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Cost and Time Over Run in Construction Projects

Mohit Vijay Helwande[1], Dr. Yashvant Patil[2], Prof. Pallavi.[3]
[1]*M.E. Construction Engineering and Management Student, Department of Civil Engineering SSJCET Asangaon*
[2]*Head of Department, Department of Civil Engineering SSJCET Asangaon*
[3]*Assistant Professor, Department of Civil Engineering SSJCET Asangaon*

Abstract: ***Construction industry is one of the biggest and fast-growing industry in India which is providing employment to millions of people and also contributing for economic development of nation. But the major and common problem faced by this industry is cost overrun and time overrun. Therefore, there is need to study this topic. This research paper will help to understand cost and time overrun in construction project. Hence the main aim of these paper is to identify the factors affecting cost overrun and time overrun in construction project and provide suitable strategies to avoid it. Method used in this research is both quantitative and qualitative method. Interviews were taken from some of the experienced professionals in this industry and questionnaire survey is conducted to collect data from the respondent from contractor, consultant, clients and students. Total 81 respondent participated in the survey. From the result it is seen that for estimating cost, 73% respondent and for estimating time, 89% respondent use combination of calculation and experience. From the study it is also understood that the problem of cost and time control is not only about the techniques being used it is also about the poor management of techniques and poor supervision. Cost overrun refers to when project goes beyond the estimated cost and factors affecting cost overrun is Poor Estimate, Design changes, Scope creep, Delays, Inflation, Poor project management, Unforeseen site conditions, Material and labour cost fluctuations and Contractual disputes. Time overrun is when project get delayed beyond estimated schedule and factors affecting time overrun is Project Planning, Design Changes, Weather Conditions, Workforce Productivity, Unforeseen Conditions, Regulatory and Permitting Issues, Coordination and Communication. Based on this recommendation were given with some strategies to avoid cost and time overrun in construction projects they are Accurate cost estimation, Risk assessment, Effective project management, change management and Communication. Further research is required in project control providing a checklist for the same, so that major points can be taken care of.***

Keywords: Construction Industry, Cost overrun, Time overrun, Project Control, Project management software's

I. INTRODUCTION

The Construction sector in India is the most important part of the Country's Economy. This provides employment to about 54 million of people all over the country as per survey in 2021. It also contributes about 7-8% of GDP. Infrastructure activities accounted for a 13% share of the total FDI inflows of USD 81.72 bn in financial year 2021. This shows how important it is to control and manage the projects in good quality and efficiently.

For managing project successfully there are four fundamental constraints needs to be considered which are scope, cost, time, and quality. It is necessary to consider whether the project is within those four constraints and how well these constraints are balanced. Majority of construction projects in both developed and developing countries are facing the problems of cost overrun and time over. According to a report by the Ministry of Statistics and Programme Implementation, the average cost overrun in construction projects in India was 37.5% between 2008 and 2012. Another study by the Indian Institute of Technology (IIT) Delhi found that the average cost overrun in infrastructure projects in India was around 20% to 25%. However, according to a report by the Ministry of Statistics and Programme Implementation, the average time overrun in projects monitored by them during the period of April 2020 to December 2020 was 34.33%.

Therefore, it is very important to understand cost overrun and time overrun and factors affecting them. Cost overrun occurs when the final cost or expenditure of the project exceeds the original estimation cost. And time overrun occur when project gets delayed beyond its estimated completion time. Some of the major factors for cost overrun are Poor Estimate, Design changes, Scope creep, Delays, Inflation, Poor project management, Unforeseen site conditions, Material and labour cost fluctuations and Contractual disputes. And for time overrun are Project Planning, Design Changes, Weather Conditions, Workforce Productivity, Unforeseen Conditions, Regulatory and Permitting Issues, Coordination and Communication. It is important to have control on the factors that impact cost over runs and time over run which ultimately reduces the performance of the overall project.

