

Project risk factors leading to construction cost overruns

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Abstract:

Most of the construction projects fail to be completed within cost and time. This study aimed to assess the project risk factors that lead to construction cost overruns. The study employed a quantitative research approach. A purposive sampling technique was used to source data from a sample size of 50 respondents. A survey questionnaire was used to collect data from professionals involved in designing and executing construction projects, based in Gauteng province in South Africa. The respondents include Architects, Engineers, Construction Project Managers and Quantity Surveyors. Data were analysed using the relative importance index. The top ten major causes of cost overruns were identified. Results revealed that incompetent contractors, lack of project risk governance, poor project controls, inadequate communication, inadequate planning, payment delays by project owners, inadequate knowledge about the project and its complexity, inaccurate estimates, ineffective decision-making process, and poor contract management are risk factors for cost overruns. Project management companies could use this study's results to improve project control effectiveness.

Keywords:

Construction projects, project cost overruns, project risk factors

1 Introduction

Infrastructure projects are complex and they consume lot of capital resources (Chigara, et al., 2013). The projects contribute significantly to improve socio-economic growth of a country. The projects are impacted by both cost and schedule delays. The risk of cost and schedule delays affect the project completion time and the budget to complete the project. This is cost overruns in terms of both schedule and project budget. Cost overrun factors must be identified and mitigated as part of risk management strategy to improve project performance (Memon, 2013). Kelly (2009) reports that substantial cost overruns have been identified in infrastructures across twenty nations in five continents; and the study found that nine out of ten projects, from a sample of 258 were subject to cost overruns. Cost affects construction activities throughout the project's life cycle and is a key parameter of project performance. Therefore, identifying causes of cost overruns will help in developing a management process to manage deadline driven complex capital projects (Allahaim and Liu, 2013). Enforcing project risk management at early stages of the project will assist in mitigating cost overrun risk factors. The main aim of this study was to evaluate the project risk factors that contribute to construction cost overruns. Identifying these factors at early stages of the project will assist project

managers to provide mitigations against possible shedule delays and to manage the project costs with the project budget.

2 Literature Review

Contractors and project owners are both affected by cost overruns in the delivery of infrastructure projects. Project construction complexity impacts the execution of a project and often has high risk of cost overruns (Oluwajana et al., 2022). The following risk factors were identified in the literature.

2.1 Planning and procurement-related risks

Inadequate planning of project activities can lead to cost overruns (Oluwajana et al., 2022; Ammar et al., 2022). Poor planning also affects poor procurement preparation of the construction activities (Lal & Mathew, 2022). The other factor associated with poor planning is inadequate equipment (Oluwajana et al., 2022). With proper planning, the timely deployment of equipment will assist with the execution of the construction activities without delays. Planning of construction activities should provide details of how the activities will be executed, how procurement will be done and how the resources will be sourced. Without this level of details, the contract duration will be poorly forecasted. Unrealistic contract duration can lead to project cost overruns (Albtoush et al., 2022; Badawy et al., 2022; Shashikanth & Prasad, 2021). An extension of time would be required, and this will affect the project costs (Rustandi et al., 2022).

2.2 Project experience and skills

Execution of project activities requires experienced project personnel and skilled resources. Inadequate management skills can affect the decision-making on the project, which could delay the execution of project activities (Vivek & Rao, 2021; Namous & Al Battah, 2021; Tahmasebinia & Song, 2022; Tahmasebinia & Song, 2022; Alekhya et al., 2021). The contractor's experience can also affect the resourcing of the project and execution of project activities (Namous & Al Battah, 2021; Oluwajana et al., 2022; Tahmasebinia & Song, 2022; Alekhya et al., 2021).

2.3 Scope change

A change in project conditions such as scope changes, specification changes, change orders, and design changes can lead to project cost overruns (Ammar et al., 2022; Albtoush, et al., 2022; Lal, & Mathew, 2022; Rustandi et al., 2022; Ajibike et al. 2022; Ahmed & Arocho, 2021; Oluwajana et al., 2022; Tahmasebinia & Song, 2022; Ammar et al., 2022; Alekhya et al, 2021). These changes affect both schedule and cost. The delay in approving the design and scope changes can lead to further cost overruns in terms of both time and cost (Fashina, 2021; Tahmasebinia & Song, 2022).

2.4 Site management and supervision

Management and supervision of construction works are some of the project risk factors which could lead to construction cost overruns (Radzi et al., 2022; Tahmasebinia & Song, 2022; Alekhya et al., 2021). Site management requires adequate human resources aligned with the construction activities. Inadequate resourcing can lead to project cost and schedule overruns (Radzi et al., 2022; Tahmasebinia & Song, 2022; Alekhya et al.,

2021). Meanwhile, adequate resourcing with lack or poor supervision affect the productivity of construction work. Poor productivity results in slow progress, leading to cost overruns because of schedule delays.

2.5 Delay of delivery of materials

The risk associated with the delay in construction material delivery could be due to inaccurate lead times during the project planning. This leads to project cost and schedule overruns (Ajibike et al., 2022; Namous & Al Battah, 2021; Oluwajana et al., 2022; Tahmasebinia & Song, 2022).

