete to high- strength concrete or from standard wiring to fire-resistant cabling incurs added costs. If the new material specifications weren't accounted for in the initial budget, costs can increase significantly, especially for specialized or imported materials with higher market prices or limited suppliers.

p) Insufficient number of equipment and tools: Cost overruns due to an insufficient amount of equipment in construction projects can arise from various inefficiencies and delays. When there are not enough pieces of equipment to perform the necessary tasks, work slows down or stops altogether. This causes labour to wait for the required equipment to become available, leading to idle time that adds to labour costs without corresponding productivity. Insufficient equipment can prolong the project schedule, resulting in extended costs for labour, management, site facilities, and equipment rentals.

q) Mistakes during construction: Cost overruns due to mistakes made during construction are common and can arise from human error, poor planning, inadequate supervision, or miscommunication.

r) Work suspension during litigation: Cost overruns due to work suspension during litigation are a significant risk in construction projects. Legal disputes can arise from contract disagreements, claims of poor workmanship, delays, or other breaches, leading to costly pauses in construction. When work stops, labours, site supervisors, and project managers may still need to be paid, especially if they are on retainer or salaried contracts.

s) Delay in inspection and approval of completed works: Cost overruns due to delays in inspection and approval of completed works are a frequent issue in construction projects. When these delays happen, projects face both direct and indirect costs that can escalate quickly. Delays in inspection and approval force laborers and equipment to remain on standby. Idle time means labour and equipment costs are still incurred without productive work, which can substantially increase the budget. Longer project durations mean higher costs for site facilities, utilities, and general site maintenance. These costs accumulate over time, increasing project expenses and pushing the project over budget.

t) Disputes/Accidents/Strikes on site: Cost overruns caused by disputes or accidents on construction sites can significantly impact budgets and timelines. Both issues disrupt productivity, incur unexpected costs, and may lead to extended project durations. Disputes and accidents often halt work until issues are resolved or sites are deemed safe. This affects the entire project schedule, leading to delays in other tasks and extending the overall timeline, which incurs additional costs for labour, management, and equipment.

u) Increase in cost of skilled labour: Cost overruns due to increased costs of skilled labour are a common challenge in the construction industry. As demand for skilled workers rises, so do their wages, leading to significant impacts on project budgets. When the demand for skilled labour outstrips supply, wages tend to rise. Contractors must pay higher rates to attract and retain qualified workers, increasing the overall labour costs for the project.

v) Inadequate monitoring and control: Cost overruns due to inadequate monitoring and control are a significant issue in construction projects. When projects lack effective oversight, the risk of budget increases, schedule delays, and resource mismanagement rises substantially. Without proper monitoring, project managers may struggle to keep track of actual expenditures compared to budgeted amounts.

w) Political interference:

Cost overruns due to political interference are a common issue in public and private sector projects, often leading to increased expenses, delays, and reduced efficiency. Politicians may push for changes in a project's scope or add new features to align with their own agendas or respond to public pressures. These changes can require new resources, materials, or labour, increasing costs beyond the original budget.

x) Additional work/Direct change orders by client: Cost overruns due to additional work requested by the client are a common challenge in project management. When clients request changes or add new requirements during a project's life cycle, it can increase both direct and indirect costs. Scope creep occurs when clients request additional work outside of the originally agreed-upon project scope. These incremental requests accumulate, leading to increased material, labour, and time requirements, which drive up costs.

