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MANAGEMENT

EVALUATION OF THE FACTORS CAUSING COST AND TIME OVERRUN IN
THE NAMIBIAN CONSTRUCTION INDUSTRY

PREPARED BY

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS OF MSC IN PROJECT MANAGEMENT

UNIVERSITY OF CAPE TOWN

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13 JUNE 2022

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ACKNOWLEDGEMENTS

First of all, I would like to praise the Lord for giving me the strength and good health to endure the challenging academic work while pursuing my professional career. I would also like to express my sincere appreciation for my supervisor, Professor Abimbola Windapo, for her invaluable guidance, critiques, and professionalism through this research work.

I would like to acknowledge the people who have been supportive in the completion of this research work. It has been very challenging task, especially while practicing in the engineering industry. Furthermore, I would like to express my gratitude to my family for giving me the encouragement to persevere through this research as I was going through personal challenges. With special thanks to my brother, Kaleb Gizaw Negussie, for reading through my dissertation and giving me corrections.

Last but not least, I would like to thank my friend, Fitsum Abadi, for his support and assistance in giving me valuable input at different stages of the research.

ABSTRACT

Cost and time are one of the two primary parameters that require due considerations throughout the project lifecycle and are the determining factors for project success. However, it is very common that many projects fail to achieve their goal of being completed within the planned budget and schedule. Several articles on cost and time overrun in the construction industry worldwide, holistically, and locally, were reviewed. However, limited studies were conducted in the Namibian construction industry. It is against this background that this study investigates the factors causing time and cost overrun in the Namibian construction industry and posits strategies to mitigate cost and time overrun on construction projects.

The study adopted a quantitative research approach that employs a survey research design in data collection from a sample drawn from a population of professionals in the Namibian construction industry. The survey instrument — a questionnaire — was administered via email. The data collected was analysed using descriptive and inferential statistics comprising of means, percentages, Relative Importance Index (RII) and Spearman Correlation.

The study found that five of the main factors contributing to cost overrun on the construction projects in Namibia from a ranking perspective are contractors' financial constraints, inadequate contractor experience, inefficient project planning and scheduling by the contractor, poor site management and delay in progress payment by the client. While the main causes of time overrun were found to consist of inadequate contractor experience, contractor's cashflow difficulty, poor site management and supervision, slow decision making by the client, and deficiency in project planning and scheduling by the contractor. Furthermore, this study revealed that four out of the five factors causing cost and time overrun are related to contractors, while one was client related.

The study also found that key strategies proposed to mitigate cost overrun on projects from a ranking perspective include ensuring that consultants submit their drawings and documentations on time, frequent coordination between all the project parties and adequate project planning and scheduling. The key strategies proposed to mitigate time overrun, based on a ranking perspective, are proper planning of the work, adequate and close supervision of

the project, and the consultant ensuring that drawings and documentations are submitted on time.

Spearman correlation was carried out in order to measure the correlation between top ten rated cost and time overrun factors and construction performance. The result showed that there is positive correlation between cost and time overrun factors against construction performance however it was not statistically significant and this may be due to the small sample size .

However, two of the top 10-time overrun factors — which include availability of finance of contractors, deficiency in project planning and scheduling, experience in project planning, late delivery of construction material and equipment, and extension of time claim cost overrun factors — showed a moderate and positive impact on construction performance. Further investigation of the hypothesis may be required.

Based on these findings, the study concludes that projects on which an inexperienced contractor is engaged, and for which poor payment regimes exist, will experience time and cost overruns. The study recommends that activities undertaken at the execution stage should be properly monitored to prevent time and cost overruns on the project as a whole.

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ABBREVIATIONS

cidb: Construction Industry Development Board.

CI: Construction Industry.

GDP: Gross Domestic Product.

IPPR: Institute for Public Policy Research.

NPC: National Planning Commission.

NSA: Namibian Statistics Agency.

PM: Project Manager.

PMBOK: Project Management Body of Knowledge.

PMI: Project Management Institute.

PWC: Price Waterhouse Cooper.

RII: Relative importance index.

RA: Road Authority of Namibia.

RSA: Republic of South Africa.

UK: United Kingdom.

USA: United States of America.

WB: World Bank.

WBS: Work Breakdown Structure.

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CHAPTER ONE: INTRODUCTION

This chapter presents the background and motivation for the study. The challenges that are encountered in the construction industry with regards to poor cost and time performance practices are outlined. Furthermore, the problem statement, research question, aim and objective, significance, and limitations of the study are discussed.

1.1 BACKGROUND TO THE STUDY

Globally, time and cost on construction projects has become a research area of concern, and there have been numerous studies conducted in many countries on these matters (Mansfield, Ugwu, Doran, 1994, Olawale and Sun, 2010, Shimete and Wall, 2017, Endut, Akintoye and Kelly, 2009, Rahman, Memon and Karim, 2013, Haseeb et al. 2011). According to the traditional project management school of thought, the three constraints of a project are cost, time and quality, sometimes referred to as the project management triangle. These have been of paramount importance as key measures in evaluating project success. It is mostly during the implementation stage that most time and cost overruns in construction projects occur (Malkanthi, Premalal and Mudalige, 2017).

Akhund et al. (2018) and Shehu, Endut and Akintoye (2014) define time overrun as a project exceeding the allocated time for completion that was agreed upon during the bidding stage, such that the progress of the work falls behind the planned time. According to PMI (2017), time management is a process that is vital in managing the project time in order to ensure that it is completed within the time allocated. At the same time, Malkanthi et al. (2017) and (Memon, Rahman and Azis (2012) describe cost overrun as the project's actual cost exceeding the planned cost in instances where the project requires more funding than what is allocated at the bidding stage. Project cost management deals with the resources that are needed on a project to achieve its intended project goal (Project Management Institute, 2017). Three cost management components are outlined in the PMBOK; namely estimating, budgeting and cost control. In construction, project control aims to certify that the project achieves the desired outcome within allocated budget and time (Olawale and Sun, 2010).

The construction sector is vital for many developing countries, as it accounts for the delivery of infrastructure projects (Asiedu and Adaku, 2020). Haseeb et al. (2011) and Oladapo (2007) note that the Construction Industry (CI) is the major beneficiary of public sector expenditure

in infrastructure development and plays an important role in the economic growth of a country. Similarly, according to data from National Planning Commission (2019), the construction sector is seen as one of the major contributors to the Namibian economy's Gross Domestic Product (GDP), and also provides the bulk of the employment to the local working human capital. In line with the government's priorities, the National Budget spending goes towards capital projects, with the bulk going towards infrastructure development (National Planning Commission, 2019). However, according to latest indicators from National Planning Commission (2019), there has been a significant contraction in the economy of Namibia since 2017, which was driven by the significant decline in the construction industry that is a key growth driver.

Rahman et al. (2013) state that, through the implementation of infrastructure projects such as roads, hospitals and schools, the CI improves the quality of life in the country. Anaman and Osei-amponsah (2007) and Rahman et al. (2013) note that there is a substantial correlation between rate of growth of construction industry and the rate of macroeconomic growth of developing countries.

Project delays and cost overrun are considered chronic problems facing public projects due to the complex and fragmented construction industry (Rahman et al., 2013). As the CI is a time-driven industry, the infrastructure development is greatly affected due to work that is below the required standard, time and cost overrun, wastage and low productivity (Rahman et al., 2013). Time and cost overrun seem to be the most critical challenges (Memon, Rahman and Azis, 2012) and are major issues faced globally, whether in developing or developed countries. Traditionally construction projects are inundated by cost and time overrun (Flyvbjerg et al., 2003). Flyvbjerg et al. (2003) conducted a study on cost overrun on transport projects in 20 countries and determined that 90% of the projects faced cost overrun. Memon et al. (2012) noted that cost overrun in the Malaysian construction industry is quite common.

Flyvbjerg et al. (2003), and Rahman et al. (2013) stated that cost overrun in construction projects is a worldwide phenomenon that ensures that projects are seldom completed within the allocated budget and construction projects are prone to cost escalation. The research conducted in these studies have noted that many have tried to identify a possible solution to the risks associated with cost overrun. However, road and rail projects still experienced an average of 20% and 45% cost overrun, respectively.

Cost overrun is predominantly severe in most developing and sub-Saharan countries, and project cost control is a challenge for contractors and consultants (Adjei, Aigbavboa and Thwala, 2017). In South Africa, cost overruns on infrastructure projects are a major problem. The Price Water Coopers (2013) report outlines that large projects tend to exceed the allocated budget by more than 50%. Chihuri and Pretorius (2010) and Baloyi and Bekker (2011) note that the construction projects on the construction of the Gautrain and 10 Stadia respectively for the 2010 world cup in South Africa showed significant cost escalation. Chihuri and Pretorius (2010) showed that the initial cost of the Gautrain project, which was estimated to cost R7 billion in 2002, escalated to R25 billion, which is 257% cost escalation. Baloyi and Bekker (2011) established that the cost of construction for the stadia experienced an average of 45% cost increase.

Using studies undertaken in Malaysia, Endut et al. (2009) and Memon et al. (2012) found that construction projects experience cost escalation and time delays. While Endut et al. (2009) found that 54% of public and 62.8% of private sector projects had a cost overrun, Menon et al. studied the respondents' perception and established that 89% of their study respondents experienced cost overruns. Also, in terms of time overrun, Endut et al. (2009) found that 79.5% of public and 66.65% of private sector projects had time overrun. Memon et al. (2012) established that 92% of respondents indicated that their infrastructure projects experienced time overrun. This suggests that that construction projects experience high cost and time overruns. Having reviewed several literatures on cost control practices, Adjei et al. (2017) found that the challenges that exist currently in cost control practices within the construction industry are mainly attributed to the attitudes of management, which resist the call to change and adopt modern cost control techniques. This acts as a barrier to implementation of an effective cost control practices.

Project delays in construction projects has caused various problems to the construction industry, thus attracting negative image in that sector (Toor and Ogunlana, 2008). Aibinu and Jagboro (2002) note that it is vital that one creates understanding that project time overrun negatively affects project delivery. Asiedu and Alfen, (2016) noted that erroneous project schedules cause project implementation to be non-viable, therefore resulting in time wastage and reduction in the amount of infrastructure that could have been implemented from a specific funding.

There are several factors involved in the construction industry that lead to project delays in most developing countries. Assaf and Al-Hejji (2006), Akhund, et al. (2018) and Elinwa and Joshua (2001) identified several factors that impact time overrun in the implementation of construction projects undertaken in Saudi Arabia, Pakistan, and Nigeria, respectively. While Assaf et al. (2006) studied the different perceptions that existed by construction project parties, Akhund, et al. (2018) and Elinwa and Joshua (2001) examined the construction projects themselves. The outcomes of these studies established those financial difficulties by project sponsors, inadequate planning, scheduling and site monitoring, financial difficulty by contractors and change order are the most significant contributing factors to project time overrun.

Similarly, Shehu et al. (2014) assessed factors that are causing time overrun in the Malaysian construction project by examining the perceptions of contractors, consultants, and clients in both the public and private sectors. The study uncovered that the contractor's cashflow is the major contributing factor to time overrun in the Malaysian construction industry irrespective of the project sector. Additionally, Mahamid, Bruland and Dmaid (2012) and Gebrehiwet and Luo (2017) carried out a study on the causes of delay in construction projects. The studies were undertaken in Palestine and Ethiopia, respectively. Mahamid et al. (2012) identified political situation and award of projects to the lowest bidder as top causes of delays, whereas Gebrehiwet and Luo (2017) found that corruption, price increase in materials, lack of quality material, late design, and documentation are major causes of delays. Aligned to the findings of Assaf and Al-Hejji (2006), Akhund et al. (2018) and Elinwa and Joshua (2001), the study also found that payment delays by the client, ineffective project planning and scheduling form part of the top factors that cause project delay.

Kaming et al. (1997) examined the construction of building projects in Indonesia through a questionnaire survey, and identified that design changes, poor labour productivity, inadequate planning, material shortage are common factors affecting time overrun, whereas material cost increase, erroneous estimation of material and degree of complexity are factors predominantly contributing to cost overrun. Similarly, Mansfield et al. (1994), Olawale and Sun (2010) and Shimete and Wall (2017) conducted a study on factors contributing to time and cost overrun on road projects in Nigeria, UK, and Namibia. The study outcomes showed that major factors contributing to construction projects being delayed and over budget are design changes, change

in site condition, financing, poor contract management, inaccurate project time duration and complexity of the work.

Koushki, Al-Rashed and Kartam (2005) and Frimpong, Oluwoye and Crawford (2003) carried out a study on factors causing cost and time overrun in Kuwait and Ghana. Koushki et al. (2005), through an interview survey of project owners in the private residential projects, while Frimpong et al. (2003) carried out questionnaire survey in ground water construction projects. Koushki et al. (2005) identified the three main causes of cost overrun as owner's financial constraints, material-related problems and contractor-related problems, and later posited that the main causes of time overrun are change orders, owner's financial constraint and owner's lack of experience, Frimpong et al. (2003), on the other hand, found that the main causes of cost and time overrun are financial difficulties by the owner, poor contract management, material procurement, poor technical performance and inflation causing increase in material price.

It can be inferred from the preceding paragraphs that there are several factors that contribute to cost overrun that also contribute to project time overrun. As time and cost are prominent performance criterion for project success, overrun in either area is a problem that is unfortunately experienced in most construction projects. Frame (1997) conducted a study on 8000 construction projects and established that 84% of the projects did not satisfy the three traditional performance criteria of completing projects within allocated time, budget, and standard of quality. This was further supported by Asiedu and Alfen (2016) and Asiedu and Adaku (2020), who noted that, of all the different performance measures of construction projects, cost and time seem to be the most prominent performance criterion in order for a project to be deemed successful.

Cost and time overrun on construction projects are most prevalent in developing countries (Le-Hoai, Lee and Lee, 2008). As mentioned above, cost and time overrun has been researched globally and regionally. However, there is little to no research done surrounding the construction industry in Namibia. This may be attributed to a lack of knowledge capacity due to the limited tertiary institutions and limited research (Kgabi, 2011). Moreover, the population size of Namibia, which is small in comparison to other countries cited in the literature review, may present a unique condition. Given the review presented above and the mentioned gap in

knowledge, this research seeks to evaluate factors that are causing cost and time overrun within the Namibian construction industry.

1.2 STATEMENT OF THE PROBLEM

Time delays and cost escalation are critical issues facing several large, medium, and small construction projects in Namibia during the project implementation stage, which is a major concern. This has created a major bottleneck in infrastructure development within Namibia. Previous research focused on factors that contribute to cost overrun on road projects implemented by the Roads Authority of Namibia (RA). However, the mentioned study had a limitation in that only road projects constructed within a five-year period (2008-2013) in Namibia were considered; a small subset of the construction industry and not representative. Furthermore, only secondary data collection methods were used in the study. There is a lack of adequate studies, and limited knowledge, available on factors contributing to cost overrun and time delay within the construction industry in Namibia. Therefore, this study evaluates the factors causing cost and time overrun within the Namibian construction industry with an aim towards developing sustainable construction projects.

1.3 RESEARCH QUESTION

The following research question is going to be investigated in this study:

What are the factors causing time and cost overrun on projects in the Namibian Construction Industry during the implementation stage?

1.4 AIM OF THE STUDY

This research evaluates the factors causing time and cost overruns on construction projects in the Namibian construction industry during the implementation stage.

1.5 RESEARCH HYPOTHESES

H0_A: Client-related problems have no significant impact on time and cost overruns (performance) of construction projects in Namibia.

H0_B: Contractor-related problems have no significant impact on time and cost overruns (performance) of construction projects in Namibia.

H1A: Client-related problems have a significant impact on time and cost overruns (performance) of construction projects in Namibia.

H1B: Contractor-related problems have a significant impact on time and cost overruns (performance) of construction projects in Namibia.

1.6 RESEARCH OBJECTIVES

The objectives of this research are to:

1. Find out the level of performance of construction projects.
2. Identify the different factors causing cost and time overrun on construction projects.
3. Determine the different measures used by construction industry stakeholders to minimize or control time and cost overrun on construction projects.
4. Find out if there is any relationship between the factors that cause time and cost overrun and performance of construction projects.

In order for a construction project to be successful, it needs to be completed within the project cost and time. Project performance is typically measured by comparing final cost or time against planned budget or time respectively (Baccarini, 2004).

1.7 LIMITATIONS OF THE STUDY

According to Price and Murnan (2004), limitations are a potential weakness in the study, and influence the outcome of a research. One of the limitations to this research is that most of the studies carried out are outside of Namibia, and they might not have addressed some country-specific characteristics such as protests and low population size. This could be due to resources available in this research area worldwide unlike in Namibia. Another possible limitation is the difficulty of acquiring a substantial number of responses to the questionnaire survey issued to the construction industry. A small sample size might not provide more sound/reliable and generalisable results. Finally, the population does include registered professionals, but it is difficult to ascertain from this research whether this group will have a bias towards the employer.

1.8 SCOPE OF THE STUDY

The study is limited to the construction industry within Namibia. The literature review is limited to material in English that relates to cost and time overrun within the construction

industry, both in the rural and urban areas. The study was drawn mainly from the professionals in the Khomas region, where most of the consultants, contractors and client offices are located. The information used to answer the research question was gathered from project managers, consultants and contractors working on construction projects in Namibia.

1.9 SIGNIFICANCE OF THE STUDY

This research will assist the Namibian government, which consists of departments such as the Ministry of Works and Transport, Ministry of Rural Urban Development, Ministry of Finance and Municipalities and which, therefore, is the largest owner of infrastructure projects in Namibia, to make use of the factors identified in this research as a tool to prepare a mitigating strategy that will address time and cost overruns on construction projects. The study findings will also help clients, consultants, and contractors in updating the operations of their respective disciplines in order to eradicate cost and time overrun. Moreover, it will provide a guide for further studies on construction projects.

1.10 STRUCTURE OF THE RESEARCH REPORT

The study will be structured into the following five chapters.

Chapter 1 – covers the Introduction of the study: The introduction provides a background and motivation for the study. The challenges being encountered in the construction industry with regards to poor cost and time performance practices will be deliberated on. Furthermore, the problem statement, objective, research question, significance, and limitations of the study will be presented.

Chapter 2 – Literature Review: A critical review of the existing literature pertaining to the study is provided under this chapter. The literature review provides a more in-depth investigation into the research question, which aims to identify factors that cause cost and time overrun in the Namibian construction industry.

Chapter 3 – Research Methodology: The research methodology provides the approach utilised in order to examine the research objectives. It further addresses the survey method to be followed, the type and source of data collected, and the technique used to collect the data with ethical considerations in mind.

Chapter 4 – Data analysis and discussion: This chapter presents the findings of the data collected in the survey, an analysis, and a discussion of the collected data, and serves to address the objectives of the study.

Chapter 5 – Conclusion and Recommendations: The conclusion shall convey what can be inferred/deduced from the research findings and will further ascertain whether the study objectives have been fulfilled. The recommendations will offer several propositions into enhancing and eliminating the problems of time and cost overruns on projects. It will also suggest recommendations of future research in the study area.

1.11 SUMMARY OF THE CHAPTER

This chapter presented the background of the research and an understanding of the cost and time overrun issues being experienced by the construction industry. The background to the research problem, aims and objectives to be achieved, the significance of the study, limitations encountered, and structure of the research report were provided. The study evaluates the factors causing cost and time overruns in the construction industry and suggests mitigating measures that may be implemented during construction stage to avoid these issues being experienced.

CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter will present the review of literature on time and cost overruns. The literature review evaluates the factors causing cost and time overrun within the construction industry. It investigates what factors are causing time and cost overrun on projects in the Namibian Construction Industry during the implementation stage from theoretical perspectives. Furthermore, the review seeks to identify measures that are currently implemented in order to avert the problem of cost and time overrun on construction projects.

2.2 OVERVIEW OF THE CONSTRUCTION INDUSTRY

The construction industry is an important sector of the economy, as it plays a vital role in economic development by facilitating socio-economic growth (Lopes, 1998). The pivotal role that the construction industry plays in the economic development of many developing countries has been addressed by many (World Bank, 1984; Lopes et al., 2002; Anaman and Osei-amponsah, 2007; and Ofori, 2012). The construction industry is the mechanism or instrument through which a country achieves its development objective, both in rural and urban areas (Enshassi, Al-Hallaq and Mohamed, 2006). However, Lopes (1998) noted that most Sub-Saharan African countries have not simply been developmentally standing still, but have been dramatically moving backwards. This notion was supported by (Lopes^a, Oliveira^a and Abreu^a, 2017), where their study showed that in low-income countries such as Sub-Saharan Africa the share of construction in the national economy follows a U-shaped development pattern where there will be an increase in the first stage of development until its contribution reaches about 6% of GDP followed by a sustainable growth and ultimately decrease relatively in later stage of development.

The construction industry provides the backbone for many developing countries' economies, as it accounts for the delivery of public sector infrastructure projects such as road network, factories, social infrastructures such as schools, hospitals, police stations etc., Office buildings and factories, and also plays an important role in the economic growth of a country (Oladapo, 2007; Haseeb et al., 2011; Giang and Pheng, 2011; Ofori, 2012; and Asiedu et al., 2020). A thriving construction industry in many countries also significantly contributes to the Gross

Domestic Product (GDP) of those countries, hence providing toward the livelihood of people (Ofori, 2012). This is also the case in Namibia.

Lopes et al. (2002) conducted a study on a sample of developing Sub-Saharan countries, many of which were from Southern African Development Community (SADC) and found that there is a positive correlation between construction and GDP, whereby the industry has the capacity to contribute directly to the growth of the economy in these countries as the result of an increase in the growth of the construction sector. This was supported by Anaman and Osei-amponsah (2007) and Rahman et al. (2013), whose studies concluded that there is a considerable correlation between rate of growth of construction industry and the rate of macroeconomic growth of developing countries.

Oladapo (2007) and Enshassi et. al. (2006) studies in Nigeria and Palestine respectively showed that the construction industry has contributed 70% and 26% to the GDP of the respective country. However, Oladapo (2007) noted that, post-independence, the contribution of the construction industry to GDP contracted drastically to 1% due to poor performance and low productivity. On the contrary, Endut et al. (2009) and Sambasivan and Soon, (2007) found that the construction industry in Malaysia grew from 6% to 15% since the seventies, and its contribution to the country's GDP was around 5%, which is much less than that of Nigeria post-independence and to Palestine. Lopes et al. (2002) noted that the share of construction in GDP increases in the early stages of economic development (i.e., developing countries), but, in the industrially advanced countries (i.e., developed countries), the impact that the construction will have in the growth of GDP declines.

The National Planning Commission (2019) of Namibia stated that the construction sector is seen as one of the major contributors to the Namibian economy, giving 26.5% of the GDP and also providing 16.4% of the employment in the country. This contribution to the Namibia's GDP whiles creating employment opportunities was acknowledged by the World Bank (2019). This was supported by Windapo et al. (2013), who conducted a study in the South Africa found that the construction industry is a major contributor of employment, mainly to the areas of unskilled labour and development and transfer of technology. In line with the government's priorities, the national budget spending goes in bulk towards capital projects in infrastructure development (National Planning Commission, 2019). However, according to latest indicators from National Planning Commission (2019), there has been a significant contraction in the

economy of Namibia since 2017. According to Matthys (2021) the construction performance declined by 11.8% in 2020 which is considered to be significant as the construction industry is predominantly a key growth driver.

2.3 PROJECT CONSTRAINTS

Globally, time and cost on construction projects have become research areas of concern, and there have been numerous studies conducted in many countries (Mansfield et al., 1994; Endut et al., 2009; Olawale and Sun, 2010; Shimete and Wall, 2017; Rahman et al., 2012; Rahman, Memon and Karim, 2013). According to the traditional project management school of thought, the three constraints of a project are cost, time and quality which are sometimes referred to as the project management triangle (Project Management Institute, 2017). Figure 2-1 shows the project triple constraints.

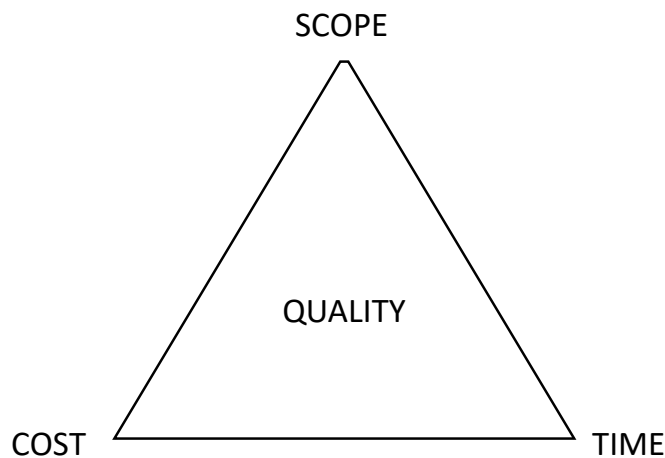


Figure 2-1: Project Triple Constraints (Project Management Institute, 2017)

The triple constraints are indicators of project performance. Time and cost have become the most evident and noteworthy criteria used in order to measure the performance of construction projects (Asiedu and Alfen, 2016).

According to Morris (1990), time and cost overrun during the implementation stage of construction projects within the public sector has been a regular occurrence since the early sixties. Time and cost overrun are predominantly common issues that are experienced in most construction projects and are also vital performance criterion for project success. Frimpong et

al. (2003) posit that project success is when a project meets the goal and objectives of a project plan. Construction projects in Namibia are not an exception to these. Memon et al. (2012) observed that, in order to improve the performance of a time and cost performance, the most important step to understand the contributing factors. Chan and Kumaraswamy (1997) noted that projects are successfully delivered when they fall within planned budget and time. Similarly, Frimpong et al. (2003) state that a project is successful when it has achieved the technical specifications, the schedule is maintained and the project is completed within the allocated budget.

Endut et al. (2009) and Memon et al.(2012) used studies undertaken in Malaysia to show that construction projects experience cost escalation and time delays. While Endut et al. (2009)found that 54% of public and 62.8% of private sector projects had a cost overrun, Memon et al. (2012) studied the respondents' perception. They established that 89% of their study respondents had experienced cost overruns on construction projects. Also, in terms of time overrun, Endut et al. (2009) found that 79.5% of public and 66.65% of private sector projects had time overrun. Memon et al. (2012) established that 92% of respondents indicated that their infrastructure projects experienced time overrun, suggesting that construction projects experience high cost and time overruns.

More than 4000 construction projects were examined in Morris' study (1990), and it was found that projects are rarely implemented within allocated time and budget. Similarly, Frame (1997) conducted a study on 8000 construction projects and established that 84% of the projects did not satisfy the three traditional performance criteria of completing projects within allocated time, budget, and standard of quality. These were further supported by Asiedu and Alfen (2016) and Asiedu et al. (2020). They noted that, of all the different performance measures of construction projects, cost and time seem to be the most prominent performance criterion in order for a project to be successful. It may be concluded that many projects are mismanaged, resulting in cost and time overrun.

2.5 TIME OVERRUN IN CONSTRUCTION PROJECTS

There are quite a number of definitions for project delays within the realm of construction management. Aibinu and Jagboro (2002), Assaf and Al-Hejji (2006), ;Haseeb et al. (2011). Shehu et al. (2014), Mukuka, Aigbavboa and Thwala (2015) and Akhund, et al. (2018) describe

project delay as a project exceeding the allocated time for completion that was agreed upon during the bidding stage, which forms a part of the contract agreement, causing delay in the delivery of the facility (Sambasivan and Soon, 2007).

Therefore, this research defines time overrun as the instance when the project takes longer to complete than the agreed time that was defined in the signed contract between the client and contractor. Construction delay has an effect on both the client/owner and the contractor. Delay causes the owner of the project to lose potential income from the unattainability of the facility or rentable space, whereas the contractors lose money due to increased cost of material and higher cost of overheads as the result of a prolonged construction period (Assaf and Al-Hejji, 2006; (Toor and Ogunlana, 2008). According to the Project Management Institute (2017), time management is a process that is vital in managing the project time such that it is completed within the time allocated.

Project delay can occur prior to the construction stage, during the inception and design stage (Dayi, 2010). However, Chan and Kumaraswamy (1997), noted that it predominantly occurs during the construction stage, and not many delays are attributed to the pre-construction stage of a project lifecycle.

Project delays in construction projects has caused various problems to the construction industry, thus giving that sector a negative image (Toor and Ogunlana, 2008). Abdul-Rahman et al. (2006) reinforce that schedule delay disrupts work progress, eventually leading to project abandonment and contract termination. This was further reinforced by Asiedu and Alfen (2016), who claim that erroneous project schedules can cause project implementation to be non-viable, therefore resulting in time wastage and the reduction of the amount of infrastructure that could have been implemented from a specific amount funding. There are limited studies carried out on time overrun in the construction industry in Namibia. This study sets out to identify the causes that contribute to project delay in Namibia.

2.5.1 Types of Schedule Delays on Construction Projects

Trauner et al. (2009) examined how delays impact the ability of the construction projects to achieve its planned schedule. The research uncovered that there are two categories of delays,

namely those that are critical and those that are non-critical. The critical delay will have an impact on the completion period, as it will impact the critical path of the project, whereas the non-critical delays have no impact on the completion period. In a construction project, the critical path is the list of activities that will take the shortest time to complete. Syed et al. (2014) and Trauner et al. (2009) categorise schedule delays that are critical into further four groups, namely non-excusable, excusable non-compensable, excusable compensable and concurrent delays. Similarly, Menesi (2007) noted that excusable delays are further divided into compensable and non-compensable delays.

Syed et al. (2014), Trauner et al. (2009) and Asiedu and Alfen (2016) found that the types of delay are determined based on the parties involved as well as the contract clauses that relate to schedule delays. In contrast, Memon et al. (2012) classify delays into two categories, namely internal delays, which are caused by the parties involved in the contract (i.e., client or contractor), and external delays, which are caused by force majeure that are beyond the control of the contracting parties.

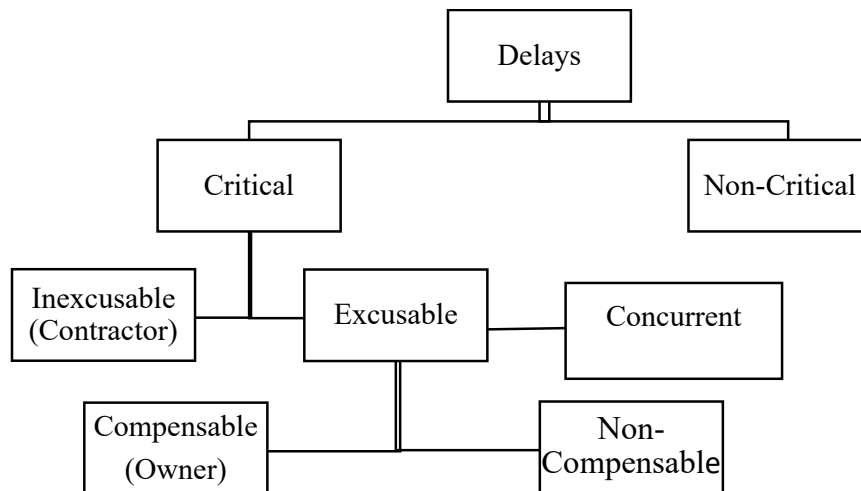


Figure 2-2: Types of Delays (Trauner et al., 2009)

Non-excusable or inexcusable delays are delays that are caused by the contractor, or delays for which the contractor is responsible and assumes the risk (Kikwasi, 2012) such that the contractor may not be granted extension of time to complete the project and may also be liable for any damages that the client may incur (Menesi, 2007). This is further supported by Gardezi

et al. (2014), who opined that, when the delay is the sole responsibility of the contractor or its supplier, no compensation will be awarded and, in fact, the contractor is required by law to expedite the works or pay penalties to the client. Excusable delays, on the other hand, are delays that are caused beyond the contractor's control, and this relieves him of any responsibility (Asiedu and Alfen, 2016).

Excusable delays are divided into two, namely compensable and non-compensable. delays non-compensable excusable delays are both caused by factors that are unforeseen, and neither the contractor nor the client is therefore responsible for the delays. An example of this delay is a Force Majeure event. On the other hand, a compensable excusable delay is a delay that is caused by the owner, normally as a result of scope change of the works or breach of the contract by the owner (Kikwasi, 2012). Therefore, the contractor will be granted with an extension of time.

Finally, concurrent delay is when more than one type of delay impacts the critical path of the project at the same time, even if the delays are unrelated to one another (Menesi, 2007). Similarly, Trauner et al. (2009) and Mubarak (2016) define concurrent delay as two independent causes of delay that occur simultaneously. Both parties (client and contractor) involved in the contract are responsible for the delay.

2.5.2 Factors that Cause Delays on Construction Projects

Even though there has been continuous advancement of technology and techniques that are being implemented to manage projects, delays are still persisting within the construction industry. Mobbs (1982), cited in Aibinu and Jagboro (2002) noted that, in developed countries such as the USA, UK and West Germany, time management is better than most developing countries, and that construction delays can be averted if the factors that contribute to prolonging the planned duration of a construction project are efficiently addressed (Sambasivan and Soon, 2007).

There are several factors involved in the construction industry that led to project delays in most developed and developing countries. Several studies were carried out that investigated the main factors that cause delay in different countries. Assaf et al. (1995) and Chan and Kumaraswamy

(1997) carried out a survey on 56 and 83 potential factors causing delays within the construction projects in Saudi Arabia and Hong Kong respectively. Chan and Kumaraswamy (1997) identified poor management and supervision, unforeseen site conditions, slow decision making and client-initiated variations as the five major factors causing delays, whereas Assaf et al. (1995) found that awarding the project to lowest bidder and change order as the most common causes of delay. On the contrary, Ogunlana and Promkuntong (1996) studied causes of construction delays in high rise buildings in Thailand, and found that material shortage is the most acute problem faced in developing economy.

Other studies considered the differences in perception by different groups as the causes of delays in construction projects. Assaf and Al-Hejji (2006), Akhund et al. (2018), Elinwa and Joshua (2001) identified several factors that impact time overrun in the implementation of construction projects undertaken in Saudi Arabia, Pakistan, and Nigeria, respectively. While Assaf et al. (2006) studied the different perceptions that existed by construction project parties, Akhund et al. (2018) and Elinwa et al. (2001) examined the construction projects themselves. The outcomes of these studies established those financial difficulties by project sponsors, inadequate planning, scheduling and site monitoring, financial difficulty by contractors and change order are the most significant contributing factors to project time overrun. Hence, it is shown that delays in construction projects can be attributed to all the parties that are involved, although the degree of impact does vary.

Similarly, Shehu et al. (2014) assessed factors that are causing time overrun in the Malaysian construction project by examining the perceptions of contractors, consultants, and clients in both the public and private sectors. The study has uncovered that the contractor's cashflow is the major contributing factor to time overrun in the Malaysian construction industry irrespective of the project sector. On the contrary, Mahamid et al. (2012) and Gebrehiwet and Luo (2017) carried out a study on the causes of delay in construction projects in Palestine and Ethiopia respectively. Mahamid, et al. (2012) identified that political situation and award of projects to the lowest bidder are the top causes of delays, whereas Gebrehiwet and Luo (2017) found that corruption, price increase in materials, lack of quality material, late design, and documentation are the major causes of delays. Aligned to Assaf and Al-Hejji (2006), Akhund et al. (2018) and Elinwa and Joshua (2001) found that payment delays by the client and ineffective project planning and scheduling are part of the top factors that cause project delay.

An assessment of the delay factors as was presented in previous studies were investigated and classified into seven groups making use of Bramble and Callahan's (1992) classification principle. The different groups into which time overrun factors were grouped are (1) Contractor-related causes, (2) Consultant-related causes, (3) Client-related causes, (4) Contract relationship-related causes, (5) Labour-related causes, (6) Material and Equipment-related causes and (7) External causes. This classification is similar to studies carried out by Chan and Kumaraswamy (1997).

Having reviewed previous studies on time overrun both regionally and internationally, it was observed that there are many factors that lead to time overrun that were identified by different authors, although there are some factors that are found across studies. The factors that were identified by the different authors is presented in Table 2-1. Although these studies looked at many different factors, it was deemed necessary to only highlight those factors that were considered to be highly rated by virtue of being identified in more than one study.

Table 2-1: Factors influencing Time Overrun on Construction Projects

No	Author	Country	Year	Predominant Factors
1	Ogunlana and Promkuntong	Thailand	1996	Short supply of materials, lack of technical personnel, frequent design change and coordination problem, poor project management and low technical, and managerial skills of contractors.
2	Chan and Kumaraswamy	Hong Kong	1997	Inadequate contract experience, poor experience in site management and supervision, slow decision making, deficiency in project planning and scheduling, lack of subcontractor's skill, delay in material procurement, low labour productivity, design changes, poor experience in contract management, poor communication between parties, shortage of skilled labour, unrealistic project duration, shortage of construction material, complexity of design, and unexpected ground condition.