2.6 Inaccurate estimation

Cost estimation should be based on a reliable estimation tools and techniques. Inaccurate cost estimation can lead to poor project budgeting and cash flow projections. Inaccurate cost estimation can lead to cost overruns (Ammar et al., 2022; Fashina et al., 2021; Oluwajana et al., 2022). Accurate cost estimation will reduce cost variances during the execution of the project activities.

2.7 Financial risks

Project do experience financial-related risks such as fluctuation of the currency, material price changes and inflation (Badawy et al., 2022; Rustandi et al., 2022). The financial-related risks must be identified at the early stages of the project. Financial risk significantly impacts project success (Ajibike et al., 2022). The project manager must provide mitigation to avoid cost overruns.

3 Research Methodology

The study employed a quantitative research approach, and a survey questionnaire was used to collect the data. The survey questionnaire was completed by fifty participants across the built environment industry, mainly professionals with more than three years experience. The respondents included all industry practitioners both in the public and private sector i.e., Construction Project managers, Quantity surveyors, Architects, Civil Engineers, Electrical Engineers, Mechanical Engineers and Construction Managers. Purposive sampling was used to solicit research information from industry practitioners. The questionnaire comprised of Section A: Biographical Information and Section B: Cost Overruns Risk Factors.

Thirty-nine factors contributing to cost overruns were listed for respondents to rank. Respondents were requested to select these factors by using a five-point Linkert scale, meaning 5=major and 1=minor. The rationale for using the scale was to establish the level agreement amongst the professionals on which factors, exposes the projects to the risk of cost overruns. The contribution of each of the factors to construction cost overruns was evaluated. Relative Importance Index (RII) was used to rank the attributes as perceived by the respondents. Relative Importance Index (RII) was computed using equation:

$$RII = W / A * N \quad (0 \leq RII \leq 1)$$

Where:

W – represents the weight given to each factor by the respondents and ranges from 1 to 5, (where 1 is “Minor Influence” and 5 is “Major Influence”)

A – represents the highest weight (i.e., 5 in this case) and

N – represents the total number of respondents

The method has been used in similar studies such as (Sambasivan & Soon, 2007; Fallahnejad, 2013).

4 Research Findings

The results of the project risk factors contributing to project cost overruns are summarised in Table 1.

4.1 Biographical data

4.1.1 Distribution of highest qualifications

Results indicate that 57% of respondents hold bachelor's degrees, 7% of respondents hold Honours degrees, 12% of the respondents hold Master's degrees, 21% of the respondents hold National diplomas and 2% of the respondents hold college certificates. The overall pattern of responses shows a well-qualified participants for the study.

4.1.2 Number of years spent in the construction industry

Research findings indicate that 66. 67% of respondents have more than 10 years of construction industry experience. A total of 33.33% share the experience of two (2) to six (6) years working in the industry. The results indicate a well-experienced sample for the research study.

4.1.3 Managerial level held in the organisation

The findings in the section indicate that a total 73% of the respondents hold middle, senior and executive management positions, whilst 20% are at an intermediate level and 7% entry levels of management. Majority of the respondents were at the level of accountability and decision making in their respective organisation, which show the acceptable level of managerial level for the study. The overall demographic findings of highly experienced respondents combined with, educational credentials and level of managerial positions held at respective organisations; indicates that the sample is well-qualified and knowledgeable group. Responses can therefore be deemed to have been received from an informed group of participants.

4.2 Description of the results

Comparing the ten factors from each group shows high level of agreement amongst the professionals on which factors significantly influence poor cost performance. Lack of project risk governance structure was ranked first by three groups (Architect, Engineers and QS) and sixth by CPM. This is due to a lack of formalised risk management process with organisation throughout the project's life cycle. The ranking by CPM shows that in most instances they carry risk management responsibility during execution.

Design changes and incomplete designs during tender stage were ranked third (3rd) and fourth (4th) respectively by one group (QS). The sentiment shared by this group is because they rely on the designs for preparations of preliminary cost estimates and production of tender documents. Practice and experience show that design-related risk factors are prevalent in most construction projects. From their study conducted in Malaysia, Memon, Rahman and Azis (2011) found that poor designs and frequent design changes ranked first (1st) and 7th, respectively, amongst top ten cost overruns risk factors. Sharma and Goyal (2014) ranked design changes (1st) and improper design and delay in producing design documents. The results further indicate that there is no significant difference between the points of view of the four groups that responded to this study, except for three factors.

Table 1: Overall group RII ranking

No	Factor	RII	Ranking
1	Incompetent contractors	0.73	1
2	Lack of project risk governance structure	0.71	2
3	In adequate communication and slow decision making	0.67	3
4	Lack of appropriate planning	0.66	4
5	Poor project controls (cost and schedule)	0.64	5
6	Payment delays by clients	0.64	5
7	Lack of knowledge about the project and its complexity	0.63	7
8	Insufficient planning and inaccurate estimates	0.63	7
9	Ineffective decision-making process	0.63	7
10	Poor contract management	0.63	7

The results (Table 1) indicate incompetent contractor, lack of project risk governance structure, inadequate communication and slow decision making, lack of appropriate planning, poor project controls (cost and schedule), payment delays by clients, lack of knowledge about the project and its complexity, insufficient planning and inaccurate estimates, ineffective decision-making process and poor contract management as the top ten risk factors. These were also identified in Memon, Rahman and Azis (2011) as significant factors leading to project cost overruns. According to the respondents, incompetent contractors has the most negative influence on project cost performance as it, has ranked first amongst all factors.