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 05, May-2025

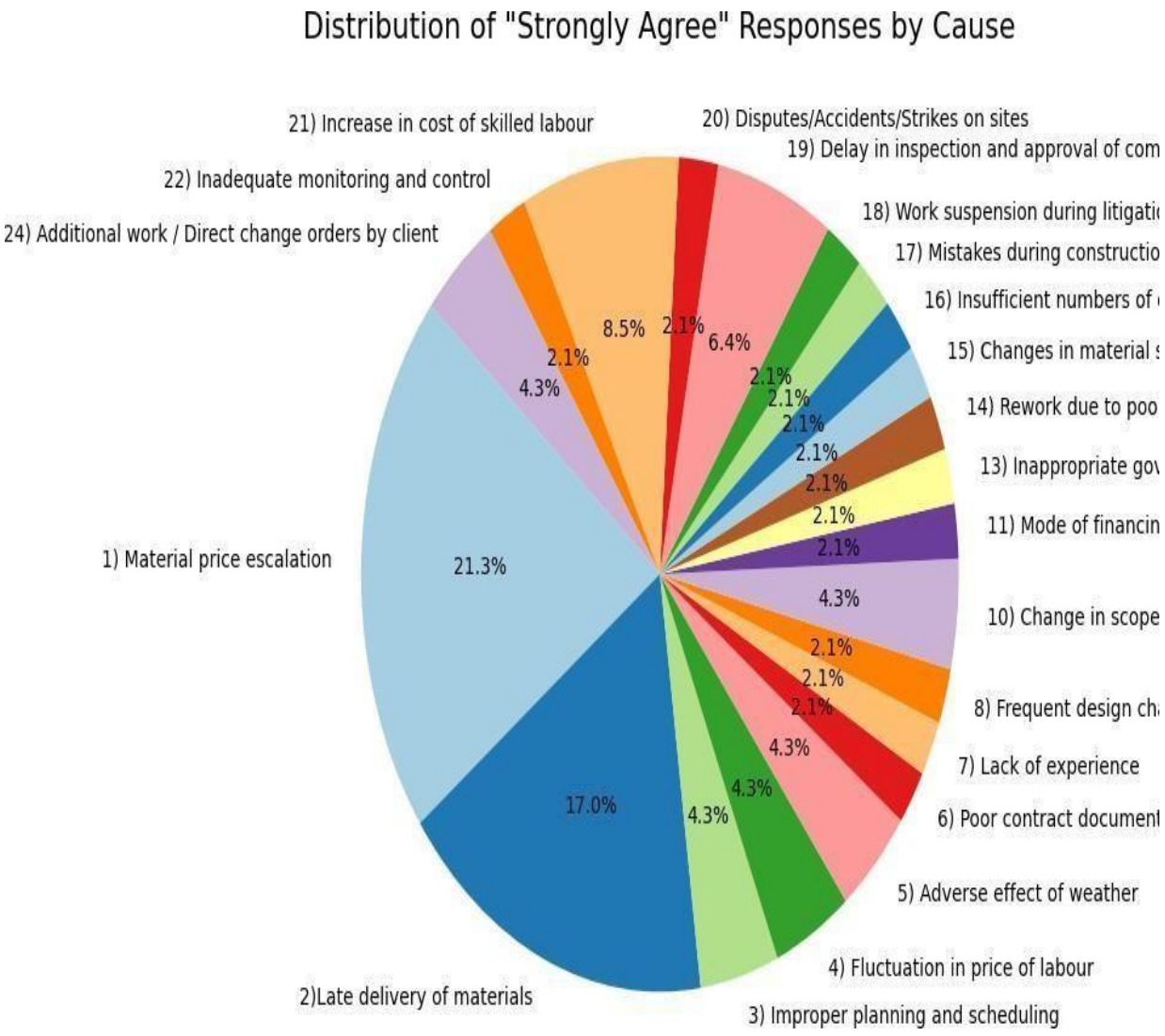


Fig.1.Analysis of cost overrun % by using python

3.2 Risk Analysis

3.2.1 Design of Questionnaire of Risk Analysis

A vital stage in ensuring the success of the research is identifying the important features for the study and creating the questionnaire. The reasons for building risks have previously been the subject of much research, and a well-established, peer-reviewed collection of risks characteristics is accessible in the literature. The primary delay characteristics documented in the literature have been included into the questionnaire used for this study. Four main categories were used to identify a total of 31 risks attributes: difficulties relating to clients, tender, materials, and equipment. In- person interviews with Indian construction professionals were also carried out in order to represent the Indian context and the cross-section of the previously available risks characteristics. Based on these two comments, the final questionnaire survey focused on design. Table 1 enumerates the properties.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 05, May-2025

Factor	Weightage
Neutral	1
Disagree	2
Strongly disagree	3
Agree	4
Strongly agree	5

