The impact of cost overruns and delays in the construction business

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Abstract: The construction industry is negatively affected by cost and time overruns which further negatively impacts the contractual stakeholders. Construction delays and cost overruns are a global phenomenon since one of the major problems in the construction industry involves unexpected incurred costs and late delivery of projects. The success and failure of any project depends upon many factors and the Project Manager is considered to be the key contributor to the success of any project, as well as to guide the team members to achieve the client satisfaction. In addition, the roles, responsibilities, duties, and competencies of Project Managers have a direct impact on successfully completing construction projects on time and within budgeted cost. The study aimed to find the key competency skills that the Project Manager must possess to mitigate time and cost overruns. A quantitative research approach was adopted to determine the key competency skills of a Project Manager with respect to cost and time delays. A web-based questionnaire was published in the Eastern Cape Masters Builders Association (MBA) bulletin aimed at contractors registered with the association. The results revealed that the key competencies required to mitigate for cost overruns are comparable to those required to mitigate against time overruns. The study investigated the need for project managers to better equip themselves with key competency skills to perform optimally to reduce the occurrence of cost and time delays on construction projects. The aim of this research was to assist Construction Managers to choose the right candidate as a Project Manager. It would also assist inspiring Project Managers to acquire the key competency skills. The paper responds to the conference theme given that the reduction of cost and time overruns promotes the sustainability of the Built Environment.

Keywords: Contractor, Construction industry, Cost overruns, Project manager, Time overruns

1. Introduction
The construction industry is a good indicator of economic performance and growth in a country, it also contributes significantly to the Gross Domestic Product (GDP) of many countries, South Africa included. Hansen-Addy [1] noted that the construction industry significantly contributes to job creation in many economies, which therefore places much importance of its impact on a nation’s GDP.

Despite the progressive economic potential, the construction industry faces challenges of cost and time overruns which has an undesirable impact on the contractual parties involved in the project. Construction delays and cost overruns are a world-wide phenomenon since one of the major problems in the construction industry involves unexpected acquired costs and the late delivery of projects [2].

Flyvbjerg [3] studied 258 projects across the world and concluded that 90% of construction projects are experiencing cost increases and delays. The award of the 2010 FIFA World cup in South Africa resulted in ten stadia being upgraded or newly constructed. Almost all the projects experienced time and cost overruns [4]. The initial budgeted cost of the Johannesburg Soccer City was R 2.2 billion and the final cost amounted to R 3.7 billion. Moses Mabhida stadia experienced a 68% increase in cost while Mbombela stadia had an increase of 66%. The results of the study indicated that the increase in material cost was the largest single contributor for the delays and cost overruns.

Researchers have investigated the significant factors that lead to time overruns and time delays. It was found that design changes, cash flow, and poor management are the most significant factors. The
circle of investigation into overruns cannot be complete unless established critical factors are matched against respective mitigation strategies to control the occurrence in which the overruns occur. That is why Roslan and Zainun [5] investigated the factors of cost and time overruns due to their existence in the various stages of the project lifecycle. The main causes were then aligned with possible matching mitigation strategies. Another study conducted by Olawale and Sun [6] further categorised the mitigation measures according to the broad function they measure; Preventive, Predictive, Corrective and Organisational measures respectively.

The success and failure of any project depends upon many factors. Speculand [7] noted that nine out of ten projects failed due to incompetent project managers. Project Managers are considered to be the key contributor to the success of any project, as well as to guide the team members to achieve the client satisfaction. In addition, the Project Managers’ roles, responsibilities, duties, and competencies have a direct impact on the success of construction projects. Abdulsamadi- Ali and Chiseshe [8] study show that there is an extremely strong correlation between the Project Manager and the success of the construction projects.

There are several competency skills that a Project Manager must have in order to prevent cost overruns and to control time delays. A quantitative research approach was adopted for this study to determine the key competency skills for a project manager to adopt in order to mitigate the occurrence of cost and time overruns. A web-based questionnaire was published in the Eastern Cape Master Builders Association (MBA) bulletin, targeting contractors that are registered with the association. The average scores from the respondents were calculated, tabulated and used to determine the key competencies. Based on the results from the respondents, it was found that the key competency skills needed to mitigate cost overruns were comparable to those required to manage time overruns.

