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ASSESSMENT OF COST OVERRUNS IN CONSTRUCTION PROJECTS USING RISK MANAGEMENT TECHNIQUES

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ABSTRACT

Cost overruns still constitute a serious problem within the construction industry and impact financial performance, project schedule and project success negatively. The current study focuses on evaluating the frequency of cost overruns in the construction industry, major risk factors behind them, the use of risk management techniques to overcome them and their effectiveness. The study utilizes a descriptive cross-sectional research design where 150 construction projects/respondents will be sampled using structured questionnaires and project-related information which will be analyzed using frequencies and percentages. It was found that 30.0% of projects have cost overruns of 5-10% while only 12.0% have zero cost overruns. Major risk factors included material price increase (78.7%), design changes (70.0%), labor cost increase (64.0%) and delays (61.3%). Risk management techniques used include regular cost monitoring and control (84.0%), risk identification and assessment (79.3%) and contingency budgeting (74.7%). In addition, 72.7% of respondents regard risk management techniques to be effective or very effective in controlling cost overruns. The study concludes that systematic risk identification, continuous cost monitoring, accurate estimation, and contingency planning are important for reducing cost escalation and improving the financial performance of construction projects.

Keywords: *Cost Overruns; Construction Projects; Risk Management; Cost Control; Risk Assessment; Contingency Planning.*

1. INTRODUCTION

Construction projects are critical for the development of any economy and make a major contribution to the development of infrastructure, residential buildings, commercial structures, transport systems, and industrial projects. Successful completion of such projects requires proper cost, time, quality, resource, and risk management. Out of these aspects, cost management plays a particularly crucial role, as any increase in the cost of the project may have an impact on its profitability, completion, and overall customer satisfaction. Project cost overrun happens when the total cost of the construction project becomes higher than initially estimated or approved during the project's planning and approval process. Cost overrun may cause losses and delay the completion of projects.

Cost overruns may arise in the construction process due to a variety of reasons. These include increases in material prices, increase in labour costs, changes in the design and scope of the project, errors in cost estimates, poor planning, construction delay, inflation, contractors' issues, unanticipated site conditions, and delay in approvals or regulation. There are also external variables such as market fluctuation and economic changes that make it difficult to forecast costs in the construction process. It is therefore very important to identify possible risks early and estimate their impacts on construction costs. Therefore, identifying potential risks at an early stage and assessing their possible impact on project costs are essential for improving cost control and reducing financial uncertainty.

Risk management offers a process to identify, analyse, assess, and control risks that can potentially affect the construction project. Some of the risk management methods used in construction projects include risk identification and assessment, cost tracking, contingency planning, project progress tracking, assessing risk from suppliers and contractors, schedule risk assessment, risk allocation via contract terms, documenting risks, quantitative risk assessment, and sensitivity analysis. Proper implementation of the above-mentioned risk management methods allows construction project managers to foresee potential threats, implement proper preventive actions, use their resources effectively, and address any risk situations promptly. On the other hand, the efficiency of risk management could be determined by the extent to which these methods are implemented.

The current research is cantered on an examination of the cost overruns magnitude, determination of key risk factors that have led to the emergence of cost overruns, and risk management strategies employed in the construction sector. Besides, the study will attempt to evaluate the efficiency of these strategies in addressing cost overruns. Through such a review, the study intends to emphasize the significance of risk identification, proper cost monitoring, contingency plans, and risk assessment in improving cost performance and reducing the likelihood of significant cost overruns in construction projects.

2. LITERATURE REVIEW

Afzal et al. (2021) reviewed artificial intelligence-based risk assessment techniques to identify interdependences of various risks which lead to cost overruns in the construction industry. It was pointed out by the authors that cost overruns in construction projects were the results of various interconnected risks instead of singular risks. They described the ability of artificial intelligence in order to assess and predict such risks in an effective way. The researchers have stressed that proper risk assessment techniques can be used to reduce cost overruns in the construction projects.

Canesi and Gallo (2023) studied the topic of risk assessment within the context of sustainable infrastructure development projects and stressed the significance of risk assessment for reducing the likelihood of cost overruns in such projects. The authors noted that by systematically identifying and assessing risks, it would be possible to achieve greater control of costs, which would enhance the performance of such projects. The study underscored the necessity of incorporating risk assessment in infrastructure development and management for addressing the uncertainties that may result in cost increases.