Table 3. Likert scale

3.2.2. Experience of responders in construction sector of risk analysis

DATA		RII	RANK
Client related factors	Delay in land acquisition and hand over	0.5081	16
	Delay in providing approval	0.5567	3
	Change of orders	0.5333	9
	Delay in progress payments	0.5261	11
Planning	Ineffective project management and scheduling	0.5171	13
	Subcontractor finilization delay	0.4954	18
	Poor coordination between all teams	0.4720	24
	Level of risk management documentation	0.5153	14
	Initiation of procurement before drawing approval	0.5135	15
	Poor decision making skills of project teams	0.4666	25
Execution	Poor site management and supervision	0.4828	20
Tot	Lack of tallented staff at site	0.5351	8
	Rework due to mistakes	0.5549	4

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 05, May-2025

	Poor procurement strategies	0.4810	21
Materials	Late delivery of materials	0.5711	1
	Changes in material types and specifications during construction	0.5423	7
	Escalation of material prices	0.5639	2
Equipment	Shortage of equipment	0.5513	5
	Poor equipment productivity	0.5459	6
	Slow mobilisation of equipment	0.5297	10
	Low labour productivity	0.5225	12
Construction methods	Change in construction methodology at later stage due to constraints	0.5045	17
	Late delivery of construction drawings	0.4504	26
	Less experience of site teams in construction methods	0.4882	19
Labour productivity	Inexperienced labour	0.4720	24
	Less experience of design team in construction methods	0.4054	28
Tender	Past project failure history and lessons not taken into consideration during tender	0.4810	21
	Unrealistic cycle time taken for some tasks in schedule during bidding time	0.4756	22
	Inadequate site investigation data made false commitment	0.4737	23

Table 4. Risk analysis using RII method

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 05, May-2025

3.2.3 Risk Factors

a) Client related factors: Due to the client's inability to finance and pay for finished work, the client's delivery of the site to the contractor to begin work has been delayed (Koushki, Rashid, & Kartam, 2005). Delay caused by client orders changing during the execution process. Delay caused by the client's/delayed owner's decision-making process, as well as delays caused by the owner's poor communication and coordination with the other parties involved.

b) Contractor related factor: Risks brought on by the contractor's unstable finances, delays brought on by the project's shoddy planning and scheduling, dangers resulting from disputes between the contractors and other stakeholders, dangers resulting from the contractors' subpar construction techniques and poor site management, and dangers resulting from the technical staff's lack of training. In order to avert adverse circumstances that may jeopardize the project and its stakeholders, the causes of the contractor's bankruptcy must to be identified.

c) Materialrelated factor: The implementation stage was delayed due to a lack of building supplies. Delays brought on by poor material quality, delayed material procurement on site, and changes in the kinds of construction materials used.

d) Equipment related factor: Equipment-related variables raise the risk of building projects dramatically. Downtime and delays, higher expenses, risks to safety, effects on productivity and quality, reliance on other sources, and operator skill and training.

e) Labour related factor: In construction projects, labour-related hazards include a range of issues that may affect worker productivity, safety, and efficiency. Key dangers associated with labour are as follows: Lack of skilled workers, inexperienced workers, low worker productivity, risks to worker safety and injuries, labour disputes, and strikes

f) Construction method risk: Risks associated with building methods are critical to the overall viability and sustainability of construction projects. Schedule and budget adherence, improved construction quality, safer work conditions, regulatory compliance, and stakeholder satisfaction are all impacted by the proactive identification, evaluation, and mitigation of these risks.

g) Tender risk: In order to compete for the chance to start the project, contractors must submit bids or proposals during the tendering process, which is crucial to building projects. But there are also a number of dangers associated with this phase that might affect the project's feasibility and success.