Table 2-1: Factors influencing time overrun on construction projects cont'd

No	Author	Country	Year	Predominant Factors
3	Kaming et al.	Indonesia	1997	Design change, poor labour productivity, inadequate planning, and shortage of resources.
4	Elinwa et al	Nigeria	2001	Delay in progress payment, delay in material and equipment delivery, design change, equipment breakdown, mistakes and discrepancies in contract documentation, and inclement weather.
5	Enshassi et al	Palestine	2003	Deficiency in project planning and scheduling, mistakes during the construction stage, low labour productivity, delay in material and equipment delivery, delay in reviewing and approving drawings, shortage of skilled labour, unrealistic contract duration, unexpected ground condition, low quality material, shortage of labour, mistake and error in design, and bad weather conditions.
6	Frimpong et al.	Ghana	2003	Monthly payment difficulties from agencies, poor contractor management, material procurement, poor technical performances, escalation of material prices, contractor financial difficulties, insufficient cashflow during construction, bad weather, and planning and scheduling deficiencies.
7	Koushki et al.	Kuwait	2005	Change orders, owner's financial constraints, owner's lack of experience, shortage of materials, inclement weather, and scarcity of labour.
8	Aibinu and Odeyinka	Nigeria	2006	Contractor's financial difficulties, client cashflow problem, architect's incomplete drawing, subcontractor's slow mobilisation, equipment breakdown, and maintenance problem.

Table 2-1: Factors influencing time overrun on construction projects cont'd

No	Author	Country	Year	Predominant Factors
9	Kaming et al.	Indonesia	2006	Design Change, poor labour productivity, inadequate planning, and shortage of resources.
10	Sambasivan and soon	Malaysia	2007	Contractor's improper planning, contractor's site management, inadequate contractor experience, inadequate client's finance, and payment of completed work, material shortage, inefficient labour supply, equipment availability and failure, lack of communication between parties, and mistakes during construction stage.
11	Assaf et al.	Saudi Arabia	2006	Contractor's financial difficulties, change orders by owner, inadequate contractor experience, delay in progress payment by owner, shortage of labour, delay in material delivery, ineffective planning and scheduling by contractor, poor site management, type of project bidding and award, and low productivity level of labour.
12	Le-Hoai et al.	Vietnam	2008	Poor site management and supervision, poor project management assistance, financial difficulties by owner, financial difficulties by contractor, design changes, unforeseen site conditions, slow payments towards completed work, material shortage, price fluctuations, and inaccurate estimates.
13	Toor and Ogunlana	Thailand	2008	Lack of resources, poor site management, shortage of labour, design delays, planning and scheduling deficiencies, change orders, and contractor's financial difficulties.

Table 2-1: Factors influencing Time Overrun on Construction Projects Cont'd

No	Author	Country	Year	Predominant Factors
14	Kaliba et al.	Zambia	2009	Delayed payments and financial difficulties by client, contract modification, economic problems, delay in material procurement, inclement weather, labour dispute and strike, environmental protection and mitigation costs, and changes in drawings.
15	Olawale and Sun	UK	2010	Design change, inaccurate evaluation of project duration, complexity of works, project risk and uncertainties, and non-performance of sub-contractors and suppliers.
16	Baloyi and Bekker	South Africa	2011	Incomplete drawings, design changes, client's slow decision making, late issue of instructions, and shortage of skilled labour.
17	Kikwasi	Tanzania	2012	Design change, delay in payment to contractor, information delay, funding problems, poor project management, compensation issues, and disagreement on the valuation of work done.
18	Memon et al.	Peninsular of Malaysia	2012	Design and documentation issues, inadequate financial resources, poor project management, poor contractor site management and poor communication, lack of labour, and lack of material and machinery resource.
19	Mahamid et al.	Palestine	2012	Unstable political situation, segmentation of West Bank and limited movement between areas, award of project to lowest bid price, progress payment delay by owner, and shortage of equipment.

Table 2-1: Factors influencing Time Overrun on Construction Projects Cont'd

No	Author	Country	Year	Predominant Factors
20	Rahman et al.	Malaysia	2013	Financial problems, manpower problems, poor site management, authority approvals, subcontractors, clients' influence, design problems, shortage of manpower, ineffective construction method, lack of skills, and poor planning and scheduling.
21	Gardezi et al.	Pakistan	2014	Law and order situation, design changes, financial situation of the client, war and terrorism, poor site management, discrepancies between drawings and specifications, payment delays, inflation of local currency, unrealistic duration, and bureaucracy.
22	Shehu and Endut	Malaysia	2014	Cashflow problems faced by contractor, late payment from client to contractor, and payment problem between main contractor and sub-contractor.
23	Gobishanker et al	Sri Lanka	2015	Conflicts in sub-contractor's schedule, delay in progress payment, bad weather conditions, difficulties in financing project, shortage of labour, and frequent change of sub-contractors.
24	Samarghandi et al.	Iran	2016	<u>Owner-related issues</u> —lack of attention to inflation and inefficient budgeting schedule. <u>Contractor-related issues</u> —inaccurate budget and resource planning, weak cash flow, inaccurate pricing, and bidding. <u>Consultant-related issues</u> — inaccurate technical documents.
25	Asiedu and Alfen	Ghana	2016	Default in payments by client, client refusal to pay interest on delay payment, lengthy payments in delay, bribery, and conflict of interest in the selection of contractors.

Table 2-1: Factors influencing Time Overrun on Construction Projects Cont'd

No	Author	Country	Year	Predominant Factors
26	Gebrehiwet and Luo	Ethiopia	2017	Corruption, lack of utilities on site, inflation/price increases in materials, lack of quality materials, late design and documents, slow delivery of materials, late in approving and receiving complete project work, poor site management and performance, late release budget, and ineffective project planning and scheduling.

From the studies reviewed, a total of fifty-one (51) factors that were deemed appropriate to Namibian construction projects were selected to form part of this study. These time overrun factors include inadequate contractor experience, contractor's financial difficulty, poor site management and supervision, slow decision making by the client, deficiency in project planning and scheduling, delay in progress payment toward completed works, owner's financial constraints, subcontractor's competence and non-performance, and the global pandemic (Covid-19). The following factors deemed inappropriate in the case of Namibia such as War, political instability, project material monopoly were not considered in the study.

Other factors that lead to time overrun include mistakes during the construction stage, change order and scope change, delay in material procurement, poor labour productivity, delay in material and equipment delivery by vendors, design changes, poor contract management, delay in site mobilisation, delay in reviewing and approving drawings and documentation, lack of communication between parties, shortage of skilled labour supply, lack of coordination between parties, dispute between parties, unrealistic contract duration and requirements imposed, competency of design team, shortage of construction material in the market, delay in awarding the contract, complexity of project design, unexpected ground conditions, low motivation, delay in implementing changes to the scope of work, lack of quality material, scarcity of labour supply, shortage of equipment, mistake and error in design, equipment breakdown, inaccurate material estimate, delays in inspection and testing of works, delay in design documentation, delay in work approval by local authorities, mistakes and discrepancies in contract documentation, unpredictable weather conditions, force majeure, inflexibility of the consultant, fraudulent practices and kickbacks, change in government regulations, strike, delay in land compensation, an accident during construction, unrest by local communities, and demining.

These factors were then scored based on major factors identified by the different authors and the top fifteen (15) factors that were cited the most are shown in Table 2-2, with the full table of all factors included in **Appendix E**.

Table 2-2 accumulates factors leading to time overrun that were mentioned in previous studies, ranking them by how often they appeared across multiple studies. The table, therefore, cites the factors that most influence time overrun across multiple projects from different years and geographical regions.

Table 2-2: Factors influencing time overrun ranked based on citation

S/No	Factors influencing time overrun	Source														
		Delay in progress payment toward completed work	Deficiency in project planning and scheduling	Design changes by consultant	Changes in design by client	Lack of finance by contractor	Availability of finance (owner's financial constraint)	Shortage of construction material in market	Experience in site management and supervision (Poor)	Shortage of labour supply	Unpredictable weather conditions	Mistake and error in design	Shortage of skilled labour supply	Delay in material delivery	Inadequate contractor experience	Low labour productivity
1	Gebrehiwet and Luo (2017)	✓	✓						✓					✓		
2	Asiedu and Alfen (2016)	✓														
3	Samarghandi et al. (2016)		✓			✓										
4	Gobishanker et al (2015)	✓					✓			✓						
5	Shehu and Endut (2014)	✓				✓										
6	Gardezi et al. (2014)	✓		✓	✓		✓		✓			✓				
7	Mahamid et al. (2012)	✓														
8	Memon et al. (2012)					✓			✓	✓						
9	Kikwasi (2012)	✓		✓	✓		✓									
10	Baloyi and Bekker (2011)			✓	✓											
11	Olawale and Sun (2010)			✓	✓											
12	Kaliba et al. (2009)	✓					✓				✓	✓				
13	Toor and Ogunlana (2008)		✓			✓		✓	✓	✓						
14	Le-Hoai et al. (2008)	✓		✓	✓	✓	✓	✓	✓	✓						
15	Assaf et al. (2006)	✓	✓			✓			✓	✓				✓		✓
16	Sambasivan and Soon (2006)	✓	✓				✓	✓	✓	✓					✓	✓
17	Rahman et al. (2006)	✓	✓	✓	✓	✓	✓		✓	✓		✓		✓		
18	Kaming et al. (2006)		✓	✓	✓	✓		✓								✓
19	Aibinu and Odeyinka (2006)					✓	✓					✓				
20	Enshassi et al (2006)		✓					✓		✓	✓	✓	✓	✓		✓
21	Koushki et al. (2005)						✓	✓		✓	✓					
22	Frimpong et al. (2003)	✓	✓			✓										
23	Elinwa et al (2001)	✓		✓	✓						✓			✓		
24	Kaming et al. (1997)		✓	✓	✓			✓		✓		✓				✓
25	Chan and Kumaraswamy (1997)		✓	✓	✓			✓	✓				✓		✓	✓
26	Ogunlana and Promkuntong (1996)	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	
	Total Score	15	12	11	11	10	10	10	9	9	7	6	6	6	5	5

2.5.2.1 Delay in progress payment, lack of contractor finance and lack of owner finance.

These three factors are among the top five (5) cited factors that cause time overrun according to previous studies reviewed. They are grouped together as they are all financial-related factors. Construction work requires substantial amount of money from both owners and contractors. When construction payments are delayed on projects, it becomes very difficult for contractors to bear the daily expenses on site, which leads to delays. Studies by Frimpong et al. (2003) and Le-Hoai et al. (2008) have identified financial difficulties faced by owner and contractor as part of the top five major causes of cost and time overrun in Ghana and Vietnam. However, it is opined that such difficulties to make payments during implementation stage may be mitigated if the cost are planned from the inception and controlled regularly (Sohu et al., 2018).

Slow progress payment by clients for completed work, predominantly on government-funded projects, is among the main complaints which contractors state that clients failing to pay for completed work timeously is the main cause of delays in construction projects. (Le-Hoai, Lee and Lee, 2008).

2.5.2.2 Deficiency in project planning and scheduling.

Contractors often fail to provide a practical work programme during the inception stage of construction projects. This is frequently linked to contractor's lack of experience or understanding of what the project entails. Poor project planning and scheduling is closely linked to an unrealistic time schedule and delay in material procurement. Improper planning and scheduling, which is identified by Sambasivan and Soon (2007) and Sweis et al. (2008) as one of the top five factors that cause time overrun in their studies in Malaysia and Jordan respectively, is a result of contractor's personnel failing to understand the project scope. A well thought through reporting and feedback process between the different project team is imperative in ensuring that the projects are effectively planned before the construction begins (Asiedu and Adaku, 2020). Moreover, Frimpong et al. (2003) discovered that delay in material procurement due to poor planning in construction of ground water projects in Ghana is one of the critical factors causing delays on construction projects. In different studies, this factor has been described as inadequate early planning, poor planning and scheduling, and delay in procurement of material.

2.5.2.3 Experience in site management and supervision.

Poor site management and supervision on construction projects lead to sub-standard work that does not conform to the quality and specification that is set out in the construction drawings. Therefore, it is considered to be one the major factors that causes delays. According to Sambasivan and Soon (2007) and Rahman et al. (2013) respectively, improper site management is the second- and fifth-most critical factor that causes time overrun. This factor is closely related to the incompetence and weakness of the contractor and his personnel (Le-Hoai, et al., 2008). This may also result in poor communication with sub-contractors and suppliers, which will adversely affect the progress report and result in delays (Harisaweni, 2007).

2.5.2.4 Design change by client and consultant.

Design change may be introduced either by the client or the consultant. This is normally introduced due to lack of clarity in the design brief, ambiguity in requirements, and/or opposing understanding by different parties. These factors are also referred to as change orders or rework due to change, and they lead to variations. These factors were identified as major contributors of both time and cost overrun in several studies reviewed for this research. Chan and Kumaraswamy (1997) noted that, when variations are introduced by the client in the middle of the project, that project suffers significant delay. This was supported by Assaf and Al-Hejji (2006), who also noted that a change order by the client is a major contributor that impacts timeous completion of the project. Assaf et al. (1995) and Kaming et al. (1997) investigated large building projects in Saudi Arabia and Indonesia, respectively, and found that design change is one of the major factors that cause delays in construction projects.

Koushki et al. (2005), Baloyi and Bekker (2011) and Kikwasi (2012) investigated delays and cost increases in construction of private residential projects in Kuwait, Stadia construction in South Africa and cause and effect of delay in Tanzania, respectively. They observed that variation due to change order is one of the critical causes of time overrun in construction projects. It is interesting that several studies reviewed in this research indicated that design change contributes to the slowing down of project execution, which, in turn, results in the extension of project duration from its original planned time. Therefore, it is imperative that,

during the inception stage of a project, the client clearly outlines the design brief, and that the consultant clearly understands the requirement.

2.5.2.5 Shortage of construction material.

Shortage of material has major effect on construction projects. Le-Hoai et al. (2008) noted that large projects and rapid infrastructure development may require materials to be ordered and imported from other countries, which may cause delays. This factor had similar ranking in in the research of Kaming et al. (1997), Koushki et al. (2005); Sambasivan and Soon (2007), Toor and Ogunlana (2008) and (Memon et al. (2012). Although this factor is normally attributed to contractors not ordering material in time, it could also be attributed to unreliable suppliers who attempt to cover their unreliability by blaming the shortage of material (Le-Hoai et al., 2008). Ogunlana and Promkuntong (1996) noted that this factor is by far the most acute problem in the Thai construction industry. This is no exception to most Namibian projects, where some materials are imported from South Africa and, if not planned and procured timeously, this import causes delay on projects.

2.5.2.5 Experience in contract management.

According to Le-Hoai et al. (2008), poor contract management seems to be an issue in most developing countries where more attention is given to awarding the contract to a company rather than managing the contract itself. Although most government projects provide the legal framework to control contract management work in construction, if there are no professionals that are well-versed with the contract and are able to manage the contract, it will lead to project delays (Le-Hoai et al., 2008).

Frimpong et al.'s (2003) study found that poor contract management was ranked the second most critical factor that contributes to time and cost overrun in ground water projects in Ghana. This is credited to the fact that project contracts are awarded to the lowest responsive bid. However, lowest bidders tend to lack management skills, and minimal attention is given to planning, cost control, site management and resource allocation, which are all contributing factors to cost and time overrun (Frimpong et al., 2003). This factor is a problem that is attributed to, and in direct control of, the contractor (Ogunlana and Promkuntong, 1996).

2.5.2.5 Labour supply.

Scarcity of labour supply is another factor that is widely considered as a major problem that causes project delays. Gobishanker et al. (2015) investigated construction projects in Sri Lanka as well as foreign construction projects (Singapore, Qatar, U.A.E, Hong Kong etc), and found that shortage of labour as a cause for delays was ranked fifth most pertinent, whereas results from the foreign construction projects ranked shortage of labour as the second most critical cause of delay. Similarly, in a study conducted by Assaf and Al-Hejji (2006) and Sambasivan and Soon (2007) on large construction projects in Saudi Arabia and cause and effects of delays in Malaysian construction industry respectively, shortage of labour was ranked as one of the top factors that cause delay. This shows that shortage of labour is a critical factor that causes delay in most Asian countries.

2.6 COST OVERRUN ON CONSTRUCTION PROJECTS

According to Frimpong et al. (2003), cost performance on construction projects is the most significant indicator of success, as it shows or measures the profitability of the construction projects. Flyvbjerg et al. (2003) and Flyvbjerg et al. (2009) revealed that, in order for a project to be successful, it will have to be completed within the cost budget that was assigned to it. This was supported by Sambasivan and Soon (2007), who noted that cost is the most important performance measure on construction projects.

Avotos (1983), Memon et al. (2012) and Malkanthi et al.(2017) posit that cost overrun is when the final cost of a project surpasses the original planned cost estimate, and where the project requires more funding than what was allocated at the bidding stage. According to Singh (2009), cost overrun is unforeseen costs that a project incurs in excess of the amount estimated for its completion that occur as the result of the actual cost being underestimated.

Flyvbjerg et al. (2003), in a study of the cost performance of 258 construction projects in 20 countries, found that 90% of the projects experienced cost overrun. Similarly, Cantarelli (2009) noted that cost overrun is a common problem that exists in Dutch transport infrastructure projects. with an average of 10.3% cost escalation from the planned cost. Also, Memon et al. (2012) revealed that cost overrun in Malaysian construction industry is quite common.

Cost overrun is predominant and severe in most developing and sub-Saharan countries, and project cost control is a challenge for contractors and consultants (Adjei et al., 2017). In South Africa, cost overruns on infrastructure projects are a major problem. The PwC (2013) report outlines that large projects within South Africa tend to exceed the allocated budget by more than 50%. Chihuri and Pretorius (2010) and Baloyi and Bekker (2011) note that the construction of the Gautrain and ten stadia for the 2010 World Cup in South Africa showed significant cost escalation. Chihuri and Pretorius (2010) showed that the initial cost of the Gautrain project, which was estimated to cost R7 billion in 2002, escalated to R25 billion, which is a 257% cost escalation. Baloyi and Bekker (2011) established that the cost of construction for the stadia experienced an average 45% cost increase.

Aris et al. (2013) found that, in the construction project, it is seldom that cost overrun factors are not effectively planned against or taken into consideration, and this leads to substantial amount of cost overrun. Having reviewed several studies on cost control practices, Adjei et al. (2017) found that the challenges that exist currently in cost control practices within the construction industry are mainly attributed to the attitudes that management has toward changing current cost control techniques and adopting modern cost control techniques, and these negative attitudes act as a barrier to the implementation of effective cost control practices. Windapo et al. (2017) conducted a study to scrutinise the drivers of cost overrun (i.e., construction equipment, labour, and material), and found that there is a significantly positive relationship between construction equipment and building construction index; therefore, construction equipment needs to be used appropriately to avoid cost escalation during construction. This is further supported by the CIDB (2017), in that historical evaluation of construction data showed that cost of material increased year on year at a rate of inflation.

2.6.1 Factors Causing Cost Overrun in Construction Projects

There are many factors that lead to cost overrun in construction projects, making it one of the major challenges that construction projects face. Several studies have been conducted to review the numerous causes of cost overrun. This study has identified several factors from this literature, and they will be critically investigated in order to identify the top causes of cost overrun in the Namibian construction industry. It is important to identify the most influential factors that cause cost overrun in Namibia in order to propose suitable mitigating measures.

Previous studies on cost overrun factors were reviewed, and it was observed that the factors are repetitive among different studies both regionally and internationally. A total of thirty-six (36) factors were selected for this study, which include fluctuation of prices (inflation), change order or scope change, inadequate experience in project planning and scheduling, poor experience in site management, and underestimation of project costs.

Other factors include frequent design change, mistakes during construction, experience in project management, financial difficulty of contractor, delay in progress payment, financial difficulty by the owner, lack of contractor experience, inaccurate quantity take-off, lack of coordination between parties, shortage in material and equipment, project complexity, shortage of skilled labour, delay in client's contract award, mistakes and errors in design, unexpected ground conditions, force majeure, fraudulent practices and kickbacks, extension of time claim, shortage of site labour, no experience of project area, mismanagement (poor handling and wastage), exchange rate fluctuation, increase cost of labour, late delivery of construction material and equipment, poor communication between parties, slow information flow between parties, consulting team competence, incomplete design at the time of tender, low motivation, delays in work approval by local authorities, and delay in inspection and testing of works.

These factors were scored based on the number of times they were cited by the authors reviewed, and the top fifteen (15) factors influencing cost overrun on construction projects are presented in Table 2-3. However, the full table of factors is included in **Appendix F**. Some of the cost overrun factors that were cited the most correspond to those described under time overrun and these factors are therefore not included in this section. Instead, described below are the top ten (10) factors that were identified to lead only to cost overrun.

2.6.1.1 Price fluctuations

Price fluctuation is key for underestimation of cost in several construction projects. Rahman et al. (2013) found that material price fluctuation is ranked as the highest cause of cost overrun. In concurrence with this result are findings from Azhar et al. (2008), Le-Hoai et al., (2008) and Ameh et al., (2010). This factor is a result of suppliers' monopoly, scarcity of material locally, and inflation in the country. Price fluctuation is a result of scarcity of materials or when demand exceeds supply. This leads to an increase in the price of raw material, which will, in turn, increase project cost.

Table 2-3: Factors influencing cost overrun ranked based on citation

S/N o	Source	Cost overrun Factors														
		Fluctuation of prices (Inflation)	Change order or scope change	Inadequate experience in project planning and scheduling	Poor experience in site management	Underestimation of project cost	Frequent design changes	Mistakes during construction	Experience in project management	Financial difficulty of contractor (i.e., cashflow difficulty)	Delayed progress payment	Financial difficulty of owner	Lack of contractor experience	Inaccurate quantity take-off	Lack of coordination between parties	Shortages in material & equipment
1	Sitwala and Wium (2020)		✓													
2	Asiedu and Adaku (2020)		✓	✓												
3	Akinradewo et al. (2019)		✓			✓			✓	✓					✓	
4	Durdyev et al. (2017)		✓		✓	✓			✓							
5	Shimete and Wall (2017)		✓	✓	✓					✓			✓			
6	Wanjari and Dobariya (2016)	✓	✓					✓		✓					✓	
7	Rahman et al. (2013)	✓		✓	✓		✓	✓	✓	✓	✓	✓				✓
8	Aziz (2013)	✓	✓	✓	✓			✓	✓		✓					
9	Baloyi and Bekker (2011)	✓	✓			✓							✓			
10	Ameh et al. (2010)	✓	✓	✓	✓		✓		✓			✓				
11	Cantarelli et al. (2010)	✓	✓	✓			✓									
12	Olawale and Sun (2010)	✓				✓	✓				✓			✓		
13	Enshassi et al. (2010)	✓		✓									✓			✓
14	Kaliba et al. (2009)					✓										
15	Azhar (2008)	✓	✓	✓	✓	✓										
16	Le-Hoai et al. (2008)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					✓
17	Omoriegie & Radford (2006)	✓			✓		✓						✓			
18	Koushki et al. (2005)	✓														
19	Frimpong et al. (2003)	✓	✓	✓				✓			✓					
20	Kaming et al. (1997)	✓				✓					✓					
	Total Score	14	13	10	8	8	6	6	6	5	5	4	4	4	3	3

2.6.1.2 Change order or scope change

Change order is associated with contract modification and causes the most cost overrun in construction projects (Asiedu and Adaku, 2020; Koushki et al., 2005). Aziz (2013) observed that a change order’s impact is influenced by the timing of the change order, and that the change is usually due to unforeseen circumstances. Azhar, et al. (2008) noted that a scope change, or change order, arises from extensive variation due to change in brief and redesign. This should be controlled by the owner’s agent. It results in the underestimation of project cost as it is introduced when

construction projects are not going according to plan, resulting in additional cost. Change orders by clients is a major influence that exasperates the completion of construction projects within the cost that was proposed at the beginning of a project.

2.6.1.3 Inadequate project planning and scheduling, and site management

Incompetence in the contractor's ability to plan, schedule and site manage causes cost overrun in construction projects. Poor project planning and site management and supervision has been a weakness of most contractors in Vietnam (Le-Hoai et al., 2008). This is why Le-Hoai et al. (2008) noted that it is important that the contractor selection process should be given enough attention by the client or client's agent. Lo et al. (2006) suggested that the selection of consultants should also be done carefully, in order to ensure that they are able to carry out their role satisfactorily. Asiedu and Alfen (2016) noted that public sector construction projects tend to commence in haste due to political reasons, and there is therefore not much thought that goes into planning.

Asiedu and Alfen (2016) further investigated cost overrun in public sector projects and found that poor contract planning, and supervision are the top factors that cause cost overrun. This is supported by Frimpong et al. (2003) and Azhar et al. (2008) in their studies on construction projects in Ghana and Pakistan respectively. Enshassi et al. (2010), on the other hand, found that inadequate project planning and supervision was not considered as a main cause in projects in Gaza, ranking it instead as eighteenth out of forty-two factors. This suggests that there are other factors that are more critical in Gaza than project planning and supervision.

2.6.1.4 Underestimation of project cost

Underestimation of project cost is when the owner's agent estimates the project cost to be lower than the market price. In some government agencies the project fund is allocated based on the estimate provided. This factor is attributed to the fact that projects can only go ahead if the price provided by the contractor is within the estimate of the work as prepared by the consultant as the owner's agent (Flyvbjerg et al., 2003).

2.7 OVERVIEW OF MEASURES USED IN MINIMIZING TIME AND COST OVERRUNS ON CONSTRUCTION PROJECTS

It is critical to manage both Managing cost and time in construction projects in order to achieve the successful project completion. However, based on previous studies reviewed in this study, projects seldom achieve success in completion of projects full completion within the planned budget and time.

Construction projects often face uncertainties even though meticulous planning takes place before construction begins, and these uncertainties are due to the heterogenous nature of the construction industry (Abdul-Rahman et al., 2006). It is therefore imperative that problems are identified by the project team as early as possible, and that the most appropriate and economical solutions are then implemented (Abdul-Rahman and Berawi, 2002).

The mitigation measures put in place in order to minimise and control time and cost overrun factors during the implementation stage have been identified through a through literature review. Having reviewed factors that cause time and cost overrun and their understanding in the previous sections, this study proposed thirteen (13) mitigating measures to control both time and cost overrun factors. The measures proposed for time overrun factors are: proper planning of work, adequate and close supervision of projects, consultant to ensure drawings and documentations are submitted on time, effective and lucid communication between all parties, early engagement of project managers, adequate focus on quality, cost and delivery of the project, contractor to ensure sufficient cashflow at the start of the project, adequate training of project staff, payments to contractor and consultant done timeously, adequate understanding of contractors on project task, effective mobilisation and release of resources, approvals of variation orders are done timeously, and forecast planning by contractor against unforeseen delays (i.e. labour strike).

Similarly, measures identified to mitigate cost overrun factors are: consultant to ensure drawings and documentations are submitted on time, frequent coordination between all the project parties, adequate project planning and scheduling, utilising experienced subcontractors and suppliers, effective strategic planning by contractor, effective and lucid communication between all the project parties, perform pre-construction planning of project tasks and resources needed, use of appropriate construction methods, conducting frequent progress meetings,

contractor to ensure sufficient cashflow at the start of project, effective site management and supervision, ensure adequate training of project staff, and early engagement of community.

Olawale and Sun (2010) classified mitigating measures into three implementation strategies, namely proactive, re-active and organisational. Based on the study that was carried out by Azis et al. (2013), the proposed cost control measures for this study are classified under the implementation strategies that were introduced by (Olawale and Sun, 2010). This was presented in Table 2-4.

Table 2-4: Mitigating measures for cost overrun factors with implementation strategy.

No	Mitigating measure for cost overrun	Implementation strategy (Azis et al., 2013)
1	Consultant to ensure drawings and documentations are submitted on time	Pro-active
2	Frequent coordination between all the project parties	Re-active
3	Adequate project planning and scheduling	Pro-active
4	Utilising experienced subcontractors and suppliers	Re-active and organisational
5	Effective strategic planning by contractor	Pro-active
6	Effective and lucid communication between all the project parties	Pro-active and organisational
7	Perform pre-construction planning of project tasks and resources needed	Pro-active, re-active and organisational
8	Use of appropriate construction methods	Pro-active
9	Conducting frequent progress meetings	Re-active and organisational
10	Contractor to ensure sufficient cashflow at the start of project	Pro-active
11	Effective site, management, and supervision	Pro-active
12	Ensure adequate training of project staff	Organisational
13	Early engagement of community	Pro-active

2.8 CHAPTER SUMMARY

This chapter reviews various cost and time overrun factors that were investigated by previous authors in their studies on the construction industry regionally and internationally. It also reviewed the different mitigating measures that may be implemented in order to minimise the impact of cost and time overrun on construction projects. Based on reviewed studies on cost and time overrun factors in construction projects, factors differ depending on the environment

that exists within the country. Therefore, there are no universal factors that are responsible for cost and time overrun to projects.

The chapter set out to identify list of cost and time overrun factors that were identified by prior studies, and these factors were then grouped under seven groups, namely contractor-related, consultant-related, client-related, material and equipment-related, labour-related, contract-related, and external. These were then presented to the sample group in a form of questionnaire. Chapter three, which follows this chapter, presents the methodology for this research.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 INTRODUCTION

According to Kothari (2004), research methodology is the way in which the question that the research is trying to address is resolved. This involves the various steps adopted by the researcher when examining the research problem. The research methodology, therefore, provides a framework upon which the research process is executed (Offermann et al., 2009).

In this chapter, the methods used to carry out the research, as well as the survey instrument, are outlined. This section of the study outlines the method and scientific procedures used when conducting the study, methods of data collection for the study, and analysis of the data using statistical methods. The topics that will be covered under this chapter are research design and approach, area of the study, population of the study, sampling technique used, sample size, methods of data collection with ethical issues adopted for the study, and data analysis.

A thorough review of literature in the study area was undertaken in order to ascertain the views from experts in the industry. Through this process, one was able to ascertain factors that cause time and cost overrun in the construction industry. As a result, a total of 36 cost overrun and 51-time overrun factors were identified to be put forward as part of the survey questionnaire.

The research question in this study is designed to evaluate the factors that cause time and cost overrun on projects in the Namibian construction industry. This research makes use of a quantitative/descriptive method, as it aims to form an accurate description of the survey respondent's perception of what causes time and cost overrun in the Namibian construction industry. Quantitative research explores the relationships between variables measured numerically and that are analysed using a range of statistical and graphical techniques (Saunders et. al., 2019). Therefore, this study is designed to collect the views from clients, consulting firms and construction firms with regard to the factors that cause time and cost overrun, and the measures that may be used to minimise the impact within the construction industry. The approach to conducting the methodology for this research is shown in Figure 3-1.

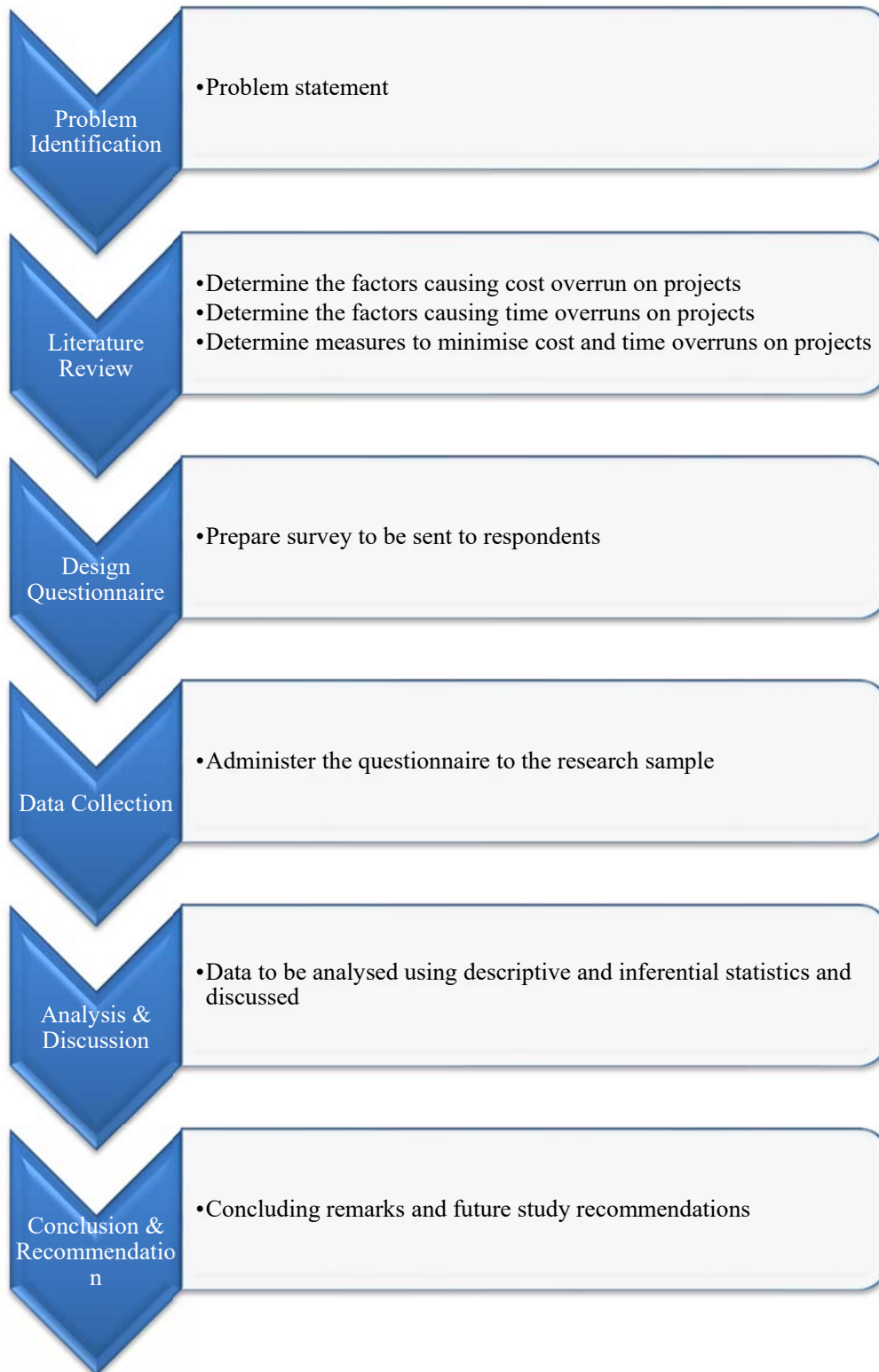


Figure 3-1: Main Activities of the Research

3.3 RESEARCH APPROACH AND DESIGN

Saunders et al (2019) classify research approaches into three: quantitative, qualitative, and mixed methods. The quantitative research method may be expressed and is based on measurement of quantity (Kothari, 2004), whereas the qualitative research method entails quality, and deals with the subjective nature or perspective of the subject (Kothari, 2004). Quantitative research examines the relationship between variables measured numerically that are then analysed using statistical and graphical techniques (Saunders et al., 2019). Furthermore, research may be descriptive or analytical. Descriptive research consists of surveys, and it accurately depicts the characteristics of an individual or a group, whereas analytical research is used for cases where the information or data is already available, allowing this data to be analysed to make critical evaluation (Kothari, 2004). This research was based on responses to a structured questionnaire survey where data is gathered and analysed using statistical methods. As the design applies the use of questionnaire that are appropriate to assess the respondents perception and experience on the core objectives of the study within the Namibian construction industry and seeks to collect and analyse information on cost and time overrun, the research took the descriptive and quantitative research approach. Kikwasi (2013) used descriptive and quantitative research method to obtain the views of clients, consulting and construction firms and regulators in his study on causes and effects of delay in construction projects in Tanzania. Similarly, Akinradewo, et al (2019) used descriptive and quantitative research methods in a study revisiting causative factors of Project cost overrun in building projects in Nigeria.

Kothari (2004) describes a research design as an advanced plan of the methods that will be utilised in order to collect the appropriate data from the research participants, and the techniques that will be used in their analysis, keeping in view the objective of the research. Therefore, it outlines the protocol to be followed for the collection, evaluation, and analysis of the data.

3.4 AREA AND POPULATION OF THE STUDY

This study was conducted in Namibia, and the questionnaire was designed in such a way that it enabled a better representation of the study population across the different construction projects undertaken within the country. Use of a survey facilitates research with a large sample

size (Saunders et al., 2019). This research examines the factors that cause time and cost overrun in the Namibian construction industry and the different measures that are adopted in order to avert them.

The research population consisted of professionals that can provide valuable information that will help address the research question. The targeted professionals for this study include architects, quantity surveyors, project managers, engineers, and construction managers. The population size of 1883 was obtained from the list of professionals in Namibia that are active in the construction industry. The population consists of all 1883 professionals listed in the existing membership directory of the Engineering Council of Namibia (ECN), Namibian Council for Architects and Quantity Surveyors (NCAQS), and the Construction Industries Federation of Namibia (CIF), which are statutory bodies for consultants and contractors respectively. The reason why this study uses the above-mentioned target professionals is because they are registered professionals who are working in the Namibian construction industry and who are well versed on the cost and time management of construction projects. The study population size is shown in the Table 3-1 below.