2. Literature review

2.1 Cost Overruns defined

A cost overrun is simply defined as an excess of actual cost over budget [6]. A cost overrun may also be referred to as "cost escalation," "cost increase," or "budget overrun". According to Singh [9] cost overruns are unforeseen costs incurred in excess of an estimated amount due to an under-estimation of the actual cost. Shakantu [10] views cost overruns as simply an incidence, where the final or actual cost of a project surpasses the original or initial estimates. Furthermore, cost overruns may be viewed as the percentage of actual or final costs over the estimated or tender cost of a project.

In construction, cost overruns are considered as one of the most important problems that impede projects progress, since it reduces the contractor’s profit leading to enormous losses, and leaving the project in great troubles. Construction cost is one of the peak criteria of success of a project throughout its lifecycle and is of high concern to those who are involved in the construction industry.

2.1.1 Significant factors causing cost overruns

Allahaim and Liu [11] conducted a study on various infrastructure projects which spanned five continents to investigate the causes of cost overruns. The aim of the research was to develop an empirical based classification of the major causes of cost overruns. The major causes were identified and classified by the author as follows:

- Planning and control uncertainty – The author identified planning as key in project planning. Similarly, a study by Buba and Tanko [12] identified that a project to succeed, proper planning must be developed in order to improve cost controls. Panthi, Farooqui and Ahmed [13] stated that construction businesses should look at utilising four basic management tools which are; planning, organizing, leading and controlling to improve their cost controls and reduce cost increases problems. Furthermore, the causes under planning were the lack of experience by project managers, strategic misrepresentation, changes in materials and equipment, design error, poor financial control on site, waste on site, shortage of site workers, poor site management and communication, lack of coordination, equipment availability and lack of implementation of technology.
• Change in scope – Scope change occur due to alterations in design of architectural, structural or service components. This is often the results of the client’s change of plans or scope [14]. According to Allahaim and Liu [11] the main causes of scope change resulted from unrealistic designs from owners and changes due to omissions. Smith [15] also identified that scope changes are client related cost overruns that usually occur due to variations made by the consultants.

• Site conditions – These are causes related to environmental issues, social and culture impact. This issues can lead to increases to the uncertainty of tasks and outcomes, which can make planning and estimating difficult. The increasing of the environmental requirements impacts on construction operations [11] for example, environmental issues such as unexpected geological conditions can lead to increases in the uncertainty task and outcomes which can make planning and estimating difficult. Khoshgoftar, Bakar and Osman [16] identified site conditions as major impact of cost overruns in Iranian building projects. The author said that the measurement of environmental issues has many consequences in the construction industry which results mainly the increase of costs of construction projects and the time taken to process design, planning and construction life cycle. The public exposure of the project over their environmental impact had adverse impact on the project itself which can lead to the abandonment or cancellation of the project itself. According to Allahaim and Liu [11] the British Rail’s high-speed link to Channel Tunnel had cost overruns of up to US$ 1.4 billion as a result of changes in site conditions.

• Market Fluctuation – The author mentioned that such conditions can be experienced when the prices of labour and materials required to construct a project fluctuate unpredictably, or when government regulations change unpredictably, which leads to increase in cost construction. Market related uncertainties affect both project duration and cost [17]. The researcher said that the manager must consider all kinds of resources in the design of construction to ensure that the resources match each other and adjust other types of resources when the availability of any resource is raised or lowered by uncertainty. This classification of cost overruns includes monthly payment difficulties by the client, slow payments of completed works, cashflow during construction, market conditions, fluctuation in money exchange rates, high interest rates charged by banks, fraudulent practises, political complexities, practise of assigning contract to lowest bidding, laws and regulatory framework.

2.2 Time Overruns

Time overruns are defined as extra time required to finish a given project beyond its original planned duration, whether compensated for or not [18]. According to Singh [9] time overruns are defined as the difference in time between the actual and the initially planned dates of completion. Time overruns can also be defined as an act or event that extends the time to complete or perform an act under the contract [19] The author also defined time overruns as simply the time overrun either beyond the completion date specified in a contract or beyond the date that the parties agreed upon for delivery of a project. It is a project slipping over its planned programme and is considered a common problem in construction projects globally.

Delivering projects within the contract stipulated time is one of the yard sticks of measuring a successful project. Despite its proven importance, it is not uncommon to see construction projects failing to achieve their objectives. However, construction projects schedule overruns have negative impacts on all construction parties including the client. The factors of delays studied in a project development project were typically classified as time delays. In the study, it was found that the top ten major factors that contributed to project delays was, poor site management by the contractor, weather conditions, poor site conditions, incomplete documents from the consultant, lack of experience on the part of the consultant’s site staff, financial problems of the contractor, contract modifications by the client, construction mistakes and defective work by the contractor, delay in approving major changes in the scope of work by the consultant and lastly, contractor having coordination problems with other parties [20].

