Assessment of the mitigating measures for cost overruns in the South African construction industry

M Morena and C Amoah

Department of Quantity Surveying and Construction Management University of the Free State. Bloemfontein, 9300, South Africa

Abstract: This study investigated the causes of cost overruns and cost management methods to minimize cost overruns in the South African construction industry. The methodology used is a quantitative approach. Closed-ended and open-ended survey questions were used to gather data from 130 construction professionals, of which, 74 completed questionnaires were returned. The data received were analyzed by making use of both a computer programme called Statistical Package for Social Sciences (SPSS) and a content analysis method. The findings from the study revealed that the most common and significant causes of cost overruns were changes in the scope of work, decision making, planning, the inadequate experience of contractors, an increment of material prices, provision of weather conditions, unskilled labour, late design and lack of coordination. The findings also indicate the effects of cost overruns as disputes claims, extension of time, reduced profit to the contractor, and bad public relations. The study has identified cost management methods that can reduce cost overruns in the South African construction industry as effective planning, accurate estimate, tracking status of the project, use of scheduling tools, an inspection of works, communication, site meetings, proper methods of construction and evaluation of work completed. This study, therefore, suggests that all construction professionals must be equipped with factors of cost overruns in order to implement the correct measures to minimise cost overruns

Keywords: Keywords: Cost overruns, Cost management, Construction projects, South Africa

1. Introduction

The construction is considered as a major contributor to the economic activities in South Africa. It is used frequently by the government to stimulate development and helps financial recuperation from recessions [1]. The construction industry accounts for more than 10% of the world’s economy [2]. Memon et al. [3] demonstrate that the financial development of a nation depends on an expansive degree on the development business as it gives an essential framework, for example, roads, hospitals, schools, and other upgraded facilities. Likewise, it contributes essentially to the nation’s gross domestic product (GDP). Hence, it is important that construction projects are finished effectively within time, budget, and expected quality requirements. However, the construction industry is faced with issues, such as low quality and profitability, cost overrun, time overrun, construction waste, and others. Amongst these, cost overrun is a serious issue since it influences the overall advancement of the nation [1]. Construction is one of a kind industry that involves complex and dynamic procedures, and in South Africa, it has seen exponential growth, particularly after the World Cup that was held in 2010. But the industry has seen more projects being finished over budget and late. This issue has moved toward becoming a practice in the South African construction industry—the financial plan of projects expanded by an excess of 400% throughout the years [4].
The client and contractor have the main goal of finishing the project on time and within budget. This goal is for the client to utilize the end-result of the final product, which has value, and the contractor to end indirect expenditure as early as possible so as to begin with other projects [3]. The majority of the projects are completed over time and cost. Deferral in completion date brings about increment in cost as a result of tremendous aggregates held up, which bring no income. A portion of the projects frequently ends up uneconomical because of the time and cost overruns. According to Salim and Waghmare [5], time and money used unnecessarily is money and time wasted; hence, a proficient control framework must be utilized to accomplish the desired outcomes. Effective control must start at the early stage of the project, and it must be supported by appropriate and logical estimation and information examination [5].

As indicated by Mukuka et al. [6], cost overruns do not occur normally. They define cost overruns as the change in contract amount divided by the initial contract amount. Cost overruns can be defined as an excess of real cost over the spending plan. It is also sometimes called cost acceleration, cost increment, or budget overrun [7]. Cost is constantly a standout amongst the most imperative purposes behind the success of a project. For the most part, the greater part of the primary elements impacting project costs are subjective, like the significance of a customer on development time, the arranging capacity of the constructor, finding strategies, and some economic situations. A successful project is the one that can conquer the cost confines applied to it [8]. The construction project is thought to be the achievement when it applies the iron triangle limitations, which include; time, cost, and quality [9].

The management of project cost has been studied for a long time where most projects either fizzled or displayed cost overruns. Project usefulness, the management of the project, which demonstrates whether the project meets the financial plan, and assessment of the project, measures to perceive whether an undertaking is fruitful [10]. Great cost management of project cost is a critical undertaking for the effective finishing of a project. More often than not, it is hard to accomplish great cost management. Compelling cost planning relates the outline of structures to their cost so that while taking full thought of value, changes, risks, utility, and appearance, the cost of a project is wanted to be within the monetary limit of the expenditure [11].