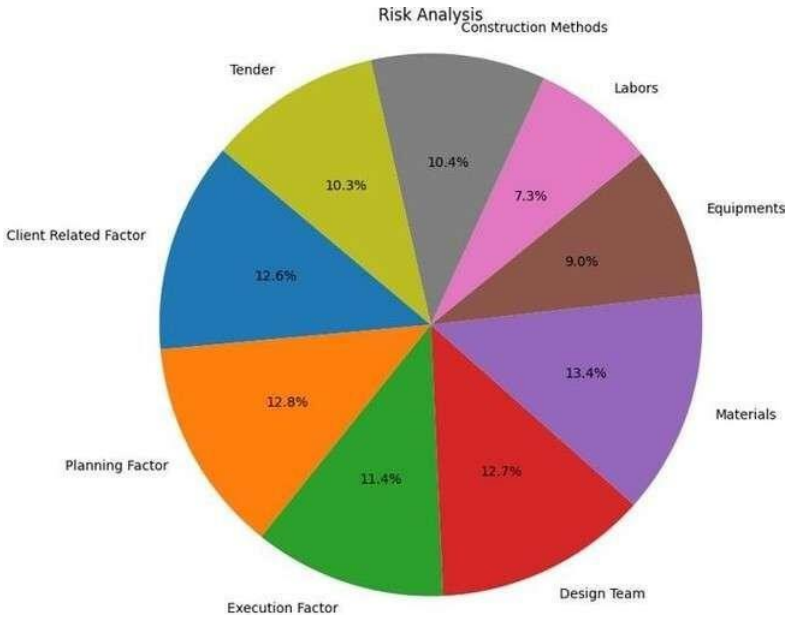


Fig 2: Analysis of risk factors % using python

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 05, May-2025

4. RESULT

For risk analysis

Relative Importance Index = 0.571171 (Materials) Python = 13.4% (Materials)

For cost overrun

Relative Importance Index = 0.725 (Materials) Python = 21.3% (Materials)

From the above study it is concluded that material related factor is the highest for both case.

5. CONCLUSION

In conclusion, a reliable framework for identifying the factors most critical to the project's success may be obtained by using Python and the Relative Importance Index (RII) in risk analysis for construction projects. This study makes it abundantly evident which material-related characteristics are the most relevant to risk. This highlights how important it is to have meticulous material management, procurement planning, and quality control methods for building projects. Material- related variables (RII. O.57,0.725) have been shown to be the most significant drivers to project risk using this technique. Using RII and Python, stakeholders may get valuable insights into the relative relevance of various risk factors, enabling them to take proactive measures to mitigate risks and make informed choices. When material-related risks are seen as significant, project managers may better allocate resources, implement targeted risk management measures, and increase the overall resilience of the project. It is anticipated that in the future, the use of advanced analytical tools such as Python and RII would improve risk assessment methods in building projects, resulting in higher output, lower costs, and project success. Maintaining the resilience of building initiatives in the face of uncertainty requires constant modification and adjustment of these techniques to account for evolving risk situations and shifting market circumstances. In construction projects, cost overruns are a major problem that frequently leads to budget overruns, missed deadlines, and decreased profitability. Analysing these overruns aids in determining their root causes and putting management plans into action. The Relative Importance Index (RII) and Python programming are the main tools used in this study to assess and control cost overruns in building projects. An organised, effective method of analysing and controlling cost overruns is provided by the combination of Python and RII in construction project cost management. This strategy can significantly enhance project outcomes and profitability in the construction sector by emphasising data analysis and factor prioritisation.

5.1 Future of the Study

This research is limited to projects involving the construction of industrial building, highways, commercial building and appartments.

1. This study may potentially be expanded to include other projects types, such as infrastructure projects and lower projects related risk implications.
2. The restricted variables are analysed in this research. The outcomes may be altered by concentrating on the smaller components.
3. In addition, the research might be expanded to include specific projects and plans as well as infrastructure projects.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 05, May-2025