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II. LITERATURE REVIEW

Aishwarya Prashant Patil et al. (2017) in this research paper try to explain the most common problem of the construction project which is cost overrun and time overrun. It also has an impact on economy of nation as people as well as nation both required to wait for the completion of public goods and services longer than planned which ultimately delays the growth potential of the economy. According to this paper major causes of time over run is delays in land acquisition, regulatory approval and poor project co-ordination with stakeholders. And major causes of cost over run is design changes, incorrect evaluation of project time and cost, risk and uncertainty related with project. This paper identifies the major factors for cost overrun and time over run from the analysis through the case study of MJM Hospital, Pune extension of construction work for 3 floor above existing building. Major factors include Delay in Progress payment, Inaccurate planning and scheduling of project by contractors, Rainy weather, non-availability of experienced technical staff of contractor, Excessive work in hand of Contractors, Poor liquidity of contractors, Shortage of labours, Delay in approving extra work and variation, Poor site management and supervision of contractors and Ineffective time management of contractor. Researcher concluded by giving recommendation to control this over run by proper planning at start of project, rate variation in material and labour to be considered, proper study of project scope, optimize utilization of resources, proper communication between stakeholders and wastage of resources should be minimum.

A.S. Ali et al. (2010) in this research paper say that in order to manage project successfully it is necessary to consider four fundamental constraints that are time, cost, scope and quality. The paper describes about the major problem in construction industry of Malaysia is cost overrun. Cost overrun occurs when the final cost of project exceeds the estimated cost. This paper identifies and explain the most important factors affecting cost overrun in construction industry. These factors include Inaccurate or poor estimation of original cost, Inflation of project costs, Improper planning, Fluctuation in price of raw materials, Poor project management, Lack of experience, Obsolete or unsuitable construction equipment's and methods, unforeseen site conditions, Mistake in design, Insufficient fund, Poor contract management, High cost of machineries and construction cost underestimation. The researcher found some measures to control construction costs and to overcome problem of cost overrun they are Proper project costing and financing, Competent personnel, Appropriate Scope Definition, Proper Cost Control, Risk Management during Project Execution, Appropriate Contractual Framework, Increase Supply of Materials, Realistic Cost Estimation, Efficient Management. Researcher came to conclusion that poor estimation of original project cost and underestimating the construction cost is the two main factors for the problem of cost overrun in Malaysian construction project.

Harshita Ambre et al. (2019) in this research paper describes about construction industry in india which provides employment to about 32 million people in india and contribute about 7-8% of GDP. 3 important parameters that define construction project is mainly cost, time and quality. This paper focuses on cost overrun which is the major problem faced by construction industry. Cost overrun is the excess of actual cost over budget. Cost overrun occur in major construction project and magnitude of cost overrun varies from project to project. It reduces the profit margin which is mainly due to complexity of project and inadequate management of man, material, machinery and resources in project. A questionnaire study was designed with 15 important questions related to cost overrun, which was sent to 60 construction professionals across India and from the result 7 important factor affecting cost overrun is identified. The factors are political situation, fluctuation of prices of materials, level of competitors, currency exchange, deficiencies in project planning, faulty contract management and economic instability. All the respondent indicated that average cost overrun in construction project is between 10-30%. At last few recommendations is given to avoid cost overrun which says proper project planning should be done at start of project, change in rate of material and labour should be considered while finalizing budget, stakeholder management should be done, regular meeting should be conducted to resolve disputes and avoid unnecessary additional claims, clarity in project scope at start and resource management should be done to avoid idle manpower on site.

Bojan Stojcetovic et al. (2014) in this paper focusses on 'Iron triangle' which include Cost, Time & Quality, which is used in project management for measuring project success. Cost, Time and Quality are closely related to one another change in one will affect other two. The triangle is called Iron because although the sides can shorten or lengthen they are unbreakable. It is very important for project manager to balance and harmonize between cost, time and quality to meet project objectives. There are many examples that project gets completed within budget and timeline but failed to delivered desired quality expectations of project. Once project is completed then time and cost problem is no longer an issue for the project manager but quality performance become a key issue. Some of the benefits of quality in project performance are customer satisfaction, cost reduction, productivity increase and better competitiveness. Project cost management includes processes involved in estimating, budgeting and controlling costs so that the project can be completed within approved budget. Source of cost of quality are failure, prevention and appraisal. Failure means cost associated with scrap and rework which is more than sum of lost product and additional work. Prevention cost begins with planning, which may cost more in early stage but prevents later cost which is huge.