Because of poor cost management nowadays, the construction industry is confronted with cost overruns. This has moved toward becoming a significant issue for the construction industry. Poor cost management is one of the biggest and most intense issues when it comes to project cost in South Africa and other developing nations [8]. According to Mulenga [12], to maintain a strategic distance from construction cost overruns, the first and most critical factor is to distinguish and comprehend the variables in charge of the overruns. Revamps during development as a consequence of design changes, mistakes, and oversight are the major contributors to cost overruns in projects. The cost overruns can mean a negative reputation for the design team and loss of client certainty. The repercussions for contractors are comparable as they see their net revenues shrivel [13].

Quantity surveyors are utilized to deal with the money related parts of the construction project. Nevertheless, cost overruns are typical on construction projects. The quantity surveyor must work with other team members in order to minimise cost overruns since they are cost specialists. The consciousness of the wellspring of cost overruns enables quantity surveyors to distinguish potential issue territories and to give exhortation on the best way to limit them [14]. Hence, the aim of this research is to gain insight into the cost management principles in the construction industry that may reduce the project cost overruns.

1.2. Objectives of the study
The main objectives of the study are:
1. To examine the determinants of cost overruns in the South African construction industry.
2. To examine the effects of cost overruns in the South African construction industry.
3. To determine cost management methods that are available for construction projects that will minimize cost overruns in the construction industry.
2. LITERATURE REVIEW

2.1 Definition of cost overruns
In the construction project, the cost is one of the factors that must be considered throughout the project’s life cycle, and it can be viewed as a standout amongst the most vital parameters of the project and the main force of project achievement. Despite its demonstrated significance, construction projects have been failing to accomplish their objectives within the predefined cost. Cost overrun can be defined as the change in contract amount divided by the original contract award amount [12]. Khabisi [10] states that cost overrun happens when the initial budget has been exceeded when calculating the final cost of the project. As the project progresses during the execution stage, the initial estimate also changes. Consequently, it is essential to be cautious with the budget that will be considered to compute the overrun of the project.

2.2 Causes of cost overruns
Cost overruns occur in the construction industry from project inception to completion, which is mainly attributed to the factors that have a severe impact on cost performance. South Africa is one of the countries that face the problem of cost overrun. As mentioned above, cost overruns are when the final cost of the project exceeds the budget amount [15]. According to the study conducted by Baloyi and Bekker [1], clients late contract award, increment in material cost, project complexity, increment in labour cost, change arranges by client amid construction, inaccurate material estimates, inaccurate quantity take-off, shortage of skilled labour, the contrast between chosen offer an expert estimate, and manpower shortage lead to cost overruns. Nkobane [16] conducted the study and the following were identified as the causes of cost overrun in the project: “increment of material prices due to economic and political conditions, the supply of raw materials and equipment by contractors, change of nearby money in connection to different monetary forms, delays in construction, price fluctuation, and absence of cost reports during the construction stage, project materials imposing business model by a few providers, delay in the preliminary handing over of the project, unpredictable weather conditions, labour unrest, terrible designation of specialists inside the site, delays in basic leadership by government, the disappointment of particular planning, delays in costing varieties and extra works, wrong choice of site, absence of cost reports amid development organize, delays in costing varieties and extra works, and overtime work hours of supervising workers.” Khabisi [10], also identified thirty-two variables of which, the following are rated as the top ten of causes of cost overrun: change in the extent of the task, income, and money related troubles looked by temporary workers, variation orders, delays in basic leadership, visit configuration changes, poor planning, absence of coordination between parties, wrong cost and time estimate, policy in accepting lowest tender, blunders, and exclusions in the plan, and off base amount take-off.