Afzal et al. (2020) developed a cost risk-contingency approach for dealing with cost overrun situations in metropolitan projects through the use of Fuzzy-AHP and simulations. In particular, this study is concerned with prioritizing cost risks and the determination of contingency measures to be considered when there is an uncertainty in the cost aspect of projects. It was shown in the study that the combination of risk prioritization and simulation may give a better foundation for estimation of cost impacts and contingent actions. The study concluded that an integrated cost-risk framework could support improved financial planning and reduce the likelihood of significant cost overruns in large-scale metropolitan projects.

Elbashbishy et al. (2022) explored the effect of construction risk factors on the occurrence of cost overruns with simulation of risk path methodology. The researchers explored the effects of various construction risk factors and their interactions, which led to the creation of cost overruns within the construction projects. The research revealed the significance of analyzing the risk path and its combined effects, as opposed to considering each risk factor independently. This implies that simulation of construction risk can provide a useful strategy for managing cost overruns.

3. RESEARCH METHODOLOGY

The research used a descriptive cross-sectional design, in which 150 construction projects were surveyed. Information was gathered using a well-structured questionnaire and data related to projects, and analysed through frequencies and percentages to determine the level of cost overruns, risks involved and risk management measures along with their efficiency in controlling project costs.

3.1 Research Design

This current research employed a descriptive cross-sectional research methodology in the evaluation of cost overruns in construction projects, and the risk factors and risk management strategies involved in the cost performance of such projects. This study specifically analyzed the degree of cost overruns, risk factors responsible for cost overrun, risk management strategies that are widely used, and their effectiveness in cost control.

3.2 Study Population and Sample Size

A sample size of 150 construction projects or respondents was used in the research. Cost performance of projects and risk management practices were factors that were analyzed in relation to the projects. The sample offered information about the size of cost overruns, project risks, risk management practices, and their efficiency in cost control.

3.3 Data Collection

The data collection methods included a structured questionnaire and project cost data. The structured questionnaire contained questions that focused on four broad issues which include: the level of cost overrun, factors that contribute to the cost overruns, risk management methods used in the construction projects, and the effectiveness of these methods. Project cost data was utilized in classifying projects based on cost overruns.

3.4 Study Variables

Some of the key variables considered in the research were:

- **Cost overrun percentage:** None, less than 5 %, between 5-10 %, between 11-20 %, and more than 20 %.
- **Risk factors:** Increase in material prices, change in design, increase in labor cost, delays in construction process, poor cost estimation, inflation, insufficient planning, problems with the contractor, unforeseen site conditions, and delays due to regulation.
- **Management of risk factors:** Cost control, risk identification, contingency budgeting, progress monitoring, supplier evaluation, schedule risk assessment, risk allocation, risk documentation, quantitative risk assessment, and scenario/sensitivity analysis.
- **Efficiency of risk management:** Very efficient, efficient, moderate efficiency, slightly efficient, and inefficient.

3.5 Data Analysis

Data collection and analyses were conducted using descriptive statistics. Calculations were done on frequency and percentages to determine how cost overruns, risk factors, and risk management practices are distributed, as well as the effectiveness of risk management. These findings were represented in four tables with graphs.

4. RESULTS

Table 1 and Fig. 1 show the distribution of the 150 construction projects based on the degree of cost overrun. The projects were categorized into five groups: no cost overrun, cost overrun less than 5%, 5%-10%, 11%-20%, and cost overrun greater than 20%.

Table 1: Distribution of Construction Projects According to the Extent of Cost Overrun

Cost Overrun Level	Frequency (n)	Percentage (%)
No overrun	18	12.0
Less than 5%	32	21.3
5–10%	45	30.0
11–20%	36	24.0
More than 20%	19	12.7
Total	**150**	**100.0**