2.2.1 Significant factors causing time overruns
Enshassi, Kumaraswamy and Jomah [21] classified the construction delays into compensable delay, critical delay, non-critical delay, excusable delay and concurrent delay. They were classified as follows:

- A compensable delay is one where a contractor is entitled to financial recovery in the form of direct and indirect time related costs arising from an employer risk event. These are delays due to late instruction by the project manager or chief consultant, variation due to owner and late commencement of construction works due to the owner.
- Critical delay is a delay to the progress of any activity on a critical path of a project, which causes delay to the project completion. Critical delays depend on the project itself, contracts plan, contracts sequence and all the physical constraints of the project.
- Excusable delay is a delay for which a contractor will have relief from damages and potential financial entitlement depending on contractual circumstances. The types of delays under this category includes labour strikes, natural disasters (fires, floods, earthquakes), changes initiated by the owner errors and omissions in plans.
- Non-excusable delay is a delay caused by contractor. Under this category is delays caused by mobilisation, late performance by suppliers, faulty workmanship by contractor and late performance by subcontractors.

2.2.2 Causes of cost and time overruns due to project managers’ incompetency

It is evident that Project Manager’s competency is key for any construction projects to succeed. Competence refers to the skill and capacity required to complete assigned activities within the project’s constraints [22]. Explained from a semantics perspective, ‘competence’ has been used to define a particular knowledge or observable characteristics, whereas ‘skills’ are an amalgamation of expertise and facilities, mixed together by organisation process and culture [22]. The author further explained that if a project manager does not possess the required competences, performance can be jeopardised.

Major causes of cost overruns and delays are caused by poor project management practices. Academic scholars equally noted the importance of project management competency noting that lack of improvement in project performance would cause a tremendous stride in cost control, quality and time taken to finish a construction project [23].

The responsibilities of project managers range from project administrators to construction team leaders. To effectively execute a project, the latter needs to possess a unique set of knowledge and competencies [24]. Project management professional competencies can be achieved through a combination of knowledge gained during training, skills developed through working experience and finally, the application of the previous knowledge acquired. The knowledge that a project manager has is very distinctive from that of other construction professionals, such as critical path analysis and project cash flow forecast.

Nkando and Meyer [25] identified the competencies of project managers under three distinct categories as follows:

- Key competencies – the personal, interpersonal, financial control, leadership style, design abilities, professional practice and business competencies common to all pathways and compulsory for all candidates for planning costs and budgets. Risk management, planning, site organisation, decision-making and coordination are key for the time management of a project.
- Core competencies – the primary competencies of your chosen APC pathway, which may include business skills, law, measurement and practical project management.
- Optional competencies – a set of competencies selected by the candidate. These are mostly technical competencies, but certain mandatory competencies also appear on the optional competency list and candidates are permitted to select one of these at a higher level.

2.3 Effects of project delays
The impact of cost overruns has evident effects in the construction industry. Mukuka, Aigbavboa and Thwala [18] investigated the consequences that will occur when the causes of cost and time are not identified and worked on effectively. The authors identified the effects and ranked them as follows:

- Cost overrun: The effect of cost overruns to the client implies added costs to the agreed contract sum, resulting in less returns on investment.
- Time overrun: Time delay might have the incapacitating effect on contracts and consultants in terms of growth in adversarial growth.
- Dispute and Claims: Disputes and claims arise because of the losses incurred through schedule overrun.
- Litigation: Disputes, due to schedule overruns, can lead to court cases for resolution especially when large penalties are at stake.

3. Research methodology
A quantitative research method was carried for this study. A quantitative research examines the relationships between variables, which are measured numerically and analysed using a range of statistical and graphical techniques [26]. Data was obtained in the form of structured questionnaire which allowed for precise, objective and reliable results. The research method used was the mono-method. Data was collected using both the secondary data collection and primary data collection methods. Secondary data was mainly used in the evaluation of literature, collected from peer-reviewed journals, books and online sources. The primary data was made in the form Questionnaire which supports the use of interval Likert scales to measure data and allows for use of descriptive statistics to analyse data [26].