Sources of cost overruns are risk and uncertainties, technical errors in design and estimation, suspicious of foul play, managerial incompetence, deception and delusion, and corruption [17]. Causes of cost overruns according to Subramani et al. [18] are improvements because of wrong work, moderate basic leadership at the arranging phase of a task, poor contract administration, poor venture timetables and administration, poor plan, increments in the costs of materials and machines, land acquisition problems, long-term taken between the outline and the season of offering, and poor estimation. Shibani and Arumugam [8] on the other hand suggest the following as the main causes of cost overrun in India: financial limitations of the contractor, lack of knowledge when it comes to operating machines, ineffective equipment, outdated construction methods, site costs, transportation costs, machinery costs, labour costs, unreasonable time schedule, antagonistic political conditions, regular change of contractor, clashes between owners and other parties [8].

Mukuka et al. [6] identified the following factors that cause cost overruns: inadequate financial provision, inadequate planning, inaccurate estimates, variation orders, contractors inexperience, poor workmanship, overdesign, poor project management assistance, shortage of skilled site workers, insufficient time for estimation, change in project design, lack of executive capacity by the employer, and project complexity. Most recently, Al-Hazim et al. [19] investigated determinants of cost overruns and identified the following as the main culprits: “inaccurate quantity take-off, material price fluctuation, inadequate review and contract documents, cost underestimation, lack of coordination at the design phase, delay in supply of raw material and equipment, inaccurate
2.3. Effects of cost overruns

Cost overruns may have serious effects on project deliverables. Khabisi [10] presumed that cost overruns lead to time invade, expanded venture cost because of expansion of time, debate amongst proprietor and contractual worker, wastage of citizen’s cash, organization risk to bankruptcy, the diminished benefit to the temporary worker, mediation, add up to extend deserting, sitting assets, deferring in getting benefit by the customer, making worry for contractual workers, loss of certainty from general society, postponing the customers to return credits, obliteration and remaking, and case. As indicated by Mukuka et al. [6], the impact of cost invades include; development ventures delays, expanded undertaking cost because of augmentation of time, risk of organizations, venture relinquishment, under-usage of plant and gear bought for the task, secures customer's capital, under-use of labour assets.

Mulenga [12] recorded the following as the impact of cost invades expansion of time, loss of benefit, debate, low quality of work because of rushing the venture, terrible notoriety with compression group, end of agreements, makes worry of the customer, negative social effect, speeding up misfortunes, and prosecution. Time invades, spending overwhelms, low quality finished tasks, and terrible advertising, case, assertion, question and claims, and aggregate surrender [20].

2.4 Cost management methods

Cost management, according to Georgas and Vallance [21], is defined as “the process of planning and controlling the budget of a project. It includes activities such as planning, estimating, budgeting, financing, funding, managing, and controlling the cost so that the project can be completed within the approved budget and on time”. It also includes proactive strategies, productive arranging, administration of the site, project supervision, appropriate arranging and game plan of the project, sorted out the administrative instrument, and legitimate strategies for development [8]. Furthermore, organisational strategies, unmistakable fitting quality on past experience, standard coordination between the related gatherings, expanding human assets in the business, and finish organization of contractual workers are also said to be cost management strategies [8].

Standard gatherings on advancement, utilizing capable subcontractors and providers, attributing less weight to costs, and more weight to capacities and prior execution of contractors to improve the contracts and their procedures are some reactive and organisational strategies [8]. According to Lili [22], the specific cost management practice that must be followed are:

- Make reasonable construction period, reasonable prediction of construction period ensures a smooth implementation of the project, improve construction efficiency, and ensure project quality and economic benefits of the enterprises;
- Allocating human resources scientifically. In view of the uneven technical level and comprehensive quality of the labour forces, it is necessary to screen and allocate human resources reasonably, control construction pace and quality strictly, eliminate waste, and control the construction cost-effectively in the construction site;
- Control use of building materials account for as high as 70% of the total project cost, so reasonable control of the price and use of raw materials is a major content of project cost control, specifically purchase, transportation and use of building materials should be supervised and checked strictly, reasonable price of materials confirmed, use of material controlled properly, so as to reduce the building cost and control the project cost; and
- Effective control of issuing the certificate and design modification. In construction practices, changes in design schemes and construction plans are inevitable, which results in extra expenditures, so these changes should be considered in advance to make a reasonable budget.