Table 3-1: Study Population Size

Professional Group	Study Population
Quantity Surveyors	199
Architects	141
Engineers	1543
Total	1883

A survey was conducted through a questionnaire that was sent through email to the target group. A total of 114 surveys were received from different project groups, namely contractors, consultants, and clients.

3.5 SAMPLING TECHNIQUES AND SAMPLE SIZE

This section addresses the sampling procedure that was used in the study. It presents how the sample size was determined, what type of sampling techniques were used and how the respondents were identified.

3.5.1 Sampling

According to Saunders et al. (2019), a set of data selected from a population is defined as a sample or sub-group. Therefore, sampling is a process that involves the selection of a proportion of a population as a representative of the whole population (Singh and Masuku, 2014). There are different sampling techniques that are available to researchers and each has its effect on the way the study generalises the sample (Kothari, 2004). Therefore, the sampling technique enables the researcher to collect data from a sample as opposed to the entire population. Singh and Masuku (2014) noted that sampling has benefits of collecting data faster at a lower cost.

3.5.2 Sampling Techniques

Singh and Masuku (2014) describe sampling techniques as a method of selecting individuals from a sample. Kothari (2004) states that samples are either classified as probability samples or non-probability samples. Saunders et al. (2019) define probability sampling as a chance sampling technique whereby every item in the population has equal chance of being selected. Non-probability sampling, also known as purposive sampling, on the other hand, is a technique whereby the researcher uses their judgement to select the sample.

According to Kothari (2004), random a sampling technique allows for an equal probability of a participant being deliberately selected from the sample of a targeted group, thus ensuring the selection of a better representative of the sample that is likely to provide invaluable data for the study. Fricker (2015) further corroborates this by noting that random sampling minimises the chance of bias in the selection of participants in a survey.

Therefore, this study used the random sampling technique in selecting the respondents of the study. The study involves the participation of diverse professionals from the Namibian construction industry, therefore providing a broader perspective of the factors that are causing time and cost overrun and the measures that may be implemented to reduce these factors. Random sampling was used to select the respondents from the above-mentioned statutory bodies for consultants and contractors, respectively, in the Namibian construction industry.

3.5.3 Sampling Size Determination

Determination of a sample is a common method in survey research. As part of this research, it will be difficult and impractical to collect a response from the total population, and the study will therefore have to identify a reasonable sample size that can be used to determine a generalised finding. Singh et al (2014) describe sample size determination as a technique used to select the number of observations that are to be included in the sample. Sample size is calculated by the optimum number necessary to enable a valid inference to be made about the population (Marshall, 1996). Marshall (1996), as cited by Islam (2018), further noted that the bigger the sample size, the smaller the chance of a random sampling error and, since the sampling error is inversely proportional to the square root of the sample size, there will not be much gained from studying a larger sample. However, according to Singh et al (2014), the larger the sample size, the higher the precision of the outcome of the result. The total number in the population for this study were 1883 construction professionals obtained from Engineering Council of Namibia (ECN), Namibian Council for Architects and Quantity Surveyors (NCAQS) and Construction Industries Federation of Namibia (CIF).

The sample size was determined using Cochran's statistical formula using Eq. (1) and (2).

$$n = \frac{m}{1 + \frac{(m-1)}{N}} \quad (\text{Eq.1})$$

Where:

n = Sample size of limited population

m = Sample size unlimited population

N= Population size

m is estimated using the following formula:

$$m = \frac{z^2 xPx(1-P)}{\varepsilon^2} \quad (\text{Eq.2})$$

Where:

z = score of the confidence level

P = Estimated proportion of the attribute present in the population: (0.5) for maximum variability

ε = Precision level: (5%=0.05)

Sample size for this study:

Using a 95% confidence level,

$$m = ((1.96^2) \times 0.5 \times (1-0.5))/0.1^2 = 384.2 \sim 385$$

Therefore,

$$n = 385 / (1 + ((385 - 1) / 1883)) = 319.8 \sim 320$$

From the above calculation using Cochran's formula, the required sample size for this population was 320. The questionnaire was then distributed to 320 professionals that were randomly selected from the population. A total of 114 questionnaire responses were received, and from these responses came the results of this study. The response rate of this questionnaire survey was 36%. According to Burgess (2001), it is common that the survey response rates obtained are around 20%. A survey conducted by Chan and Kumaraswamy (1997), Olawale and Sun (2010), and Wanjari and Dobariya (2016) in similar studies of either cost or time overrun factors in the construction industry found that the response rate to their survey yielded 37%, 44% and 45% respectively, which were considered to be good response rate. On the other hand, Toor and Ogunlana (2008) and Aziz (2013) conducted surveys on the causes of delay and cost variation in Thailand and Egypt respectively and reported a response rate of 95% and 78% respectively, which was considered to be very good.

Sullivan (2016) noted that, according to the central limit theorem, where you have a population with a mean and standard deviation with a random sample size greater or equal to 30, the distribution of the sample mean can be approximated reasonably well by a normal distribution. Therefore, taking Burgess (2001) and Sullivan (2016) into consideration, the sample of 114 responses that was collected in this study is sufficient enough to carry out the quantitative analysis for this study.

3.6 METHOD OF DATA COLLECTION

Amongst the different data collection methods available, the survey was adopted as the primary method of data collection. The primary data is primarily collected for a specific research project, either through an experiment or survey, whereas secondary data is data that are already

collected by others for a different purpose which are further analysed to provide additional insight /knowledge to a new study (Kothari, 2004).

In this study, the primary data was collected through the use of a questionnaire survey that makes use of interval Likert scales to measure the data and allows the use of descriptive statistics to analyse the data (Saunders et al., 2019). The questionnaire consists of five parts (i.e., Part A to Part E), where Part A identifies the demographic information of respondents, Part B determines the level of cost and time performance of one identified project, Part C and D determine the level of time and cost overrun factors identified during the literature review, and Part E determines the level of measures that may be implemented in order to minimise cost and time overrun in projects.

This survey involves the collection of primary data from the target group of a population by means of posing questions and collecting their responses . Singh et al (2014) state that descriptive surveys provide direct sources of significant information relating to human behaviour.

In general, there are two types of questionnaires, namely structured and unstructured questionnaires. Kothari (2004) defines structured questionnaires as clear-cut and pre-determined questions that the participants independently respond to. The structure of all the questions is similar and the questionnaires are easy to administer. Whereas, in the case of unstructured questionnaires, the interviewer asks questions to respondents and changes the sequence and wording of the questions dynamically (i.e. not pre-determined) (Kothari, 2004).

The study was based on data obtained through a structured questionnaire sent out to target survey respondents using Survey Monkey as a platform in order to gather relevant numerical data. By conducting the survey using a Structured questionnaire, the collected data which is coded can easily be analysed using statistical programs (Kothari, 2004)

3.6.1 Data Gathering

In this study, the selected data collection instrument used was a questionnaire. The questionnaire is a structured questionnaire that is constituted of both open-ended and close-

ended questions that address the objectives of the study. According to Kothari (2004), open-ended questions permit the respondents to freely interpret the questions, whereas the closed-ended questions are defined in advance, and the respondents are limited to pre-determined responses that are given. Questionnaires are inexpensive instruments of data collection, as opposed to interviews (Kothari, 2004).

Part of the questionnaire in this study requires the respondents to rank the factors that cause cost and time overrun on projects using a five-point Likert scale (5 = Extremely High, 4 = High, 3 = Moderate, 2 = Low, 1 = Minimal impact). Moreover, a further five-point Likert scale was used to determine the measures used to minimise time and cost overrun on construction projects, where 5=Strongly Agree, 4=Agree, 3=Undecided, 2=Disagree and 1=Strongly disagree.

3.6.2 Questionnaire Design

During the literature review of this research, 36 factors that cause cost overrun and 51 factors that cause time overrun in construction industries were identified. These factors, drawn from the literature review, were listed into seven respective groups, namely contractor-related causes, consultant-related causes, client-related causes, contract relationship-related causes, labour-related causes, material- and equipment-related causes, and external causes. Furthermore, thirteen (13) measures that may be used to minimise time and cost overrun respectively were identified. These factors and measures that were identified from the literature review were used in developing the questionnaire. The questionnaire design took into consideration the study objective with the aim of addressing the research question.

3.6.3 Contents of the Questionnaire

The study questionnaire was divided into five sections as shown in Table 3-2. The full questionnaire is included as part of **Appendix D**. However, the sections that was included is shown below.

The respondents were given the opportunity to add other factors and measures that were not included in the survey. The questionnaire was designed such that it may be completed within the shortest possible time.

Table 3-2: The sections of the questionnaire used in the study.

Section	Description
A: Background information.	This provides the demographic characteristics of the respondents of this questionnaire.
B: Determining the level of cost and time performance of one identified project.	This section identifies a project that respondents are conversant with and outlines the geographical location, type of project, the planned and actual cost of the project and planned and actual time of the project.
C: Determining the time overrun factors.	This section presents the time overrun factors from the literature review. In this section, respondents are asked to rate the level of impact each factor has on time overrun, based on the five-point Likert scale, with regards to the project chosen for the survey.
D: Determining the factors causing cost overrun.	This section presents the factors causing cost overrun from the literature review. In this section, respondents rate the level of impact each factor has on cost overrun, based on the five-point Likert scale, with regards to the project chosen for the survey.
E: Determining the different measures used to minimise time and cost overrun on construction projects.	Respondents identify measures that may be adopted in order to reduce time and cost overrun on construction projects.

3.6.4 Questionnaire Administration

This section outlines the way in which the questionnaire survey was administered to the respondents. The more traditional approach used to conduct a questionnaire was through pen and paper. However, due to the advancement of technology and computer literacy, researchers now have the opportunity to ease the burden of data accumulation and analysis (Leedy and Ormrod, 2015). The questionnaire was administered using emails to professionals randomly selected from a database of the Engineering Council and Namibian Council for Architects and Quantity surveyors.

According to Kothari,(2004), the most common and widely-used method of collecting data is through mailing of questionnaires to prospective respondents. This is also economical as opposed to the paper-based questionnaire that needs to be issued to respondents, potentially saving time and the cost of travelling long distances to reach the respondents. In this study, the

research questionnaire was designed and distributed via a cloud-based software platform called Survey Monkey. Survey Monkey was used in order to ensure that the questionnaire is distributed to the sample population faster and with ease. It also saves time and cost by making the data gathering process more convenient. This method makes it possible to track responses and analyse results. According to Alfaro (2016), this software provides data analysis, sample selection, data representation and bias elimination. Moreover, the platform provides the researcher with tools to remind the participants via an email to complete the survey and to monitor the completion rate of the survey.

3.7 METHOD OF DATA ANALYSIS

Once the data had been collected successfully, it was processed and analysed using a computer software. The Statistical Package for Social Sciences (SPSS) was used to analyse the questionnaire data. The data that was gathered was edited, analysed, and interpreted in order to address the study objective. The analysed data was then presented in the form of tables, charts, and graphs. Furthermore, the interpretation of the results was narrated.

3.7.1 Relative Importance Index

This section outlines the way in which the responses from the Likert scale were analysed and the results were ranked using Relative Importance Index. Relative Importance Index (RII), as adopted by Assaf et al. (1995), Chan and Kumaraswamy (1997), Olawale and Sun (2010) and Gebrehiwet and Luo (2017), was used in order to analyse and rank the results.

Relative importance index (RII) = $RII \frac{\sum W}{AxN}$, (RII ranges between 0 and 1) (Eq. 3)

$$\sum W = (w_1 * n_1) + (w_2 * n_2) + (w_3 * n_3) + (w_4 * n_4) + (w_5 * n_5)$$

Where:

W is the total weight given to each factor by respondents, and ranges from 1 to 5, (where “1” is “Minimal Impact” and “5” is “Extremely High”);

n_i is frequency of i^{th} response given for each cause, $i=1$ (minimal impact) $i=5$ (extremely high);

w is weighting given to each factor by respondents, and it ranges from 1 to 5, w=1(minimal impact) w=5(extremely high);

A is the highest weight ranking available (that is 5 in this study); and

N is the total number of respondents that have answered the question.

This index calculation was used in order to determine the relative significance and ranking of cost and time overrun factors.

3.7.2 Mean item scores

Mean is the simplest and most common measure of arithmetic average, also known as central tendency, that is determined by dividing the total of the given value of items with the total number of items (Kothari, 2004: 132). According to Kothari (2004:132), the weighted mean is the most appropriate method to calculate the realistic average of a data. It is calculated by the following formula:

$$\bar{X}_w = \frac{\sum w_i X_i}{\sum w_i} \quad (\text{Eq. 4})$$

Where: $\bar{X}_w = \text{weighted item}$
 $w_i = \text{weight of item}$
 $X_i = \text{value of item}$

Tables and charts were used in order to analyse and interpret the data collected from the questionnaire survey.

3.7.3 Percentages

Percentages are used in presentation of data by simplifying numbers to fit into a 0 to 100 range (Kothari, 2004:129). Percentages are the simplest form of summarising and presenting data for individual variables such that they are used for analysis (Kothari, 2004:18). If there are categorical data, the table summarises the number of frequencies in each category in order to facilitate comparison of results (Saunders et al., 2019). In the data analysis section of this research, charts and tables were used in order to present the data collected from the questionnaire survey.

3.7.4 Spearman's Correlation

Spearman's correlation test is also known as Spearman's coefficient of rank correlation. It measures the monotonic association between two ranked variables. The test was used to demonstrate how well the clients, consultants and contractors agree or disagree on the severity of factors that cause time and cost overrun.

The formula used to calculate the Spearman rank correlation is shown as follows:

$$r_s = 1 - \left[\frac{6 \times \sum d^2}{n(n^2 - 1)} \right] \quad (\text{Eq. 5})$$

Where: r_s = Spearman's rank correlation coefficient;

d = the difference between ranks assigned to variables for each cause; and

n = number of pairs of rank

3.8 VALIDITY AND RELIABILITY

According to Kothari (2004), validity refers to the degree to which a test measures what it wished to measure, whereas reliability refers to the precision and exactness of the measuring procedure and the stability and consistency of the data.

According to Saunders, et al. (2019) and Kothari (2004), a pilot study should be undertaken in order to pre-test the questionnaire designed for this study. This is used as a test of the main survey before it is disseminated to the target group. The designed questionnaire was administered to a colleague at work who works as a consultant, and a contractor with whom I had worked on a prior project. Both test subjects were engineers working within the Namibian construction industry. During this process, feedback of some of the weaknesses of the questionnaire was given, and these weak areas included grammar mistakes, the survey being too long, and some questions being ambiguous and leading. Based on this feedback, the questionnaire survey was improved, and the due care was taken to ensure that the questions are concise and clearly understood by the respondents. Thereafter, the updated survey was sent out to the sample population.

This study sought to identify whether the data received from the questionnaire was reliable or not. The Cronbach Alpha (α) test was conducted in order to measure the reliability and consistency of a questionnaire data. According to Li and Wang (2007) and Yang and Ou (2008), a Cronbach Alpha (α) value less than 0.3 is considered to be unreliable and unacceptable, whereas a Cronbach Alpha (α) value more than 0.7 has a high reliability level.

$$\alpha = \frac{Nxc}{v+(N-1)c} \quad (\text{Eq. 6})$$

Where: α is Cronbach Alpha

N is number of items

C is average inter-item covariance among the items

V is average variance

The Cronbach Alpha (α) reliability score for factors that cause cost and time overrun was investigated, and the results are presented in Table 3-3.

Table 3-3: Cronbach Alpha (α) reliability co-efficient for time and cost overruns.

Field	Cronbach's Alpha (α)
Cost overruns	0.933
Time overruns	0.971
Total	0.976

The results show that the Cronbach Alpha (α) values for this are greater than 0.7 for each field of respondents investigated. The result suggests that all the variables in the questionnaire are highly reliable. In this study, the overall Cronbach Alpha was 0.976, and this indicates very good overall reliability. Therefore, the data is reliable and able to be used for further analysis and interpretation.

3.9 ETHICAL CONSIDERATIONS

According to Rogers (1987), there are four ethical principles that need to be considered when conducting research, namely the participants' protection from harm, the right to privacy, right to anonymity and confidentiality, and the right to self-determination. This ensures that the

participants on this research are caused no harm and their confidentiality is protected. The research study was conducted with the full consent of the participants, which was obtained prior to commencement of the research. The letter of consent and confidentiality and the consent form and subsequent EiR approval is attached as part of **Appendix A&B**. Before the questionnaire was sent to the participants, it was reviewed by the author's supervisor, and a pilot survey was sent to two professionals. This study has prioritised the privacy of the respondents, and all communication with the participants was done with complete transparency. Application for ethics clearance was lodged at the University of Cape Town and approval was granted. Refer to **Appendix C**.

3.10 CHAPTER SUMMARY

The chapter outlines the research methodology that was used in this study. This chapter outlines the study population, sampling technique and sample size, methods of data collection, and analysis using the SPSS statistical software. The next chapter presents the data that was collected and analysed in order to address the research question.

CHAPTER FOUR: DATA PRESENTATION, ANALYSIS AND DISCUSSIONS

4.1 INTRODUCTION

This chapter answers the research question outlined in chapter one by presenting and discussing the research findings that were gleaned from the responses to the completed questionnaires. The questionnaire was distributed randomly amongst a sample of 350 professionals listed in the membership directory at the Engineering Council of Namibia (ECN), Namibian Council for Architects and Quantity Surveyors (NCAQS) and Construction Industries Federation of Namibia (CIF). At the end of the survey period (June – August 2021) 114 responses were received. The data was analysed using descriptive and inferential statistics.

4.2 DATA PRESENTATION

This section outlines the demographic characteristics of the respondents and the data obtained about the participants' views on factors causing time and cost overrun.

4.2.1 Background profile of the respondents

4.2.1.1 Age Distribution of Respondents

One of the demographic characteristics in the questionnaire survey is the age distribution of the respondents who have participated in the study. The results of the age distribution of respondents within the study are shown in Figure 2-1. The figure shows a normal distribution with slight skew to the right. The result shows that 69.1% of the respondents are between the age group of 31-35 and 41-45, with the highest percentage of respondents (36%) belonging to the age group of 31-35 years of age. This reflects that the majority of the respondents have significant level of experience in the construction industry; therefore, they can provide a response that can address the objective of this study.

4.2.1.2 Gender Analysis of Respondents

Another demographic characteristic that was evaluated in the questionnaire survey is the gender of the respondents. The number of male and female participants in this study was analysed using a descriptive statistic, and the results are shown in the pie chart as shown in Figure 4-2.

The analysis shows that the majority of the respondents (82.5%) who participated in the survey were male, while the female respondents made up 17.5%. This also shows that the construction industry, that constitutes of contractors, engineers, architects, quantity surveyors and clients, is male dominated.

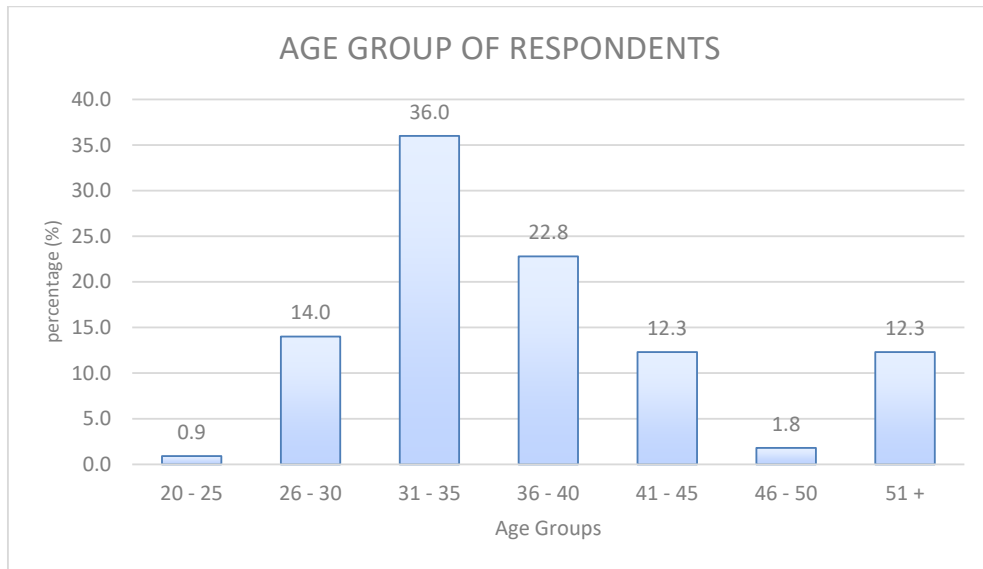


Figure 4-1: Age Analysis of Respondents

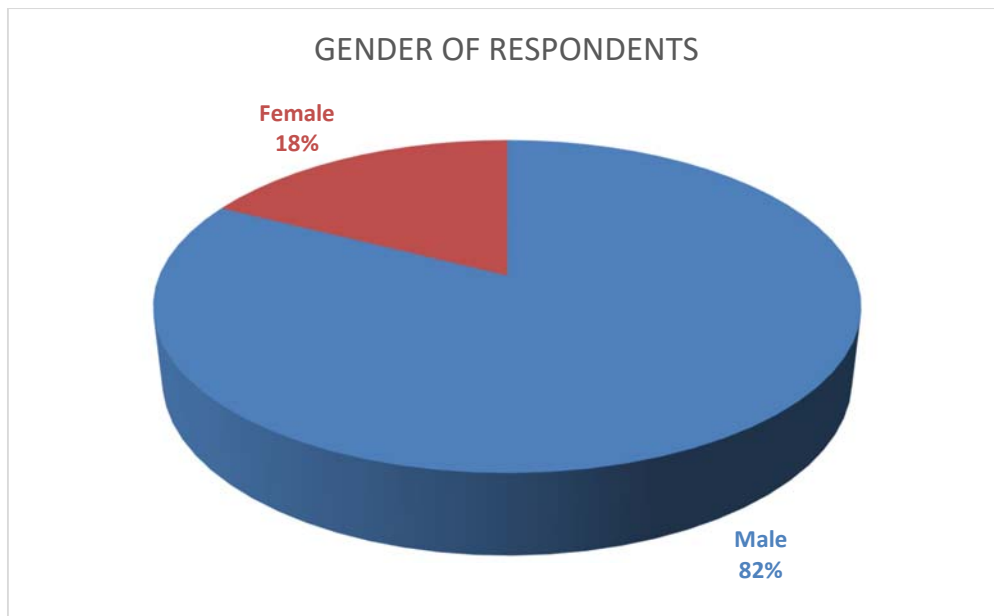


Figure 4-2: Gender Analysis of Respondents

Given the high proportion of male respondents the inference that may be deduced from these results is that the responses are skewed towards high project performance.

4.2.1.3 Educational Background of Respondents

The study also established the educational background of the respondents who participated in the research. The results are reflected in

Figure 4-3. A significant percentage of the respondents (58.8%) hold a Bachelor's degree, followed by 36.8% of the respondents holding a Master's degree. This was followed by Certificate/Diploma holders at 4.4%. There were no respondents with Matric or PhD qualifications. This shows the diverse group of qualified professionals involved in the study, and more than 90% of the professionals have qualification of a Bachelor's degree or better. The combination of educational background and experience is imperative in identifying the factors that cause cost and time overrun in the Namibian construction industry and the possible measures that may be used to address the level of performance.

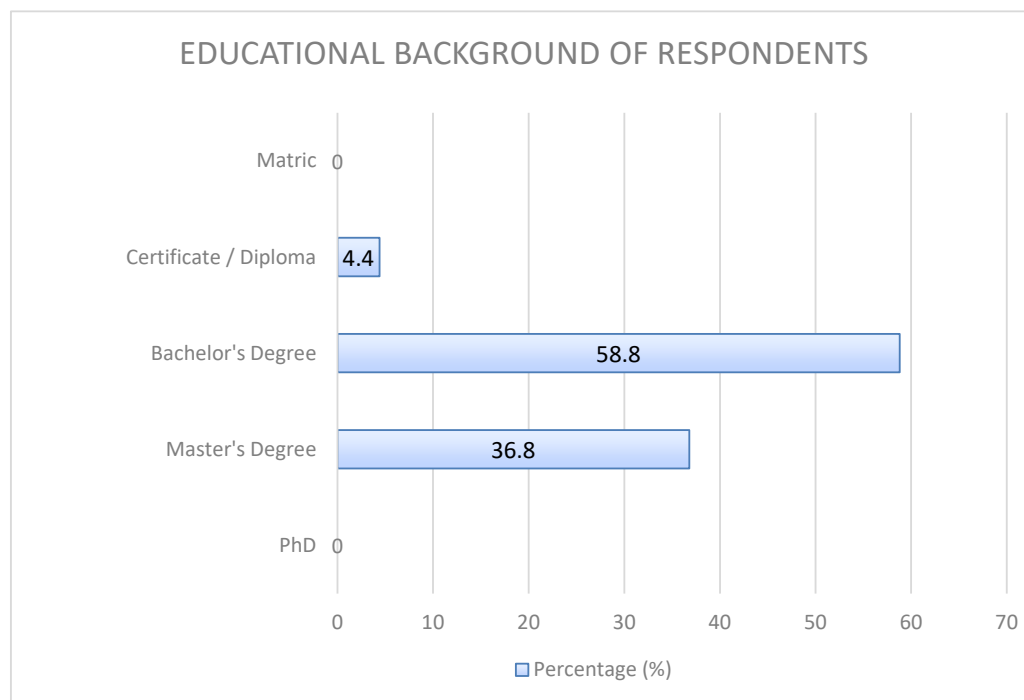


Figure 4-3: Educational Background Analysis of Respondents

4.2.1.4 Professional and Area of Expertise of respondents

The study sought to know the different professionals that participated in the study. The output of the results is presented in Figure 4-4. The significant percentage of the respondents (49.1%) were Engineers, followed by project managers at 19.3%, which are closely followed by quantity surveyors and architect with 14.9% and 9.6% respectively. Site agents constitute the smallest percentage of the total responses with just 0.9%. This shows that the study has a good representation of construction professionals, with the majority of the respondents for this survey consisting of consultants and clients, whereas contractors constitute the smallest percentage of less than 1%. The objective of this study will be addressed by these professionals.

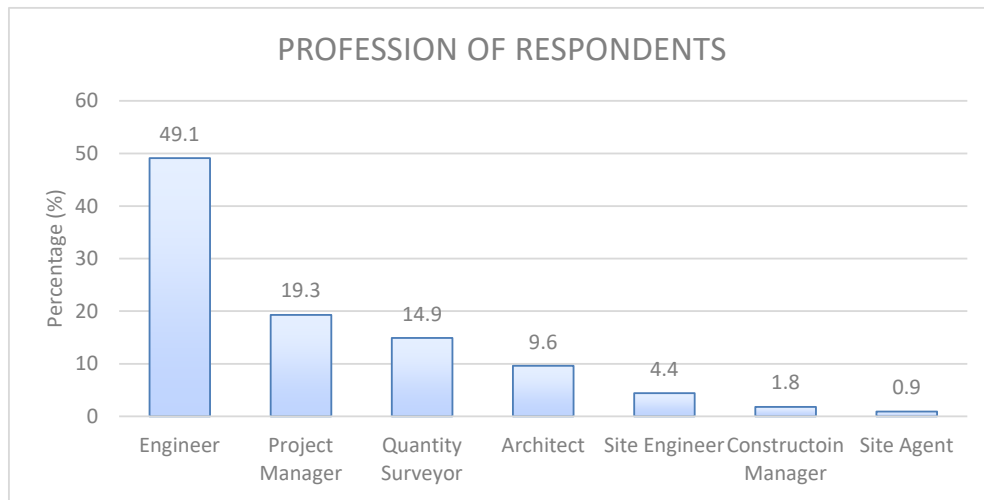


Figure 4-4: Profession of Respondents

Figure 4-5 presents the area of expertise of the respondents. The majority of the respondents (35.1%) had experience in civil engineering, with building construction being second highest area of expertise with 21.9%. Mechanical engineering, electrical engineering and building and civil construction had very close area of expertise with 14%, 16.7% and 11.4% respectively. Respondents with specialist work of expertise had the lowest percentage of 0.9%. This shows that the majority of the respondents' areas of expertise are in the civil engineering and building construction, whereas less than 1% were involved in specialist work that requires specialised work such as wastewater treatment specialist, light weight roof steel manufacturers. The Site Engineer is the Engineers representative on site in monitoring quality of the construction work while the Engineer is the project consultant

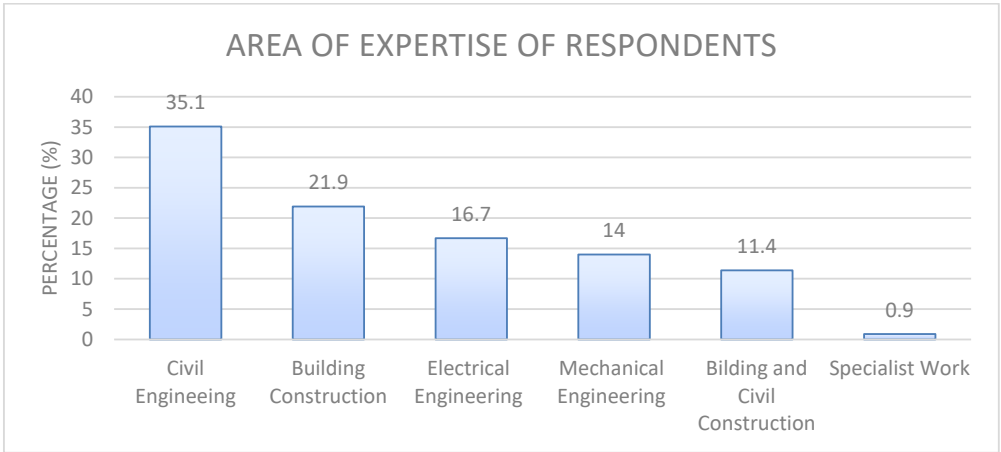


Figure 4-5: Area of Expertise of Respondents

Figure 4-5 refers to the area of expertise of the respondent's whether they are involved in the Civil engineering, building construction, mechanical engineering work they are involved in whereas, Figure 4-4 shows their profession. For instance, Architects and Quantity surveyors can be involved in building construction. Engineers can be involved in Civil, Electrical, or mechanical engineering work.

4.2.1.5 Years of Work Experience

Another variable that was addressed by the study is the number of years of experience of the respondents. The results from 114 respondents on the years of experience of are presented in Figure 4-6.

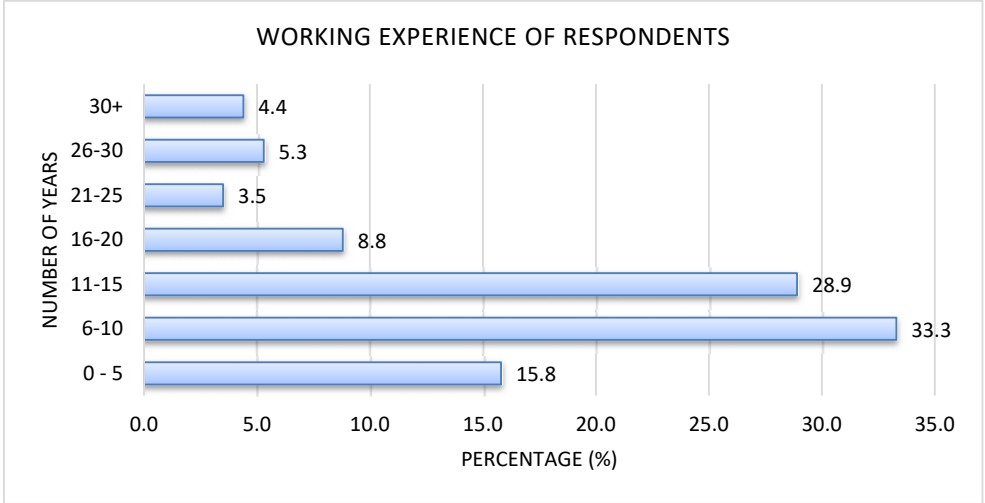


Figure 4-6: Years of work experience in the construction industry

A significant number of the respondents (33.3%) have between 6–10 years of experience, followed by 28.9% of the respondents who have between 11–15 years of experience. Therefore, it can be concluded that the respondents in this survey are well-experienced, with 50.9% of the respondents having more than 10 years’ experience in the construction industry. Furthermore, a significant number of the respondents had obtained a Bachelor’s degree, which shows that the respondents are competent enough and capable to participate in the survey.

4.2.1.6 Project Locations

The location of projects that are identified by the respondents and the output of the results are shown in Figure 4-8 and the different regions of Namibia where the projects were located is shown in Figure 4-7. The largest percentage (41.2%) of the projects identified by the respondents are located in the central region (Khomas, and Otjozondjupa), which was followed by the northern region (Kavango, Kunene, Ohangwena, Omusati, Oshana, Oshikoto and Zambezi) with percentage of 29.8%. The southern (Hardap and Karas) and western (Erongo) regions have approximately similar number of projects identified in the study with 13.2% and 11.4% respectively. The eastern region (Omaheke) had the least number of projects identified by the respondents with just 4.4% in this study.

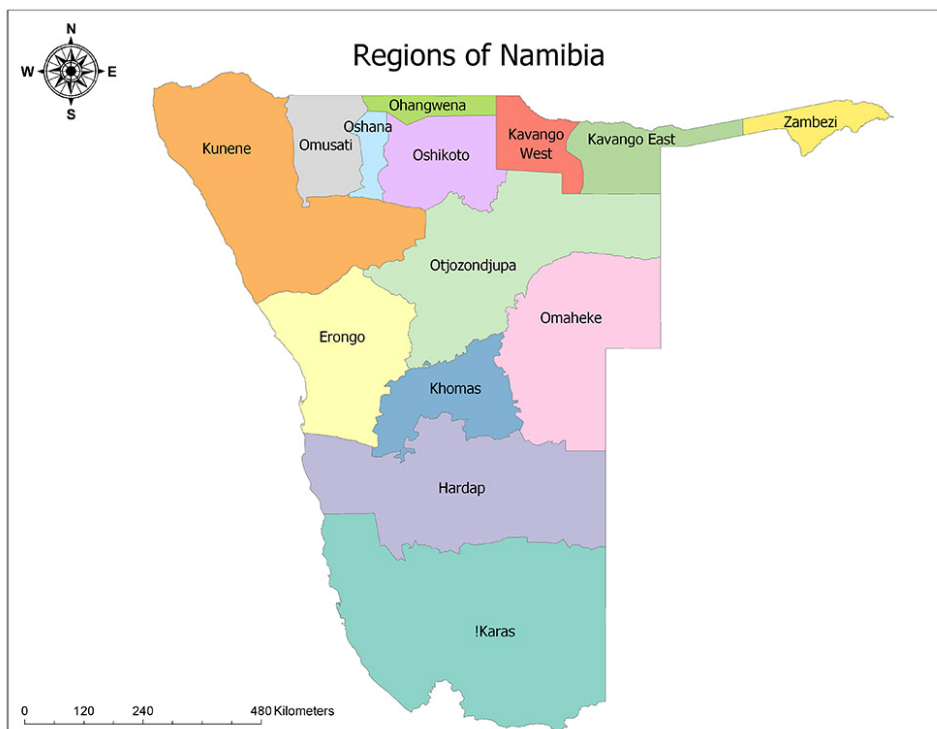


Figure 4-7: Regions of Namibia (World Atlas, 2021)

The main purpose of this is to see if the data collected is representative of the overall scenario of the Namibian construction industry. The result shows that it encompasses the different regions of Namibia, with the northern and central regions especially well represented.

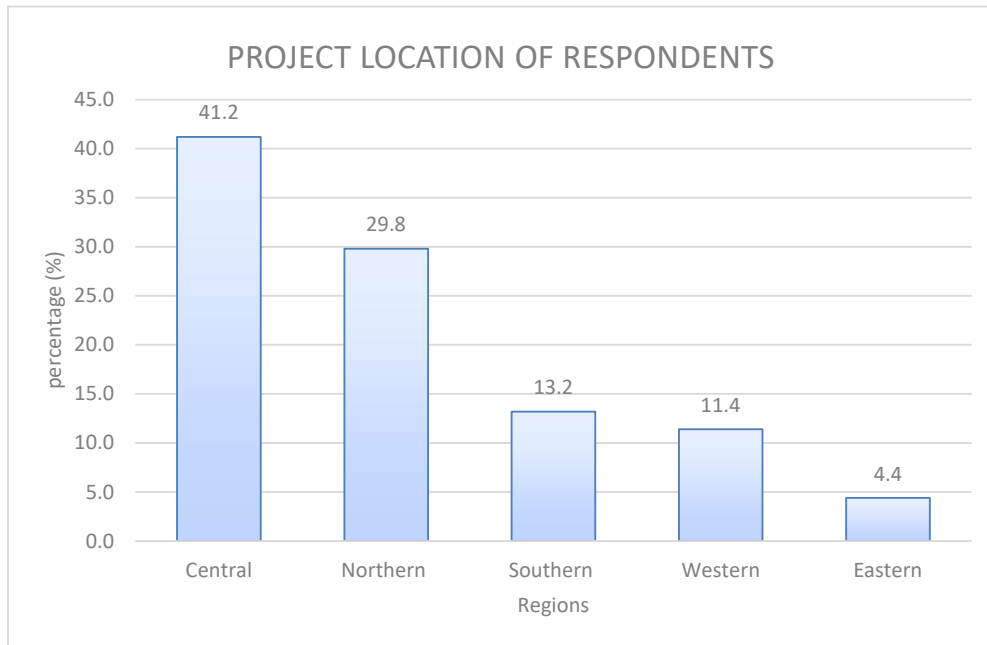


Figure 4-8: Regions of the project location of respondents

4.2.1.7 Project Role of Respondents

The role of respondents who participated in this study are categorised into three groups as shown in Figure 4-9.