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Appraisal cost begins with inspection of incoming supplies. Failure cost are responses that occur repeatedly over time and prevention/appraisal costs are the investments that provide cost benefits repeatedly. Project time management includes first proper planning and then control and execution. If project is not planned properly and attempted to complete on fast track it will leads to poor quality and increase cost. So if the project time is required to be compresses it should be planned with increase in labour and equipment which lead to cost increase.

U.Sindhu Vaardini et al. (2016) in this paper describes about cost overrun which is most important problem faced by construction industry. It is essential to have control on cost performance of projects to ensure if the construction cost is within the estimated budget. Therefore, project cost management is needed to keep the project within its defined budget. The aim of this paper to identify the factors affecting cost overrun in construction projects. For this literature review of various research paper on this topic is done by author. Data collected from this research paper is analysed by most suitable method and factors were identified. Based on the reviews it was identified that poor climatic conditions, improper planning and scheduling, fluctuations in the material rate, lack of proper site management, monitoring and controlling, improper management of resources in construction project and poor financial control in site can yield to cost overruns. Author also recommended that future studies on this topic can be done on different types of projects like infrastructure projects, water supply, industrial and other specialized projects. And also, various studies can be done to predict the actual cost of a project based upon the significant delay factors by constructing a prediction model.

Devanshu Pandit et al. (2014) in this research paper focuses on the role of project control from Indian perspective. The main role of project control is to create system, procedures and tools to monitor and control project delivery. The paper identified the most important 5 project control factors that are Safety, Quality, Cost, Schedule and Risk and then tried to explain each factor in detail. Clear policies, procedures & standards, housekeeping, accessibility, use of PPE's comes under Safety Section. QA Policies, Quality audit, specification, control charts and analysis come under Quality control Section. Cost Estimates, Budget and Budgetary Controls, Cost monitoring system and Change Order Management comes under Cost control section. Construction Schedule (Master Schedule), Resource Schedule, Use of Software and tools for Schedule control comes under Schedule Control. Risk Identification, Risk Analysis- Quantitative & Qualitative, Risk Mitigation, Risk Monitoring & Control comes under Risk Management. Further to these studies author explains about Analytical Hierarchy Process (AHP) which is very useful in weighting and decision-making problems. AHP is most popular decision-making method owing to its ability to reflect the way in which people think. AHP method is used for weighing this 5 project control factors and based on this Quality control has highest weight of 32.71% followed by safety at 23.64%, Risk management at 16.44%, Schedule control at 14.74% and cost control section has lowest weight of 12.48%. It concludes that control related to quality and safety is more important than schedule and cost by the respondent.

George Otim et al. (2011) in this research paper first tried to identified the problem faced by contractors of Uganda in controlling the cost on site. To identify this problem, researcher did a questionnaires survey on 130 sites in Nakawa division in Kampala city. The scope is limited to current cost control techniques being used, problem faced and proposed solution. The cost control techniques used by contractors on sites are schedules, site inspection, the project budget, meetings, cost and work progress records and reports, monitoring work and cost performance and evaluation using bill of quantities. The problem includes delays by client to release money, delays to make decision, lack of material and equipment, bad weather, overlapping of activity, unclear and incomplete drawing, making good defective work and failure to control productivity of resources. It is also understood that the problem of cost control is not about only the techniques being used, it is about the poor management of techniques and poor supervision. Then he explained some most important points related to cost control on construction site which include Project resource and controls, Materials, Plant, Labour and Time & Cost relationship.

III. RESEARCH METHODOLOGY

The main aim of this paper is to identify the factors affecting cost and time overrun in construction industry and give suitable strategies to avoid it in projects. For this study is done by reviewing various research paper from this topic. For this around 10 research paper studied. And also, personal interview was done with senior professionals from this field. Further to this to understand current scenario in construction industry survey is done. The data for this research were collected via structured questionnaire survey from the engineers, contractors and clients involved in various types of construction projects. The format of questionnaire took into the consideration the objectives of the study with the aim to answer the research question. The Research questions were framed based on the literature [1] to [10], and finalized with the help of the most experienced professionals from the same industry and also special care was done for phrasing the questions that are easily understood by the respondents. It is understood that respondent will be uncomfortable to share if any loop holes exit in their organisation related to project control. Therefore, to keep confidentiality, name of the organisation is not asked and name of the respondent is kept optional.