According to Otim et al. [23], controlling project cost forms part of the cost management exercise. Below is the cost control techniques that may be used on site: Examination of works; Site gatherings; Recordkeeping; Work programs; Assessment of works completed; Project spending plan; and checking work and cost performance.
According to Memon [24], project managers should endeavour to remain within the extent of the work that was initially arranged. This is just in light of the fact that battling scope creep is one of the challenging tasks for the project manager. At the point when the project advances, request for things that were not planned for at the beginning of the project starts to come. The project is in danger when there is scope creep. The most important measure to apply controls and convince each and every stakeholder why scope creep can hurt the project. The creator additionally brought up that the partners in the venture ought to be in agreement. Utilization of powerful correspondence can help decrease the postponements by abstaining from working mistakes and by improving the booking of work. The utilization of booking instruments and graphs are good administration strategies in light of the fact that legitimate planning is fundamental in complex tasks. Since uncalled for booking can cause wrong cost estimations and increment the sit out of gear times of a portion of the colleagues. An essentially Gantt graph can be utilized or further developed venture planning apparatuses are accessible for booking. It is important that the project manager tracks the progress of all the activities at all times and uses different metrics to do so. This will give early flags of project delays, while additionally offering chances to settle the issues that happened previously [24].

Nkobane [16] stated the following as mitigation measures for cost overruns:

- Clearly defined project scope must be established at the beginning of the project;
- The front-end engineering and design or front-end loading must be executed according to industry guidelines;
- Project scheduling must be done in conjunction with the input from the trade contractors, construction contractors, and the owner; and
- Capital cost estimation and project cost estimations for project control must be implemented with guidance of the basic engineering together with input from trade contractors and construction contractors.

Memon et al. [3] conducted a study and pointed out the following as cost management methods: successful vital arranging, legitimate venture arranging and booking, compelling site administration and supervision, visit advance gathering, appropriate accentuation on past experience, utilization of experienced sub-temporary workers and providers, utilization of proper development strategies, utilize around date innovation use, clear data and correspondence channels, visit coordination between the gatherings, play out a preconstruction arranging of undertaking errands and assets needs, creating a human resource in the development business, complete contract organization, precise control component and enhancing contract grant technique by giving less weight to costs and more weight to the capacities and past execution of contractual workers are critical success factors for project cost control and management.

3. RESEARCH METHODOLOGY

The descriptive survey design was used as it gives a better account of features (e.g., behavior, opinions, abilities, beliefs, and knowledge of a particular individual, situation, or group) [25]. The random sampling method was used to select respondents from the lists of construction professionals. Random sampling makes it possible for each person within the population group to have the same chance of being included in the sample [26]. Welman et al. [26] suggest two steps that are necessary to draw a random sample: Firstly, the researcher should identify all the units of analysis in the sampling frame and give them consecutive numbers. Secondly, the method used to choose the units of analysis should be fair in order to allow equal opportunity for each number to be selected.

In following the view of Welman et al. [26], the researcher first acquired the lists of all the construction professionals operating from the Free State from the relevant professional bodies such as South African Council for Quantity Surveyors Profession (SACQSP), South African Council for Project and Construction Managers Profession (SACPMP), etc. In order to be included in the sample frame, respondents are supposed to have worked or currently working on construction projects. A structured survey questionnaire was distributed electronically via email to a total of 130 participants that were randomly selected. Blumberg et al. [27] state that using electronic means to solicit information has become ubiquitous in modern living as it is relatively less costly in comparison to the
personal interview. This method of data collection also guarantees the anonymity of respondents and hence makes it possible for the researcher to get unlimited access to participants, unlike the other types of interviews or surveys [27].

However, Blumberg et al. [27] state the disadvantages of this mode of data collection as the less information that the researcher obtains, and some participants may not cooperate with long questionnaires, as well as its high rate of non-responsive errors. To mitigate these limitations, a brief explanation regarding the purpose of the survey was given to the participants prior to the survey questions to draw the attention of the respondents on how relevant it is for them to participate. The research questions were also made to be simple in order not to waste the respondent’s time in filling in the questionnaire. According to Reja et al. [28], close-ended questions limit the respondent’s opinion on alternatives offered. Taking the view of Reja et al. [28], into consideration, closed-ended questions was adopted to extract the views of the respondents.