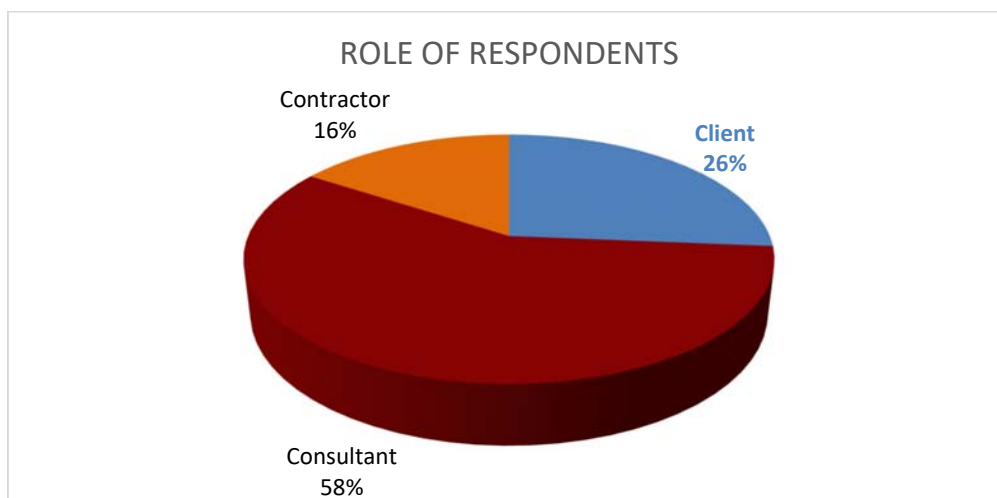


Figure 4-9: Role of respondents on projects

The above figure shows that the majority of the respondents (58%) who participated in this research survey are consultants ‘personnel who are tasked to design and supervise construction projects’. They are followed by clients and contractor’s personnel, who are involved in construction projects in the Namibian construction industry with 26% and 16% respectively. Therefore, any project delay and cost overrun factors that may exist within the industry are evaluated by these categories of respondents, and this helps in identifying which cost and time overrun factors have a significant adverse effect on construction projects. The result of the study is not expected to be skewed as the study included representatives of the different professionals in the different sectors (i.e., Client, Consultant and Contractor).

4.2.2 Level of Cost and Time Overruns on Construction Projects in Namibia

This section of the study presents the data collected from the participants on the level of cost and time overruns on construction projects that they were involved in and conversant of that were completed within the last five years.

4.2.2.1 Planned and Actual Cost of the Identified Project

Percentage Ranking function was used to categories the raw data of actual and planned cost of the projects identified by the respondents for the study. Figure 4-10 presents the results of planned cost of projects identified by respondents. 41% of the projects had a planned cost between N\$1-20 million. This was followed by 21% and 19% of projects that had a planned cost of over N\$100 million and N\$20-50 million respectively. Projects in the N\$50-100 million and less than N\$1 million had the lowest initial budget with 11% and 9% respectively.

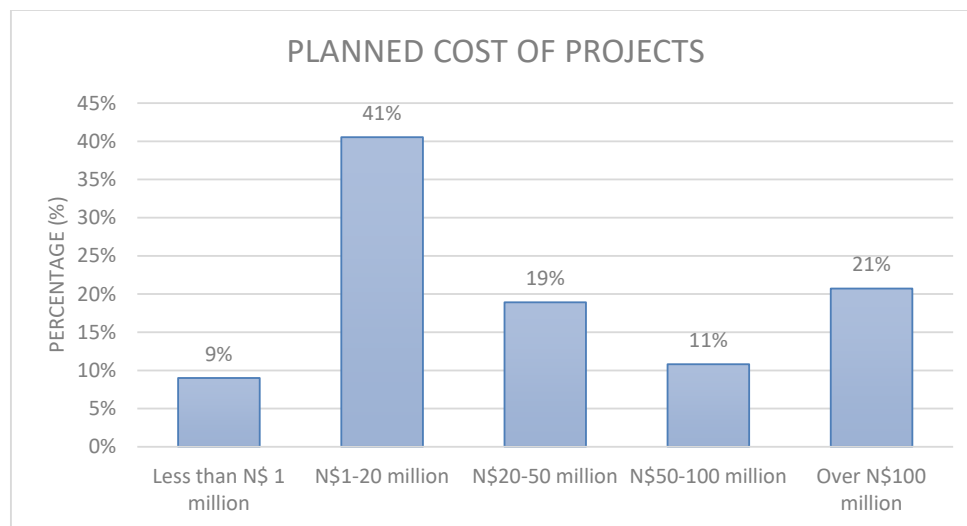


Figure 4-10: Planned cost of identified projects

The actual cost of the project is the final amount that was certified by the principal agent in order to be paid by the client at project completion. The actual cost of projects identified by respondents are presented in Figure 4-11. Projects that cost between N\$1–20 million accounted for 40% of the study, while those that ranged between N\$20–50 million and over N\$100 million accounted for 20% and 22% respectively. Projects that cost less than N\$1 million had the lowest frequency of 5%.

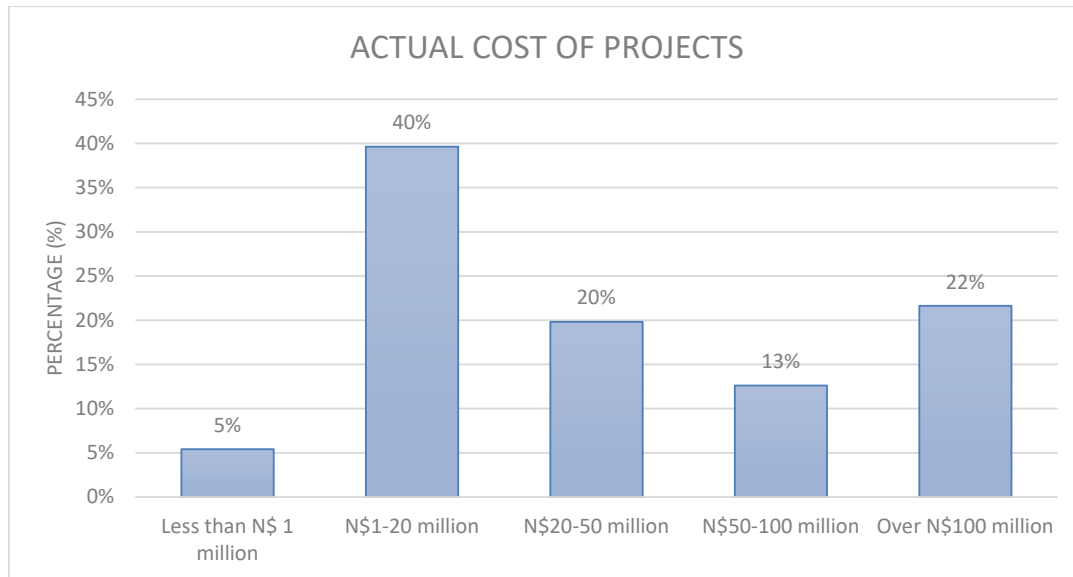


Figure 4-11: Actual cost of identified projects

4.2.2.2 Average cost overrun of the project

Analysis of the responses from clients, consultants, and contractors regarding the cost of construction projects in Namibia was carried out. From the study, it was found that, on average, construction projects in Namibia experienced 16% cost overrun.

4.2.2.3 Analysis of cost overrun in construction projects

The analysis of clients', consultants' and contractors' responses regarding cost overrun in construction projects in Namibia during the last five years were conducted, and the results are presented in Table 4-1.

Table 4-1: Participants' responses with regards to cost overrun

Range	Clients	Consultants	Contractors	Total
<= 0	25.0%	31.8%	43.3%	32.7%
0-10	24.8%	22.0%	20.7%	20.9%
10-20	17.4%	14.4%	29.3%	18.2%
20-30	16.5%	4.8%	1.2%	7.2%
30-50	9.1%	19.0%	2.3%	13.7%
50-100	5.3%	6.4%	2.8%	5.4%
>100	1.9%	1.6%	0.0%	1.9%

Approximately 42% of the clients and 36.4% of the consultants that participated in the survey indicated that projects experience cost overrun of between 0–20% from their original planned cost. About 19% of the consultants and 9% of clients indicated that projects experience between 30–50% cost overrun. Approximately 40% of the contractors who participated on the survey indicated that projects experience cost overrun of between 0–20%. All the respondents (i.e., clients, consultants, and contractors) agree that about 33% of the projects are completed within or under the planned budget, whereas 67% of them experience cost overrun. This shows that most construction projects within the Namibian construction industry experience cost overrun, which is similar to other countries as shown in the literature review.

Further analysis of cost overrun within the different project types is shown in Figure 4-12. Figure 4-12 shows that, of the six groups of project types that were identified as part of this study, electrical, housing, specialist, and civil projects in the Namibian construction industry on average experience a similar cost overrun of 23%, 23%, 20% and 19% respectively. On the other hand, commercial building and road construction projects experience the lowest percentage of cost overrun at an average 8% and 9% respectively. This indicates that all the different project types on average experience cost overrun and, out the six different types of projects, housing, and electrical projects on average experience the highest cost overrun, closely followed by specialist and civil infrastructure projects.

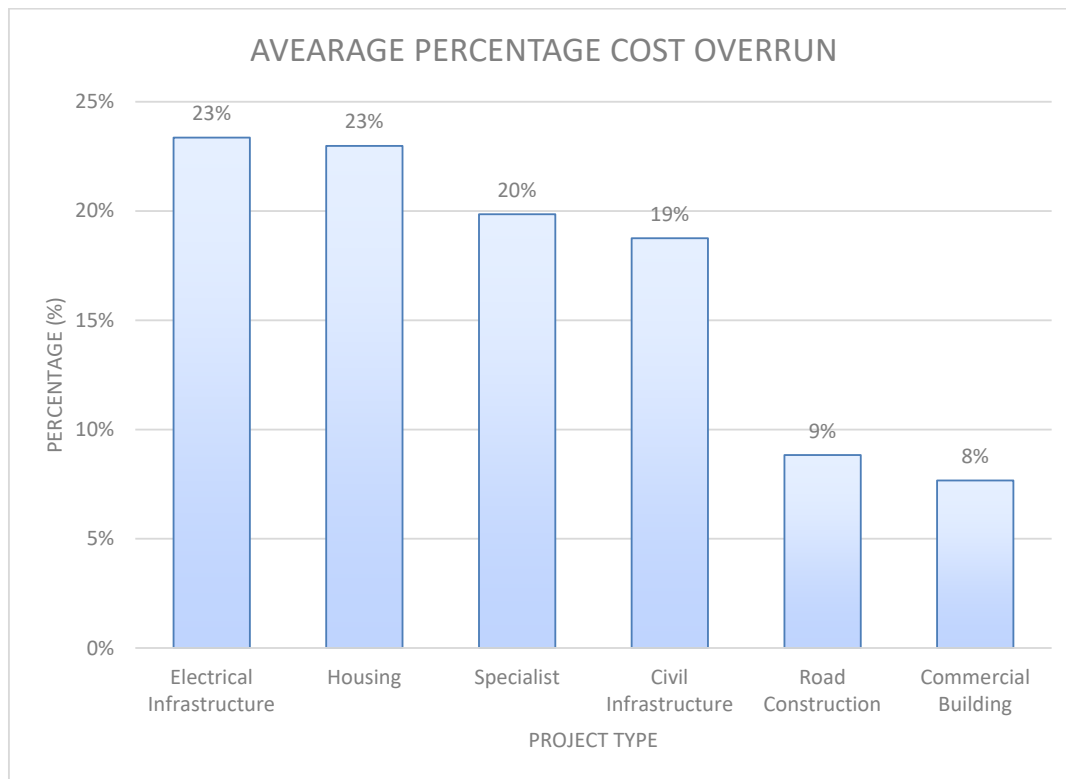


Figure 4-12: Average percentage cost overrun per project type

4.2.2.4 Average time overrun of the identified project

Similarly, the responses from clients, consultants, and contractors regarding the delay of construction projects during the last five years (2016 – 2021) were analysed. From the study of the overall survey responses, it was found that, on average, 63% of construction projects in Namibia experience delays. Figure 4-13 shows the average percentage of time overrun experienced by the different project types identified by the respondents.

Civil infrastructure and commercial building projects show an average time overrun of 85%, followed by specialist, housing and electrical projects with average time overrun of 64, 53% and 47% respectively. Although road projects experience time overrun of 35%, similar to cost overrun, they have the smallest percentage delays. These figures show that all project types identified by the respondents in Figure 4-13 experience significant project delays.

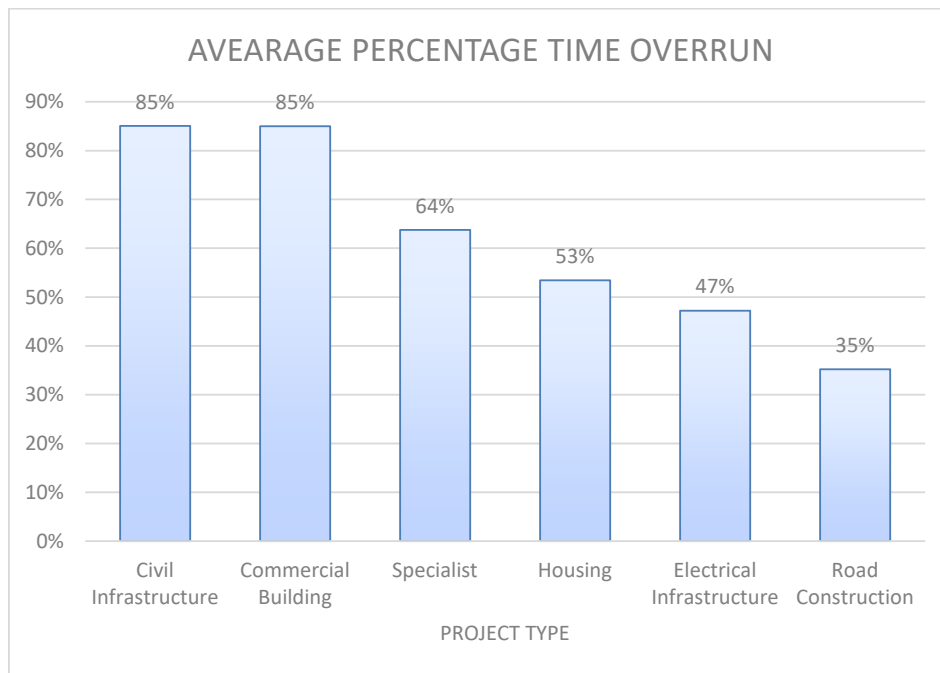


Figure 4-13: Average percentage time overrun per project type

4.2.2.6 Analysis of time overrun in construction projects

The analysis of clients', consultants' and contractors' responses regarding time overrun in the Namibian construction projects during the last five years were conducted, and the results are presented in Table 4-2.

Table 4-2: Participants' response with regards to delay

Range	Clients	Consultants	Contractors	Total
<= 0	14.2%	15.6%	0.0%	15.6%
0-10	3.3%	4.7%	11.4%	3.7%
10-20	5.3%	10.0%	45.7%	13.7%
20-30	10.4%	5.6%	5.4%	6.1%
30-50	23.9%	23.4%	8.9%	22.3%
50-100	28.6%	17.2%	21.4%	19.5%
>100	10.7%	23.4%	7.2%	18.2%

Approximately 15% of the consultants that participated in the survey indicated that projects experience between 0 and 20% time overrun from its original planned time, and about 40% of the consultants indicated that projects experience more than 50% time overrun. Approximately 39% of the clients who participated on the survey indicated that projects experience time overrun of more than 50%. Around 57% of the contractors indicated that projects experience between 0–20% delay. About 15% of the consultants and clients indicated that projects are completed within time; however, none of the contractors indicated that projects are finished on time. These shows that the majority of the construction projects identified in this study have experienced approximately 85% delay.

4.2.3 Determining the Factors Causing Cost and Time Overrun on Construction Projects

For this study, 36 cost overrun factors and 51-time overrun factors were selected from a literature review on global construction issues and were categorised into seven groups, namely contractor, consultant, client, contract relationship, labour, material, and equipment and external related factors.

4.2.3.1 Cost Overrun Factors

The data obtained from the respondents on factors that cause cost overrun on construction projects is tabulated in Table 4-3. As mentioned above, a total of 36 factors that cause cost overrun were analysed in this study using the Relative Importance Index (RII) and ranked in relation to their RII value.

Table 4-3: Ranking of overall factors causing cost overrun on construction projects

Cost Overrun Factors	Extremely High (5)	High (4)	Moderate (3)	Low (2)	Minimal Impact (1)	RII	Rank	Category
Availability of finance to execute the project	34	34	32	8	6	0.744	1	Contractor
Contractor experience	28	39	25	13	6	0.726	2	Contractor
Experience in project planning and scheduling	30	35	26	17	4	0.725	3	Contractor
Experience in site management	27	37	22	23	3	0.711	4	Contractor
Delayed progress payment	32	27	23	18	13	0.683	5	Client
Late delivery of construction material and equipment and equipment	21	33	38	14	8	0.679	6	Material & Equipment
Fluctuation of prices (Inflation)	20	35	32	20	7	0.672	7	Material & Equipment
Extension of time claim	23	29	30	21	8	0.668	8	External
Availability of finance	32	22	29	14	17	0.667	9	Client
Skilled labour	19	40	25	18	12	0.663	10	Labour
Change order or scope change	28	23	36	10	17	0.661	11	Client
Delay in client's contract award	27	21	31	23	11	0.653	12	Client
Frequent design changes	24	28	29	20	13	0.653	13	Consultant
Mistakes during construction	23	22	35	28	6	0.649	14	Contractor
Site labour	16	34	33	21	10	0.644	15	Labour
Poor communication between parties	17	29	37	17	14	0.632	16	Contract Relationship
Experience in project management	12	39	30	15	17	0.625	17	Consultant
Lack of coordination between parties	19	26	33	22	14	0.625	18	Contract Relationship
No experience of project area	19	27	29	24	14	0.623	19	Contractor
Shortages in material and equipment	18	26	33	22	14	0.621	20	Material & Equipment

Table 4-3: Ranking overall factors causing cost overrun on construction projects cont'd

Cost Overrun Factors	Extremely High (5)	High (4)	Moderate (3)	Low (2)	Minimal Impact (1)	RII	Rank	Category
Slow information flow between parties	14	28	34	27	11	0.612	21	Contract Relationship
Consulting team competence	14	38	21	16	25	0.600	22	Consultant
Project complexity	10	28	36	25	13	0.595	23	External
Mismanagement (poor handling and wastage)	11	23	39	29	11	0.589	24	Material & Equipment
Incomplete design at the time of tender	19	21	21	30	23	0.570	25	Consultant
Mistakes and error in design	13	22	30	31	18	0.567	26	Consultant
Underestimation of project cost	21	15	27	25	26	0.565	27	Consultant
Unexpected ground conditions	13	24	27	27	22	0.563	28	External
Low motivation	9	22	35	30	17	0.558	29	Labour
Exchange rate fluctuation	12	19	30	29	23	0.543	30	External
Delays in work approval by local authorities	12	21	26	28	26	0.538	31	External
Inaccurate quantity take-off	9	20	30	34	20	0.536	32	External
Delay in inspection and testing of works	10	18	32	27	27	0.525	33	Consultant
Low cost of labour	5	13	38	41	16	0.512	34	Labour
Force Majeure (acts of God)	14	14	21	25	40	0.489	35	External
Fraudulent practices and kickbacks	11	15	14	19	54	0.441	36	External

Table 4-3 shows the results on the factors that cause cost overrun in execution of construction projects in Namibia according to contractors, consultants, and client. The first column in the tables mentioned above indicates the factors that are responsible for causing cost overrun. These factors were identified from literature as mentioned above and were rated by respondents using a five-point Likert scale, where 5= Extremely High, 4=High, 3=Moderate, 2=Low and 1=Minimal Impact. The Relative Importance Index generated by the study were presented in Column 2. This index helps to identify which factors are the highest contributor to cost overrun on construction projects. The factors as shown in Table 4-3 are presented from a ranking perspective.

Lack of available finance/cash flow by the contractor is considered as the most important factor that causes cost overrun with an RII of 0.744. This was followed by inadequate contractor experience with an RII of 0.726. the other factors making up the top ten factors causing cause overruns on projects in Namibia from a ranking perspective are experience in project planning and scheduling by the contractor (RII of 0.725), experience in site management by the contractor (RII of 0.711), delay in progress payment by client (RII of 0.683), late delivery of construction Material & Equipment (RII of 0.679), fluctuation of prices/inflation (RII of 0.672), extension of time claim (RII of 0.668), Availability of finance by client (RII of 0.667) and availability of skilled labour (RII of 0.663).

On the contrary, the five factors that were ranked the least cause of cost overrun on construction projects from a ranking perspective are delay in inspection and testing of works by consultants, low cost of labour, lack of site labour, force majeure, and fraudulent practices/kickbacks.

Out of the top ten (10) factors that were identified to have caused cost overrun in projects, four (4) of them are contractor related factors whereas client related, and material related factors are two (2) each with labour and external factors were both one (1). Having said that contractor related factors make up the top four critical factors causing cost overrun with the fifth one being client related factor.

4.2.3.2 Time Overrun Factors

The data obtained from the respondents on factors that cause time overrun on construction projects is tabulated in Table 4-4. As mentioned above a total of 51 factors that cause time overrun were analysed in this study using Relative Importance Index (RII) and ranked in relation to their RII value.

Table 4-4: Ranking of overall time overrun factors in construction projects

Time Overrun Factors	Extremely High (5)	High (4)	Moderate (3)	Low (2)	Minimal Impact (1)	RII	Rank	Category
Contractor experience	30	39	24	12	9	0.721	1	Contractor
Availability of Finance (i.e., cashflow difficulty)	29	35	26	16	8	0.707	2	Contractor
Experience in Site management and supervision	21	42	27	16	8	0.691	3	Contractor
Slow decision making	32	25	30	17	10	0.691	4	Client
Deficiency in project planning and scheduling	22	38	26	20	8	0.681	5	Contractor
Delay in progress payment of completed work	32	28	18	20	16	0.670	6	Client
Availability of Finance	34	21	22	20	16	0.665	7	Client
Subcontractors' competence	19	33	28	21	12	0.646	8	Contractor
Pandemic (Covid 19)	33	16	27	15	22	0.641	9	External
Mistakes during construction stage	21	26	30	29	8	0.640	10	Contractor
Change order or scope change	24	26	24	25	15	0.633	11	Client
Delay in material procurement	23	24	27	26	14	0.628	12	Material & Equipment
Labour productivity	18	29	31	19	17	0.621	13	Labour
Delay in material and equipment delivery by vendors	18	29	32	16	19	0.619	14	Material & Equipment
Design Changes	19	23	29	29	11	0.618	15	Consultant
Changes in design	21	26	23	26	16	0.618	16	Client
Experience in contract management	12	36	31	17	18	0.612	17	Consultant
Delay in site mobilization	15	24	32	26	15	0.596	18	Contractor
Delay in reviewing and approving drawings and documentation	17	22	30	26	16	0.596	19	Client
Lack of communication between parties	19	24	26	25	20	0.595	20	Contract
Skilled labour supply	13	28	26	32	13	0.593	21	Labour
Lack of coordination between parties	14	29	23	29	19	0.582	22	Contract
Disputes between parties	20	23	21	24	26	0.577	23	Contract

Table 4-4: Ranking of overall time overrun factors in construction projects cont'd

Time Overrun Factors	Extremely High (5)	High (4)	Moderate (3)	Low (2)	Minimal Impact (1)	RII	Rank	Category
Unrealistic contract duration and requirements imposed	15	25	24	26	23	0.570	24	Client
Competence of design team	18	19	24	27	23	0.568	25	Consultant
Shortage of construction material in market	14	24	28	24	24	0.565	26	Material & Equipment
Delay in contract award	16	17	27	28	20	0.565	27	Client
Complexity of project design	13	21	29	30	21	0.556	28	Consultant
Unexpected ground / site conditions	18	22	19	24	30	0.554	29	External
Low motivation	15	21	24	29	24	0.554	30	Labour
Delay in implementing changes to scope of work	10	24	24	39	17	0.549	31	Consultant
Quality of material	14	22	25	24	29	0.544	32	Material & Equipment
Labour supply	9	23	27	36	19	0.542	33	Labour
Shortage of equipment	13	22	24	27	28	0.539	34	Material & Equipment
Mistake and error in design	14	14	27	35	24	0.528	35	Consultant
Equipment breakdown	14	15	27	28	30	0.521	36	Material & Equipment
Inaccurate material estimate	15	17	20	32	30	0.521	37	Material & Equipment
Delays in inspection and testing of works	6	20	29	36	23	0.512	38	Consultant
Delays in design documentation	5	21	22	44	22	0.500	39	Consultant
Delays in work approval by local authorities	8	21	26	24	35	0.500	40	External
Mistakes and discrepancies in contract documentation	8	14	33	25	32	0.495	41	Client
Unpredictable weather conditions	14	11	21	34	33	0.492	42	External

Table 4-4: Ranking of overall time overrun factors in construction projects cont'd

Time Overrun Factors	Extremely High (5)	High (4)	Moderate (3)	Low (2)	Minimal Impact (1)	RII	Rank	Category
Force Majeure (acts of God)	16	12	14	28	44	0.474	43	External
Inflexibility of consultant	4	16	28	36	29	0.476	44	Consultant
Fraudulent practices and kickbacks	15	15	11	19	53	0.458	45	External
Changes in government regulations and laws	12	13	15	29	45	0.456	46	External
Strike	18	6	9	29	52	0.440	47	Labour
Delay in land compensation	10	8	15	27	54	0.412	48	External
Accident during construction	7	10	14	33	50	0.409	49	External
Unrest by local communities	7	10	11	34	51	0.402	50	External
Demining	7	6	15	28	55	0.387	51	External

Table 4-4 shows the causes of time overrun distributed according to the ranking of contractors, consultants, and clients. Contractor experience and availability of funds by the contractor were rated the top two important factors that cause time overrun with an RII of 0.721 and 0.707 respectively. Contractor's experience in site management and site supervision, along with slow decision making by the client came third with the same RII of 0.691. The other factors that make up the top 10 are deficiency in project planning and scheduling by the contractor (RII of 0.681), delay in progress payment of completed works by client (RII of 0.670), availability of finance by client (RII of 0.665), sub-contractor's competency (RII of 0.646), pandemic (COVID-19) (RII of 0.641), mistakes during construction stage (RII of 0.640) and change order/scope change by client (RII of 0.633).

On the contrary, the five factors that were ranked as least likely to cause time overrun on construction projects, in the order of importance, are strikes, delay in land compensation, accident during construction, unrest by local communities and demining of previous war zones.

It may be noted there are some factors that seem to have the same RII. However, based on the higher number of 'very important' rankings by participants, they were ranked higher in this study's analysis. Furthermore, it was interesting that contractor experience and availability of funds by the contractor were also rated as the top two important factors that cause time overrun, as they were rated in the list of cost overrun factors. It is apparent that, if the contractor does not have experience and sufficient cashflow, it will lead to both cost and time overrun. During further comparison of the top 10 factors contributing to cost and time overrun, it was found that six of the factors are the same, namely contractor experience, contractor's availability of finance (i.e., cashflow difficulty), experience in site management, deficiency in project planning and scheduling by contractor, delay in progress payment towards completed work by client, and availability of finance by client to fund the project.

Out of the top ten (10) factors that were identified to have caused time overrun in projects, six (6) of them are contractor-related factors, whereas client-related and external factors were three (3) and one (1) respectively. This indicates that the respondents of this questionnaire survey believe that the most critical time overrun factors are attributed to contractor- and client-related issues.

4.2.4. Measures used to minimise Time and Cost Overrun

4.2.4.1 Measures used to minimise time overrun

The survey results obtained from the respondents on measures used in order to minimise factors that cause time overrun is tabulated in Table 4-5. There were 13 measures that were selected from the literature review and presented in the questionnaire, and the responses from the respondents were analysed in this study using Relative Importance Index (RII) and ranked in relation to their RII value.

Table 4-5: Overall ranking of minimising measures for time overrun

Minimizing Measures	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	RII	Ranks
Proper planning of the work	56	38	10	3	7	0.833	1
Adequate and close supervision of projects	48	43	9	8	5	0.814	2
Consultant to ensure drawings and documentations are submitted on time	49	41	7	7	8	0.807	3
Effective and lucid communication between all parties	53	35	9	10	7	0.805	4
Early engagement of project managers	51	34	14	6	9	0.796	5
Adequate focus on quality, cost, and delivery of the project	45	40	16	4	8	0.795	6
Contractor to ensure sufficient cashflow at the start of the project	45	40	12	9	7	0.789	7
Adequate training of project staff	39	45	17	7	6	0.782	8
Payments to contractor and consultant done timeously	47	35	14	8	9	0.782	9
Adequate understanding of contractors on project task	39	46	13	9	6	0.782	9
Effective mobilisation and release of resources	37	49	11	11	5	0.781	11
Approvals of variation orders are done timeously	38	40	21	4	10	0.763	12
Forecast planning by contractor against unforeseen delays (i.e., labour strike)	35	37	27	8	6	0.754	13

4.2.4.2 Measures used to minimise cost overrun

The survey results obtained from the respondents on measures that may be used in order to minimise factors that cause time overrun is tabulated in Table 4-6. There were 13 measures that were obtained from the literature review and presented in the questionnaire, and the responses from the respondents were analysed in this study using Relative Importance Index (RII) and ranked in relation to their RII value.

Table 4-6: Overall ranking of minimising measures for cost overrun

Minimizing Measures	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	RII	Ranks
Consultant to ensure drawings and documentations are submitted on time	55	41	6	7	3	0.846	1
Frequent coordination between all the project parties	50	41	10	8	2	0.832	2
Adequate project planning and scheduling	49	46	4	9	4	0.827	3
Utilising experienced subcontractors and suppliers	48	43	12	5	5	0.819	4
Effective strategic planning by contractor	46	47	8	8	4	0.818	5
Effective and lucid communication between all the project parties	45	45	12	6	4	0.816	6
Perform pre-construction planning of project tasks and resources needed	42	47	13	5	4	0.813	7
Use of appropriate construction methods	46	39	17	6	4	0.809	8
Conducting frequent progress meetings	46	44	11	6	6	0.809	9
Contractor to ensure sufficient cashflow at the start of project	45	43	14	6	5	0.807	10
Effective site management and supervision	49	42	9	6	8	0.807	11
Ensure adequate training of project staff	37	47	19	5	5	0.788	12
Early engagement of community	37	38	27	6	4	0.775	13

4.3 DATA ANALYSIS

The study sought to test the hypothesis that there is a significant relationship between the causes of time and cost overruns and the performance of construction projects. The entire data used for all the factors in testing the hypothesis is presented in the data table in **Appendix G**. However, the top 10 ranked cost and time factors based on the RII score are presented in ascending order in Table 4-7 and Table 4-8.