A structured questionnaire survey was designed in Microsoft excel with four sections namely; demographics, the causes of cost overruns, the causes of time overruns and the general section. In sections B and C, the respondents were allowed to voice out their opinions or outline further comments not covered by the section. A 5-point interval Likert scale was used to obtain the opinions of the respondents for the analysis of the data.

A pilot questionnaire was distributed to four Project Managers to validate the questionnaire’s quality. The questionnaires were distributed electronically via the Eastern Cape Masters Builders Association (MBA) bulletin targeting contractors that are registered with the association. There were approximately 208 building contractors registered with the MBA. Responses were received from 54 contractors which represents a response rate of 26%.

4. Results and findings

4.1 Demographics of respondents
The majority of respondents were Project Managers as the study was only targeting Project Managers.

- 83% of the respondents were male.
- 37% of the respondents were 50 years and older.
- 33% of the respondents hold a National Diploma.
- 50% of the respondents have spent more than 15 years in the Built Environment.
- 41% of the respondents fall under the construction management constituency.

4.2 Causes of cost overruns
Hypothesis 1 stated that the lack of key competency skills by Project Managers is a direct result of cost overruns. Project Managers were asked to determine the level of importance and evidence relating to the Project Managers’ key competencies concerning the causes of cost overruns. Tables 1 and 2 examined the data by ranking the level of importance and evidence on the Project Managers’ key competencies. The mean for each factor was recalculated as a percentage and ranked based on the level of importance and evidence of each factor.
Table 1 Competencies of a Project Manager (Importance)

| Ref  | Project Managers' key competencies                              | %     | Rank |
|------|-----------------------------------------------------------------|-------|------|
| Q2-1 | Planning and control                                           | 98%   | 1    |
| Q2-3 | Financial control on site                                      | 94.4% | 2    |
| Q2-2 | Application of project budget techniques                       | 94.1% | 3    |
| Q2-4 | Management of cashflow                                         | 92.2% | 4    |
| Q2-10| Strategic implementation                                       | 87.4% | 5    |
| Q2-12| Decision making                                                | 77.0% | 6    |
| Q2-11| Leadership style                                               | 73.1% | 7    |
| Q2-5 | Communication on site                                          | 73.0% | 8    |
| Q2-8 | Implementation of technology                                   | 70.0% | 9    |
| Q2-13| Negotiation skills                                             | 68.9% | 10   |
| Q2-15| Business skills                                                | 67.4% | 11   |
| Q2-6 | Coordination                                                   | 67.0% | 12   |
| Q2-14| Personal and interpersonal skills                               | 66.7% | 13   |
| Q2-7 | Design abilities                                               | 63.0% | 14   |
| Q2-9 | Arbitration and dispute resolution                             | 57.0% | 15   |

Table 2 Competencies of a Project Manager (Evidence)

| Ref  | Project Managers' key competencies                              | %     | Rank |
|------|-----------------------------------------------------------------|-------|------|
| Q2-1 | Planning and control                                           | 97.0% | 1    |
| Q2-2 | Application of project budget techniques                       | 95.2% | 2    |
| Q2-4 | Management of cashflow                                         | 93.3% | 3    |
| Q2-3 | Financial control                                             | 92.2% | 4    |
| Q2-10| Strategic implementation                                       | 85.2% | 5    |
| Q2-12| Decision making                                                | 71.9% | 6    |
| Q2-8 | Implementation of technology                                   | 71.5% | 7    |
| Q2-5 | Communication on site                                          | 71.1% | 8    |
| Q2-11| Leadership style                                               | 70.0% | 9    |
| Q2-15| Business skills                                                | 68.1% | 10   |
| Q2-13| Negotiation skills                                             | 67.4% | 11   |
| Q2-14| Personal and interpersonal skills                               | 66.7% | 12   |
| Q2-6 | Coordination                                                   | 64.8% | 13   |
| Q2-7 | Design abilities                                               | 63.0% | 14   |
| Q2-9 | Arbitration and dispute resolution                             | 57.8% | 15   |

Results in Tables 1 and 2 revealed that:
• Planning and control was ranked highest in terms of level of importance and evidence. A score of 98% was achieved for level of importance and 97% for the level of evidence.
• Financial control on site was ranked second place with a score of 94.4% and ranked fourth place for the level of evidence with a score of 92.2%.
• Ranked number three was the application of project budget techniques with a score of 94.1% and second place for the level of evidence with a score of 95.2%.
• Ranked fourth place for the level of importance was the management of cashflow with a score of 92.2% and third for the level of evidence with a score of 93.3%.
• Ranked fifth for the level of importance was the strategic implementation with a score of 87.4% and also fifth for the level of evidence with a score of 85.2%.