6. REFERENCES

1. Alali, B. & Pinto, A, 2009, 'Project, systems and risk management processes interactions. Management of Engineering & Technology', PICMET 2009 - Portland International Conference, pp.1377-1386.
2. Ana I. Irimia-Diéguez et al.,2014, 'Risk management in mega projects', Procedia - Social and Behavioral Sciences 119, pp. 407 -416
3. Baloi, P. & Price, A. 2003, 'Modelling global risk factors affecting construction cost performance', International J ournal of Project Management, vol. 21, issue 4, pp. 261–269. Berenger Y. Renault & Justus N. Agumba, 2016, 'Risk management in the construction industry: a new literature review', MATEC web of conferences, vol. 66, pp. 1-6.
4. Bon Gang Hwang & Li Ping Toh, 2014, 'Risk Management in small construction projects in Singapore: status, barriers and impact', International Journal of Project management, vol. 32, issue 1, pp. 116- 124.
5. Del Caño A., & De la Cruz, M. P. 2002, 'Integrated methodology for project risk management', Journal of Construction Engineering and Management ASCE, vol. 128, issue 6, pp. 473-485.
6. E.W.T Ngai and F.K.T. Wat, 2005, 'Fuzzy decision support system for risk analysis in e-commerce development', Decision Support System, vol.40, pp.235-255.
7. Flanagan, R. & Norman, G, 1993, 'Risk Management and Construction', V ictoria: Blackwell Science Pty Ltd, Australia. 242.
8. Hillson, D 2002, 'Use a Risk Breakdown Structure (RBS) to Understand Y our Risks', Proceedings of the Project Management Institute Annual Seminars & Symposium, San Antonio, vol. 10, pp. 3-10.
9. K rantikumar, M,hetreet al.2016, 'Risk Management in Construction Industry', International Journal of Engineering Research, vol. 5, issue. 1, pp. 153-155.
10. Loosemore, M, Raftery, J, Reilly, C & Higgon, D2006, 'Risk management in projects', Taylor & Francis, London.
11. Mason, GE 1973, 'A quantitative risk management approach to selection of construction contract provisions', Technical Report no 173, Construction institute, Dept. of Civil Engg., Stanford Uni., Stanford, California.
12. Nadeem Ehsan, Ebtisam Mirza, Mehmood Alam 2010, 'Risk Management in construction Industry', Engineering Management department, centre for advanced studies Islamabad.
13. E.W.T Ngai and F.K .T. Wat, 2005, 'Fuzzy decision support system for risk analysis in e-commerce development', Decision Support System, vol.40, pp.235-255.
14. Flanagan, R. & Norman, G, 1993, 'Risk Management and Construction', V ictoria: Blackwell Science Pty Ltd, Australia. 242.
15. Hariharan Subramanyan Priyadarshi H. Sawant & V andana Bhatt, 2012, 'Construction Project Risk Assessment: Development of Model Based on Investigation of Opinion of Construction Project Experts from India', Journal of Construction Engineering and Management.vol.138, pp. 409-421.
16. Hillson, D 2002, 'Use a Risk Breakdown Structure (RBS) to Understand Y our Risks', Proceedings of the Project Management Institute Annual Seminars & Symposium, San Antonio, vol. 10, pp. 3-10.
17. K rantikumar, M,hetreet al.2016, 'Risk Management in Construction Industry', International Journal of Engineering Research, vol. 5, issue. 1, pp. 153-155.
18. Loosemore, M, Raftery, J, Reilly, C & Higgon, D2006, 'Risk management in projects', Taylor & Francis, London.
19. Mason, GE 1973, 'A quantitative risk management approach to selection of construction contract provisions', Technical Report no 173, Construction institute, Dept. of Civil Engg., Stanford Uni., Stanford , California.
20. Nadeem Ehsan, Ebtisam Mirza, Mehmood Alam 2010,'Risk Management in construction Industry', Engineering Management department, centre for advanced studies Islamabad.
21. Olsson, R. 2007, 'In search of opportunity management: Is the risk management process enough', International Journal of Project Management, vol. 25, issue 8, pp. 745-752.
22. Patel A nkit Mahendra et al. 2013, 'A study of risk management techniques for construction projects on developing countries' 243 International Journal at innovative Technology and Exploring Engineering, vol. 3, issue 5.
23. Perera, J & Holsomback, J 2005, 'An integrated risk management tool and process', Aerospace Conference, IEEE, pp.129-136.
24. Porter, CE 1981, 'Risk allowance in construction contracts', MSc Thesis. University of Manchester.
25. Royer, PS 2000, 'Risk management: The undiscovered dimension of project management', Project Management Journal, vol. 31, no. 1, pp. 6–13.
26. Shankar Neeraj & Balasubramanian, 2005, 'Assessment of risk in construction industry', IRJET, vol. 2, Issue 1, pp. 68-72.
27. Smith NJ, Merna, T & Jobling P, 2006,'Managing Risk in construction projects Oxford: Blackwell'.
28. Shou Qing Wang et al., 'Risk management framework for construction projects in developing countries', Construction Management and Economics, vol. 22, issue 3, pp. 237-252.
29. Surabhi Mishra & Brajesh Mishra 2016, 'Study of Risk Factors Involved in Construction Projects', International journal of Innovative Research in Science, Engineering and Technology, vol.5, issue 2, pp. 1190- 1196.
30. Wang S, Dulaimi M & Aguria Y 2004, 'Risk management framework for construction projects in developing countries', Construction Management and Economics, vol. 22, issue 3, pp. 237-252. 244.
31. Wenzhe et al. 2007, 'Risk management in Chinese construction industry', Journal of Construction Engineering and Management, vol. 133, issue 12, pp. 944-956.
32. Zhou Lin, Y ang Jianping2011, 'Risk A ssessment Based On Fuzzy Network (F-ANP) In New Campus Construction Project', Systems Engineering Procedia, vol. 1 pp. 162– 168.
33. RC Walke et al. 2011, 'An Approach to risk quantification in construction projects using EMV analysis', International Journal of Engineering Science and Technology (IJEST), vol. 3 no. 9.
34. Howard, R & Serpell, A 2012, 'Procurement management: analyzing key risk management factors. RICS COBRA ', Las V egas, USA., pp. 1461- 1469.
35. K artam, N & K artam, S 2001, 'Risk and its Management in the K uwaiti Construction Industry: A contractors perspective', International Journal of Project Management, vol. 19, no. 6, pp. 325-335.
36. Marshall, C & Prusak, L 1996, 'Financial Risk and Need for Superior K nowledge Management', California Management Review, vol. 38, no.3, pp. 77- 101.
37. Schieg M 2006, 'Risk Management in Construction Project Management', Journal of Business Economics and Management, V II no. 2, pp. 77-83.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 05, May-2025