Table 4-7 Top ten ranked cost overrun factors and cost performance data

Cases	Likert Scale Rating of Factors causing Cost Overrun										Cost Performance
	Availability of finance to execute the project	Contractor experience	Experience in project planning and scheduling	Experience in site management	Delayed progress payment	Late delivery of construction material and equipment	Fluctuation of prices (Inflation)	Extension of time claim	Availability of finance	Skilled labour	
9	3	4	4	4	2	3	2	1	3	4	-46%
3	4	5	4	4	4	5	4		4	4	-17%
1	3	4	4	4	3	3	4	3	3	4	-11%
13	5	3	2	2	2	3	5	3	1	5	-9%
101	5	5	3	5	5	4	4	4	5	3	-6%
37	1	4	2	2	1	3	3	5	1	3	-4%
109	3	3	4	4	3	5	5	4	3	4	-4%
22	2	2	2	2	2	1	1	2	2	1	-2%
98	5	4	4	5	1	1	2	1	1	1	-2%
27	4	5	4	4	5	1	4	1	3	1	-1%
60	4	5	4	4	5	4	3	5	3	4	-1%
88	3	3	2	2	2	2	3	3	2	2	-1%

Table 4-7 Top ten ranked cost overrun factors and cost performance data cont'd

Cases	Likert Scale Rating of Factors causing Cost Overrun										Cost Performance
	Availability of finance to execute the project	Contractor experience	Experience in project planning and scheduling	Experience in site management	Delayed progress payment	Late delivery of construction material and equipment	Fluctuation of prices (Inflation)	Extension of time claim	Availability of finance	Skilled labour	
6	5	5	5	3	4	3	4	5	3	4	0%
11	5	4	3	4	5	5	4	3	5	4	0%
15	4	1	2	2	4	4	2	3	1	1	0%
21	5	4	3	4	5	3	2	2	5	4	0%
29	2	2	3	2	2	4	4	4	2	3	0%
30	5	3	3	4	5	3	4	4	5	3	0%
33	1	3	3	3	4	5	4	2	1	5	0%
42	5	5	4	5	5	3	3	4	5	4	0%
45	4	3	4	3	2	4	2	2	2	4	0%
47	5	5	4	4	5	4	5	2	5	2	0%
52	3	3	5	4	5	3	2	5	5	4	0%
54	3	4	5	5	4	4	5	2	4	5	0%
58	3	1	1	1	3	4	1	3	3	1	0%
62	3	2	2	2	5	3	2	3	4	4	0%
66	4	5	4	4	4	4	4	4	4	4	0%
70	4	2	3	4	4	2	3	2	4	3	0%
74	3	4	4	4	3	3	4	4	2	4	0%
75	3	4	5	5	3	2	3	2	3	3	0%
87	3	4	3	3	1	1	2	1	1	3	0%

Table 4-7 Top ten ranked cost overrun factors and cost performance data cont'd

Cases	Likert Scale Rating of Factors causing Cost Overrun										Cost Performance
	Availability of finance to execute the project	Contractor experience	Experience in project planning and scheduling	Experience in site management	Delayed progress payment	Late delivery of construction material and equipment	Fluctuation of prices (Inflation)	Extension of time claim	Availability of finance	Skilled labour	
89	2	4	5	5	3	4	4	1	3	4	0%
92	5	5	5	5	4	3	3	2	3	2	0%
96	3	4	4	4	3	3	3	3	3	3	0%
99	4	3	4	3	5	4	4	5	5	3	0%
102	3	2	4	2	4	3	2	5	4	2	0%
105	3	4	5	3	2	3	3	4	3	4	0%
107	1	1	2	3	1	5	4	3	1	1	0%
108	4	4	2	2	1	2	3	3	1	2	0%
113	5	2	4	2	4	3	4	4	5	2	0%
12	5	3	3	5	3	5	4	4	5	5	2%
28	4	4	4	4	4	4	4	4	4	4	2%
61	5	2	3	3	5	5	5	3	5	5	2%
94	4	4	5	5	5	4	4	3	5	5	2%
110	4	4	3	3	4	3	3	4	2	3	2%
17	4	5	5	5	5	5	5	4	5	5	3%
16	5	4	3	4	5	3	2	5	5	4	4%
55	2	3	3	3	3	4	4	4	2	4	4%
8	4	4	4	5	5	3	5	2	5	1	5%
25	4	4	3	4	1	1	3	1	3	3	5%
10	3	4	3	2	5	4	4	3	2	2	6%

Table 4-7 Top ten ranked cost overrun factors and cost performance data cont'd

Cases	Likert Scale Rating of Factors causing Cost Overrun										Cost Performance
	Availability of finance to execute the project	Contractor experience	Experience in project planning and scheduling	Experience in site management	Delayed progress payment	Late delivery of construction material and equipment	Fluctuation of prices (Inflation)	Extension of time claim	Availability of finance	Skilled labour	
82	5	5	5	5	3	4	3	4	3	5	6%
85	3	3	4	3	1	3	2		1	3	6%
112	3	3	1	3	4	2	2	5	4	2	6%
65	5	2	2	2	1	3	2	3	5	3	7%
68	4	1	3	2	5	2	3	4	5	1	7%
86	5	4	4	5	5	4	4	5	5	5	7%
100	5	4	2	3	5	4	5	5	5	4	7%
19	4	5	4	4	4	4	4	3	5	4	8%
50	4	5	5	5	5	5	4	4	5	4	8%
71	5	3	4	4	5	2	4	3	4	4	9%
4	3	5	5	5	3	2	2	3	3	4	10%
5	3	4	3	4	4	4	4	2	2	4	10%
14	3	3	2	1	2	4	4	4	4	2	10%
32	4	4	3	4	3	5	5	2	3	5	10%
40	5	4	4	4	3	3	3	4	5	4	10%
57	4	4	4	4	1	2	2	2	4	4	11%
69	4	2	4	3	2	2	4	5	1	2	11%
72	3	4	2	2	3	3	2	2	1	4	11%
80	3	4	4	4	2	2	3	2	1	5	11%
43	5	5	5	5	1	5	5	1	1	5	12%

Table 4-7 Top ten ranked cost overrun factors and cost performance data cont'd

Cases	Likert Scale Rating of Factors causing Cost Overrun										Cost Performance
	Availability of finance to execute the project	Contractor experience	Experience in project planning and scheduling	Experience in site management	Delayed progress payment	Late delivery of construction material and equipment	Fluctuation of prices (Inflation)	Extension of time claim	Availability of finance	Skilled labour	
64	3	5	5	4	5	3	3	3	4	3	12%
2	4	2	3	2	4	1	1	3	4	3	13%
36	4	3	4	4	3	5	4	4	3	5	13%
53	5	3	1	2	4	3	3	3	5	3	16%
34	5	4	4	4	2	3	4	1	4	2	17%
63	5	5	5	5	5	3	3	2	5	4	17%
78	4	3	2	2	1	5	4	5	1	3	17%
97	5	5	5	5	5	5	5	3	5	4	17%
20	4	5	5	3	4	4	5	4	4	4	19%
44	2	3	3	3	4	4	3	5	3	3	19%
59	5	4	5	5	5	4	5	5	5	5	20%
93	5	3	3	2	4	3	3	3	5	2	20%
18	2	2	2	2	3	2	2	2	3	2	21%
35	4	2	2	2	2	2	2	3	4	2	21%
79	3	5	5	5	5	5	3	5	3	5	25%
26	4	5	5	4	4	4	5	5	5	4	27%
90	2	3	2	2	5	1	1	5	4	2	27%
73	5	5	5	3	1	5	5	5	1	1	28%
31	5	5	5	5	3	5	3	2	3	4	29%
91	5	5	5	5	3	4	5	3	2	5	30%

Table 4-7 Top ten ranked cost overrun factors and cost performance data cont'd

Cases	Likert Scale Rating of Factors causing Cost Overrun										Cost Performance
	Availability of finance to execute the project	Contractor experience	Experience in project planning and scheduling	Experience in site management	Delayed progress payment	Late delivery of construction material and equipment	Fluctuation of prices (Inflation)	Extension of time claim	Availability of finance	Skilled labour	
106	5	3	5	5	1	3	4	5	5	3	31%
76	1	4	3	3		5	1	5	1	1	32%
77	3	4	4	3	3	5	4	4	1	1	33%
111	5	3	5	3	5	5	4	5	5	5	33%
114	4	5	5	5	2	3	1	5	2	4	33%
67	5	3	1	1	5	1	5	2	5	3	36%
83	2	3	4	3	4	3	2		2	2	39%
51	4	4	4	4	3	3	3	4	2	4	40%
81	1	1	2	2	2	3	5	4	2	1	40%
84	4	5	5	4	4	4	3	3	4	4	40%
46	3	4	4	4	5	3	3	3	3	4	42%
24	4	2	3	3	4	4	4	3	3	3	44%
7	3	5	4	4	4	3	1	4	4	4	50%
41	5	4	5	5	2	4	3	3	5	5	50%
103	1	1	2	2	3	2	3	2	3	2	50%
39	4	5	3	3	4	4	5	4	4	5	55%
23	3	3	3	4	2	4	3	3	3	3	59%
56	4	3	5	5	5	5	4	5	3	3	74%
38	3	3	3	4	4	4	3	4	3	4	100%
95	3	4	4	4	2	3	3	4	4	3	100%

Table 4-7 Top ten ranked cost overrun factors and cost performance data cont'd

Cases	Likert Scale Rating of Factors causing Cost Overrun										Cost Performance
	Availability of finance to execute the project	Contractor experience	Experience in project planning and scheduling	Experience in site management	Delayed progress payment	Late delivery of construction material and equipment	Fluctuation of prices (Inflation)	Extension of time claim	Availability of finance	Skilled labour	
49	3	4	4	4	3	3	2	2	3	4	100%
48	4	4	5	5	2	4	5	4	4	2	140%
104	3	3	3	3	3	3	3	3	3	3	150%

Table 4-8 Top ten ranked time overrun factors and time performance data

Cases	Likert Scale Rating of Factors causing Time Overrun										Time Performance
	Contractor experience	Availability of Finance (i.e., cashflow difficulty)	Experience in site management and supervision	Client's slow decision making	Deficiency in project planning and scheduling	Delay in progress payment of completed work	Availability of finance	Subcontractors' competence	Pandemic (COVID-19)	Mistakes during construction stage	
62	5	3	5	5	5	5	5	2	4	5	-100%
49	4	4	4	3	2	2	4	2	3	2	-33%
75	4	3	4	5	3	3	3	3	4	2	-17%
87	3	3	3	2	2	1	1	1	2	1	-17%
98	1	1	2	1	2	1	1	2	1	1	-8%
17	5	5	5	5	5	5	5	4	4	4	-3%
3	5	4	4	4	4	4	3	5	3	5	
5	3	4	3	3	4	3	2	2	2	2	0%
7	5	3	4	2	4	4	4	3	3	2	0%
9	4	4	4	2	3	2	3	3	1	3	0%
25	4	4	4	1	1	1	1	1	1	3	0%
32	3	3	2	3	2	4	4	2	4	4	0%
42	5	3	5	5	4	5	5	4	5	5	0%
48	2	2	4	3	4	2	3	5	4	4	0%
54	4	4	4	3	2	5	3	5	5	2	
66	5	4	4	5	3	5	4	4	5	4	0%
74	3	2	2	5	3	4	3	3	2	3	0%
91	5	5	5	3	5	1	2	2	2	5	0%
96	4	3	4	1	2	3	3	4	2	2	0%
99	4	4	3	5	4	5	5	3	4	4	
101	1	1	3	3	3	4	5	2	5	3	0%

Table 4-8 Top ten ranked time overrun factors and time performance data Cont'd

Cases	Likert Scale Rating of Factors causing Time Overrun										Time Performance
	Contractor experience	Availability of Finance (i.e., cashflow difficulty)	Experience in site management and supervision	Client's slow decision making	Deficiency in project planning and scheduling	Delay in progress payment of completed work	Availability of finance	Subcontractors' competence	Pandemic (COVID-19)	Mistakes during construction stage	
113	3	5	3	5	3	4	5	3	3	2	0%
1	4	4	4	3	4	3	3	4	4	2	6%
77	3	2	2	5	2	4	2	2	5	2	8%
36	3	4	4	4	4	5	4	5	5	4	8%
82	5	3	5	4	5	2	3	5	5	5	10%
50	5	4	4	4	4	2	5	5	5	5	11%
57	4	4	4	2	2	2	4	4	3	2	11%
24	2	3	3	2	4	4	4	3	5	4	13%
38	4	3	4	4	3	4	3	4	3	4	13%
60	4	5	4	3	4	5	2	3	2	3	13%
111	5	5	5	5	5	5	5	5	5	5	13%
14	4	4	4	4	4	3	4	5	3	4	17%
15	2	4	2	5	2	5	1	2	1	4	17%
27	1	1	1	3	1	3	3	3	5	3	17%
46	4	3	4	4	3	5	1	3	1	2	17%
52	5	4	5	4	5	5	5	4	5	4	17%
103	1	1	1	1	1	2	2	1	4	1	17%
107	1	1	2	5	1	1	1	2	5	2	17%
21	4	5	4	4	4	5	5	4	4	4	20%
80	4	4	4	2	2	2	4	3	3	2	20%

Table 4-8 Top ten ranked time overrun factors and time performance data Cont'd

Cases	Likert Scale Rating of Factors causing Time Overrun										Time Performance
	Contractor experience	Availability of finance (i.e., cashflow difficulty)	Experience in site management and supervision	Client's slow decision making	Deficiency in project planning and scheduling	Delay in progress payment of completed work	Availability of finance	Subcontractors' competence	Pandemic (COVID-19)	Mistakes during construction stage	
8	4	4	4	5	3	5	4	4	5	3	25%
22	3	2	1	3	2	2	2	3	1	2	25%
40	4	3	4	3	4	3	5	4	1	3	25%
44	3	3	3	3	4	4	3	3	1	3	25%
65	2	2	2	1	2	1	1	2	3	3	25%
39	5	3	3	5	4	5	4	4	5	5	29%
81	1	1	1	4	2	1	1	2	5	2	30%
2	2	2	3	4	2	4	4	1	1	1	33%
33	5	4	5	5	5	2	2	5	5	5	33%
58	1	2	1	3	1	3	2	1	3	1	33%
70	4	4	2	3	3	4	3	3	3	2	33%
89	3	2	5	2	5	2	2	5	3	4	33%
20	5	5	4	3	4	1	5	5	3	3	35%
23	3	2	3	4	3	2	2	3	4	2	36%
95	3	2	3	3	3	2	3	4	4	4	40%
35	2	3	2	3	2	3	4	4	1	3	44%
6	3	5	3	5	4	4	2	2	3	3	50%
18	3	3	2	2	4	3	2	2	3	4	50%
28	4	4	4	1	4	4	3	4	5	4	50%
31	5	5	3	2	3	2	2	3	2	4	50%

Table 4-8 Top ten ranked time overrun factors and time performance data Cont'd

Cases	Likert Scale Rating of Factors causing Time Overrun										Time Performance
	Contractor experience	Availability of finance (i.e., cashflow difficulty)	Experience in site management and supervision	Client's slow decision making	Deficiency in project planning and scheduling	Delay in progress payment of completed work	Availability of finance	Subcontractors' competence	Pandemic (COVID-19)	Mistakes during construction stage	
34	4	4	3	5	4	4	5	2	5	3	50%
41	5	5	5	2	3	1	5	5	1	1	50%
43	5	5	5	1	5	1	1	5	1	5	50%
55	4	2	3	2	3	2	2	4	3	2	50%
61	5	5	5	5	5	5	5	5	4	5	50%
64	3	5	4	5	3	5	5	4	3	3	50%
72	3	2	3	3	1	3	3	1	1	2	50%
76	3	1	3	2	3	1	1	1	1	4	50%
92	4	4	4	3	4	3	2	4	4	4	50%
94	4	5	4	5	4	5	5	4	3	5	50%
110	3	4	4	3	4	4	4	3	2	3	50%
10	4	5	4	3	3	4	5	2	5	2	58%
112	1	4	1	5	2	4	4	3	3	1	58%
19	4	4	4	4	4	4	4	4	4	4	60%
85	2	3	3	2	3	1	1	1	3	1	63%
79	5	3	5	5	5	5	5	5	5	5	64%
53	2	2	3	3	2	4	5	3	3	2	67%
84	5	4	4	3	4	4	5	5	4	3	67%
102	3	3	3	4	4	4	3	2	1	2	67%
11	5	5	4	4	4	5	5	4	5	5	75%

Table 4-8 Top ten ranked time overrun factors and time performance data Cont'd

Cases	Likert Scale Rating of Factors causing Time Overrun										Time Performance
	Contractor experience	Availability of finance (i.e., cashflow difficulty)	Experience in site management and supervision	Client's slow decision making	Deficiency in project planning and scheduling	Delay in progress payment of completed work	Availability of finance	Subcontractors' competence	Pandemic (COVID-19)	Mistakes during construction stage	
59	5	5	5	5	5	5	5	4	5	4	75%
106	3	5	3	1	5	1	1	1	1	3	75%
100	5	5	4	5	5	5	5	5	1	4	80%
105	4	3	3	5	5	3	4	3	2	2	89%
73	2	2	2	4	4	1	1	3	5	2	92%
16	4	4	3	4	3	5	5	3	3	3	100%
26	5	4	5	4	4	5	5	4	5	5	100%
51	2	3	4	3	3	3	4	4	2	3	100%
56	3	5	5	5	5	5	2	5	5	5	100%
71	4	5	4	4	3	4	4	4	3	3	100%
83	4	4	2	3	2	3	2	3	3	2	100%
88	4	2	2	5	2	2	3	4	1	3	100%
97	4	4	4	4	5	5	5	4	5	5	100%
29	4	4	2	2	5	3	3	4	2	4	125%
114	5	4	5	2	5	2	2	3	5	3	125%
93	2	5	2	3	2	4	5	2	4	2	131%
12	4	5	5	4	4	4	5	4	5	4	133%
86	4	5	5	4	4	5	5	2	5	3	133%
104	3	3	3	3	3	3	3	3	5	3	140%
30	4	5	4	4	3	5	5	3	3	3	150%

Table 4-8 Top ten ranked time overrun factors and time performance data Cont'd

Cases	Likert Scale Rating of Factors causing Time Overrun										Time Performance
	Contractor experience	Availability of finance (i.e., cashflow difficulty)	Experience in site management and supervision	Client's slow decision making	Deficiency in project planning and scheduling	Delay in progress payment of completed work	Availability of finance	Subcontractors' competence	Pandemic (COVID-19)	Mistakes during construction stage	
68	4	5	3	5	4	5	5	4	1	2	164%
69	3	3	3	3	3	2	3	3	3	3	175%
4	5	3	4	5	4	4	3	5	2	5	200%
13	5	5	4	1	4	3	1	3	1	5	200%
37	4	3	3	1	5	1	1	3	1	4	200%
47	5	5	4	3	4	4	4	4	5	3	200%
63	5	4	5	5	5	5	5	2	2	5	200%
67	1	1	1	4	1	5	5	1	1	2	200%
109	5	5	5	5	5	4	2	4	5	5	200%
78	4	4	2	2	3	2	4	2	2	3	243%
90	2	3	1	5	1	5	3	1	3	2	261%
108	4	4	4	4	4	1	1	1	3	4	275%
45	3	2	4	2	4	2	2	4	2	3	357%

Table 4-8 above does not have time performance values. Case 3, 54 and 99 did not provided the actual final time it took for the project to come to completion. Case 3 & 54 erroneously repeated the planned and actual cost under the planned and actual period for their respective projects. However, Case 99 noted that the respondent does not have the final period for project completion.

A correlation analysis using Spearman Rho was carried out between factors that cause cost and time overrun and construction performance in order to test the relationship, and the result is presented in Table 4-9.

Table 4-9 Top ten ranked time and cost overrun factors and construction performance data

Time Factors	Correlation Coefficient	Cost Factors	Correlation Coefficient
Inadequate contractor experience	0.041	Availability of finance contractor	-0.015
Availability of finance contractor	0.198*	Inadequate contractor experience	-0.006
Experience in site management and supervision	-0.034	Experience in project planning and scheduling	0.128
Client's slow decision making	0.028	Experience in site management	0.027
Deficiency in project planning and scheduling	0.179	Delayed progress payment	-0.047
Delay in progress payment of completed work	0.056	Late delivery of construction material and equipment	0.116
Availability of finance client	0.056	Fluctuation of prices (Inflation)	0.006
Subcontractors' competence	0.006	Extension of time claim	0.170
Pandemic (COVID-19)	-0.085	Availability of finance client	0.037
Mistakes during construction stage	0.085	Skilled labour	0.023

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4-9 shows correlation coefficient for the top 10 ranked time and overrun factors, according to the RII results, and construction performance. The results show that, in general, most of the coefficients are low and weak. However, looking at the time factors, the availability of finance of contractors and deficiency in project planning and scheduling with 0.198 and 0.179 respectively shows that there was a relatively moderate and positive correlation between the two factors. Similarly, results for cost overrun factors, namely experience in project

planning, late delivery of construction material and equipment and extension of time claim, show that they have relatively moderate and positive correlation. These findings suggest that, although the values of correlation are not significantly high, there is direct relationship between availability of finance of contractors and deficiency in project planning and scheduling, experience in project planning, late delivery of construction material and equipment, and extension of time claim and construction performance. The rest of the time and cost overrun factors are weakly related to cost and time performance.

4.4 DISCUSSION OF FINDINGS

This study set out to evaluate the factors that cause time and cost overrun on construction projects in the Namibian construction industry during the implantation stage. Therefore, under this section, the results that were obtained in this study are further discussed in light of literature reviews from past studies. The objectives of this study that were established in chapter one will be reviewed, and it will be determined whether or not they have been addressed. The objectives are:

1. Find out the level of cost and time performance on construction projects in Namibia;
2. Identify the different factors that cause cost and time overrun on construction projects;
3. Establish the different measures used by stakeholders to minimise cost and time overrun on construction projects; and
4. Find out if there are any relationships between factors that cause time and cost overrun and performance of construction projects.

4.4.1 Determining the level of cost performance on construction projects

A total of 114 respondents completed the survey, of which 111 provided cost performance of the projects that was identified. From Table 4-1 it can be noted that two thirds of the respondents have indicated that their projects experienced cost overrun, whereas the remaining one third noted that the projects were completed within, or under, the allocated budget. Furthermore, overall ~23 (21%) of the projects encountered cost overrun ranging between 1–10%, and 43 (39%) of the projects experienced between 10–50% cost overrun. This is indicative of poor cost performance within the construction industry as a whole and points out

that cost overrun is a common phenomenon within the Namibian construction industry. This notion was supported by Memon, et.al. (2012), who conducted a study on construction projects in southern and central region of Peninsular Malaysia and found that 89% of respondents indicated that projects experience cost overrun, and 11% indicated that projects are completed within budget. A research conducted by Flyvbjerg et al. (2003) on global construction found that 9 out of 10 projects experience cost overrun of 50–100%. This shows that project cost overrun varies from project to project; however, there needs to be much attention provided to implementing cost control on projects.

4.4.2 Determining the level of time performance on construction projects

Respondents were asked to provide the percentage time overrun for the selected project. A total of 114 respondents provided time performance of the projects that they worked on in the past 5 years. Table 4-2 shows a significant number of respondents (84%) indicated that the abovementioned projects experienced time overrun. The largest number of respondents (42), which is 37% of the respondents, indicated that projects experience time overrun of more than 50%. This is very significant in that it shows that Namibian construction projects, similar to other parts of the world, experience time overrun. Assaf and Al-Hejji (2006) found, in their study on time performance of construction projects in Saudi Arabia, that around 70% of the projects experienced time overrun. Research done by Faridi and El-sayegh (2006) revealed that construction projects in the United Arab Emirates (UAE) experienced 50% delays.

4.4.3 Identification of factors that cause cost overrun

The assessment of factors that cause cost overrun was undertaken in order to determine the ranking of the factors based on their level of importance. The overall RII value of each factor was determined based on the overall response of respondents, and the ranking is presented in Table 4-3. Table 4-3 shows the top five most significant factors that cause cost overrun are availability of finance by contractor (RII=0.744), contractor experience (RII=0.726), experience in project planning and scheduling by contractor (RII=0.725), experience in site management by the contractor (RII=0.711) and delayed progress payment by client (0.683). Out of the top five most significant factors that cause cost overrun, the top four are categorised as contractor related.

4.4.3.1 Finance by contractor

This factor is ranked as the factor that contributes most to cost overrun (RII=0.744) based on the overall responses by the respondents. This factor indicates the financial difficulty faced by the contractor, which is an important contributor to the success of any construction projects. The contractor must be able to have the financial capacity to purchase construction materials, pay for site workers and hire plant and machinery in order for work to be implemented. Lack of sufficient cash flow may lead to project schedule being prolonged and to productivity being reduced. Therefore, a contractor needs a good financial standing and sound cash flow in order to ensure that construction work is not hindered. This was supported by Enshassi et al. (2010), who opined that poor cash flow will result in low productivity and inability of the contractor to purchase the required resources to carry out the work. Similar studies in Vietnam by Le-Hoai et al. (2008), which ranked this factor fourth most important, and in Ghana by Frimpong, et al. (2003), which ranked this factor fifth, shows that lack of sufficient finance or cash flow is also a significant factor that causes cost overrun in other parts of the world.

4.4.3.2 Inadequate Contractor Experience

The second highest major factor that contributes to cost overrun in the Namibian construction industry is lack of abundant experience by the contractor in the construction industry. This indicates that most of the contractors that exist within the Namibian construction industry are not well experienced in carrying out construction projects efficiently, which leads to projects not completing on time, wastage of material, and reworking due to sub-standard work that will stretch the final cost of the project. Ameh et al., (2010) support this notion and state that lack of contractor experience was the major cause of cost overrun in their study of telecommunication projects in Nigeria. This factor often leads to contractors' lack of ability to complete projects accurately, and this results in rework to correct the mistakes, which in turn requires more capital to hire labour, hire plants, and purchase material.

4.4.3.3 Experience in Project Planning and Scheduling

Lack of experience in project planning and scheduling is the third major contributing factor to construction cost overrun. If the contractor does not plan and schedule the work in detail, it

will lead to project delays and, subsequently, cost overrun. Technical incompetence of the team in comprehending the scope, schedule management, and planning in order to effectively control cost during the implementation of the work leads to cost variation (Asiedu and Adaku, 2020).

This was supported by Saeed (2009), who noted that the work is planned before commencement of the project in order to ensure its successful completion. Contractors need to ensure that they prepare a detailed work breakdown structure (WBS) for the project and plan their resources accordingly such that, as Kaliba et al.(2009) opined, it ensures that projects do not experience resources' holdups and are instead able to carry out the work.

4.4.3.4 Experience in Site Management

Poor site management by the contractor is ranked as the fourth highest cost variation-contributing factor. Similarly, Rahman et al., (2013) noted that poor site management is also the third major contributing factor to cost overrun in Malaysian large construction projects. This is due to the contractor's incompetency in managing site, and considerably impacts the cost performance of the project (Le-Hoai et al., 2008). This factor was ranked as the most severe in a study conducted in Vietnam by (Le-Hoai et al., 2008). Poor site management may be a result of a number of other factors, such as poor communication with sub-contractors and suppliers, or not complying to specifications and statutory requirements (Rahman et al., 2013). Harisaweni, (2007) noted that poor site management is also a major factor that contributes to cost overrun in the Indonesian construction industry.

4.4.3.5 Delay in Progress Payment

According to the respondents of the survey, they rated delay in progress payment by the client as the fifth ranked factor that causes cost overrun. This is the only client-related factor from the top five major factors in this study, as the others are contractor-related factors. This has an impact on the contractor's cash flow, which is the highest ranked factor causing negative cost performance. Frimpong et al., (2003) concurs that failure by the client to fund the contractor for work done adequately will result in hindered progress of work. Delay in progress payment by the client is ranked top contributing factor to cost overrun in the research of groundwater construction in Ghana (Frimpong et al., 2003). It is ranked as a high causation not only in

Ghana, but also in other countries such as Saudi Arabia, where Assaf, et al. (1995) and Assaf and Al-Hejji (2006) ranked this factor as second in both studies, and Malaysia (Sambasivan and Soon, 2007), which ranked it fourth.

4.4.4 Identification of factors that cause time overrun

The assessment of factors that cause delay was undertaken in order to determine the ranking of the factors based on their level of importance. The factors are grouped into seven classes. The overall ranking of these factors is associated with the RII value of each factor, was determined based on the overall response of respondents, and is presented in Table 4-4.

Similar to the highest ranked contributors to cost overrun, the top four out of five factors of time delays on projects are categorised around contractors' actions. As shown in Table 4-4, they are contractor experience (RII=0.721), availability of finance (i.e., cashflow difficulty) (RII=0.707), experience in site management and supervision by contractor (RII=0.691), slow decision making by client (RII=0.691), and deficiency in project planning and scheduling by the contractor (0.681).

4.4.4.1 Inadequate Contractor experience

In this research, the respondents ranked inadequate contractor experience as the first major cause of time overrun in construction projects in Namibia. Previous studies have also determined inadequate contractor experience as the most important cause of time overrun in construction projects in Hong Kong and Malaysia (Lo, et al., 2006; Sambasivan and Soon, 2007) . Inexperienced contractors often face re-work of construction work that led to time overrun.

4.4.4.2 Availability of finance (i.e., cashflow difficulty)

Cashflow difficulty, or financial difficulty, faced by contractors is the second highest ranked cause of delay in projects. This is perceived by respondents as one of the main causes of time overrun during the implementation stage of construction work. Financial difficulties will hinder work progress and might even lead to cessation of work (Akhund et al., 2018).

Correspondingly, similar studies in other parts of the world, namely Ghana, Nigeria, Hong Kong, Vietnam, and Jordan, have ranked contractor's financial difficulty among the major causes of time overrun (Frimpong et al., 2003; Aibinu and Odeyinka, 2006; Lo et al., 2006; Le-Hoai et al., 2008; and Sweis et al., 2008).

4.4.4.3 Experience in site management and supervision

Poor site management and supervision by the contractor has been identified as one of the major causes of project time overrun in this study. This was complemented by previous studies (Chan and Kumaraswamy, 1997; Sambasivan and Soon, 2007; Le-Hoai et al., 2008; Kaliba et al., 2009). Abdul-Rahman et al., (2006) opined that poor site management and supervision not only cause time overrun, but also cause disputes and cost overrun. Therefore, it is imperative that qualified personnel are appointed by contractors and ample time is given to site supervision.

4.4.4.4 Slow decision making

Similar to other significant factors mentioned above, slow decision making by the client is the fourth highest ranked factor as per the respondents' opinions. Therefore, it is an important factor that impacts the construction projects' completion time. This factor is significantly related to the financial cashflow difficulties of contractors, financial difficulties by clients, and delays in payment by the client.

4.4.4.5 Deficiency in project planning and scheduling

The respondents ranked deficiency in project planning and scheduling as the fifth highest time overrun factor. This is one factor that may lead to financial loss to the contractor and, indirectly, to the client. Deficiency in project planning and scheduling is a factor that manifests throughout a project life cycle, although we are referring here to the implementation stage and causes delays (Gebrehiwet and Luo, 2017). In order to execute a project within the time period allocated at the start of the project, the contractor must plan the work carefully and in detail. Similar to this study, previous studies by Assaf and Al-Hejji (2006) and Sambasivan and Soon (2007) determined ineffective project planning and scheduling as one of the major causes of time overrun.

4.4.5 Mitigating measures to control time and cost overrun

Managing time and cost in construction is one of the most vital tasks in order to successfully complete construction projects, even though it is not often the case that time, and cost are effectively managed. Having looked at the factors that cause time and cost overrun in previous sections, we proposed a total of 13 mitigation measures, that were identified from previous research that was carried out, that may assist in controlling time and cost overrun respectively. These measures were provided to the respondents in a questionnaire survey emailed to them. Then the respondents were requested to rate them based on a five-point Likert scale. The results of the mitigating measures for time and cost were analysed and ranked using RII and presented in Table 4-5: and Table 4-6 respectively. Measures to mitigate both time and cost overrun will be discussed below.

4.4.5.1 Measures to minimise time overrun

The majority of the respondents indicated that proper planning of work is one of the major measures that may be implemented in order to avert time overrun, giving this suggestion an RII = 0.833. This measure helps to develop a detailed and practical arrangement of the operations in order to realise the goal of the project. Inadequate contractor experience and deficiency in project planning and scheduling by the contractor are the first and fifth highest ranked causes of delay in the Namibian construction industry. This measure being ranked one of the highest among the respondents shows that if this measure is implemented by contractors, then the degree of time overrun may be reduced.

According to the respondents, adequate and close supervision of work is the second most important measure to ensure that time overrun does not exist in construction projects, with RII=0.814. Implementing an effective supervision of work will ensure that projects are carried out according to the specifications, and this will therefore reduce the possibility of rework, which may increase the duration of the work. Experience in site management by the contractor is the third highest ranked causes of project delays. If the contractor is able to implement adequate supervision of work during construction, the work will experience less re-work which may be attributed to poor quality and therefore reduce possible time overrun.

Consultants to ensure drawings and documentation are submitted on time is the third most critical measure that may be implemented on projects to ensure that they are completed on time with an RII=0.807. Consultants not providing the required drawings often leads to project delays, as the work may not be executed by the contractor if the information to do the work is not provided on time.

4.4.5.2 Top three measures to avert cost overrun

Consultants ensuring that drawings and documentation are submitted on time is the first most critical measure that may be implemented on projects to ensure projects are completed within budget with an RII=0.846. Consultants not providing the required drawings often leads to project delays, which, in turn, cost more money because labour on site costs money, and the longer the project takes, the longer you have to keep plants and machinery, and labour on site, leading to higher cost of the project.

According to the respondents, frequent coordination between all project parties is the second most important measure to ensure that cost overrun does not occur in construction projects (RII=0.832). All the project parties (clients, consultants, and contractors) need to meet on a regular basis in order to address issues that may arise on construction projects. It is often lack of frequent coordination between parties that leads to delay in decision making, which, in turn, may lead to suspension of work (Wanjari and Dobariya, 2016 and Sohu et al., 2018). Frequent progress meetings by all parties in order to discuss project-related issues and to re-look at the plan improves project cost performance (Azis et al., 2013). This factor is categorized as contractual relationship between the different parties in this study. Lack of co-ordination between parties was ranked 17th cost overrun factor with an (RII=0.625). Although the consultant is responsible for managing the project, it is up to all the parties involved there is good relationship.

The majority of the respondents indicated that adequate project planning and scheduling is one of the major measures that may be implemented in order to avert time overrun with an RII=0.827. This measure helps to develop a detailed work breakdown structure that is necessary for the entire project such that all the resources are allocated efficiently in order to

ensure that work is completed successfully within the budget allocated. However, most projects unfortunately face cost overrun due to lack of adequate project planning by contractors. Azis et al., (2013) classified this measure as a pro-active strategy.

4.4.6 Relationship between time and cost overrun factors and construction performance

This correlation is conducted to measure if there is an agreement or disagreement associated with construction cost and time overrun factors versus construction performance. Based on the findings of this study, availability of finance of contractors and deficiency in project planning and scheduling, which caused time overrun in projects, and experience in project planning, late delivery of construction material and equipment and extension of time claim, which caused cost overrun in projects, had a moderate and positive impact on cost and time performance of construction projects. However, the strength of the relationship between factors and performance of construction projects were relatively weak, and additional data may be required to further investigate the hypothesis. This outcome is conflicting to the industry norm that there is strong correlation between factors that cause cost and time overrun and construction performance. This may be a result of small sample size used in the study and/or there could be other factors that might not have been considered in this study which may have strong correlation that could be addressed in future studies in this research area.

4.5 SUMMARY OF THE CHAPTER

The research findings in this chapter sought to address the objectives that were set out at the beginning of the research. The chapter was centred on factors that cause time and cost overrun in construction projects, and measures that are used to minimise them. Study objectives were presented, analysed, and discussed in this chapter through application of statistical instruments such as mean, percentages presented as charts, Relative Importance Index and Spearman correlations.

The findings of this research will assist professionals within the Namibian construction industry to gain a better insight into the factors that influence cost and time during the implementation stage of construction project. Understanding these potential factors will help these practitioners to take the necessary preparation or precaution to mitigate or control the extents of time and cost overruns.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

In this chapter, an attempt was made to address the objectives that were outlined in chapter one of this study. Preceding chapters outlined the findings of the study, which made use of a questionnaire approach, in order to address the causes of cost and time overrun in the Namibian construction industry.

5.2 SUMMARY OF THE FINDINGS

The majority of professionals in the study were engineers followed by project managers, while the highest level of education attained by respondents were bachelor's degrees followed by with the Master's degree, there were no respondents with Matric and PhD. Areas of expertise were highest in civil engineering and building construction. The majority of respondents had 6-10 years of experience, followed subsequently by those with 11-15 years of experience and 0-5 years of working experience. The preceding chapters outlined the level of time and cost overrun in projects in Namibia as well as underlining their major causes. The findings sought to identify the major causes of time and cost overrun and measures that may be taken in order to mitigate the effect of these factors on the project during the construction phase.

5.2.1 Level of performance of construction projects

The first objective that needed to be addressed was to find out the level of performance of construction projects in terms of cost and time. The Namibian construction industry experienced high level of cost overrun, with 67% of the projects that were identified by the respondents completed outside of the allocated/planned budget, with 7% of the projects experiencing more than 50% cost overrun. 23% and 21% of the projects identified by the participants experienced cost overrun of between 1–10% and 20–50% cost overrun respectively. Similarly, it was also established that 83% of the projects identified by the respondents experienced time overrun. The largest percentage of the projects (37%) experienced more than 50% time overrun.

5.2.2 Factors causing cost and time overruns on construction projects

The second objective to be addressed was to identify the factors that causes time and cost overrun. A significant number of previous research papers were consulted to identify and select cost and time overrun factors. Once selected, they were ranked based on their importance in contributing to cost and time overrun. The top five causes of delays were inadequate contractor experience, financial difficulties (i.e., cashflow difficulty) by the contractor, poor site management and supervision of project by the contractor, slow decision making, and deficiency in project planning and scheduling. Regarding cost overrun, the top five main causes of cost overrun were financial difficulties by the contractor, inadequate contractor experience, poor planning, and scheduling of project by the contractor, poor site management of project by the contractor, and delayed in monthly progress payment by client.

Although the findings of this study are based on data that is unique to the Namibian construction industry, it was noted that four out of five of the factors for both cost and time overrun mentioned above were the same, and they are contractor-related problems. Whereas the fifth factor for both cost and time overrun were client-related factors. These factors were found to be comparable to factors identified in other developing countries.

5.2.3 Measures used to minimize time and cost overruns on construction projects

Similar to that of the causes, the study also helps to determine significant measures that practitioners may implement in order to mitigate the identified cost and time overrun factors. Based on the results of this research, these mitigation measures were ranked according to the level of importance as per the respondents' viewpoints. The top three mitigating measures recommended for cost overrun are: consultant must ensure that the detailed drawings and documentations are provided on time, frequent co-ordination, and continuous communication between all the parties shall be maintained throughout the project lifecycle, and adequate project planning and scheduling of the project should be done. The top three mitigating measures for time overrun were: proper planning of the works, adequate and close supervision of projects, and consultant must ensure that the detailed drawings and documentations are provided on time.

5.2.4 Relationship between factors causing time and cost overrun and performance of construction projects (Test of Hypothesis)

The study shows that, generally, there is significantly weak correlation between cost and time overrun factors and performance of construction projects. Therefore, in order to properly investigate this hypothesis, one needs to further investigate these factors with additional data. The additional data may be an increased sample size and/or considering other time and cost overrun factors.

5.3 CONCLUSION

Based on these findings, the study concludes that:

The Namibian construction industry is no different from other countries in that it experiences both time and cost overrun. Competency in project management and finances are the main problems that contribute to delays and cost increase on construction projects.

The issue of inadequate contractor experience, poor site management and supervision of project by the contractor, and deficiency in project planning and scheduling are among the major factors causing cost and time overrun.

5.4 RECOMMENDATIONS

This section of the research offers suggestions that were collected by the researcher from this study. Upon making findings, certain inferences were drawn and other suggestions from respondents taken into consideration to arrive at the recommendations of the study. In light of this, the following recommendations were generated for construction project professionals:

- Clients, consultants, and contractors should invest in relevant training of their workforce in order for them to have the required skill set to implement the latest project management techniques available in the market.
- The drawings and documentations on time emerged strongly as a mitigating measure to cost and time overrun. The need for the consultant to address this as it is the initial stage

of the construction phase is critical. Therefore, if the required information by the contractor is not provided timeously by the consultant, delay and subsequent cost increase will be imminent.

- Adequate project planning and scheduling is also a major mitigating measure that needs to be implemented to address cost and time overrun. This measure corroborates with major factors that cause time and cost overrun that were identified in this study.
- Contractors must ensure the workforce is adequately trained in order to plan, schedule, and supervise construction projects appropriately.

5.5 AREAS FOR FURTHER RESEARCH

The following are suggestions for further research that may be implemented in the Namibian construction industry:

- Similar studies can be performed on a specific region of Namibia.
- Another study can be done for specifically private or public construction projects to assess if there is any difference in cost and time overrun between the two projects.
- Mixed method study, whereby once the questionnaire data has been collected, randomly selected professionals from the sample group are interviewed in order to get a broader perception of professionals in order to widen the understanding of the measures to be implemented on projects.
- Detailed study should be done to evaluate the involvement, and impact, of a specific project party on cost and time overrun on construction projects, as this study looked at clients, contractors, and consultants at the same time.

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APPENDICES

APPENDIX A: Cover Letter of Consent and Confidentiality



UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

CONSTRUCTION ECONOMICS AND MANAGEMENT DEPARTMENT

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ETHICS COVER LETTER

Purpose of Study:

The implementation of construction projects is facing growing economic challenges such as cost, and time overrun which are continually plaguing the industry. Hence, the purpose of this study is to evaluate the factors that are causing cost and time overrun within the Namibian construction industry.