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IV. RESULTS AND DISCUSSION

The questionnaires survey involved the distribution of 20 sets of questionnaires among 110 participants from where 81 participants responded to the questionnaires. Table-1 shows information of respondents participated in the survey.

Table 1- Respondents Information

	Years of Experience					
Professionals	0 - 5	6 - 10	11 - 15	16 - 20	> 20	Total
Client	9	18		5	1	33
Consultant	2	6	2	3	1	14
Contractor	12	11	4	2	3	32
Students	2					2
Total	25	35	6	10	5	81

A. Cost Overrun

Cost overrun occurs when the final cost or expenditure of the project exceeds the original estimated cost. It reduces the profit ratio's[1] which is mainly due to the complexity of major projects and inadequate management of the Man, Material, Machinery and other resources required for the projects.

Cost Overrun Amount = Actual Expenses – Budgeted Amount

$$\text{Cost Overrun Percentage} = \frac{(\text{Actual Expenses} - \text{Budgeted Amount})}{\text{Budgeted Amount}} * 100\%$$

There are various factors that can contribute to cost overruns in construction projects. Some of the most common factors include [2]:

1) *Poor Estimate:* It is one of the biggest factors contributing for cost overrun. It may be due to the fact that at initial level there is lack of information about the project.
2) *Design Changes:* When there are changes in the design of the project, it can lead to additional costs for materials, labour, and equipment.
3) *Scope Creep:* This occurs when the project scope increases beyond what was initially planned. This can be due to client demands, changes in regulations, or unexpected site conditions.
4) *Delays:* Construction delays can result from a variety of factors, including inclement weather, labour shortages, and equipment breakdowns. These delays can increase costs due to extended project timelines and additional labour costs.
5) *Inflation:* Inflation can lead to increased costs for materials and labour, which can affect the overall cost of the project.
6) *Poor Project Management:* Inadequate project management can lead to cost overruns due to poor planning, and inefficient use of resources.
7) *Unforeseen Site Conditions:* Unexpected site conditions such as soil instability, underground utilities, and hazardous materials can result in additional costs for remediation and mitigation.
8) *Material and Labour cost Fluctuations:* Changes in the price of materials and labour can affect the overall cost of the project.
9) *Contractual Disputes:* Disputes with contractors and subcontractors can lead to delays and additional costs.

Overall, effective planning, communication, and risk management can help to minimize the risk of cost overruns in construction projects.

Cost overruns can have significant impacts on a construction project. They can lead to delays, increase the total project cost, affect the quality of work, and cause disputes between parties involved in the project. To prevent cost overruns, it is important to have a well-planned and well-managed project from the outset.

Fig-1 shows the result obtained where respondents were asked about how the cost of their projects was determined which shows that 73% of the respondent determine cost based on combination of both calculations and there experience where as 21% of the respondent use only calculations for determining their project cost.

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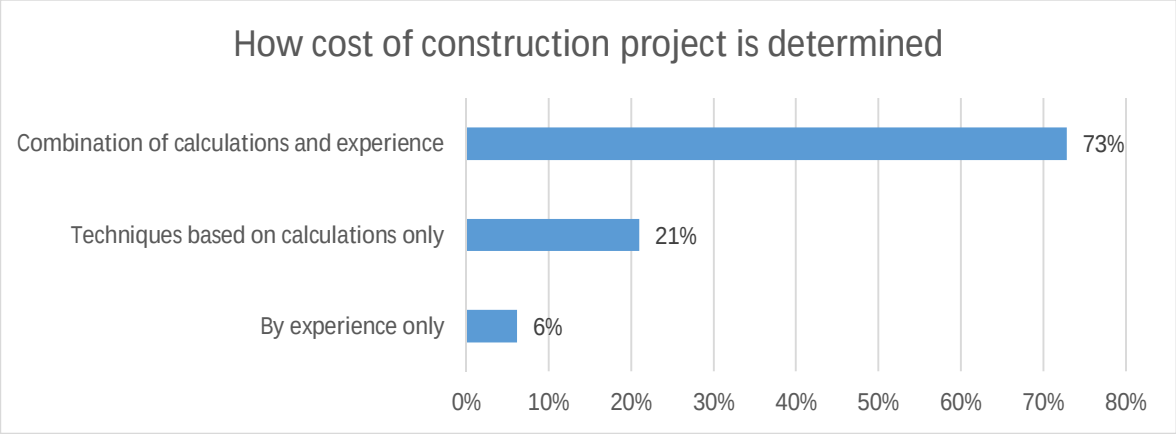


Fig – 1 Analytics on how cost of construction project is determined.