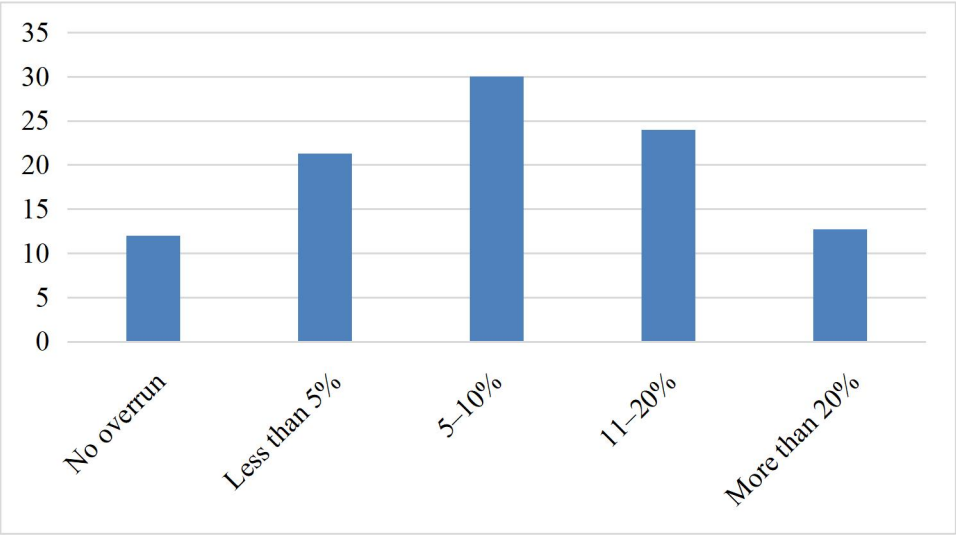

Figure 1: Graphical Representation of Distribution of Construction Projects According to the Extent of Cost Overrun

The study results demonstrated that the largest percentage of projects (30.0%) had a cost overrun between 5% and 10%, whereas 24.0% had a cost overrun between 11% and 20%. Overruns of 21.3% were lower than 5%, while overruns for 12.7% of the projects exceeded 20%. It is necessary to note that just 12.0% of the total number of projects did not have cost overrun. Overall, the results indicated that cost overruns were common among the assessed construction projects, with moderate overruns being the most prevalent.

Table 2 and Figure 2 below show the important risk factors that have been determined as contributing to cost overruns in construction projects. The risk factors involved are those relating to materials, design, labour, scheduling, estimating, finance, planning, contractor, site, and regulation.

Table 2: Major Risk Factors Contributing to Cost Overruns

Risk Factor	Frequency (n)	Percentage (%)
Material price escalation	118	78.7
Design changes and modifications	105	70.0
Labour cost increase	96	64.0
Delays in project completion	92	61.3
Poor initial cost estimation	88	58.7
Inflation and market fluctuations	84	56.0
Inadequate project planning	79	52.7
Contractor-related problems	73	48.7
Unforeseen site conditions	65	43.3
Regulatory/approval delays	57	38.0

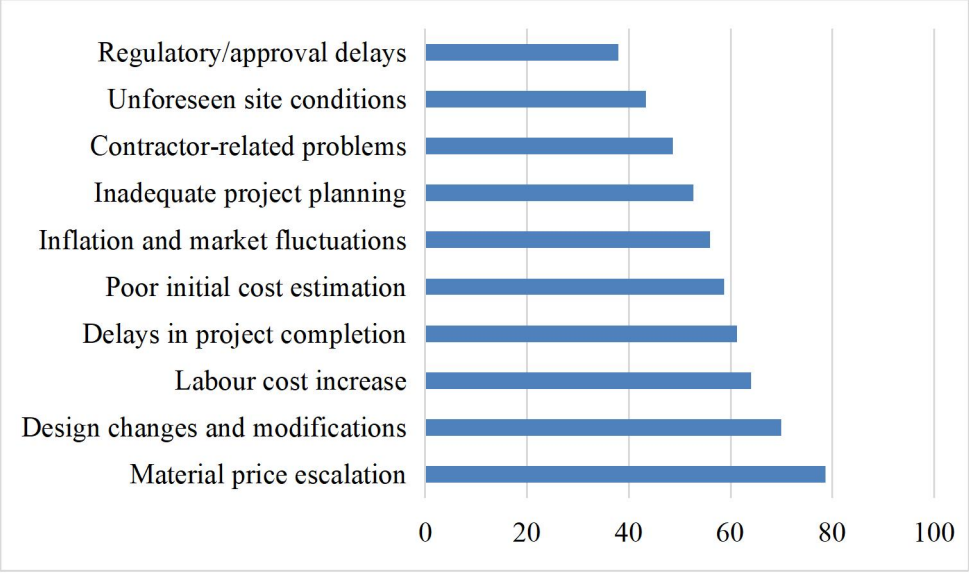

Figure 2: Graphical Representation of Major Risk Factors Contributing to Cost Overruns

The findings revealed that the most common risk factor was the increase in the cost of materials (78.7%), design and modification (70.0%), and increase in labor costs (64.0%). Project delay occurred in 61.3%, and poor cost estimation was mentioned by 58.7% as a factor leading to overrun of cost in the construction projects. Inflation and market changes were considered as a reason in 56.0% of cases, and poor project planning was found in 52.7%. Contractor issues were mentioned by 48.7%, site issues by 43.3%, and regulatory/ approval issues by 38.0%. Overall, the findings indicated that financial, design, planning, and project execution risks were major contributors to construction cost overruns.