Objectives of the study:

The specific objectives of the study are to find out the level of performance of the construction projects, identify the different factors that are causing cost and time overrun on construction projects, determine the different measures used by construction industry stakeholders in order to minimize or control time and cost overruns on construction projects and find out if there is a relationship between the factors that cause time and cost overrun and performance of construction projects.

Participation:

The participants are not obliged to participate in this survey, and it must be noted that participation is entirely Voluntary.

Expectations from Participants:

This research will only require the participant 20 minutes to complete the questionnaire survey. This is clearly indicated in the questionnaire.

Risk of harm to participant:

There is no foreseen risk or harm to the participant of this research survey. Refer to the confidentiality clause below.

Eligibility

The survey is only for Namibian based individuals that are currently practicing within the construction industry.

Confidentiality:

This research does not pose any known risks and does not request any sensitive information. Ethical issues that may arise from this research include concerns of confidentiality, anonymity, and informed consent. These will be treated by ensuring that the e-mails, phone numbers and names of the participants are not disclosed to a third party. Furthermore, any identifiable information will be stored securely and once the research data collection is completed, all the identifiable data will be irrevocably deleted. This data collection is only used for academic use only. It must be noted that any participation in the survey will be voluntary.

Menelik Negussie (Principal researcher) Signature: Date: 20 July 2021.

APPENDIX B: Consent Form



UNIVERSITY OF CAPE TOWN
 IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

CONSTRUCTION ECONOMICS AND MANAGEMENT DEPARTMENT

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CONSENT FORM

Title of the research project:

“Evaluation of the factors causing cost and time overrun in the Namibian construction industry.”

Name and position of the researcher:

Menelik Negussie, MSc (Project Management) student, Department of Construction Economics and Management, University of Cape Town.

.....Section Break (Continuous)

Please respond to the following:

- | | |
|---|---|
| <p>1. I have read Mr. Menelik Negussie’s cover letter and understand what kind of information he is seeking from me.</p> <p>2. I agree to answer the questions posed in this study and provide accurate information to the best of my ability.</p> <p>3. I understand that my participation is voluntary and that I am free to withdraw at any time without offering reasons.</p> <p>4. I agree to take part in this study.</p> | <p>Please tick</p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> |
|---|---|

Name of the participant (on behalf of the company):

Signed: → Date:

Menelik Negussie (Principal researcher) Signature: Date:

NOTE: All the information provided by you on behalf of the company will be treated as strictly confidential. The result will be presented in aggregate format and no individual disclosure will be made.

APPENDIX C: Ethics Clearance Approval

Application for Approval of Ethics in Research (EiR) Projects
Faculty of Engineering and the Built Environment, University of Cape Town

ETHICS APPLICATION FORM

Please Note:

Any person planning to undertake research in the Faculty of Engineering and the Built Environment (EBE) at the University of Cape Town is required to complete this form **before** collecting or analysing data. The objective of submitting this application prior to embarking on research is to ensure that the highest ethical standards in research, conducted under the auspices of the EBE Faculty, are met. Please ensure that you have read, and understood the **EBE Ethics in Research Handbook** (available from the UCT EBE, Research Ethics website) prior to completing this application form: <http://www.ebe.uct.ac.za/ebe/research/ethics1>

APPLICANT'S DETAILS		
Name of principal researcher, student or external applicant		Menelik Gizaw Negussie
Department		Construction Economics and Management
Preferred email address of applicant:		NGSMEN001@myuct.ac.za
If Student	Your Degree: e.g., MSc, PhD, etc.	MSc Project Management
	Credit Value of Research: e.g., 60/120/180/360 etc.	60
	Name of Supervisor (if supervised):	Prof. Abimbola Windapo
If this is a research contract, indicate the source of funding/sponsorship		
Project Title		Evaluation of the factors causing cost and time overrun in the construction industry in Namibia

I hereby undertake to carry out my research in such a way that:

- there is no apparent legal objection to the nature or the method of research; and
- the research will not compromise staff or students or the other responsibilities of the University;
- the stated objective will be achieved, and the findings will have a high degree of validity;
- limitations and alternative interpretations will be considered;
- the findings could be subject to peer review and publicly available; and
- I will comply with the conventions of copyright and avoid any practice that would constitute plagiarism.

APPLICATION BY	Full name	Signature	Date
Principal Researcher/ Student/External applicant	Menelik Negussie		10 July 2021
SUPPORTED BY	Full name	Signature	Date
Supervisor (where applicable)	Abimbola Windapo		20 July 2021

APPROVED BY	Full name	Signature	Date
HOD (or delegated nominee) Final authority for all applicants who have answered NO to all questions in Section 1; and for all Undergraduate research (Including Honours).	Dr. Frank K. Ametefe		0/08/2021
Chair: Faculty EIR Committee For applicants other than undergraduate students who have answered YES to any of the questions in Section 1.	Dr. Frank K. Ametefe		10/08/2021

APPENDIX D: Questionnaire

Questionnaire

INSTRUCTIONS

Kindly complete Section A, B, C, D and E of this Questionnaire by crossing [X] the appropriate response or filling in your answers in the space provided.

SECTION A: BACKGROUND INFORMATION

This section of the questionnaire gives the demographic characteristics of respondents. Please tick or provide the appropriate responses where applicable.

1. Company name (Optional)

.....
.....

2. State the number of employees in your organization (e.g., 500):

.....

3. When was your organization established (e.g., 1996)?

.....

4. Please indicate your gender.

- Male
- Female

5. Kindly indicate your age group

- 20 to 25
- 26 to 30
- 31 to 35
- 36 to 40
- 41 to 45
- 46 to 50
- Over 50

6. Kindly indicate your highest educational level

- PhD
- Master's Degree
- Bachelor's Degree
- Certificate or Diploma
- Matric
- Grade 12 or lower

7. What is your designated role in the organization?

- Project Manager
- Engineer (Civil, Mechanical or Electrical)
- Architect
- Quantity Surveyor
- Construction Manager
- Other

If (Other), Please Specify

.....

8. Please indicate your area of expertise:

- Building Construction
- Mechanical Engineering works
- Electrical Engineering works
- Building and Civil construction
- Civil Engineering
- Specialist construction/specialist works.
- Other

If (Other), Please Specify

.....

9. Please indicate your number of years of relevant working experience in the construction industry (e.g. 15 years)years

10. Kindly indicate the number of projects you participated in, in the past five (5) years (e.g., 4):

.....number

11. Kindly indicate if you are registered with any professional body?

- Unregistered
- In-training
- Professional member
- Career requires no registration with professional body

SECTION B: DETERMINING THE LEVEL OF TIME AND COST OVERRUN OF THE CONSTRUCTION PROJECTS YOU IDENTIFIED

Identify a project you are conversant with, and which was completed within the last five years. Use this project in answering the following questions.

1. Location of the project:

Kindly indicate the region in which the project is located

- Zambezi
- Erongo
- Hardap
- Karas
- Kavango
- Khomas
- Kunene
- Ohangwena
- Omaheke
- Omusati
- Oshana
- Oshikoto
- Otjozondjupa

Other please specify.....

2. What is your role on the project?

- Client (User ministry, regional and town council, municipalities, government agencies)
Consultant (Architect, Quantity Surveyor, Civil, Electrical or Mechanical Engineer)
- Contractor
- Other, Please Specify

.....

3. Please indicate the type of project:

- Building Construction
- Civil infrastructure (sewer and water reticulation)
- Road infrastructure (road and stormwater)
- Electrical infrastructure (electrical reticulation)

- Specialist construction/specialist works.
- Other

If (Other), Please Specify

4. Planned Cost of the project during design stage (N\$)

.....

5. Planned Cost of the project during construction stage (N\$)

.....

6. Actual final Cost of the project during design stage (N\$)

.....

7. Actual final Cost of the project during construction stage (N\$)

.....

8. Planned construction period during design stage (months)

.....

9. Planned construction period during construction stage (months)

.....

10. Actual construction period during design stage (months)

.....

11. Actual construction period during construction stage (months)

.....

12. What method was used in procuring the project: Mark all that are applicable.

- Traditional
- Design and Build
- Management Contract
- Integrated project delivery system
- Other

If (Other), Please Specify.....

SECTION C: DETERMINING THE LEVEL OF COST OVERRUN OF SELECTED CONSTRUCTION PROJECT

13. Kindly rate the factors causing **COST OVERRUN** during construction project execution on the identified project using a Likert scale of 1 to 5. Where: 5= Extremely High; 4= High; 3=Moderate; 2=Low; 1=Minimal Impact.

Factors causing cost overrun	Degree of Impact				
	Extremely High	High	Moderate	Low	Minimal impact
CONTRACTOR RELATED CAUSES					
Contractor experience					
Availability of Finance					
No experience of project area					
Experience in project planning and scheduling					
Experience in Site management					
Mistakes during construction					
CONSULTANT RELATED CAUSES					
Frequent Design Changes					
Mistakes and error in design					
Incomplete design at the time of tender					
Consulting team competence					
Delay in inspection and testing of works					
Experience in Project management					
Underestimation of project cost					
CLIENT RELATED CAUSES					
Delay in client's contract award					

Availability of Finance					
Delayed progress payment					
Change order or scope change					
CONTRACT RELATIONSHIP RELATED CAUSES					
Poor communication between parties					
Lack of coordination between parties					
Slow information flow between parties					
LABOUR RELATED CAUSES					
Skilled labour					
Site labour					
Low motivation					
High cost of labour					
MATERIAL AND EQUIPMENT RELATED CAUSES					
Fluctuation of prices (Inflation)					
Mismanagement (poor handling and wastage)					
Late delivery of construction material and equipment					
Shortages in material					
EXTERNAL CAUSES					
Exchange rate fluctuation					
Inaccurate quantity take-off					
Project Complexity					
Weather conditions					
Unexpected ground conditions					
Fraudulent practices and kickbacks					
Extension of time claim					

Delays in work approval by local authorities					
Force Majeure (acts of God)					
Other please identify					

SECTION C: DETERMINING THE LEVEL OF TIME OVERRUN OF SELECTED CONSTRUCTION PROJECT

14. Kindly rate the factors causing **TIME OVERRUN** during construction project execution on the identified project using a Likert scale of 1 to 5 where; 5= Extremely High; 4= High; 3=Moderate; 2=Low; 1=Minimal Impact

Project causing Time Overrun	Degree of Impact				
	Extremely High	High	Moderate	Low	Minimal impact
CONTRACTOR RELATED CAUSES					
Contractor experience					
Availability of Finance (i.e., cashflow difficulty)					
subcontractors' competence					
Deficiency in project planning and scheduling					
Experience in Site management and supervision					
Mistakes during construction stage					
Experience in site management					
Delay in site mobilization					
CONSULTANT RELATED CAUSES					
Experience in contract management					
Delays in inspection and testing of works					
Inflexibility of consultant					
Design Changes					
Mistake and error in design					
Delays in design documentation					

Competence of design team					
Complexity of project design					
Delay in implementing changes to scope of work					
CLIENT RELATED CAUSES					
Unrealistic contract duration and requirements imposed					
Availability of Finance					
Delay in progress payment of completed work					
Change order or scope change					
Changes in design					
Slow decision making					
Mistakes and discrepancies in contract documentation					
Delay in decision making					
Delay in contract award					
Delay in reviewing and approving drawings and documentation					
CONTRACT RELATIONSHIP RELATED CAUSES					
Lack of communication between parties					
Lack of coordination between parties					
Disputes between parties					
LABOUR RELATED CAUSES					
Labour supply					
Skilled labour supply					
Low motivation					
Labour productivity					
Strike					
MATERIAL AND EQUIPMENT RELATED					

CAUSES					
Equipment breakdown					
Shortage of equipment					
Shortage of construction material in market					
Delay in material and equipment delivery by vendors					
Delay in material procurement					
Quality of material					
Inaccurate material estimate					
EXTERNAL CAUSES					
Unpredictable weather conditions					
Unexpected ground / site conditions					
Changes in government regulations and laws					
Accident during construction					
Delays in work approval by local authorities					
Unrest by local communities					
Delay in land compensation					
Demining					
Pandemic (Covid 19)					
Fraudulent practices and kickbacks					
Force Majeure (acts of God)					
Other please identify					

SECTION E: DETERMINING THE DIFFERENT MEASURES USED BY CONSTRUCTION INDUSTRY STAKEHOLDERS TO MINIMISE TIME & COST OVERRUN ON CONSTRUCTION PROJECTS

15. Kindly indicate your level of agreement with the measures used in minimizing **TIME OVERRUN** during the construction project execution of the identified project using a Likert scale of 1 to 5 where; 5= Strongly Agree; 4= Agree; 3=Undecided; 2=Disagree; 1=Strongly Disagree

No	Strategies / Measures to minimize delays	Strongly Disagree (1)	Disagree (2)	Undecided (3)	Agree (4)	Strongly Agree (5)
1.	Early engagement of project managers					
2.	Adequate and close supervision of projects					
3.	Adequate training of Project staff					
4.	Proper Planning of the work					
5.	Effective and lucid communication between all parties					
6.	Effective mobilization and release of resources					
7.	Adequate focus on quality, cost, and delivery of the project					
8.	Contractor to ensure sufficient cashflow at the start of the project					
9.	Approvals of variation orders are done timeously					
10.	Payments to contractor and consultant done timeously					
11.	Adequate understanding of contractors on project task					

12.	Consultant to ensure drawings and documentations are submitted on time					
13.	Payments to contractor and consultant done timeously					
14.	Approvals of variation orders are done timeously					
15.	Forecast planning by contractor against unforeseen delays (i.e., labour strike)					
16.	Other please identify					

16. Kindly indicate your level of agreement with the measures used in minimizing **COST OVERRUN** during the construction project execution of the identified project using a Likert scale of 1 to 5 where; 5= Strongly Agree; 4= Agree; 3=Undecided; 2=Disagree; 1=Strongly Disagree

No	Strategies / Measures to minimize cost overrun	Strongly Disagree (1)	Disagree (2)	Undecided (3)	Agree (4)	Strongly Agree (5)
1.	Effective Site Management and supervision					
2.	Conducting frequent progress meetings					
3.	Effective strategic planning by contractor					
4.	Utilising experienced subcontractors and suppliers					
5.	Frequent coordination between all the project parties					
6.	Early engagement of community					
7.	Effective and lucid communication between all					

	the project parties					
8.	Ensure adequate training of project staff					
9.	Use of appropriate construction methods					
10.	Adequate project planning and scheduling					
11.	Contractor to ensure sufficient cashflow at the start of project					
12.	Perform pre-construction planning of project tasks and resources needed					
13.	Consultant to ensure drawings and documentations are submitted on time					
14.	Other please specify					

APPENDIX E: Factors influencing time overrun ranked based on citation

S/No	Factors	Sources																		Total Score								
		Ogunlana and Promkuntong (1996)	Chan and Kumaraswamy (1997)	Kaming et al. 1997	Elinwa et al (2001)	Enshassi et al (2003)	Frimpong et al. (2003)	Koushki et al. (2005)	Aibinu and Odeyinka (2006)	Kaming et al. (2006)	Rahman et al. (2006)	Sambasivan and Soon (2006)	Assaf et al. (2006)	Le-Hoai et al. (2008)	Toor and Ogunlana (2008)	Kaliba et al. (2009)	Olawale and Sun (2010)	Baloyi and Bekker (2011)	Kikwasi (2012)		Memon et al. (2012)	Mahamid et al. (2012)	Gardezi et al. (2014)	Shehu and Endut (2014)	Gobishanker et a; (2015)	Samarghandi et al. (2016)	Asiedu and Alfien (2016)	Gebrehiwet and Luo (2017)
1	Inadequate contractor experience	•	•							•	•	•																5
2	Availability of Finance (i.e., cashflow difficulty)	•				•		•		•		•	•	•					•			•			•			10
3	Poor experience in Site management and supervision		•							•	•	•	•	•					•		•					•		9
4	Slow decision making	•	•																									2
5	Deficiency in project planning and scheduling	•	•	•		•	•		•	•	•	•		•											•		•	12

S/No	Factors	Sources																	Total Score								
		Ogunlana and Promkuntong (1996)	Chan and Kumaraswamy (1997)	Kaming et al. 1997	Elinwa et al (2001)	Enshassi et al (2003)	Frimpong et al. (2003)	Koushki et al. (2005)	Aibinu and Odeyinka (2006)	Kaming et al. (2006)	Rahman et al. (2006)	Sambasivan and Soon (2006)	Assaf et al. (2006)	Le-Hoai et al. (2008)	Toor and Ogunlana (2008)	Kaliba et al. (2009)	Olawale and Sun (2010)	Baloyi and Bekker (2011)		Kikwasi (2012)	Memon et al. (2012)	Mahamid et al. (2012)	Gardezi et al. (2014)	Shehu and Endut (2014)	Gobishanker et a; (2015)	Samarghandi et al. (2016)	Asiedu and Alfien (2016)
6	Delay in progress payment of completed work	•			•		•			•	•	•	•		•			•			•	•	•		•	•	15
7	Availability of Finance (owner's financial constraint)	•					•	•		•	•		•		•			•			•		•				10
8	Lack of subcontractor's Skill		•					•		•						•											4
9	Pandemic (Covid 19)																										0
10	Mistakes during construction stage				•						•																2
11	Change order or scope change						•			•		•		•													4

S/No	Factors	Sources																	Total Score									
		Ogunlana and Promkuntong (1996)	Chan and Kumaraswamy (1997)	Kaming et al. 1997	Elinwa et al (2001)	Enshassi et al (2003)	Frimpong et al. (2003)	Koushki et al. (2005)	Aibinu and Odeyinka (2006)	Kaming et al. (2006)	Rahman et al. (2006)	Sambasivan and Soon (2006)	Assaf et al. (2006)	Le-Hoai et al. (2008)	Toor and Ogunlana (2008)	Kaliba et al. (2009)	Olawale and Sun (2010)	Baloyi and Bekker (2011)		Kikwasi (2012)	Memon et al. (2012)	Mahamid et al. (2012)	Gardezi et al. (2014)	Shehu and Endut (2014)	Gobishanker et a; (2015)	Samarghandi et al. (2016)	Asiedu and Alfen (2016)	Gebrehiwet and Luo (2017)
12	Delay in material procurement		•			•									•													3
13	Low labour productivity		•	•		•			•			•																5
14	Delay in material and equipment delivery by vendors	•		•	•	•						•														•	6	
15	Design Changes	•	•	•	•				•	•			•			•	•	•				•						11
16	Changes in design	•	•	•	•				•	•			•			•	•	•				•						11
17	Poor experience in contract management		•				•						•					•	•								5	

S/No	Factors	Sources																		Total Score										
		Ogunlana and Promkuntong (1996)	Chan and Kumaraswamy (1997)	Kaming et al. 1997	Elinwa et al (2001)	Enshassi et al (2003)	Frimpong et al. (2003)	Koushki et al. (2005)	Aibinu and Odeyinka (2006)	Kaming et al. (2006)	Rahman et al. (2006)	Sambasivan and Soon (2006)	Assaf et al. (2006)	Le-Hoai et al. (2008)	Toor and Ogunlana (2008)	Kaliba et al. (2009)	Olawale and Sun (2010)	Baloyi and Bekker (2011)	Kikwasi (2012)		Memon et al. (2012)	Mahamid et al. (2012)	Gardezi et al. (2014)	Shehu and Endut (2014)	Gobishanker et a; (2015)	Samarghandi et al. (2016)	Asiedu and Alfien (2016)	Gebrehiwet and Luo (2017)		
18	Delay in site mobilization																													0
19	Delay in reviewing and approving drawings and documentation					•																							•	2
20	Poor communication between parties	•	•							•	•									•										5
21	Shortage of skilled labour supply	•	•	•		•														•										6
22	Lack of coordination between parties	•																												1
23	Disputes between parties																													0

S/No	Factors	Sources																	Total Score									
		Ogunlana and Promkuntong (1996)	Chan and Kumaraswamy (1997)	Kaming et al. 1997	Elinwa et al (2001)	Enshassi et al (2003)	Frimpong et al. (2003)	Koushki et al. (2005)	Aibinu and Odeyinka (2006)	Kaming et al. (2006)	Rahman et al. (2006)	Sambasivan and Soon (2006)	Assaf et al. (2006)	Le-Hoai et al. (2008)	Toor and Ogunlana (2008)	Kaliba et al. (2009)	Olawale and Sun (2010)	Baloyi and Bekker (2011)		Kikwasi (2012)	Memon et al. (2012)	Mahamid et al. (2012)	Gardezi et al. (2014)	Shehu and Endut (2014)	Gobishanker et a; (2015)	Samarghandi et al. (2016)	Asiedu and Alfen (2016)	Gebrehiwet and Luo (2017)
24	Unrealistic contract duration and requirements imposed		•			•										•						•						5
25	Competence of design team	•					•																					2
26	Shortage of construction material in market	•	•	•		•		•		•			•	•					•									10
27	Delay in contract award																											0
28	Complexity of project design		•													•												2
29	Unexpected ground / site conditions	•	•	•		•							•															5
30	Low motivation																											0

S/No	Factors	Sources																		Total Score								
		Ogunlana and Promkuntong (1996)	Chan and Kumaraswamy (1997)	Kaming et al. 1997	Elinwa et al (2001)	Enshassi et al (2003)	Frimpong et al. (2003)	Koushki et al. (2005)	Aibinu and Odeyinka (2006)	Kaming et al. (2006)	Rahman et al. (2006)	Sambasivan and Soon (2006)	Assaf et al. (2006)	Le-Hoai et al. (2008)	Toor and Ogunlana (2008)	Kaliba et al. (2009)	Olawale and Sun (2010)	Baloyi and Bekker (2011)	Kikwasi (2012)		Memon et al. (2012)	Mahamid et al. (2012)	Gardezi et al. (2014)	Shehu and Endut (2014)	Gobishanker et a; (2015)	Samarghandi et al. (2016)	Asiedu and Alfen (2016)	Gebrehiwet and Luo (2017)
31	Delay in implementing changes to scope of work		•															•	•									3
32	Low quality of material	•				•																					•	3
33	Shortage of labour supply	•				•		•		•	•	•		•						•			•					9
34	Shortage of equipment			•						•	•									•	•							5
35	Mistake and error in design					•			•	•					•		•					•						6
36	Equipment breakdown	•			•			•		•																		4
37	Inaccurate material estimate	•	•										•															3

S/No	Factors	Sources																	Total Score																
		Ogunlana and Promkuntong (1996)	Chan and Kumaraswamy (1997)	Kaming et al. 1997	Elinwa et al (2001)	Enshassi et al (2003)	Frimpong et al. (2003)	Koushki et al. (2005)	Aibinu and Odeyinka (2006)	Kaming et al. (2006)	Rahman et al. (2006)	Sambasivan and Soon (2006)	Assaf et al. (2006)	Le-Hoai et al. (2008)	Toor and Ogunlana (2008)	Kaliba et al. (2009)	Olawale and Sun (2010)	Baloyi and Bekker (2011)		Kikwasi (2012)	Memon et al. (2012)	Mahamid et al. (2012)	Gardezi et al. (2014)	Shehu and Endut (2014)	Gobishanker et a; (2015)	Samarghandi et al. (2016)	Asiedu and Alfen (2016)	Gebrehiwet and Luo (2017)							
38	Delays in inspection and testing of works	•								•																									2
39	Delays in design documentation									•															•			•							3
40	Delays in work approval by local authorities	•								•												•													3
41	Mistakes and discrepancies in contract documentation				•										•				•	•															4
42	Unpredictable weather conditions			•	•	•	•	•							•									•											7
43	Force Majeure (acts of God)																																		0
44	Inflexibility of																																		0

S/No	Factors	Sources																		Total Score													
		Ogunlana and Promkuntong (1996)	Chan and Kumaraswamy (1997)	Kaming et al. 1997	Elinwa et al (2001)	Enshassi et al (2003)	Frimpong et al. (2003)	Koushki et al. (2005)	Aibinu and Odeyinka (2006)	Kaming et al. (2006)	Rahman et al. (2006)	Sambasivan and Soon (2006)	Assaf et al. (2006)	Le-Hoai et al. (2008)	Toor and Ogunlana (2008)	Kaliba et al. (2009)	Olawale and Sun (2010)	Baloyi and Bekker (2011)	Kikwasi (2012)		Memon et al. (2012)	Mahamid et al. (2012)	Gardezi et al. (2014)	Shehu and Endut (2014)	Gobishanker et a; (2015)	Samarghandi et al. (2016)	Asiedu and Alfen (2016)	Gebrehiwet and Luo (2017)					
	consultant																																
45	Fraudulent practices and kickbacks																													•	•	2	
46	Changes in government regulations and laws																																
47	Strike					•										•																2	
48	Delay in land compensation																			•												1	
49	Accident during construction																																
50	Unrest by local communities																						•										1
51	Demining																																0

APPENDIX F: Factors influencing cost overrun ranked based on citation

S/No	Factors	Source																Total Score					
		Kaming et al. (1997)	Frimpong et al. (2003)	Koushki et al. (2005)	Kaming et al. (2006)	Le-Hoai et al. (2008)	Azhar et al. (2008)	Enshassi et al. (2010)	Kaliba et al. (2009)	Olawale and Sun (2010)	Cantarelli (2009)	Ameh et al. (2010)	Baloyi and Bekker (2011)	Aziz (2013)	Rahman et al. (2013)	Wanjari and Dobariya (2016)	Shimete and Wall (2017)		Durdyev et al. (2017)	Asiedu and Adaku (2020)	Akinradewo et al. (2019)	Sitwala and Wium (2020)	
1	Fluctuation of prices (Inflation)	●	●	●	●	●	●		●	●	●	●	●	●	●								14
2	Change order or scope change		●			●	●				●	●	●	●		●	●	●	●	●	●	●	13
3	Experience in project planning and scheduling (inadequate)		●			●	●	●			●	●		●	●		●		●				10
4	Poor Experience in Site management					●	●				●			●	●		●	●					7
5	Underestimation of project cost	●				●	●		●			●					●		●				7
6	Frequent Design Changes					●		●	●	●	●				●								6
7	Mistakes during construction		●		●	●							●	●	●								6

S/No	Factors	Source																	Total Score			
		Kaming et al. (1997)	Frimpong et al. (2003)	Koushki et al. (2005)	Kaming et al. (2006)	Le-Hoai et al. (2008)	Azhar et al. (2008)	Enshassi et al. (2010)	Kaliba et al. (2009)	Olawale and Sun (2010)	Cantarelli (2009)	Ameh et al. (2010)	Baloyi and Bekker (2011)	Aziz (2013)	Rahman et al. (2013)	Wanjari and Dobiya (2016)	Shimete and Wall (2017)	Durdyev et al. (2017)		Asiedu and Adaku (2020)	Akinradewo et al. (2019)	Sitwala and Wium (2020)
8	Experience in Project management				●						●		●	●			●		●			6
9	Availability of Finance (i.e., cashflow difficulty)				●										●	●				●		5
10	Delayed progress payment		●		●				●						●		●					5
11	Financial difficulty of Owner	●			●								●	●								4
12	Lack of Contractor experience										●			●						●	●	4
13	Inaccurate quantity take-off				●		●					●				●						4
14	Lack of coordination between parties								●							●		●				3

S/No	Factors	Source																Total Score					
		Kaming et al. (1997)	Frimpong et al. (2003)	Koushki et al. (2005)	Kaming et al. (2006)	Le-Hoai et al. (2008)	Azhar et al. (2008)	Enshassi et al. (2010)	Kaliba et al. (2009)	Olawale and Sun (2010)	Cantarelli (2009)	Ameah et al. (2010)	Baloyi and Bekker (2011)	Aziz (2013)	Rahman et al. (2013)	Wanjari and Dobaraya (2016)	Shimete and Wall (2017)		Durdyev et al. (2017)	Asiedu and Adaku (2020)	Akinradewo et al. (2019)	Sitwala and Wium (2020)	
15	Shortages in Material & Equipment					●		●							●								3
16	Project Complexity				●				●			●											3
17	Shortage of skilled labour											●						●					2
18	Delay in client's contract award							●							●								2
19	Mistakes and error in design					●									●								2
20	Unexpected ground conditions					●							●										2
21	Force Majeure (acts of God)															●	●						2

S/No	Factors	Source																Total Score						
		Kaming et al. (1997)	Frimpong et al. (2003)	Koushki et al. (2005)	Kaming et al. (2006)	Le-Hoai et al. (2008)	Azhar et al. (2008)	Enshassi et al. (2010)	Kaliba et al. (2009)	Olawale and Sun (2010)	Cantarelli (2009)	Ameh et al. (2010)	Baloyi and Bekker (2011)	Aziz (2013)	Rahman et al. (2013)	Wanjari and Dobiya (2016)	Shimete and Wall (2017)		Durdyev et al. (2017)	Asiedu and Adaku (2020)	Akinradewo et al. (2019)	Sitwala and Wium (2020)		
22	Fraudulent practices and kickbacks											•				•								2
23	Extension of time claim						•																	1
24	Shortage Site labour												•											1
25	No experience of project area																					•		1
26	Mismanagement (poor handling and wastage)															•								1
27	Exchange rate fluctuation						•																	1
28	Increase cost of labour											•												1
29	Late delivery of construction Material & Equipment																							0

S/No	Factors	Source																	Total Score				
		Kaming et al. (1997)	Frimpong et al. (2003)	Koushki et al. (2005)	Kaming et al. (2006)	Le-Hoai et al. (2008)	Azhar et al. (2008)	Enshassi et al. (2010)	Kaliba et al. (2009)	Olawale and Sun (2010)	Cantarelli (2009)	Ameh et al. (2010)	Baloyi and Bekker (2011)	Aziz (2013)	Rahman et al. (2013)	Wanjari and Dobiya (2016)	Shimete and Wall (2017)	Durdyev et al. (2017)		Asiedu and Adaku (2020)	Akinradewo et al. (2019)	Sitwala and Wium (2020)	
30	Poor communication between parties																						0
31	Slow information flow between parties																						0
32	Consulting team competence																						0
33	Incomplete design at the time of tender																						0
34	Low motivation																						0
35	Delays in work approval by local authorities																						0
36	Delay in inspection and testing of works																						0

Appendix G: Factors that cause cost overrun and construction performance

Cases	Cost Performance	Contractor Related Causes					
		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
		Contractor experience	Availability of Finance	No experience of project area	Experience in project planning and scheduling	Experience in Site management	Mistakes during construction
1	-11%	4	3	4	4	4	2
2	13%	2	4	2	3	2	1
3	-17%	5	4	4	4	4	3
4	10%	5	3	5	5	5	5
5	10%	4	3	2	3	4	2
6	0%	5	5	2	5	3	2
7	50%	5	3	3	4	4	3
8	5%	4	4	3	4	5	4
9	-46%	4	3	2	4	4	3
10	6%	4	3	3	3	2	3
11	0%	4	5	4	3	4	5
12	2%	3	5	5	3	5	3
13	-9%	3	5	2	2	2	2
14	10%	3	3	4	2	1	4
15	0%	1	4	2	2	2	4
16	4%	4	5	4	3	4	4
17	3%	5	4	4	5	5	4
18	21%	2	2	2	2	2	2
19	8%	5	4	4	4	4	3

Cases	Cost Performance	Contractor Related Causes					
		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
		Contractor experience	Availability of Finance	No experience of project area	Experience in project planning and scheduling	Experience in Site management	Mistakes during construction
20	19%	5	4	5	5	3	2
21	0%	4	5	4	3	4	4
22	-2%	2	2	1	2	2	2
23	59%	3	3	3	3	4	3
24	44%	2	4	1	3	3	2
25	5%	4	4	1	3	4	2
26	27%	5	4	5	5	4	5
27	-1%	5	4	1	4	4	1
28	2%	4	4	4	4	4	4
29		2	2	3	3	2	3
30	0%	3	5	2	3	4	3
31	29%	5	5	5	5	5	5
32	10%	4	4	2	3	4	4
33	0%	3	1	2	3	3	4
34	17%	4	5	3	4	4	3
35	21%	2	4	3	2	2	3
36	13%	3	4	3	4	4	4
37	-4%	4	1	1	2	2	2
38	100%	3	3	2	3	4	3
39	55%	5	4	3	3	3	4

Cases	Cost Performance	Contractor Related Causes					
		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
		Contractor experience	Availability of Finance	No experience of project area	Experience in project planning and scheduling	Experience in Site management	Mistakes during construction
40	10%	4	5	4	4	4	3
41	50%	4	5	5	5	5	2
42	0%	5	5	2	4	5	5
43	12%	5	5	5	5	5	5
44	19%	3	2	5	3	3	3
45		3	4	4	4	3	4
46	42%	4	3	3	4	4	2
47	0%	5	5	4	4	4	3
48	140%	4	4	2	5	5	1
49	100%	4	3	4	4	4	4
50	8%	5	4	2	5	5	5
51	40%	4	4	2	4	4	2
52	0%	3	3	5	5	4	4
53	16%	3	5	2	1	2	2
54	0%	4	3	1	5	5	2
55	4%	3	2	3	3	3	4
56	74%	3	4	5	5	5	5
57	11%	4	4	4	4	4	2
58	0%	1	3	2	1	1	2
59	20%	4	5	4	5	5	4

Cases	Cost Performance	Contractor Related Causes					
		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
		Contractor experience	Availability of Finance	No experience of project area	Experience in project planning and scheduling	Experience in Site management	Mistakes during construction
60	-1%	5	4	4	4	4	3
61	2%	2	5	3	3	3	5
62	0%	2	3	4	2	2	5
63	17%	5	5	5	5	5	5
64	12%	5	3	4	5	4	3
65	7%	2	5	3	2	2	4
66	0%	5	4	3	4	4	4
67	36%	3	5	1	1	1	2
68	7%	1	4	1	3	2	2
69	11%	2	4	3	4	3	3
70	0%	2	4	3	3	4	3
71	9%	3	5	4	4	4	2
72	11%	4	3	5	2	2	3
73	28%	5	5	5	5	3	3
74	0%	4	3	3	4	4	2
75	0%	4	3	4	5	5	3
76	32%	4	1	4	3	3	5
77	33%	4	3	3	4	3	2
78	17%	3	4	5	2	2	1
79	25%	5	3	2	5	5	5

Cases	Cost Performance	Contractor Related Causes					
		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
		Contractor experience	Availability of Finance	No experience of project area	Experience in project planning and scheduling	Experience in Site management	Mistakes during construction
80	11%	4	3	2	4	4	2
81	40%	1	1	1	2	2	3
82	6%	5	5	5	5	5	5
83	39%	3	2	4	4	3	3
84	40%	5	4	3	5	4	3
85	6%	3	3	1	4	3	2
86	7%	4	5	3	4	5	4
87	0%	4	3	1	3	3	3
88	-1%	3	3	3	2	2	2
89	0%	4	2	2	5	5	5
90	27%	3	2	2	2	2	2
91	30%	5	5	3	5	5	5
92	0%	5	5	5	5	5	5
93	20%	3	5	2	3	2	3
94	2%	4	4	4	5	5	5
95	100%	4	3	3	4	4	3
96	0%	4	3	3	4	4	3
97	17%	5	5	5	5	5	5
98	-2%	4	5	2	4	5	1
99		3	4	4	4	3	4

Cases	Cost Performance	Contractor Related Causes					
		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
		Contractor experience	Availability of Finance	No experience of project area	Experience in project planning and scheduling	Experience in Site management	Mistakes during construction
100	7%	4	5	1	2	3	4
101	-6%	5	5	3	3	5	5
102	0%	2	3	1	4	2	1
103	50%	1	1	2	2	2	2
104	150%	3	3	3	3	3	3
105	0%	4	3	5	5	3	3
106	31%	3	5	3	5	5	5
107	0%	1	1	3	2	3	2
108	0%	4	4	4	2	2	4
109	-4%	3	3	3	4	4	5
110	2%	4	4	4	3	3	3
111	33%	3	5	5	5	3	5
112	6%	3	3	1	1	3	3
113	0%	2	5	3	4	2	3
114	33%	5	4	4	5	5	3

Cases	Cost Performance	Consultant Related Causes						
		Factor 7	Factor 8	Factor 9	Factor 10	Factor 11	Factor 12	Factor 13
		Frequent Design Changes	Mistakes and error in design	Incomplete design at the time of tender	Consulting team competence	Delay in inspection and testing of works	Experience in Project management	Underestimation of project cost
1	-11%	3	2	2	4	2	4	2
2	13%	1	1	2	1	2	1	1
3	-17%	4	2	2	4	3	5	3
4	10%	4	2	2	2	3	3	3
5	10%	2	2	4	3	2	4	3
6	0%	3	4	2	5	5	5	2
7	50%	3	1	4	3	1	4	1
8	5%	3	2	1	4	3	4	3
9	-46%	2	3	2	4	2	4	2
10	6%	4	2	4	4	2	4	3
11	0%	4	5	5	4	5	4	5
12	2%	3	4	2	4	3	4	4
13	-9%	1	1	1	1	1	1	1
14	10%	4	5	4	4	4	3	4
15	0%	5	4	5	1	5	1	2
16	4%	3	3	3	3	3	4	4
17	3%	5	4	4	4	5	5	5
18	21%	3	3	2	3	3	3	3
19	8%	4	3	3	4	4	4	5
20	19%	5	5	5	3	4	5	5