B. Time Overruns

It is the phenomenon in which the project gets delayed beyond its expected completion time due to certain difficulties i.e., more time is required to finish the project than initially planned [1]. In India majority of infrastructure project are affected by time overruns. Iyer and Jha [6] has observed that over 40% of Indian construction projects had time overrun ranging from 1 to 252 months. Some of the basic reasons for time overruns are delay in land acquisition, political pressure and their election agenda, poor program management, regulatory approval and scope change.

There are various factors that can contribute to time overruns in construction projects, including [1]:

1) *Project Planning:* Inadequate project planning and scheduling can lead to delays in completing the project. A well-planned project with a clear timeline can help avoid delays and time overruns.
2) *Design Changes:* Changes in design can cause delays, especially if the change requires additional approvals or permits. It is important to finalize the design before starting construction to minimize the risk of delays.
3) *Weather Conditions:* Inclement weather such as heavy rain, snow or extreme heat can hinder construction work and cause delays.
4) *Material Availability:* Delays in receiving materials can cause work to stop, which can result in a project taking longer than anticipated.
5) *Workforce Productivity:* Low productivity due to inefficient work processes, inadequate training or lack of motivation can lead to delays and project overruns.
6) *Unforeseen Conditions:* Unforeseen circumstances such as site conditions, underground utilities, and environmental issues can cause delays and cost overruns.
7) *Regulatory and Permitting Issues:* Delays in obtaining permits or complying with regulations can cause delays in the project.
8) *Coordination and Communication:* Poor communication and coordination between the various parties involved in the project can cause delays and misunderstandings that can impact the timeline.

It is important to anticipate and manage these factors to minimize time overruns and ensure a successful construction project.

Fig-2 shows the result obtained where respondents were asked about how the duration of their projects was determined which shows that 89% of the respondent determine their project duration based on combination of both calculations and there experience where as 7% of the respondent use only experience for determining their project duration.

By comparing the result from Fig-1 and Fig-2 and interviewing the respondent it appears that contractors favour the use of calculations and a combination of both calculations and experience to estimate the time duration of their construction projects while consultant mostly utilise experience only. This can be due to the fact that consultants are mostly involved in estimation of project duration at the early stage of the project where has at that stage availability of project information is limited to the client. And client only needs rough idea of project duration.

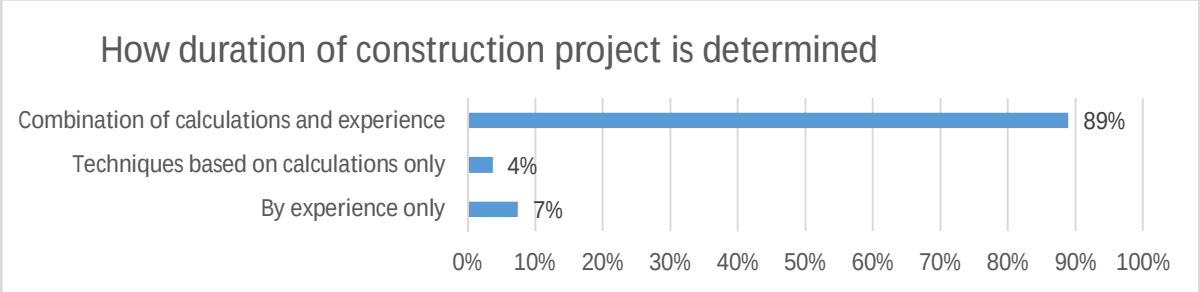


Fig – 2 Analytics on how duration of construction project is determined.

C. Project Management Software

The commonly used software's in construction industry for planning, cost and time control in India are mainly Primavera, Microsoft project and excel spreadsheet. From the survey (Fig-3) it is identified that Excel spreadsheet is most popularly used software among contractor (38%), consultant (62%) and client (65%). And second popular software is MSP.