Table 3 and Figure 3 illustrate the various risk management strategies adopted for construction projects for the identification, evaluation, monitoring, and controlling of risks related to costs and performance of the project.

Table 3: Use of Risk Management Techniques in Construction Projects

Risk Management Technique	Frequency (n)	Percentage (%)
Regular cost monitoring and control	126	84.0
Risk identification and assessment	119	79.3
Contingency budgeting	112	74.7
Regular project progress monitoring	108	72.0
Supplier/vendor risk assessment	94	62.7
Schedule risk analysis	91	60.7
Contractual risk allocation	87	58.0
Risk register/documentation	82	54.7
Quantitative risk analysis	68	45.3
Scenario/sensitivity analysis	61	40.7

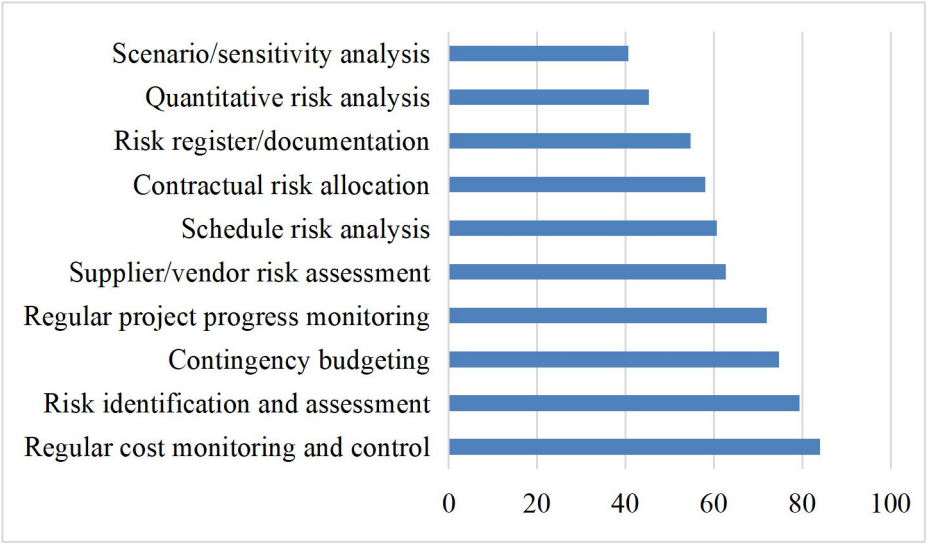

Figure 3: Graphical Representation of Use of Risk Management Techniques in Construction Projects

The results revealed that the most prevalent method was regular cost monitoring and control, which was used by 84.0% of the respondents, followed by risk identification and assessment (79.3%) and contingency budgeting (74.7%). The respondents who used regular project progress monitoring were 72.0%. Supplier/vendor risk assessment was used by 62.7% of the respondents, schedule risk analysis was used by 60.7%, and contractual risk allocation was used by 58.0%. On the other hand, quantitative risk analysis was used by 45.3% of the respondents and scenario/sensitivity analysis by 40.7%. Overall, the findings indicated greater reliance on conventional monitoring and assessment techniques, while advanced analytical approaches were comparatively less utilized.

The table 4 and figure 4 below illustrate the perceived effectiveness of different methods of risk management in mitigating cost overruns during construction projects. The effectiveness was measured using five rating scales namely; highly effective, effective, moderately effective, slightly effective and not effective.