The participants of this study include architects, quantity surveyors, project managers, construction managers, and engineers. Out of 130 questionnaires sent out, 74 completed questionnaires were returned, resulting in a response rate of 56.92%. Section A of the questionnaires aims at gaining demographic data, whereas Section B was assessing determinants of cost overruns, effects of cost overruns, and cost management methods that can be used to mitigate cost overruns in the construction industry.

Quantitative data received from the closed-ended questionnaire were analysed using a computer programme called Statistical Package for Social Sciences (SPSS) to calculate descriptive statistics such as mean and standard deviation. The open-ended questions were analysed through quantitative content analysis whereby similar characteristics and concepts were merged. Content analysis is the process of analysing verbal or written communications in a systematic way to measure variables quantitatively [29]. The features of the respondents are as follows;

3.1 The profession of the respondents
Out of 74 respondents who responded, 45% of them were quantity surveyors, 23.6% were construction managers, 14% were civil engineers and contractors respectively, 12% were architects, and 5.4% were project managers.

3.2 Respondents work industry
Sixty-four point five percent (64.50%) of the respondents work for consultants, 25% work for a contractor, and 10.5% work for the Department of Public Works.

3.3 Respondents education background
Bachelor’s degree represents the largest sample at 45.6%, followed by Honours degree at 20.2%, Masters at 18%, other at 14.8%, which is Diploma and Matric certificate, Ph.D. at 1.4%.

3.4 Number of the project being done by the respondents
Thirty percent (30%) of respondents were involved in more than 40 projects whilst 21.4% of respondents were involved in projects ranging from 30 to 40. Again, 20% of respondents were involved in projects between 20 to 30, whilst 18% of respondents were involved in projects between 10 to 20. Nine percent (9%) respondents were involved in projects that range from 5 to 10 projects, and 2% of respondents were involved in projects that are less than 5.

4. DISCUSSION OF THE RESULTS

4.1 Causes of cost overrun
Respondents were asked to determine from a list of factors likely to cause cost overruns for construction projects based on their experiences. The objective of this question was to know the determinants of cost overruns in the construction industry from a professional point of view. The findings, as indicated in Table 1, indicates that changes in the scope of work are considered as having the greatest influence on cost overruns, which ranked 1 (mean=4.50).
Table 1: Causes of cost overruns

| Causes of cost overruns               | Mean | Standard Deviation | Rank |
|--------------------------------------|------|--------------------|------|
| Changes in the scope of work         | 4.50 | 0.72               | 1    |
| Decision making (project team)       | 4.25 | 0.75               | 2    |
| Lack of project planning             | 4.25 | 0.75               | 2    |
| Inadequate experience of contractors | 4.21 | 0.78               | 3    |
| Increment of material prices         | 4.09 | 0.79               | 4    |
| Provision of weather conditions      | 4.09 | 0.79               | 4    |
| Decision making by the client        | 4.39 | 0.80               | 5    |
| Unskilled labour                     | 4.36 | 0.81               | 6    |
| Late design information              | 4.35 | 0.83               | 7    |
| Lack of coordination                 | 4.35 | 0.83               | 7    |
| Inaccurate quantity take-off         | 3.87 | 1.12               | 8    |

Respondents believe that in most cases, clients make changes to the scope after the commencement of the project, and this adds extra cost to the originally approved budget. The second-ranked factors that cause cost overruns are the decision making by the project team and lack of project planning, respectively (mean=4.25). Inadequate experience of contractors was ranked 3 (mean=4.21), followed by an increment of material prices and provision of weather conditions which was ranked 4 (mean=4.09), decision making by the client was ranked 5 (mean=4.39), unskilled labour was ranked 6 (mean=4.36), late design information and lack of coordination were both ranked 7 respectively (mean=4.35), and inaccurate quantity take-off was ranked 8 (mean=3.87).

These findings were similar to the findings by Al-Hazim, Salem, and Ahmad [19], where material price changes, delays in decision making, and weather conditions were revealed to be the major causes of cost overruns. Furthermore, the results were similar to the results shown by Salim and Waghmare [5], where poor planning, monitoring, and lack of experience by the contractor was identified as the major causes of cost overruns. However, the results were not in agreement with the study by Mulenga and Bekker [12], where unclear initial project brief, inadequate geotechnical information and undermining escalation in prices were identified as major causes of cost overruns.