Case s	Cost Performance	Consultant Related Causes						
		Factor 7	Factor 8	Factor 9	Factor 10	Factor 11	Factor 12	Factor 13
		Frequent Design Changes	Mistakes and error in design	Incomplete design at the time of tender	Consulting team competence	Delay in inspection and testing of works	Experience in Project management	Underestimation of project cost
21	0%	4	4	3	3	4	3	4
22	-2%	1	1	1	1	1	1	1
23	59%	4	3	5	3	2	4	3
24	44%	1	2	1	1	2	1	3
25	5%	2	1	1	1	1	3	3
26	27%	5	5	5	3	4	5	5
27	-1%	5	4	4	1	1	4	1
28	2%	1	1	1	1	1	1	1
29		3	2	3	4	4	3	3
30	0%	2	2	2	2	1	1	1
31	29%	4	5	5	5	3	3	5
32	10%	3	3	3	4	4	3	4
33	0%	4	4	5	3	5	4	3
34	17%	5	3	2	3	1	1	1
35	21%	2	1	2	2	3	2	2
36	13%	5	5	5	4	3	3	3
37	-4%	1	1	2	1	1	1	1
38	100%	3	3	2	4	3	4	2
39	55%	4	5	4	3	3	3	4
40	10%	4	3	2	4	3	4	3

Case s	Cost Performance	Consultant Related Causes						
		Factor 7	Factor 8	Factor 9	Factor 10	Factor 11	Factor 12	Factor 13
		Frequent Design Changes	Mistakes and error in design	Incomplete design at the time of tender	Consulting team competence	Delay in inspection and testing of works	Experience in Project management	Underestimation of project cost
41	50%	3	1	4	5	5	5	5
42	0%	3	4	4	5	4	4	4
43	12%	3	3	3	2	2	2	2
44	19%	5	2	1	2	2	3	3
45		3	3	4	4	3	4	3
46	42%	4	3	4	4	3	4	1
47	0%	4	3	3	2	2	2	5
48	140%	2	2	2	4	1	5	1
49	100%	2	2	2	4	3	4	2
50	8%	5	4	4	5	4	4	5
51	40%	3	2	3	4	3	4	3
52	0%	3	3	1	4	4	4	3
53	16%	2	1	1	1	2	2	3
54	0%	5	2	1	5	2	4	1
55	4%	4	2	1	3	3	4	2
56	74%	5	5	3	4	2	2	2
57	11%	4	3	1	4	1	4	2
58	0%	1	1	2	1	1	1	2
59	20%	5	5	5	4	4	4	5
60	-1%	3	4	5	3	3	3	2

Case s	Cost Performance	Consultant Related Causes						
		Factor 7	Factor 8	Factor 9	Factor 10	Factor 11	Factor 12	Factor 13
		Frequent Design Changes	Mistakes and error in design	Incomplete design at the time of tender	Consulting team competence	Delay in inspection and testing of works	Experience in Project management	Underestimation of project cost
61	2%	5	3	5	1	1	1	1
62	0%	2	2	2	2	2	2	2
63	17%	1	1	2	1	1	1	1
64	12%	3	3	5	4	2	4	4
65	7%	2	2	2	4	3	3	2
66	0%	4	4	5	4	3	4	4
67	36%	3	3	2	1	1	2	3
68	7%	4	3	4	3	3	3	4
69	11%	3	3	2	1	2	1	5
70	0%	2	2	3	2	2	3	3
71	9%	3	2	2	4	3	4	4
72	11%	1	3	2	2	2	2	2
73	28%	5	2	2	2	2		4
74	0%	4	4	4	4	3	5	3
75	0%	3	3	2	3	3	3	2
76	32%	4	4	2	2	4	2	1
77	33%	4	3	4	4	5	4	5
78	17%	4	4	4	5	5	3	2
79	25%	5	1	1	1	1	5	5
80	11%	2	2	1	5	1	4	2

Cases	Cost Performance	Consultant Related Causes						
		Factor 7	Factor 8	Factor 9	Factor 10	Factor 11	Factor 12	Factor 13
		Frequent Design Changes	Mistakes and error in design	Incomplete design at the time of tender	Consulting team competence	Delay in inspection and testing of works	Experience in Project management	Underestimation of project cost
81	40%	5	2	3	1	1	2	5
82	6%	5	4	5	5	4	5	5
83	39%	2	4	4	2	3	3	2
84	40%	5	4	4	3	3	4	5
85	6%	1	1	2	1	1	2	1
86	7%	3	1	1	1	1	1	1
87	0%	2	2	1	5	1	3	1
88	-1%	1	4	1	4	4	4	1
89	0%	2	2	3	1	4	2	2
90	27%	4	4	3	1	1	1	1
91	30%	4	4	3	3	3	3	2
92	0%	3	2	3	2	2	3	3
93	20%	2	2	3	2	2	2	2
94	2%	5	5	5	5	5	4	4
95	100%	5	2	4	5	2	4	5
96	0%	2	2	1	4	1	4	1
97	17%	3	3	3	4	3	4	3
98	-2%	3	2	1	4	2	5	2
99		3	4	3	4	4	3	3
100	7%	4	2	3	1	1	1	1

Case s	Cost Performance	Consultant Related Causes						
		Factor 7	Factor 8	Factor 9	Factor 10	Factor 11	Factor 12	Factor 13
		Frequent Design Changes	Mistakes and error in design	Incomplete design at the time of tender	Consulting team competence	Delay in inspection and testing of works	Experience in Project management	Underestimation of project cost
101	-6%	2	3	5	5	3	4	5
102	0%	2	1	1	1	1	3	1
103	50%	2	1	1	2	2	2	2
104	150%	3	3	3	3	3	3	3
105	0%	1	3	2	3	2	3	1
106	31%	1	1	1	1	1	3	5
107	0%	5	4	4	3	5	3	4
108	0%	4	3	1	1	1	1	1
109	-4%	5	5	5	4	4	5	4
110	2%	3	3	3	4	3	3	3
111	33%	5	5	5	4	4	4	5
112	6%	5	5	5	5	2	3	5
113	0%	4	3	4	2	3	2	1
114	33%	4	2	2	3	2	3	3

Case s	Cost Performance	Client Related Causes				Contract Relationship Related causes		
		Factor 14	Factor 15	Factor 16	Factor 17	Factor 18	Factor 19	Factor 20
		Delay in client's contract award	Availabilit y of Finance	Delayed progres s paymen t	Change order or scope change	Poor communicatio n between parties	Lack of coordination between parties	Slow information flow between parties
1	-11%	3	3	3	3	3	2	3
2	13%	4	4	4	5	1	1	2
3	-17%	4	4	4	4	4	3	4
4	10%	5	3	3	5	5	5	5
5	10%	4	2	4	3	3	3	4
6	0%	5	3	4	5	3	3	4
7	50%	2	4	4	2	3	3	3
8	5%	5	5	5	5	4	4	4
9	-46%	2	3	2	2	2	2	2
10	6%	5	2	5	4	3	4	3
11	0%	5	5	5	4	5	5	5
12	2%	4	5	3	3	4	4	4
13	-9%	3	1	2	1	4	4	4
14	10%	3	4	2	4	4	4	4
15	0%	1	1	4	4	4	4	4
16	4%	4	5	5	5	4	4	4
17	3%	4	5	5	5	5	5	5
18	21%	3	3	3	3	4	3	4
19	8%	3	5	4	4	4	5	4
20	19%	2	4	4	5	5	5	5

Case s	Cost Performance	Client Related Causes				Contract Relationship Related causes		
		Factor 14	Factor 15	Factor 16	Factor 17	Factor 18	Factor 19	Factor 20
		Delay in client's contract award	Availabilit y of Finance	Delayed progres s paymen t	Change order or scope change	Poor communicatio n between parties	Lack of coordination between parties	Slow information flow between parties
21	0%	3	5	5	4	4	5	4
22	-2%	1	2	2	5	1	1	1
23	59%	4	3	2	4	4	4	3
24	44%	4	3	4	3	3	3	3
25	5%	2	3	1	1	1	1	3
26	27%	5	5	4	5	5	4	4
27	-1%	3	3	5	3	1	1	1
28	2%	2	4	4	1	3	1	1
29		2	2	2	3	4	3	3
30	0%	3	5	5	1	1	1	1
31	29%	5	3	3	3	4	4	4
32	10%	2	3	3	3	1	1	3
33	0%	4	1	4	4	4	3	4
34	17%	3	4	2	5	3	4	2
35	21%	1	4	2	3	4	4	2
36	13%	5	3	3	4	5	5	4
37	-4%	3	1	1	1	3	2	1
38	100%	3	3	4	3	3	4	3
39	55%	5	4	4	5	4	4	5
40	10%	3	5	3	2	2	2	2

Case s	Cost Performance	Client Related Causes				Contract Relationship Related causes		
		Factor 14	Factor 15	Factor 16	Factor 17	Factor 18	Factor 19	Factor 20
		Delay in client's contract award	Availability of Finance	Delayed progress payments	Change order or scope change	Poor communication between parties	Lack of coordination between parties	Slow information flow between parties
41	50%	3	5	2	5	2	2	2
42	0%	5	5	5	5	4	4	4
43	12%	1	1	1	1	5	5	5
44	19%	2	3	4	5	3	4	3
45		2	2	2	3	4	3	4
46	42%	4	3	5	3	3	3	3
47	0%	5	5	5	3	3	3	3
48	140%	2	4	2	2	5	3	4
49	100%	3	3	3	3	3	3	3
50	8%	5	5	5	5	5	5	5
51	40%	4	2	3	3	3	3	3
52	0%	5	5	5	4	4	4	4
53	16%	2	5	4	2	2	2	2
54	0%	3	4	4	3	4	4	4
55	4%	3	2	3	3	2	2	2
56	74%	3	3	5	5	3	4	3
57	11%	1	4	1	1	2	2	2
58	0%	3	3	3	3	1	2	2
59	20%	5	5	5	4	5	4	5

Case s	Cost Performance	Client Related Causes				Contract Relationship Related causes			
		Factor 14	Factor 15	Factor 16	Factor 17	Factor 18	Factor 19	Factor 20	
		Delay in client's contract award	Availabilit y of Finance	Delayed progres s paymen t	Change order or scope change	Poor communicatio n between parties	Lack of coordination between parties	Slow information flow between parties	
60	-1%	3	3	5	4	4	4	4	
61	2%	5	5	5	5	4	5	3	
62	0%	4	4	5	2	3	4	3	
63	17%	5	5	5	1	1	1	1	
64	12%	4	4	5	5	3	3	3	
65	7%	3	5	1	1	3	3	3	
66	0%	3	4	4	3	3	5	3	
67	36%	5	5	5	4	2	2	2	
68	7%	1	5	5	4	3	3	3	
69	11%	1	1	2	1	3	3	2	
70	0%	3	4	4	4	3	3	2	
71	9%	4	4	5	3	4	3	4	
72	11%	2	1	3	3	2	2	2	
73	28%	5	1	1	3	1	2	3	
74	0%	4	2	3	4	3	3	3	
75	0%	4	3	3	2	2	2	2	
76	32%	1	1		3	5	3	2	
77	33%	5	1	3	5	3	2	3	
78	17%	2	1	1	1	4	3	2	
79	25%	5	3	5	5	5	5	5	

Case s	Cost Performance	Client Related Causes				Contract Relationship Related causes		
		Factor 14	Factor 15	Factor 16	Factor 17	Factor 18	Factor 19	Factor 20
		Delay in client's contract award	Availabilit y of Finance	Delayed progres s paymen t	Change order or scope change	Poor communicatio n between parties	Lack of coordination between parties	Slow information flow between parties
80	11%	3	1	2	1	1	1	1
81	40%	2	2	2	5	4	4	2
82	6%	5	3	3	5	5	5	5
83	39%	3	2	4	4	3	3	3
84	40%	3	4	4	4	4	4	3
85	6%	1	1	1	3	1	1	1
86	7%	2	5	5	1	2	2	2
87	0%	2	1	1	3	2	1	2
88	-1%	4	2	2	1	2	2	2
89	0%	3	3	3	4	5	5	5
90	27%	5	4	5	3	3	2	2
91	30%	5	2	3	3	3	4	3
92	0%	3	3	4	3	3	3	3
93	20%	2	5	4	3	2	2	2
94	2%	4	5	5	5	4	5	5
95	100%	4	4	2	5	2	3	2
96	0%	1	3	3	2	2	1	1
97	17%	5	5	5	3	4	3	4
98	-2%	3	1	1	2	1	2	3
99		5	5	5	5	4	5	3

Case s	Cost Performance	Client Related Causes				Contract Relationship Related causes		
		Factor 14	Factor 15	Factor 16	Factor 17	Factor 18	Factor 19	Factor 20
		Delay in client's contract award	Availabilit y of Finance	Delayed progres s paymen t	Change order or scope change	Poor communicatio n between parties	Lack of coordination between parties	Slow information flow between parties
100	7%	4	5	5	3	2	2	2
101	-6%	2	5	5	4	5	5	4
102	0%	2	4	4	2	1	2	1
103	50%	2	3	3	3	2	2	2
104	150%	3	3	3	3	3	3	3
105	0%	4	3	2	4	3	3	3
106	31%	5	5	1	1	1	1	1
107	0%	1	1	1	3	3	3	4
108	0%	3	1	1	1	3	1	2
109	-4%	5	3	3	5	3	4	4
110	2%	3	2	4	3	3	3	3
111	33%	2	5	5	5	5	5	5
112	6%	3	4	4	1	5	5	5
113	0%	2	5	4	4	3	3	4
114	33%	2	2	2	5	3	3	3

Case s	Cost Performance	Labour Related causes				Material and Equipment Related causes			
		Factor 21	Factor 22	Factor 23	Factor 24	Factor 25	Factor 26	Factor 27	Factor 28
		Skilled labour	Site labour	low motivatio n	High cost of labour	Fluctuation of prices (Inflation)	Mismanagemen t (poor handling and wastage)	Late delivery of construction material and equipment	Shortages in material
1	-11%	4	3	2	3	4	3	3	3
2	13%	3	2	1	1	1	1	1	1
3	-17%	4	4	3	4	4	4	5	4
4	10%	4	4	5	3	2	4	2	2
5	10%	4	4	3	4	4	3	4	3
6	0%	4	4	3	2	4	3	3	3
7	50%	4	2	1	1	1	1	3	3
8	5%	1	1	1	1	5	4	3	4
9	-46%	4	4	3	3	2	2	3	3
10	6%	2	2	3	4	4	3	4	3
11	0%	4	4	5	3	4	5	5	5
12	2%	5	4	4	2	4	5	5	5
13	-9%	5	5	3	2	5	3	3	3
14	10%	2	2	3	3	4	4	4	4
15	0%	1	1	1	1	2	2	4	4
16	4%	4	5	3	3	2	2	3	2
17	3%	5	5	4	4	5	5	5	5
18	21%	2	2	2	2	2	2	2	2
19	8%	4	3	3	2	4	5	4	3
20	19%	4	4	5	5	5	5	4	4

Case s	Cost Performance	Labour Related causes				Material and Equipment Related causes			
		Factor 21	Factor 22	Factor 23	Factor 24	Factor 25	Factor 26	Factor 27	Factor 28
		Skilled labour	Site labour	low motivati on	High cost of labour	Fluctuation of prices (Inflation)	Mismanagemen t (poor handling and wastage)	Late delivery of construction material and equipment	Shortages in material
21	0%	4	4		3	2	3	3	4
22	-2%	1	2	2	1	1	1	1	1
23	59%	3	3	3	3	3	3	4	4
24	44%	3	3	3	3	4	2	4	3
25	5%	3	3	3	2	3	2	1	1
26	27%	4	3	3	2	5	3	4	3
27	-1%	1	1	1	1	4	1	1	3
28	2%	4	4	4	1	4	1	4	1
29		3	3	4	3	4	3	4	5
30	0%	3	2	2	4	4	2	3	3
31	29%	4	4	3	2	3	2	5	4
32	10%	5	4	3	2	5	3	5	5
33	0%	5	3	2	4	4	4	5	3
34	17%	2	2	2	2	4	3	3	3
35	21%	2	3	3	2	2	3	2	4
36	13%	5	4	5	2	4	4	5	5
37	-4%	3	3	4	2	3	3	3	1
38	100%	4	4	3	3	3	3	4	4
39	55%	5	4	4	3	5	3	4	4
40	10%	4	4	1	2	3	1	3	3

Cases	Cost Performance	Labour Related causes				Material and Equipment Related causes			
		Factor 21	Factor 22	Factor 23	Factor 24	Factor 25	Factor 26	Factor 27	Factor 28
		Skilled labour	Site labour	low motivation	High cost of labour	Fluctuation of prices (Inflation)	Mismanagement (poor handling and wastage)	Late delivery of construction material and equipment	Shortages in material
41	50%	5	5	4	3	3	3	4	1
42	0%	4	4	4	4	3	3	3	3
43	12%	5	5	5	5	5	5	5	5
44	19%	3	5	4	3	3	3	4	4
45		4	3	4	3	2	2	4	2
46	42%	4	4	3	3	3	3	3	3
47	0%	2	2	2	2	5	4	4	5
48	140%	2	3	4	2	5	4	4	4
49	100%	4	4	2	2	2	2	3	2
50	8%	4	5	2	2	4	2	5	2
51	40%	4	3	2	3	3	3	3	4
52	0%	4	4	4	3	2	2	3	3
53	16%	3	2	3	2	3	3	3	2
54	0%	5	5	1	3	5	3	4	2
55	4%	4	3	2	4	4	4	4	3
56	74%	3	3	2	2	4	5	5	5
57	11%	4	2	2	2	2	2	2	2
58	0%	1	1	1	3	1	1	4	4
59	20%	5	4	4	5	5	5	4	5

Case s	Cost Performance	Labour Related causes				Material and Equipment Related causes			
		Factor 21	Factor 22	Factor 23	Factor 24	Factor 25	Factor 26	Factor 27	Factor 28
		Skilled labour	Site labour	low motivati on	High cost of labour	Fluctuation of prices (Inflation)	Mismanagemen t (poor handling and wastage)	Late delivery of construction material and equipment	Shortages in material
60	-1%	4	3	3	3	3	4	4	3
61	2%	5	5	1	3	5	5	5	5
62	0%	4	4	3	2	2	3	3	2
63	17%	4	4	4	1	3	3	3	1
64	12%	3	3	3	3	3	3	3	3
65	7%	3	3	3	2	2	3	3	3
66	0%	4	3	3	3	4	3	4	4
67	36%	3	3	1	3	5	1	1	2
68	7%	1	1	1	1	3	1	2	2
69	11%	2	2	2	2	4	2	2	2
70	0%	3	3	4	3	3	2	2	3
71	9%	4	3	4	2	4	3	2	3
72	11%	4	4	2	2	2	2	3	1
73	28%	1	2	2	4	5	2	5	5
74	0%	4	4	3	3	4	3	3	3
75	0%	3	3	4	3	3	2	2	2
76	32%	1	1	1	1	1	1	5	1
77	33%	1	1	1	1	4	2	5	4
78	17%	3	5	4	2	4	4	5	5
79	25%	5	5	5	5	3	5	5	3

Case s	Cost Performance	Labour Related causes				Material and Equipment Related causes			
		Factor 21	Factor 22	Factor 23	Factor 24	Factor 25	Factor 26	Factor 27	Factor 28
		Skilled labour	Site labour	low motivati on	High cost of labour	Fluctuation of prices (Inflation)	Mismanagemen t (poor handling and wastage)	Late delivery of construction material and equipment	Shortages in material
80	11%	5	4	2	3	3	2	2	1
81	40%	1	2	2	2	5	2	3	4
82	6%	5	5	4	5	3	4	4	3
83	39%	2	2	2	2	2	2	3	3
84	40%	4	4	3	4	3	4	4	4
85	6%	3	3	1	1	2		3	
86	7%	5	5	5	2	4	4	4	4
87	0%	3	3	3	2	2	1	1	1
88	-1%	2	4	2	2	3	4	2	3
89	0%	4	4	2	2	4	4	4	2
90	27%	2	2	1	1	1	3	1	1
91	30%	5	5	4	2	5	4	4	2
92	0%	2	2	3	2	3	3	3	3
93	20%	2	2	2	2	3	2	3	2
94	2%	5	5	4	4	4	3	4	4
95	100%	3	4	2	3	3	2	3	4
96	0%	3	3	1	1	3	2	3	2
97	17%	4	4	3	4	5	3	5	5
98	-2%	1	1	2	2	2	3	1	1
99		3	3	3	2	4	4	4	4

Cases	Cost Performance	Labour Related causes				Material and Equipment Related causes			
		Factor 21	Factor 22	Factor 23	Factor 24	Factor 25	Factor 26	Factor 27	Factor 28
		Skilled labour	Site labour	low motivation	High cost of labour	Fluctuation of prices (Inflation)	Mismanagement (poor handling and wastage)	Late delivery of construction material and equipment	Shortages in material
100	7%	4	4	5	3	5	3	4	4
101	-6%	3	3	2	3	4	3	4	5
102	0%	2	1	2	1	2	2	3	1
103	50%	2	1	2		3	2	2	2
104	150%	3	3	3	3	3	4	3	4
105	0%	4	3	3	3	3	3	3	2
106	31%	3	3	1	1	4	4	3	3
107	0%	1	3	3	4	4	2	5	5
108	0%	2	2	2	2	3	4	2	4
109	-4%	4	4	4	3	5	4	5	5
110	2%	3	3	3	3	3	3	3	3
111	33%	5	5	5	3	4	5	5	5
112	6%	2	2	2	2	2	2	2	2
113	0%	2	2	2	3	4	3	3	2
114	33%	4	4	3	2	1	4	3	3

Case s	Cost Performance	External causes								
		Factor 29	Factor 29	Factor 30	Factor 31	Factor 32	Factor 33	Factor 34	Factor 35	Factor 36
		Exchange rate fluctuatio n	Inaccurate quantity take-off	Project Complexit y	Weather condition s	Unexpecte d ground conditions	Fraudulent practices and kickbacks	Extension of time claim	Delays in work approval by local authorities	Force Majeure (acts of God)
1	-11%	4	3	3	3	3	2	3	3	3
2	13%	1	1	1	1	4	1	3	1	1
3	-17%	5	4	3	4	4	4		4	4
4	10%	1	2	2	1	1	3	3	3	1
5	10%	4	2	4	3	4	1	2	3	1
6	0%	3	3	4	3	5	2	5	3	5
7	50%	1	1	1	1	1	1	4	2	1
8	5%	5	4	3	1	1	2	2	2	2
9	-46%	2	2	3	3	2	2	1	3	2
10	6%	4	3	2	3	1	1	3	2	1
11	0%	5	4	4	4	4	5	3	4	5
12	2%	4	2	3	3	3	3	4	3	4
13	-9%	2	3	4	1	1	1	3	1	1
14	10%	5	4	4	3	3	4	4	3	3
15	0%	2	4	2	4	5	1	3	5	1
16	4%	3	3	3	2	3	2	5	3	5
17	3%	4	5	4	4	4	4	4	5	4
18	21%	4	4	4	5	5	2	2	4	5
19	8%	4	3	4	3	3	4	3	3	3
20	19%	5	5	5	3	3	3	4	4	4

Case s	Cost Performance	External causes								
		Factor 29	Factor 29	Factor 30	Factor 31	Factor 32	Factor 33	Factor 34	Factor 35	Factor 36
		Exchange rate fluctuatio n	Inaccurate quantity take-off	Project Complexit y	Weather condition s	Unexpecte d ground conditions	Fraudulent practices and kickbacks	Extension of time claim	Delays in work approval by local authorities	Force Majeure (acts of God)
21	0%	2	3	4	3	3	4	2	4	3
22	-2%	1	2	2	2	4	1	2	2	1
23	59%	3	3	3	3	3	3	3	4	2
24	44%	2	2	3	3	4	1	3	3	3
25	5%	1	1	1	1	1	1	1	1	1
26	27%	5	5	4	4	4	3	5	4	2
27	-1%	3	3	3	4	4	1	1	1	1
28	2%	3	1	1	1	1	1	4	1	4
29		4	4	4	2	2	4	4	3	3
30	0%	3	1	2	1	1	1	4	1	1
31	29%	3	3	3	3	3	3	2	2	2
32	10%	3	3	4	5	3	3	2	2	2
33	0%	2	3	4	3	4	3	2	5	5
34	17%	4	1	2	1	1	1	1	1	4
35	21%	3	2	3	4	3	1	3	2	1
36	13%	1	2	3	3	4	3	4	2	3
37	-4%	2	1	3	2	1	1	5	1	1
38	100%	3	3	3	2	3	4	4	4	3
39	55%	5	3	4	2	2	5	4	4	1
40	10%	2	2	3	1	2	1	4	2	2

Case s	Cost Performance	External causes								
		Factor 29	Factor 29	Factor 30	Factor 31	Factor 32	Factor 33	Factor 34	Factor 35	Factor 36
		Exchange rate fluctuatio n	Inaccurate quantity take-off	Project Complexit y	Weather condition s	Unexpecte d ground conditions	Fraudulent practices and kickbacks	Extension of time claim	Delays in work approval by local authorities	Force Majeure (acts of God)
41	50%	3	2	4	1	1	1	3	1	1
42	0%	4	4	3	2	3	5	4	5	4
43	12%	1	1	1	1	1	1	1	1	1
44	19%	3	4	4	4	4	2	5	2	5
45		2	2	2	2	4	4	2	2	2
46	42%	3	3	4	3	3	5	3	3	3
47	0%	3	3	3	2	2	2	2	3	3
48	140%	2	5	4	2	3	5	4	5	2
49	100%	2	2	2	1	2	1	2	3	2
50	8%	5	1	5	5	1	1	4	1	1
51	40%	3	2	2	2	2	2	4	2	2
52	0%	2	2	2	2	2	1	5	3	1
53	16%	3	2	1	3	3	3	3	3	2
54	0%	2	3	3	3	2	2	2	5	3
55	4%	4	3	2	1	1	1	4	3	2
56	74%	4	4	4	5	5	3	5	5	5
57	11%	2	2	2	2	2	4	2	2	3
58	0%	3	1	3	1	1	1	3	3	4
59	20%	4	4	5	4	4	4	5	5	5
60	-1%	3	4	2	2	2	4	5	3	3

Cases	Cost Performance	External causes								
		Factor 29	Factor 29	Factor 30	Factor 31	Factor 32	Factor 33	Factor 34	Factor 35	Factor 36
		Exchange rate fluctuation	Inaccurate quantity take-off	Project Complexity	Weather conditions	Unexpected ground conditions	Fraudulent practices and kickbacks	Extension of time claim	Delays in work approval by local authorities	Force Majeure (acts of God)
61	2%	5	1	3	1	5	1	3	3	1
62	0%	2	2	2	2	2	5	3	2	2
63	17%	3	1	1	3	2	1	2	1	1
64	12%	3	3	3	3	5	4	3	4	3
65	7%	2	3	2	2	2	4	3	1	3
66	0%	3	3	3	3	4	5	4	3	2
67	36%	5	2	3	4	4	1	2	1	3
68	7%	2	2	4	3	2	1	4	4	1
69	11%	2	4	4	2	5	1	5	2	2
70	0%	2	3	2	2	4	2	2	4	2
71	9%	1	2	4	2	1	1	3	1	1
72	11%	1	2	1	1	1	1	2	1	2
73	28%	5	2	2	2	2	2	5	2	5
74	0%	3	4	5	2	3	4	4	2	3
75	0%	1	1	3	3	3	1	2	1	1
76	32%	1	1	5	5	5	1	5	2	5
77	33%	1	5		3	4	1	4	5	5
78	17%	3	4	2	2	5	1	5	2	1
79	25%	1	5	5	1	1	5	5	5	1
80	11%	1	2	4	3	2	1	2	1	1

Cases	Cost Performance	External causes								
		Factor 29	Factor 29	Factor 30	Factor 31	Factor 32	Factor 33	Factor 34	Factor 35	Factor 36
		Exchange rate fluctuation	Inaccurate quantity take-off	Project Complexity	Weather conditions	Unexpected ground conditions	Fraudulent practices and kickbacks	Extension of time claim	Delays in work approval by local authorities	Force Majeure (acts of God)
81	40%	3	3	3	2	4	1	4	2	5
82	6%	1	3	3	2	3	4	4	4	3
83	39%	2	4	3	4	3	2		3	2
84	40%	3	4	4	4	4	3	3	4	2
85	6%									4
86	7%	4	2	4	4	4	1	5	4	1
87	0%	1	1	1	1	1	1	1	1	1
88	-1%	2	1	1	5	5	1	3	1	1
89	0%	1	3	3	2	4	1	1	1	1
90	27%	1	1	1	2	2	1	5	1	2
91	30%	2	2	3	2	2	1	3	2	1
92	0%	2	2	3	2	2	2	2	2	2
93	20%	1	2	3	2	2	1	3	2	3
94	2%	4	5	5	4	4	3	3	4	4
95	100%	3	3	5	1	2	1	4	1	2
96	0%	2	2	4	3	2	1	3	1	1
97	17%	5	3	5	3	4	2	3	2	4
98	-2%	2	2	2	4	3	1	1	3	2
99		2	4	3	3	3	2	5	5	3
100	7%	4	2	3	1	5	1	5	4	1

Case s	Cost Performance	External causes								
		Factor 29	Factor 29	Factor 30	Factor 31	Factor 32	Factor 33	Factor 34	Factor 35	Factor 36
		Exchange rate fluctuation	Inaccurate quantity take-off	Project Complexity	Weather conditions	Unexpecte d ground conditions	Fraudulent practices and kickbacks	Extension of time claim	Delays in work approval by local authorities	Force Majeure (acts of God)
101	-6%	3	3	4	2	3	5	4	4	5
102	0%	1	1	1	1	3	1	5	1	1
103	50%	2	2	2	1	1	1	2	2	1
104	150%	3	3	3	3	3	3	3	3	3
105	0%	3	2	2	2	3	1	4	3	1
106	31%	1	1	1	1	1	5	5	1	1
107	0%	4	4	2	1	2	1	3	4	4
108	0%	1	1	2	2	1	1	3	2	1
109	-4%	4	5	4	4	5	2	4	3	4
110	2%	3	3	3	3	2	2	4	2	2
111	33%	4	5	5	5	5	5	5	5	5
112	6%	2	4	2	1	3	1	5	4	1
113	0%	2	2	2	3	2	1	4	4	4
114	33%	1	2	3	2	2	2	5	2	1

Appendix G: Factors that cause time overrun and construction performance

Cases	Time Performance	Contractor Related Causes						
		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
		Contractor experience	Availability of Finance (i.e., cashflow difficulty)	Subcontractors' competence	Deficiency in project planning and scheduling	Experience in Site management and supervision	Mistakes during construction stage	Delay in site mobilization
1	6%	4	4	4	4	4	2	4
2	33%	2	2	1	2	3	1	3
3		5	4	5	4	4	5	3
4	200%	5	3	5	4	4	5	3
5	0%	3	4	2	4	3	2	3
6	50%	3	5	2	4	3	3	3
7	0%	5	3	3	4	4	2	2
8	25%	4	4	4	3	4	3	2
9	0%	4	4	3	3	4	3	2
10	58%	4	5	2	3	4	2	3
11	75%	5	5	4	4	4	5	4
12	133%	4	5	4	4	5	4	4
13	200%	5	5	3	4	4	5	3
14	17%	4	4	5	4	4	4	2
15	17%	2	4	2	2	2	4	5
16	100%	4	4	3	3	3	3	4
17	-3%	5	5	4	5	5	4	4
18	50%	3	3	2	4	2	4	3

Cases	Time Performance	Contractor Related Causes						
		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
		Contractor experience	Availability of Finance (i.e., cashflow difficulty)	Subcontractors' competence	Deficiency in project planning and scheduling	Experience in Site management and supervision	Mistakes during construction stage	Delay in site mobilization
19	60%	4	4	4	4	4	4	4
20	35%	5	5	5	4	4	3	5
21	20%	4	5	4	4	4	4	3
22	25%	3	2	3	2	1	2	3
23	36%	3	2	3	3	3	2	2
24	13%	2	3	3	4	3	4	2
25	0%	4	4	1	1	4	3	3
26	100%	5	4	4	4	5	5	3
27	17%	1	1	3	1	1	3	1
28	50%	4	4	4	4	4	4	4
29	125%	4	4	4	5	2	4	4
30	150%	4	5	3	3	4	3	2
31	50%	5	5	3	3	3	4	2
32	0%	3	3	2	2	2	4	4
33	33%	5	4	5	5	5	5	5
34	50%	4	4	2	4	3	3	1
35	44%	2	3	4	2	2	3	4
36	8%	3	4	5	4	4	4	4
37	200%	4	3	3	5	3	4	1

Cases	Time Performance	Contractor Related Causes						
		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
		Contractor experience	Availability of Finance (i.e., cashflow difficulty)	Subcontractors' competence	Deficiency in project planning and scheduling	Experience in Site management and supervision	Mistakes during construction stage	Delay in site mobilization
38	13%	4	3	4	3	4	4	3
39	29%	5	3	4	4	3	5	4
40	25%	4	3	4	4	4	3	3
41	50%	5	5	5	3	5	1	1
42	0%	5	3	4	4	5	5	5
43	50%	5	5	5	5	5	5	5
44	25%	3	3	3	4	3	3	4
45	357%	3	2	4	4	4	3	2
46	17%	4	3	3	3	4	2	1
47	200%	5	5	4	4	4	3	3
48	0%	2	2	5	4	4	4	3
49	-33%	4	4	2	2	4	2	2
50	11%	5	4	5	4	4	5	5
51	100%	2	3	4	3	4	3	3
52	17%	5	4	4	5	5	4	5
53	67%	2	2	3	2	3	2	2
54		4	4	5	2	4	2	1
55	50%	4	2	4	3	3	2	3
56	100%	3	5	5	5	5	5	5

Cases	Time Performance	Contractor Related Causes						
		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
		Contractor experience	Availability of Finance (i.e., cashflow difficulty)	Subcontractors' competence	Deficiency in project planning and scheduling	Experience in Site management and supervision	Mistakes during construction stage	Delay in site mobilization
57	11%	4	4	4	2	4	2	2
58	33%	1	2	1	1	1	1	1
59	75%	5	5	4	5	5	4	5
60	13%	4	5	3	4	4	3	3
61	50%	5	5	5	5	5	5	5
62	-100%	5	3	2	5	5	5	4
63	200%	5	4	2	5	5	5	5
64	50%	3	5	4	3	4	3	3
65	25%	2	2	2	2	2	3	2
66	0%	5	4	4	3	4	4	4
67	200%	1	1	1	1	1	2	1
68	164%	4	5	4	4	3	2	1
69	175%	3	3	3	3	3	3	2
70	33%	4	4	3	3	2	2	3
71	100%	4	5	4	3	4	3	4
72	50%	3	2	1	1	3	2	3
73	92%	2	2	3	4	2	2	2
74	0%	3	2	3	3	2	3	3
75	-17%	4	3	3	3	4	2	4

Cases	Time Performance	Contractor Related Causes						
		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
		Contractor experience	Availability of Finance (i.e., cashflow difficulty)	Subcontractors' competence	Deficiency in project planning and scheduling	Experience in Site management and supervision	Mistakes during construction stage	Delay in site mobilization
76	50%	3	1	1	3	3	4	4
77	8%	3	2	2	2	2	2	4
78	243%	4	4	2	3	2	3	4
79	64%	5	3	5	5	5	5	5
80	20%	4	4	3	2	4	2	2
81	30%	1	1	2	2	1	2	1
82	10%	5	3	5	5	5	5	5
83	100%	4	4	3	2	2	2	1
84	67%	5	4	5	4	4	3	3
85	63%	2	3	1	3	3	1	1
86	133%	4	5	2	4	5	3	2
87	-17%	3	3	1	2	3	1	2
88	100%	4	2	4	2	2	3	2
89	33%	3	2	5	5	5	4	3
90	261%	2	3	1	1	1	2	2
91	0%	5	5	2	5	5	5	4
92	50%	4	4	4	4	4	4	3
93	131%	2	5	2	2	2	2	2
94	50%	4	5	4	4	4	5	4

Cases	Time Performance	Contractor Related Causes						
		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
		Contractor experience	Availability of Finance (i.e., cashflow difficulty)	Subcontractors' competence	Deficiency in project planning and scheduling	Experience in Site management and supervision	Mistakes during construction stage	Delay in site mobilization
95	40%	3	2	4	3	3	4	2
96	0%	4	3	4	2	4	2	1
97	100%	4	4	4	5	4	5	5
98	-8%	1	1	2	2	2	1	3
99		4	4	3	4	3	4	4
100	80%	5	5	5	5	4	4	2
101	0%	1	1	2	3	3	3	3
102	67%	3	3	2	4	3	2	3
103	17%	1	1	1	1	1	1	2
104	140%	3	3	3	3	3	3	3
105	89%	4	3	3	5	3	2	2
106	75%	3	5	1	5	3	3	3
107	17%	1	1	2	1	2	2	1
108	275%	4	4	1	4	4	4	4
109	200%	5	5	4	5	5	5	2
110	50%	3	4	3	4	4	3	3
111	13%	5	5	5	5	5	5	5
112	58%	1	4	3	2	1	1	1
113	0%	3	5	3	3	3	2	3