4.2.1 Incompetent contractor

Poor contractor performance was a contributor to both cost and schedule overruns for groundwater projects in Ghana (Frimpong, Olowe & Crawford, 2003). A study by Sharma and Goyal (2014) reported incompetent sub-contractors as another contributing factor.

4.2.2 Lack of project risk governance structure

The findings are supported by a study done by Mbachu and Nkado (2007), which found that poor business and project risk management has major influence of cost overruns;

though their findings are not specific to lack of structure that deals with project risk governance, has to do with poor business and project risk management. Results of many studies globally revealed that inadequate planning, design changes and poor contract management are amongst the top-ranking factors. Continued prevalence of these factors could be attributed to structural deficiency in project risk management. Most of the factors ranked amongst the top ten have to do with project governance rather than physical implementation on the ground.

4.2.3 Inadequate communication and slow decision making

Slow decision making contributes to cost overruns (Srivastava & Patil, 2011). Slow information flow between parties and lack of communication between parties were found to be contributing to project cost overruns for projects in Malaysia (Memon et al., 2011). Other causes include information delays (Kikwasi, 2012), lack of communication between parties (Durdyev et al., 2012), and inadequate construction information for the contractor (Monyane, 2013).

4.2.4 Inappropriate planning

Poor planning was found to be a main causes of cost overruns reported by Sharma and Goyal (2014) for studies carried out in Nigeria and UK. A study by Durdyev et al. (2012) supports this finding that improper planning has a major influence to cost overruns. This is consistent with Oluwajana et al. (2022) and Ammar et al. (2022), whose studies found that inadequate planning of project activities can lead to cost overruns.

4.2.5 Poor project controls (cost and schedule)

In project controls which have to do with cost and time management, Mbachu and Nkado (2007) reported that inept cost management and time management challenges are the main contributing factors. Similar findings were observed in the study carried out by Ramabodu and Verster (2010) in the Free State province which revealed that lack of cost planning and monitoring is amongst the major causes of cost overruns.

4.2.6 Payment delays by clients

Delay in processing contractors' payment contributes to both cost and time delay, affecting the contractors' productivity on site (Baloyi & Bekker, 2011). Delays in progress payment by owner was also reported as the main contributor from a study by Sharma and Goyal (2014).

4.2.7 Lack of knowledge about the project and its complexity

Lack of knowledge is also found to be the main cause of cost overruns of construction projects in India (Sharma & Goyal, 2014).

4.2.8 Insufficient planning and inaccurate estimates

Inaccurate cost estimate was found to contribute to cost overruns in the transportation projects in Nigeria (Mansfield et al., 1994). Inaccurate estimates was also observed by Sharma and Goyal (2014), from the study done by Okpala and Aniekwu (1998) in Nigeria. Inaccurate cost estimate lead to project cost overruns (Ammar et al., 2022; Fashina et al., 2021; Oluwajana et al., 2022).

4.2.9 Ineffective decision-making process

Monyane (2013), in their South African study found that delays in decision-making by the government contribute to cost overruns. Slow decision-making has the highest impact on project cost overruns (Flybjerg et al., 2004). Inadequate management skills influence slow decision-making and it has an impact on the execution of project activities (Vivek & Rao, 2021; Namous & Al Battah, 2021; Tahmasebinia & Song, 2022; Tahmasebinia & Song, 2022; Alekhya et al., 2021). Delays in decisions were reported as the main contributing factor from the study by Sharma and Goyal (2014) in India.

4.2.10 Poor contract management

Poor contracts management was found to impact cost overruns in infrastructure projects in Nigeria (Baloyi & Bekker, 2011) and in construction projects in India (Srivastava & Patil, 2016).

5 Conclusion and Further Research

There are project risk factors that contribute to construction project cost overruns. The study's top ten project risk factors are centred around management and organisational process, the project owners, and contractors. These project risk factors are: Lack of project risk governance structure, Inadequate communication and slow decision making, Lack of appropriate planning, Poor project controls (cost and schedule), Payment delays by clients, Lack of knowledge about the project and its complexity, Insufficient planning and inaccurate estimates, Ineffective decision-making process, and Poor contract management. Failure to manage construction activities results from poor planning of all project lifecycle activities. The results also confirmed that a lack of formal project risk governance has a major influence on poor cost performance. The main cause of cost overruns is project management and project leadership-related factors.

This study contributes to the construction management practice in that project managers should assess project risks during the early stages of the project to ensure proper mitigation strategies during the project life cycle. Most of these risks are centred around planning. Inadequate planning leads to other factors such as contractor experience, cost estimation, and resourcing. Further research should focus on the risk mitigation strategies during the project life cycle to reduce the impact of these factors on the overall project schedule and cost.

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