Based on the findings, financial control, planning and control, application of project budget techniques, management of cashflow and strategic implementation were recommended as the key competency skills by the Project Managers.

4.3 Causes of time overruns

Hypothesis 2 stated that the lack of key competency skills by Project Managers is a direct result of time delays. Project Managers were asked to determine the level of importance and evidence relating to the Project Managers’ key competencies concerning the causes of time overruns. Tables 3 and 4 examined the data by ranking the level of importance and evidence on the Project Managers’ key competencies. The mean for each factor was calculated and ranked based on the level of importance and evidence of each factor.

| Table 3 Competencies of a Project Manager (Importance) |
|--------------------------------------------------------|
| **Ref** | **Project Managers’ key competencies** | **Mean** | **Rank** |
| Q3-4 | Planning and scheduling | 4.87 | 1 |
| Q3-1 | Time management techniques | 4.85 | 2 |
| Q3-3 | Application of construction methods | 4.67 | 3 |
| Q3-13 | Risk management | 4.57 | 4 |
| Q3-6 | Decision making | 4.56 | 5 |
| Q3-9 | Timeous material ordering | 4.50 | 6 |
| Q3-11 | Strategic implementation | 4.43 | 7 |
| Q3-5 | Communication skills | 3.59 | 8 |
| Q3-8 | Site organisation | 3.50 | 9 |
| Q3-2 | Conflict management techniques | 3.41 | 10 |
| Q3-10 | Management of cashflow | 3.35 | 11 |
| Q3-7 | Management of labour | 3.33 | 12 |
| Q3-12 | Procurement and financial management | 3.30 | 13 |

| Table 4 Competencies of a Project Manager (Evidence) |
|-----------------------------------------------------|
| **Ref** | **Project Managers’ key competencies** | **Mean** | **Rank** |
| Q3-1 | Time management techniques | 4.85 | 1 |
| Q3-4 | Planning and scheduling | 4.81 | 2 |
| Q3-3 | Application of construction methods | 4.67 | 3 |
| Q3-6 | Decision making | 4.53 | 4 |
Results in Tables 3 and 4 revealed that:

- Planning and scheduling and were ranked first and second place respectively for the level of importance with a mean of 4.87%. Time management techniques was rated second place for the level of importance and first place for the level of evidence with a mean of 4.85, planning and scheduling was ranked second place with a mean of 4.81.
- Application of construction methods was ranked third place for the level of importance with a mean score of 4.67 and in the same way for the level of evidence.
- Risk management was ranked fourth place for the level of importance with a mean score of 4.57 and fifth place for the level of evidence with a mean score of 4.52.
- Decision making was ranked fifth for the level of importance with a mean score of 4.56 and fourth place for the level of evidence with a mean score of 4.53.

Based on the findings, planning and scheduling, time management, application of construction methods, decision making and risk management were recommended as key competency skills by the Project Managers.

5. Conclusion
Cost overruns are one of the critical problems faced in the construction industry. A project may be considered to be a successful project only when it is completed within the budgeted cost. Studies revealed that the success and failure of any project depends upon many factors. It is noted that the Project Manager is considered the key contributor to the success of any project. Thus, the objective of the study was to investigate the main causes of cost and time overruns. The study also aimed to determine the key competency skills necessary for Project Managers to mitigate against cost and time overruns. The study further investigated the effects of project delays and mitigation measures thereof. Based upon the various literature reviews, key competency factors required by the Project Manager to control cost and time overruns were identified. A quantitative research approach was followed using a structured questionnaire. Based upon the findings it can be concluded that the key competencies needed for cost overruns are comparable to the key competencies needed to manage time overruns. The study discovered that the key competencies for preventing cost overruns were financial control, planning, and control, application of project budget techniques, management of cashflow and strategic implementation. The key competencies for time overruns was planning and scheduling, time management, application of construction methods, decision-making and risk management.

6. Recommendations
It is recommended that the South African Council of Project and Construction Management Professionals (SACPCMP) be encouraged to focus and emphasise on the key competency that which affect cost and time delays. It is suggested that the Project Managers need to equip themselves with knowledge of cashflow, budgets, planning and scheduling, risk management and strategic implementation. This will positively benefit construction firms, clients and other key stakeholders.
involved in construction industry. Contractors should look at appointing Project Managers with a proven track record of completing projects within the allocated time and budget.

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