Cases	Time Performance	Contractor Related Causes						
		Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
		Contractor experience	Availability of Finance (i.e., cashflow difficulty)	Subcontractors' competence	Deficiency in project planning and scheduling	Experience in Site management and supervision	Mistakes during construction stage	Delay in site mobilization
114	125%	5	4	3	5	5	3	3

Cases	Time Performance	Consultant Related Causes								
		Factor 8	Factor 9	Factor 10	Factor 11	Factor 12	Factor 13	Factor 14	Factor 15	Factor 16
		Experience in contract management	Delays in inspection and testing of works	Inflexibility of consultant	Design Changes	Mistake and error in design	Delays in design documentation	Competence of design team	Complexity of project design	Delay in implementing changes to scope of work
1	6%	4	2	2	2	2	2	2	4	2
2	33%	1	2	1	1	1	1	1	1	2
3		5	4	4	3	5	4	3	5	4
4	200%	3	3	2	5	2	2	2	2	4
5	0%	3	2	4	4	3	2	4	3	4
6	50%	5	3	2	4	4	4	3	3	3
7	0%	3	2	2	2	1	3	3	1	2
8	25%	3	4	4	5	2	2	2	2	2
9	0%	4	2	2	2	2	2	4	3	2

Cases	Time Performance	Consultant Related Causes								
		Factor 8	Factor 9	Factor 10	Factor 11	Factor 12	Factor 13	Factor 14	Factor 15	Factor 16
		Experience in contract management	Delays in inspection and testing of works	Inflexibility of consultant	Design Changes	Mistake and error in design	Delays in design documentation	Competence of design team	Complexity of project design	Delay in implementing changes to scope of work
10	58%	2	1	1	3	2	2	2	3	4
11	75%	4	5	4	5	5	5	5	4	4
12	133%	5	3	3	3	4	4	3	4	5
13	200%	1	1	1	1	1	1	1	1	1
14	17%	4	4	4	5	5	4	5	4	4
15	17%	2	4	1	5	4	1	2	2	2
16	100%	4	4	3	4	4	3	3	4	4
17	-3%	5	5	4	5	5	5	5	4	5
18	50%	3	2	4	2	3	3	3	4	2
19	60%	4	4	4	4	5	4	4	4	4
20	35%	5	5	1	5	5	4	5	4	3
21	20%	3	3	4	4	5	4	4	5	5
22	25%	1	2	1	2	1	2	1	2	2
23	36%	2	2	2	4	2	2	2	2	4
24	13%	2	2	1	3	3	2	2	4	2
25	0%	4	1	1	1	1	1	1	1	1
26	100%	5	3	2	5	5	4	5	4	5
27	17%	1	3	3	4	3	3	2	3	3
28	50%	1	1	1	1	1	1	1	1	1
29	125%	3	2	2	2	2	2	4	3	2
30	150%	1	1	2	2	2	2	3	2	2

Cases	Time Performance	Consultant Related Causes								
		Factor 8	Factor 9	Factor 10	Factor 11	Factor 12	Factor 13	Factor 14	Factor 15	Factor 16
		Experience in contract management	Delays in inspection and testing of works	Inflexibility of consultant	Design Changes	Mistake and error in design	Delays in design documentation	Competence of design team	Complexity of project design	Delay in implementing changes to scope of work
31	50%	2	2	2	2	2	2	2	2	2
32	0%	3	3	3	3	4	3	3	3	2
33	33%	4	5	4	3	3	4	3	4	4
34	50%	3	1	1	5	2	2	2	2	2
35	44%	2	2	3	2	1	2	2	3	2
36	8%	4	3	3	5	4	4	3	4	4
37	200%	1	1	1	1	1	1	1	1	1
38	13%	4	3	4	3	3	3	4	3	3
39	29%	4	3	3	4	5	3	4	5	4
40	25%	4	2	2	3	2	2	4	5	2
41	50%	5	1	1	4	1	1	5	1	1
42	0%	5	4	5	4	4	4	5	5	5
43	50%	2	2	2	2	2	2	2	2	2
44	25%	2	3	2	4	1	3	2	4	3
45	357%	3	2	2	3	3	4	3	2	2
46	17%	4	3	3	4	3	4	4	1	4
47	200%	3	3	2	3	2	2	3	2	2
48	0%	4	4	3	5	4	4	5	3	4
49	-33%	4	2	2	3	2	2	4	3	2
50	11%	5	4	2	5	5	2	5	5	2

Cases	Time Performance	Consultant Related Causes								
		Factor 8	Factor 9	Factor 10	Factor 11	Factor 12	Factor 13	Factor 14	Factor 15	Factor 16
		Experience in contract management	Delays in inspection and testing of works	Inflexibility of consultant	Design Changes	Mistake and error in design	Delays in design documentation	Competence of design team	Complexity of project design	Delay in implementing changes to scope of work
51	100%	4	3	3	3	3	3	4	3	3
52	17%	4	4	4	3	3	1	1	1	3
53	67%	2	2	2	2	1	2	2	2	1
54		4	2	2	4	3	2	4	3	2
55	50%	4	3	3	2	2	2	4	2	2
56	100%	3	3	3	3	3	3	3	3	3
57	11%	4	2	2	4	2	2	4	2	2
58	33%	1	1	1	2	1	1	1	3	3
59	75%	5	4	4	5	5	5	5	5	4
60	13%	4	3	3	3	3	3	4	3	3
61	50%	4	5	5	5	5	5	5	5	5
62	-100%	2	2	2	2	2	2	2	2	2
63	200%	1	1	1	1	1	1	1	1	1
64	50%	3	2	2	2	2	2	3	2	3
65	25%	4	2	2	2	2	2	2	2	2
66	0%	4	4	3	3	3	4	4	5	3
67	200%	1	1	1	2	1	1	1	1	1
68	164%	4	3	3	4	2	3	3	4	4
69	175%	3	2	2	2	3	1	1	2	4
70	33%	3	2	2	3	2	2	2	3	3
71	100%	3	4	3	3	2	2	3	3	3

Cases	Time Performance	Consultant Related Causes								
		Factor 8	Factor 9	Factor 10	Factor 11	Factor 12	Factor 13	Factor 14	Factor 15	Factor 16
		Experience in contract management	Delays in inspection and testing of works	Inflexibility of consultant	Design Changes	Mistake and error in design	Delays in design documentation	Competence of design team	Complexity of project design	Delay in implementing changes to scope of work
72	50%	3	2	2	2	1	1	1	2	3
73	92%	2	3	1	3	4	2	2	2	4
74	0%	3	2	3	4	3	4	3	5	5
75	-17%	3	3	2	2	2	2	2	2	2
76	50%	3	4	3	4	3	2	2	3	3
77	8%	2	4	1	5	4	4	2	4	3
78	243%	4	2	2	2	2	2	5	4	1
79	64%	3	3	3	3	3	3	3	3	3
80	20%	5	1	1	2	1	1	5	4	2
81	30%	1	1	1	4	2	2	1	2	4
82	10%	3	2	3	3	3	3	3	3	2
83	100%	4	4	3	4	2	3	2	3	2
84	67%	4	4	2	3	4	4	5	4	4
85	63%	2	1	1	2	2	1	1	1	2
86	133%	1	1	1	3	1	1	1	3	1
87	-17%	3	1	1	2	1	2	3	3	1
88	100%	4	1	1	1	4	2	5	1	4
89	33%	1	4	3	2	2	2	1	1	1
90	261%	1	1	1	1	2	3	2	1	1
91	0%	3	2	2	3	3	2	3	2	2
92	50%	3	2	3	2	2	2	2	2	2

Cases	Time Performance	Consultant Related Causes								
		Factor 8	Factor 9	Factor 10	Factor 11	Factor 12	Factor 13	Factor 14	Factor 15	Factor 16
		Experience in contract management	Delays in inspection and testing of works	Inflexibility of consultant	Design Changes	Mistake and error in design	Delays in design documentation	Competence of design team	Complexity of project design	Delay in implementing changes to scope of work
93	131%	2	2	2	2	2	2	2	2	2
94	50%	4	4	5	5	5	4	5	5	5
95	40%	4	3	2	5	2	2	5	5	2
96	0%	4	1	1	1	1	1	4	4	2
97	100%	4	4	3	3	3	3	3	3	4
98	-8%	1	2	1	3	1	1	1	2	1
99		3	2	3	3	3	3	3	3	4
100	80%	4	2	2	4	2	1	1	4	4
101	0%	3	3	4	4	4	3	4	2	3
102	67%	2	1	1	1	1	2	1	1	1
103	17%	1	1	2	2	1	1	1	1	1
104	140%	3	3	3	3	3	3	3	3	3
105	89%	4	3	3	3	3	2	3	2	2
106	75%	2	1	1	1	1	1	1	1	1
107	17%	1	2	4	2	3	3	3	1	3
108	275%	1	1	1	4	2	1	1	1	2
109	200%	2	2	2	3	1	2	1	1	2
110	50%	4	3	3	3	3	3	3	3	3
111	13%	5	5	5	5	5	5	5	5	5
112	58%	3	3	3	5	4	4	4	2	3
113	0%	3	3	4	4	3	4	2	2	5

Cases	Time Performance	Consultant Related Causes								
		Factor 8	Factor 9	Factor 10	Factor 11	Factor 12	Factor 13	Factor 14	Factor 15	Factor 16
		Experience in contract management	Delays in inspection and testing of works	Inflexibility of consultant	Design Changes	Mistake and error in design	Delays in design documentation	Competence of design team	Complexity of project design	Delay in implementing changes to scope of work
114	125%	3	3	2	3	2	2	2	3	3

Cases	Time Performance	Client Related Causes								
		Factor 17	Factor 18	Factor 19	Factor 20	Factor 21	Factor 22	Factor 23	Factor 24	Factor 25
		Unrealistic contract duration and requirements imposed	Availability of Finance	Delay in progress payment of completed work	Change order or scope change	Changes in design	Slow decision making	Mistakes and discrepancies in contract documentation	Delay in contract award	Delay in reviewing and approving drawings and documentation
1	6%	2	3	3	3	3	3	2	2	3
2	33%	5	4	4	5	2	4	1	2	1
3		3	3	4	5	3	4	4	4	4
4	200%	2	3	4	5	5	5	2	5	2
5	0%	2	2	3	3	4	3	3	4	2
6	50%	4	2	4	5	5	5	3	4	3
7	0%	2	4	4	2	2	2	1	3	2
8	25%	4	4	5	4	5	5	3	4	4
9	0%	2	3	2	2	3	2	2	2	2
10	58%	3	5	4	4	4	3	3	2	4

Cases	Time Performance	Client Related Causes								
		Factor 17	Factor 18	Factor 19	Factor 20	Factor 21	Factor 22	Factor 23	Factor 24	Factor 25
		Unrealistic contract duration and requirements imposed	Availability of Finance	Delay in progress payment of completed work	Change order or scope change	Changes in design	Slow decision making	Mistakes and discrepancies in contract documentation	Delay in contract award	Delay in reviewing and approving drawings and documentation
11	75%	5	5	5	4	4	4	4	5	5
12	133%	3	5	4	4	4	4	4	3	4
13	200%	3	1	3	1	1	1	1	3	1
14	17%	3	4	3	5	5	4	3	3	2
15	17%	1	1	5	1	1	5	1	1	5
16	100%	4	5	5	5	5	4	3	3	3
17	-3%	4	5	5	5	5	5	4	4	5
18	50%	3	2	3	3	4	2	3	5	3
19	60%	4	4	4	3	3	4	4	3	3
20	35%	5	5	1	5	5	3	3	3	4
21	20%	4	5	5	4	4	4	3	3	3
22	25%	1	2	2	5	2	3	1	2	2
23	36%	4	2	2	4	4	4	3	4	3
24	13%	4	4	4	2	1	2	3	2	1
25	0%	1	1	1	1	1	1	1	1	3
26	100%	4	5	5	5	5	4	4	5	5
27	17%	1	3	3	3	3	3	3	3	3
28	50%	1	3	4	1	1	1	1	1	1
29	125%	4	3	3	2	2	2	3	2	2
30	150%	3	5	5	3	3	4	2	4	4
31	50%	2	2	2	2	2	2	2	2	3

Cases	Time Performance	Client Related Causes								
		Factor 17	Factor 18	Factor 19	Factor 20	Factor 21	Factor 22	Factor 23	Factor 24	Factor 25
		Unrealistic contract duration and requirements imposed	Availability of Finance	Delay in progress payment of completed work	Change order or scope change	Changes in design	Slow decision making	Mistakes and discrepancies in contract documentation	Delay in contract award	Delay in reviewing and approving drawings and documentation
32	0%	4	4	4	3	3	3	3	4	3
33	33%	4	2	2	3	4	5	5	5	5
34	50%	1	5	4	5	5	5	1	1	1
35	44%	2	4	3	2	2	3	3	2	3
36	8%	5	4	5	4	4	4	2	3	2
37	200%	2	1	1	1	1	1	1	3	1
38	13%	3	3	4	3	3	4	3	4	4
39	29%	5	4	5	4	5	5	4	4	4
40	25%	2	5	3	3	3	3	3	2	2
41	50%	1	5	1	5	3	2	1	1	1
42	0%	5	5	5	5	5	5	3	4	4
43	50%	1	1	1	1	1	1	1	1	1
44	25%	2	3	4	4	4	3	2	2	2
45	357%	3	2	2	3	2	2	3	2	3
46	17%	1	1	5	4	4	4	1	2	2
47	200%	3	4	4	2	3	3	2	5	2
48	0%	2	3	2	2	2	3	4	3	3
49	-33%	2	4	2	2	2	3	3	2	3
50	11%	5	5	2	4	5	4	5	5	5
51	100%	4	4	3	3	3	3	3	3	3
52	17%	4	5	5	3	3	4	3	5	3

Cases	Time Performance	Client Related Causes								
		Factor 17	Factor 18	Factor 19	Factor 20	Factor 21	Factor 22	Factor 23	Factor 24	Factor 25
		Unrealistic contract duration and requirements imposed	Availability of Finance	Delay in progress payment of completed work	Change order or scope change	Changes in design	Slow decision making	Mistakes and discrepancies in contract documentation	Delay in contract award	Delay in reviewing and approving drawings and documentation
53	67%	2	5	4	2	2	3	1	3	2
54		4	3	5	4	4	3	2	4	5
55	50%	3	2	2	2	2	2	2	2	2
56	100%	2	2	5	5	5	5	5	5	5
57	11%	2	4	2	2	4	2	2	2	2
58	33%	3	2	3	3	2	3	2	2	3
59	75%	5	5	5	4	5	5	5	5	5
60	13%	3	2	5	2	3	3	2	1	3
61	50%	1	5	5	5	5	5	4	4	5
62	-100%	2	5	5	4	2	5	2	5	4
63	200%	1	5	5	1	1	5	1	3	5
64	50%	4	5	5	4	4	5	4	3	3
65	25%	1	1	1	2	1	1	1	1	1
66	0%	4	4	5	3	3	5	4	3	3
67	200%	5	5	5	3	3	4	1	5	2
68	164%	5	5	5	5	4	5	1	1	4
69	175%	3	3	2	2	2	3	2	1	3
70	33%	3	3	4	2	3	3	3	2	3
71	100%	4	4	4	4	4	4	3	3	3
72	50%	2	3	3	2	2	3	2	1	3
73	92%	3	1	1	4	4	4	2	2	4

Cases	Time Performance	Client Related Causes								
		Factor 17	Factor 18	Factor 19	Factor 20	Factor 21	Factor 22	Factor 23	Factor 24	Factor 25
		Unrealistic contract duration and requirements imposed	Availability of Finance	Delay in progress payment of completed work	Change order or scope change	Changes in design	Slow decision making	Mistakes and discrepancies in contract documentation	Delay in contract award	Delay in reviewing and approving drawings and documentation
74	0%	5	3	4	4	4	5	5	4	3
75	-17%	2	3	3	2	2	5	1	3	2
76	50%	1	1	1	2	3	2	1	1	2
77	8%	3	2	4	5	5	5	3	5	4
78	243%	3	4	2	3	2	2	2	2	2
79	64%	5	5	5	5	3	5	3	5	5
80	20%	2	4	2	2	2	2	1	3	2
81	30%	3	1	1	5	5	4	1	1	2
82	10%	4	3	2	4	3	4	3	3	4
83	100%	2	2	3	3	3	3	4	3	1
84	67%	4	5	4	4	4	3	4	4	4
85	63%	1	1	1	3	1	2	1	1	1
86	133%	1	5	5	1	1	4	1	1	1
87	-17%	2	1	1	2	2	2	1	2	2
88	100%	1	3	2	1	1	5	1	1	1
89	33%	4	2	2	4	4	2	1	1	1
90	261%	1	3	5	2	2	5	5	5	5
91	0%	2	2	1	1	2	3	2	4	2
92	50%	2	2	3	2	2	3	2	3	3
93	131%	2	5	4	3	2	3	2	2	3
94	50%	5	5	5	5	5	5	3	3	4

Cases	Time Performance	Client Related Causes								
		Factor 17	Factor 18	Factor 19	Factor 20	Factor 21	Factor 22	Factor 23	Factor 24	Factor 25
		Unrealistic contract duration and requirements imposed	Availability of Finance	Delay in progress payment of completed work	Change order or scope change	Changes in design	Slow decision making	Mistakes and discrepancies in contract documentation	Delay in contract award	Delay in reviewing and approving drawings and documentation
95	40%	4	3	2	5	5	3	2	2	2
96	0%	3	3	3	3	2	1	1	1	1
97	100%	5	5	5	4	4	4	4	3	4
98	-8%	1	1	1	2	2	1	1	3	3
99		3	5	5	5	5	5	5	5	5
100	80%	4	5	5	3	4	5	3	2	2
101	0%	4	5	4	4	4	3	3	3	5
102	67%	2	3	4	1	1	4	1	2	3
103	17%	1	2	2	2	2	1	1	1	2
104	140%	3	3	3	4	4	3	3	3	4
105	89%	3	4	3	3	3	5	2	2	3
106	75%	1	1	1	1	1	1	1	1	1
107	17%	1	1	1	1	2	5	3	3	4
108	275%	1	1	1	1	1	4	1	3	4
109	200%	2	2	4	5	3	5	3	4	4
110	50%	3	4	4	3	3	3	3	3	3
111	13%	5	5	5	5	5	5	5	3	5
112	58%	1	4	4	1	1	5	3	3	5
113	0%	3	5	4	4	4	5	2	2	3
114	125%	4	2	2	4	4	2	2	2	4

Cases	Time Performance	Contract Relationship Related causes			Labour Related causes				
		Factor 26	Factor 27	Factor 28	Factor 29	Factor 30	Factor 31	Factor 32	Factor 33
		Lack of communication between parties	Lack of coordination between parties	Disputes between parties	Labour supply	Skilled labour supply	low motivation	Labour productivity	Strike
1	6%	3	2	2	4	4	2	4	2
2	33%	2	1	1	3	2	2	4	1
3		5	4	4	5	4	4	4	5
4	200%	5	5	5	2	2	5	3	1
5	0%	3	2	2	4	4	2	4	1
6	50%	4	4	3	2	2	3	4	2
7	0%	4	4	1	2	2	2	2	2
8	25%	4	4	4	1	1	1	1	1
9	0%	2	2	2	3	3	2	3	1
10	58%	2	3	2	2	3	2	2	2
11	75%	5	5	5	5	4	4	4	5
12	133%	5	4	4	4	5	4	5	2
13	200%	2	2	4	1	3	4	5	2
14	17%	4	4	4	4	3	4	4	5
15	17%	2	2	2	2	2	2	1	2
16	100%	3	3	3	4	4	3	3	5
17	-3%	5	5	5	5	5	4	4	4
18	50%	5	4	3	1	2	3	4	5
19	60%	4	4	4	3	4	3	3	5

Cases	Time Performance	Contract Relationship Related causes			Labour Related causes				
		Factor 26	Factor 27	Factor 28	Factor 29	Factor 30	Factor 31	Factor 32	Factor 33
		Lack of communication between parties	Lack of coordination between parties	Disputes between parties	Labour supply	Skilled labour supply	low motivation	Labour productivity	Strike
20	35%	3	2	2	3	4	5	5	5
21	20%	4	5	5	2	3	3	4	3
22	25%	1	2	1	2	2	1	2	1
23	36%	3	3	2	4	3	3	3	2
24	13%	3	2	4	3	4	2	3	2
25	0%	1	1	1	1	1	1	1	1
26	100%	4	4	4	3	3	3	4	5
27	17%	1	3	3	3	2	1	3	1
28	50%	1	1	1	4	4	4	4	1
29	125%	4	4	4	2	2	4	3	2
30	150%	2	3	3	2	4	2	4	2
31	50%	2	2	2	2	3	3	2	1
32	0%	3	3	3	3	3	4	4	1
33	33%	5	5	5	5	5	3	4	5
34	50%	3	3	1	1	1	1	1	1
35	44%	4	3	2	2	2	3	3	1
36	8%	4	4	3	3	4	5	5	1
37	200%	2	2	1	1	2	4	3	1
38	13%	3	3	3	2	2	2	2	3

Cases	Time Performance	Contract Relationship Related causes			Labour Related causes				
		Factor 26	Factor 27	Factor 28	Factor 29	Factor 30	Factor 31	Factor 32	Factor 33
		Lack of communication between parties	Lack of coordination between parties	Disputes between parties	Labour supply	Skilled labour supply	low motivation	Labour productivity	Strike
39	29%	4	3	5	2	3	5	3	2
40	25%	2	2	2	4	4	2	4	1
41	50%	2	2	1	3	3	1	1	1
42	0%	5	5	5	4	4	4	4	4
43	50%	1	1	1	5	5	5	5	5
44	25%	3	4	5	3	4	4	3	1
45	357%	3	3	2	2	2	3	2	2
46	17%	1	1	1	1	1	1	1	1
47	200%	2	2	2	2	2	2	2	2
48	0%	5	5	5	3	3	5	4	5
49	-33%	3	3	2	4	4	3	4	2
50	11%	5	4	5	2	5	2	5	4
51	100%	3	3	3	4	3	2	3	2
52	17%	4	4	4	3	4	3	3	2
53	67%	2	1	3	2	3	3	2	1
54		4	4	4	4	4	3	4	4
55	50%	2	2	2	4	4	2	4	1
56	100%	5	5	5	3	3	3	3	3
57	11%	2	2	3	3	3	2	4	1

Cases	Time Performance	Contract Relationship Related causes			Labour Related causes				
		Factor 26	Factor 27	Factor 28	Factor 29	Factor 30	Factor 31	Factor 32	Factor 33
		Lack of communication between parties	Lack of coordination between parties	Disputes between parties	Labour supply	Skilled labour supply	low motivation	Labour productivity	Strike
58	33%	1	1	2	1	1	1	1	1
59	75%	5	4	5	4	4	5	5	5
60	13%	4	4	4	2	3	2	3	1
61	50%	5	5	5	5	5	5	5	5
62	-100%	2	2	4	2	5	4	4	2
63	200%	2	1	2	2	2	4	2	1
64	50%	4	4	4	3	3	3	3	3
65	25%	1	3	3	1	3	1	3	1
66	0%	4	4	3	3	4	3	3	3
67	200%	1	1	1	1	1	1	1	1
68	164%	3	3	3	2	2	1	1	1
69	175%	2	3	4	2	2	2	2	1
70	33%	3	2	3	2	2	3	3	2
71	100%	4	4	4	3	3	3	3	3
72	50%	2	2	1	3	4	2	2	1
73	92%	2	2	1	1	1	1	2	1
74	0%	3	3	3	3	4	4	4	3
75	-17%	2	2	2	1	1	1	1	1
76	50%	3	2	2	1	1	1	1	1

Cases	Time Performance	Contract Relationship Related causes			Labour Related causes				
		Factor 26	Factor 27	Factor 28	Factor 29	Factor 30	Factor 31	Factor 32	Factor 33
		Lack of communication between parties	Lack of coordination between parties	Disputes between parties	Labour supply	Skilled labour supply	low motivation	Labour productivity	Strike
77	8%	2	2	2	1	1	1	1	1
78	243%	5	5	5	4	4	4	4	4
79	64%	5	5	5	5	5	5	5	3
80	20%	1	1	1	4	5	1	4	1
81	30%	3	2	1	1	2	2	2	1
82	10%	4	4	3	3	4	5	5	2
83	100%	3	3	5	2	2	1	1	1
84	67%	3	4	4	4	4	3	3	5
85	63%	1	1	1	2	2	1	1	1
86	133%	1	1	1	4	5	5	5	1
87	-17%	1	1	1	2	2	2	2	2
88	100%	1	1	4	3	3	2	3	1
89	33%	4	4	3	2	3	2	3	1
90	261%	1	2	5	2	2	1	2	1
91	0%	2	3	3	2	2	4	3	2
92	50%	3	3	2	2	3	2	3	2
93	131%	2	2	2	2	2	2	2	2
94	50%	4	5	4	4	5	5	5	5
95	40%	2	2	2	3	2	1	2	1

Cases	Time Performance	Contract Relationship Related causes			Labour Related causes				
		Factor 26	Factor 27	Factor 28	Factor 29	Factor 30	Factor 31	Factor 32	Factor 33
		Lack of communication between parties	Lack of coordination between parties	Disputes between parties	Labour supply	Skilled labour supply	low motivation	Labour productivity	Strike
96	0%	1	1	1	4	3	1	3	1
97	100%	5	4	4	4	3	4	5	2
98	-8%	1	1	1	1	1	1	1	1
99		4	4	4	3	3	2	3	2
100	80%	2	2	2	2	2	4	4	2
101	0%	5	4	5	2	3	4	4	5
102	67%	1	1	1	1	2	2	3	1
103	17%	1	1	1	2	2	1	1	1
104	140%	4	2	4	4	4	5	5	2
105	89%	4	3	1	3	2	3	3	2
106	75%	1	1	1	3	3	2	2	5
107	17%	3	3	1	2	2	3	5	4
108	275%	3	2	2	1	1	2	2	1
109	200%	4	4	3	5	5	5	5	1
110	50%	3	4	3	4	4	4	4	3
111	13%	5	5	5	5	5	5	5	5
112	58%	5	5	5	1	1	1	1	1
113	0%	3	4	4	2	2	2	3	1
114	125%	3	3	1	3	4	3	5	1

Cases	Time Performance	External causes										
		Factor 41	Factor 42	Factor 43	Factor 44	Factor 45	Factor 46	Factor 47	Factor 48	Factor 49	Factor 50	Factor 51
		Unpredictable weather conditions	Unexpected ground / site conditions	Changes in government regulations and laws	Accident during construction	Delays in work approval by local authorities	Unrest by local communities	Delay in land compensation	Demining	Pandemic (Covid 19)	Fraudulent practices and kickbacks	Force Majeure (acts of God)
1	6%	3	3	2	2	3	3	2	2	4	2	3
2	33%	3	5	1	1	4	1	1	3	1	1	1
3		5	5	5	4	4	4	4	4	3	5	4
4	200%	1	1	1	1	1	1	1	1	2	1	1
5	0%	4	4	1	2	3	1	2	2	2	1	2
6	50%	2	5	2	2	2	2	2	4	3	2	2
7	0%	1	1	1	1	1	1	1	1	3	1	1
8	25%	1	1	1	1	2	1	1	1	5	1	1
9	0%	2	2	1	2	2	2	2	2	1	2	2
10	58%	1	2	1	1	3	1	1	1	5	1	4
11	75%	5	4	4	3	4	5	5	4	5	5	4
12	133%	3	4	2	2	3	2	2	2	5	2	4
13	200%	1	1	1	1	1	1	1	1	1	1	1
14	17%	2	3	4	4	3	4	3	3	3	4	3
15	17%	5	5	1	1	5	1	1	1	1	1	1
16	100%	5	5	4	3	3	4	3	3	3	3	5
17	-3%	4	4	5	4	5	4	5	5	4	4	4
18	50%	5	3	1	4	1	3	4	4	3	3	4
19	60%	3	3	4	4	3	3	4	3	4	5	3
20	35%	4	4	4	4	3	4	3	3	3	4	4

Cases	Time Performance	External causes										
		Factor 41	Factor 42	Factor 43	Factor 44	Factor 45	Factor 46	Factor 47	Factor 48	Factor 49	Factor 50	Factor 51
		Unpredictable weather conditions	Unexpected ground / site conditions	Changes in government regulations and laws	Accident during construction	Delays in work approval by local authorities	Unrest by local communities	Delay in land compensation	Demining	Pandemic (Covid 19)	Fraudulent practices and kickbacks	Force Majeure (acts of God)
21	20%	3	4	2	2	3	2	2	1	4	4	2
22	25%	3	4	1	1	2	2	1	1	1	1	1
23	36%	2	2	1	1	4	1	1	2	4	2	2
24	13%	3	4	3	2	3	2	3	2	5	1	3
25	0%	1	1	1	1	1	1	1	1	1	1	1
26	100%	4	5	5	3	5	5	3	3	5	3	3
27	17%	3	3	2	1	1	1	1	1	5	1	1
28	50%	1	1	3	1	1	1	1	1	5	1	5
29	125%	2	2	2	2	2	2	2	2	2	4	2
30	150%	1	2	1	1	1	1	1	1	3	1	1
31	50%	3	4	3	2	3	5	5	3	2	2	2
32	0%	4	2	2	2	2	2	2	2	4	2	2
33	33%	3	4	1	5	4	4	5	3	5	5	5
34	50%	1	1	4	1	1	1	1	1	5	1	5
35	44%	4	3	2	2	2	2	2	2	1	1	1
36	8%	4	4	2	3	3	2	1	1	5	3	3
37	200%	2	1	5	1	1	1	1	1	1	1	1
38	13%	3	3	3	3	3	2	3	1	3	4	3
39	29%	2	3	5	2	4	2	2	3	5	5	1
40	25%	1	2	1	2	2	1	2	1	1	1	1

Cases	Time Performance	External causes										
		Factor 41	Factor 42	Factor 43	Factor 44	Factor 45	Factor 46	Factor 47	Factor 48	Factor 49	Factor 50	Factor 51
		Unpredictable weather conditions	Unexpected ground / site conditions	Changes in government regulations and laws	Accident during construction	Delays in work approval by local authorities	Unrest by local communities	Delay in land compensation	Demining	Pandemic (Covid 19)	Fraudulent practices and kickbacks	Force Majeure (acts of God)
41	50%	1	1	1	2	1	1	1	1	1	1	1
42	0%	3	4	5	3	4	4	5	5	5	5	5
43	50%	1	1	1	1	1	1	1	1	1	1	1
44	25%	5	5	2	5	2	5	3	1	1	1	5
45	357%	2	4	2	2	2	2	2	2	2	3	2
46	17%	1	1	1	1	1	1	1	1	1	5	1
47	200%	2	2	2	2	2	2	2	2	5	2	2
48	0%	2	2	2	3	4	2	3	4	4	5	2
49	-33%	3	2	3	2	3	3	3	3	3	3	3
50	11%	5	2	2	5	1	1	2	3	5	5	1
51	100%	2	2	2	3	3	2	2	1	2	2	2
52	17%	1	1	1	3	1	3	1	1	5	1	1
53	67%	3	3	2	2	2	1	2	2	3	3	1
54		3	1	4	1	5	3	4	3	5	3	3
55	50%	1	1	1	1	1	1	1	1	3	1	1
56	100%	5	5	2	2	4	3	3	5	5	5	5
57	11%	2	2	1	2	2	2	1	2	3	4	2
58	33%	1	1	1	1	3	1	1	1	3	1	3
59	75%	4	4	4	4	4	4	4	5	5	4	5
60	13%	2	3	4	2	4	2	2	2	2	4	2

Cases	Time Performance	External causes										
		Factor 41	Factor 42	Factor 43	Factor 44	Factor 45	Factor 46	Factor 47	Factor 48	Factor 49	Factor 50	Factor 51
		Unpredictable weather conditions	Unexpected ground / site conditions	Changes in government regulations and laws	Accident during construction	Delays in work approval by local authorities	Unrest by local communities	Delay in land compensation	Demining	Pandemic (Covid 19)	Fraudulent practices and kickbacks	Force Majeure (acts of God)
61	50%	5	5	5	5	4	3	5	1	4	4	4
62	-100%	2	2	2	2	2	2	2	2	4	4	2
63	200%	2	1	5	1	3	1	1	1	2	1	1
64	50%	2	4	3	3	4	2	2	2	3	3	2
65	25%	1	1	1	1	1	2	1	1	3	4	3
66	0%	3	5	3	3	3	4	4	3	5	5	2
67	200%	3	4	1	1	1	1	1	1	1	1	2
68	164%	1	1	2	1	4	1	1	1	1	1	1
69	175%	2	5	2	1	1	1	1	1	3	1	2
70	33%	2	3	2	2	3	2	2	2	3	3	2
71	100%	2	2	3	3	3	3	3	3	3	2	2
72	50%	1	1	1	1	2	1	1	1	1	1	1
73	92%	1	1	5	1	1	1	1	1	5	1	1
74	0%	4	5	3	5	5	2	2	3	2	5	3
75	-17%	2	2	2	1	1	1	1	1	4	1	1
76	50%	5	3	1	1	1	1	1	1	1	1	5
77	8%	5	5	5	1	4	1	1	1	5	1	5
78	243%	2	5	2	2	2	2	2	2	2	2	2
79	64%	5	5	5	5	5	5	5	5	5	5	5
80	20%	2	2	1	1	1	1	1	2	3	1	1

Cases	Time Performance	External causes										
		Factor 41	Factor 42	Factor 43	Factor 44	Factor 45	Factor 46	Factor 47	Factor 48	Factor 49	Factor 50	Factor 51
		Unpredictable weather conditions	Unexpected ground / site conditions	Changes in government regulations and laws	Accident during construction	Delays in work approval by local authorities	Unrest by local communities	Delay in land compensation	Demining	Pandemic (Covid 19)	Fraudulent practices and kickbacks	Force Majeure (acts of God)
81	30%	1	3	1	2	1	1	1	1	5	1	5
82	10%	2	2	1	1	4	1	3	1	5	4	1
83	100%	2	1	3	1	3	2	1	1	3	2	2
84	67%	2	3	3	3	3	3	3	2	4	3	2
85	63%	1	1	1	1	1	1	1	1	3	1	3
86	133%	3	4	1	1	3	1	1	1	5	1	1
87	-17%	1	2	1	1	1	2	1	1	2	1	1
88	100%	4	4	1	1	1	1	1	1	1	3	1
89	33%	1	3	1	1	1	1	1	1	3	1	1
90	261%	2	2	1	1	1	1	1	1	3	1	2
91	0%	2	2	2	2	2	2	2	2	2	2	2
92	50%	2	2	2	3	3	3	3	2	4	2	2
93	131%	3	3	3	2	2	2	2	2	4	2	4
94	50%	5	5	4	4	5	4	4	3	3	4	4
95	40%	1	1	1	1	1	1	1	1	4	1	1
96	0%	1	1	1	1	1	1	1	1	2	1	1
97	100%	3	3	2	2	2	2	2	2	5	2	5
98	-8%	4	3	2	1	1	2	1	1	1	1	1
99		2	4	3	2	4	2	4	2	4	2	4
100	80%	1	5	1	1	1	1	1	1	1	1	1

Cases	Time Performance	External causes										
		Factor 41	Factor 42	Factor 43	Factor 44	Factor 45	Factor 46	Factor 47	Factor 48	Factor 49	Factor 50	Factor 51
		Unpredictable weather conditions	Unexpected ground / site conditions	Changes in government regulations and laws	Accident during construction	Delays in work approval by local authorities	Unrest by local communities	Delay in land compensation	Demining	Pandemic (Covid 19)	Fraudulent practices and kickbacks	Force Majeure (acts of God)
101	0%	3	2	3	4	4	5	5	5	5	4	5
102	67%	1	3	1	1	1	1	1	1	1	1	1
103	17%	2	1	1	2	2	1	1	2	4	2	1
104	140%	2	4	4	4	4	3	5	4	5	5	5
105	89%	1	3	2	2	2	2	2	2	2	1	1
106	75%	1	1	1	1	1	1	1	1	1	1	1
107	17%	1	1	4	2	3	2	1	1	5	1	3
108	275%	2	1	1	1	2	1	1	1	3	1	1
109	200%	3	4	4	1	2	1	1	1	5	1	1
110	50%	2	2	2	2	2	2	2	2	2	2	2
111	13%	5	5	5	5	5	5	5	5	5	5	5
112	58%	1	4	3	1	3	1	1	1	3	1	1
113	0%	2	1	1	1	4	1	3	2	3	1	4
114	125%	1	1	1	1	4	1	1	1	5	1	1