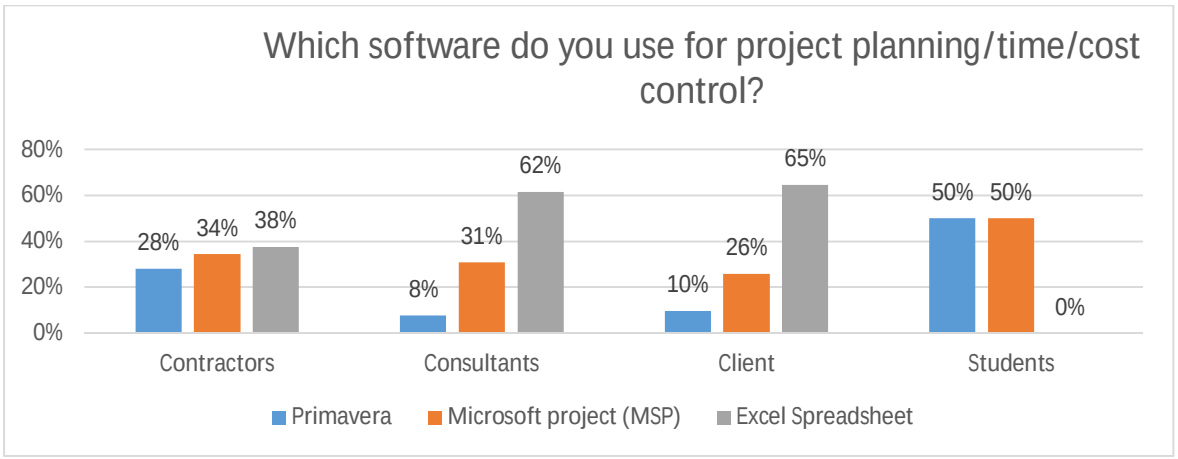


Fig – 3 Analytics on which software is used for project planning/ time/ cost control

Fig-4 shows the result of survey where contractor, client and consultant were asked about How frequently cost and time control techniques being applied in their construction project. And the result shows that 64% always use, 33% rarely use and 3% do not use cost and time control techniques in construction project. In spite of implementation and availability of cost and time control techniques in construction project still some projects get delayed and could not complete in budget. The reason [7] for this is that the problem of cost and time control is not only about the techniques being used it is also about the poor management of techniques and poor supervision.

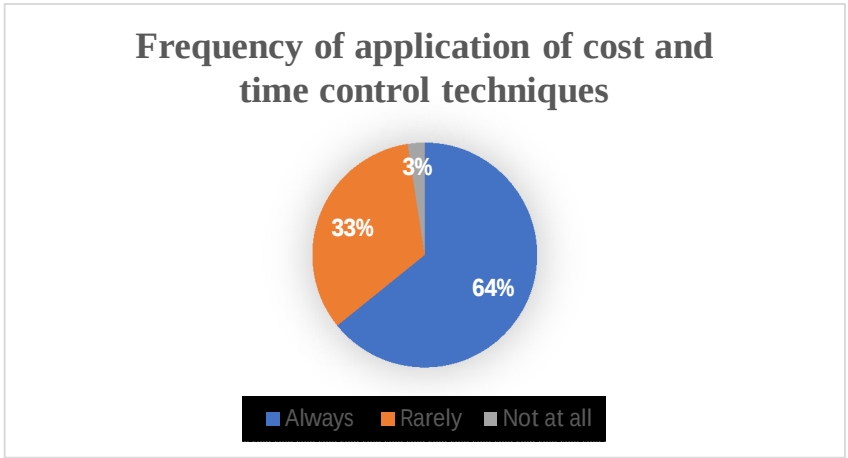


Fig-4: Analytics on frequency of application of cost and time control techniques

V. CONCLUSION

The project is said to be successful only when it is completed in time, cost and required quality. These, paper will help us to understand the most common problem of construction industry that is cost overrun and time overrun. Some of the most common factors affecting cost overrun and time overrun in construction project is identified here. And based on this some strategies that can help prevent cost overrun and time overrun is listed below:

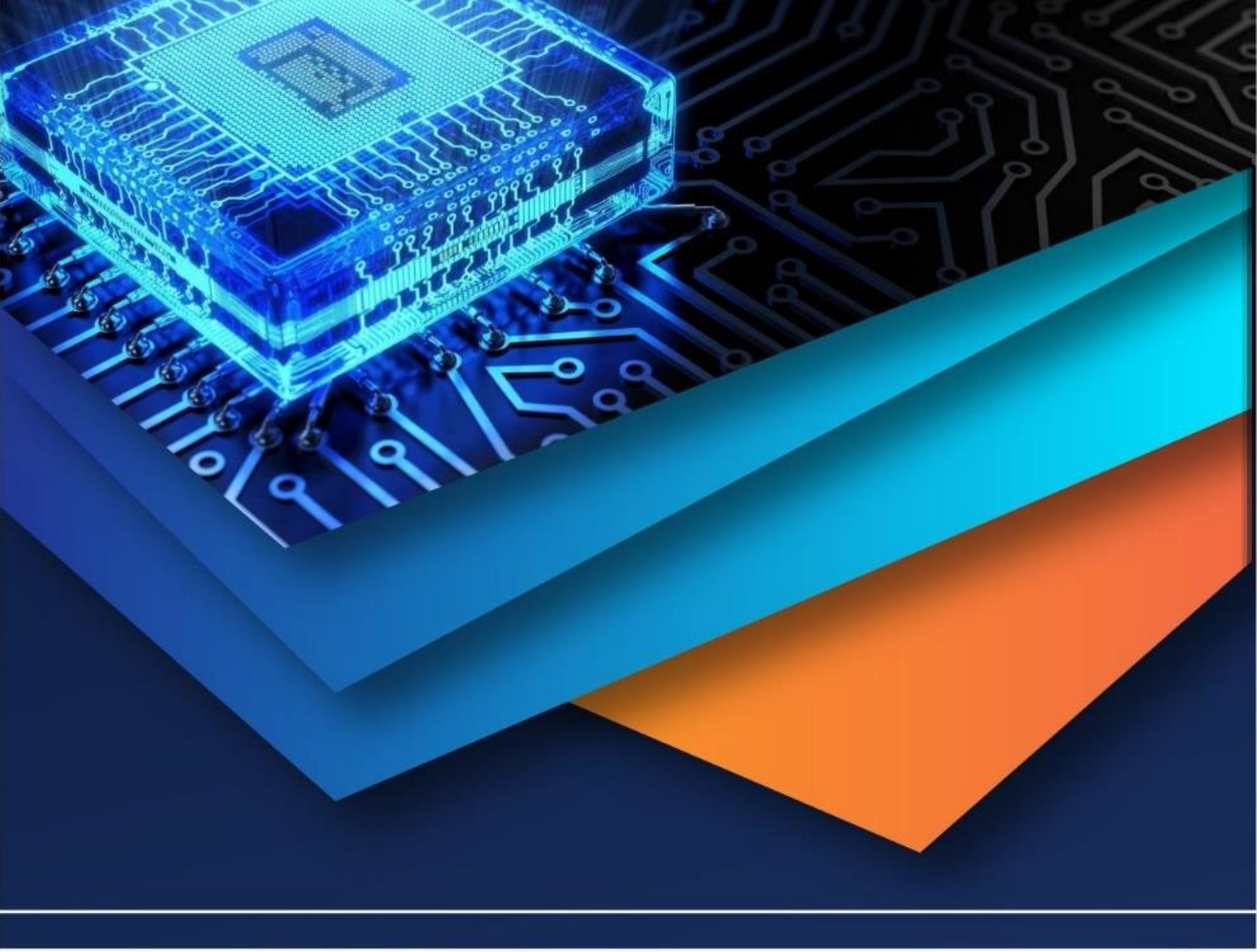
1) *Accurate Cost Estimation:* Conduct a thorough analysis of the project requirements and develop an accurate cost estimate based on the scope of work, materials required, and labour costs.
2) *Risk Assessment:* Identify potential risks that could affect the project and develop contingency plans to mitigate those risks.
3) *Effective Project Management:* Hire experienced project managers who can oversee the project and ensure that it is completed on time and within budget.
4) *Change Management:* Implement a change management process that allows for changes to be made to the project plan while minimizing their impact on the budget.
5) *Communication:* Establish clear communication channels between all parties involved in the project to ensure that everyone is aware of any changes or issues that may impact the project budget.

By implementing these strategies, construction projects can be completed on time and within budget by minimizing the risk of cost overruns and time overruns.

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