4.2 Effects of cost overruns

Respondents were asked to indicate the consequences of cause overruns on construction projects based on their experiences. This question aimed to know the impact of cost overruns in the construction industry. The findings, as indicated in Table 2, shows dispute claims as to the major effect of cost overruns and are ranked 1 (mean=4.45).

Table 2: Effects of cost overruns

| Effects of cost overruns               | Mean   | Standard Deviation | Rank |
|---------------------------------------|--------|--------------------|------|
| Disputes claims                       | 4.45   | 0.70               | 1    |
| Extension of time                     | 4.38   | 0.75               | 2    |
| Reduced profit to the contractor      | 4.33   | 0.84               | 3    |
| Project abandonment                   | 4.29   | 0.87               | 4    |
| Bad public relations                  | 4.25   | 0.91               | 5    |

The second-ranked effect of cost overruns is an extension of time (mean=4.38). This is followed by reduced profit to contractor, ranked 3 (mean=4.33), followed by project abandonment, raked 4 (mean=4.29), and lastly, bad public relations, which is ranked 5 (mean=4.25). These findings
were found to be similar to the findings of Khabisi [10], where time overruns, disputes between client and project team, and loss of confidence by investors were revealed as major effects of cost overruns. However, the findings of the current study were in disagreement with the study by Mukuka et al. [6], where the risk of organization, venture relinquishment, and under-usage of labour assets was identified as major effects of cost overruns in construction projects.

4.3 Cost overruns mitigation methods
Respondents were requested to rate on a 4-point scale on their agreement or disagreement of the cost management methods to mitigate cost overruns in construction projects. The respondents were to select from the following scale, strongly disagree, disagree, agree, and strongly agree. Respondents ranked effective and efficient planning first (mean=4.47), followed by accurate estimate, tracking the status of the project, and monitoring and controlling project cost (mean=4.42; rank=2), respectively.

| Management method to reduce cost overruns | Mean | Standard Deviation | Rank |
|-----------------------------------------|------|--------------------|------|
| Effective and efficient planning        | 4.47 | 0.71               | 1    |
| Accurate estimate                       | 4.42 | 0.74               | 2    |
| Tracking status of the project          | 4.42 | 0.78               | 2    |
| Monitoring and controlling project cost | 4.42 | 0.78               | 2    |
| Use of scheduling tools                 | 4.11 | 0.83               | 3    |
| Inspection of works                     | 4.11 | 0.83               | 3    |
| Proper methods of construction          | 4.11 | 0.84               | 3    |
| Communication                           | 3.56 | 0.89               | 4    |
| Site meetings                           | 3.03 | 1.11               | 5    |
| Evaluation of work completed            | 3.03 | 1.13               | 5    |

The next management method that can be used to mitigate cost overruns were identified as the use of scheduling tools, an inspection of works and proper methods of construction (mean=4.11; rank=3) respectively, communication (mean=3.56; rank 4), site meetings (mean=3.03; rank=5) and evaluation of work completed (mean=3.03; rank=5). These findings were also found to be similar to the findings of Otim et al. [23], where work programs, checking work, and cost performance were major cost control methods that can be used to mitigate cost overruns. However, the findings were different from the study conducted by Memon et al. [3], where site meetings, utilization of experienced labours, and complete contract organization were identified as major management methods that can reduce cost overruns.

5. CONCLUSION AND RECOMMENDATION

Results reveal that cost overruns can be reduced in construction projects. However, most of the construction projects are still facing the problem of cost overruns. The study revealed that change in scope of work, decision making, planning, the inadequate experience of contractors, and increase of material prices are the most common and significant factors causing cost overruns in the South African construction industry. Furthermore, the study identified cost management methods that can minimize cost overruns as effective and efficient planning, accurate estimate, and tracking status of the project and the use of scheduling tools. The study recommends that professionals in the construction industry should always do proper planning, estimating, managing, and controlling the cost in construction projects. The project team should implement an effective project reporting system to increase the likelihood of project success, and for these to happen, the project team should be equipped with causes of cost overruns at all times during the project implementation.
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