Table 4: Perceived Effectiveness of Risk Management Techniques in Controlling Cost Overruns

Effectiveness Level	Frequency (n)	Percentage (%)
Highly effective	48	32.0
Effective	61	40.7
Moderately effective	27	18.0
Slightly effective	10	6.7
Not effective	4	2.6
Total	**150**	**100.0**

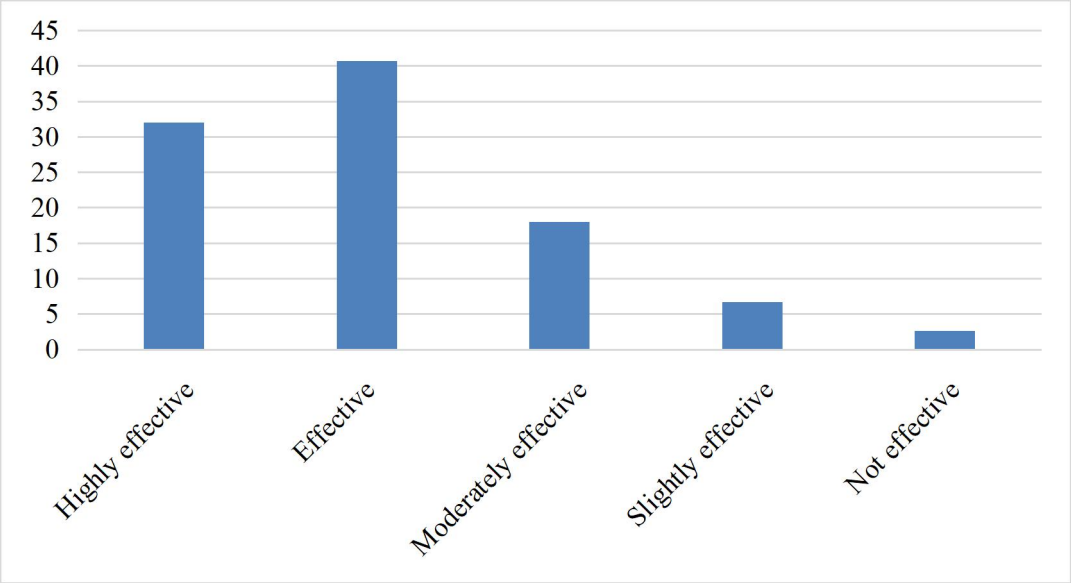

Figure 4: Graphical Representation of Perceived Effectiveness of Risk Management Techniques in Controlling Cost Overruns

The study revealed that 40.7% of the sample found the techniques to be effective, while 32.0% found them to be highly effective. This makes a total of 72.7% who perceived the techniques to be either effective or highly effective. The percentage of people who found the techniques moderately effective was 18.0%, while those who found them to be slightly effective and not effective were 6.7% and 2.6% respectively. Overall, the findings indicated that risk management techniques were generally perceived as effective in controlling cost overruns in construction projects.

5. DISCUSSION

The findings indicate that cost overruns have been prevalent in the construction projects with 30.0 percent suffering from overruns within the range of 5 to 10 percent. Price escalation of materials (78.7 percent), changes in design (70.0 percent), labor costs (64.0 percent) and delay of project (61.3 percent) are some of the main causes for cost escalation. These findings highlighted the importance of accurate cost estimation, effective planning, and early identification of financial and project-related risks.

Cost control (84.0%), risk identification (79.3%), and contingency budgeting (74.7%) were among the most popular risk management techniques used. In addition, 45.3% of respondents used quantitative risk analysis, while 40.7% performed scenario analysis. It was found out that 72.7% of respondents found the use of risk management techniques to be effective or highly effective. Therefore, it is possible to say that proper risk management plays an important role in controlling construction costs.

6. CONCLUSION

The above-mentioned research findings suggest that cost overrun is one of the serious and widespread problems of construction projects, which occurs with 30.0% of projects in terms of 5-10% of the cost overrun followed by 24.0% of the project cost overrun from 11-20%. The main causes of cost escalation include material price increase (78.7%), change and modification in design (70.0%), cost increase due to labour (64.0%), delay in the project completion (61.3%), and inaccurate cost estimation at the beginning of the project (58.7%). All these findings stress the necessity for proper planning, realistic cost estimation, and identification of the project risks as early as possible. The most common methods of risk management include regular cost monitoring and control (84.0%), identification and assessment of risks (79.3%), and contingency budgeting (74.7%). In addition, the relatively low popularity of the quantitative risk analysis (45.3%) and scenario/sensitivity analysis (40.7%) stresses the necessity of using more advanced approaches for risks assessment. Finally, 72.7% of the respondents think that risk management techniques are effective or very effective in managing cost overruns. Thus, the results of the research show that the effective identification of risks, regular cost monitoring, realistic estimation, proper project planning, effective contingency management, and application of analytical methods of risk management may help to avoid cost overruns.

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