38. Y eo K & Ren, Y 2004, 'Risk management capability maturity model for complex product systems (CoPS) projects', International Engineering Management Conference, i pp. 807-811. 245.
39. Ammar Ahmed et al. 2007, 'A review of techniques for risk management in projects', Benchmarking: An International Journal, vol.14, No.1, pp. 22-36.
40. Boodman, DM 1977, 'Risk Management and Risk Management Science: An overview', Paper presented at the Session of Risk Management, TIMS 23rd. Annual Meeting of Institute of Management Sciences, Greece.
41. Hertz DB & Thomas H, 1983, 'Risk analysis and its application', John Wiley and Sons, Inc., New Y ork.
42. Hillson David 2002, 'Extending the risk process to managing opportunities', International Journal of project management, vol.20, pp.235 – 240.
43. Jannadi Osama Ahmed & Almishari Salman 2003, 'Risk Assessment in Construction', Journal of Construction Engineering and Management, ASCE, pp.492-503
44. Schatteman Damien et al. 2008, 'Methodology for Integrated Risk Management and Proactive Scheduling of Construction Projects' Journal of Construction Engineering and Management, ASCE, November V olume, pp.885-893.
45. Ward Stephen 1999, 'Requirements for an effective project risk management process', Project Management Journal, pp.37-43.
46. Akintoye A.S & Macleod M.J 1997, 'Risk analysis and management in construction', International Journal of Project Management, vol. 12, no. 1, pp. 31–38. 246.
47. Baker S, Ponniah D & Smith S 1999, 'Risk response techniques employed currently for major projects', Construction Management and Economics, vol. 17, no. 2, pp. 205– 213.
48. Barnes NMI 1983, 'How to allocate risks in construction contracts', International Journal of Project Management, vol. 1, no. 1, pp. 24–28.
49. Jaafari A , Coles J & Anderson R, 1995, 'Risk assessment on development projects, the case of lost opportunities', The Australian Institute of Building Papers, vol. 6, pp. 21–35.
50. K im S & Bajaj D 2000, 'Risk management in construction: an approach for contractors in South K orea', Cost Engineering, vol. 42, no. 1, pp. 38–44.
51. Mak S & Picken D 2000, 'Using risk analysis to determine construction project contingencies', Journal of Construction Engineering and Management-ASCE, vol. 126, no. 2, pp. 130–136.
52. Miller R & Lessard D 2001, 'Understanding and managing risks in large engineering projects', International Journal of Project Management, vol. 19, no. 8, pp. 437–443.