Research proposal sample

PHD Research Proposal

IMPACT OF LEAN CONSTRUCTION ON PERSISTENT COST AND TIME OVERRUNS IN SOUTH AFRICA'S CONSTRUCTION PROJECTS

1. INTRODUCTION

Globally, the construction industry has been associated with cost and time overruns for a long time (Adam, Josephson, & Lindahl, 2017). This has prompted many countries to implement corrective and preventive measures geared towards reduction or elimination of cost and time overruns associated with the construction industry as suggested by previous studies (Abbasi, Noorzai, Gharouni Jafari, & Golabchi, 2020; Abdul-Rahman, Takim, & Min, 2009; Adam et al., 2017; Agren, Jingmond, & Landin, 2011). As a result of the various measures, many countries such as Portugal, United Kingdom and Norway have registered reduction in the number of projects experiencing cost and time overruns especially in the construction industry (Adam et al., 2017). The narrative seems different in South Africa. Many recent construction projects have experienced huge cost and time overruns despite the availability of many solutions put in place by many previous studies (Makondo & Chiromo, 2020; Monyane, Emuze, Awuzie, & Crafford, 2019; Mukuka, Aigbavboa, & Thwala, 2015; Tshidavhu & Khatleli, 2020; Tshidavhu, 2019). According to Tshidavhu and Khatleli (2020), this problem may be as a result of three things: i) The root causes of cost and time overruns in government sponsored projects are yet to be known or fully understood; ii) little or no actions are being taken to prevent cost and time overruns in public projects (this may be intentional or non-intentional); ii) The current actions and policies seem ineffective in preventing cost and time overruns associated with these projects (this may occur if the root cause of the problem is not well understood).

This research seeks to examine the root causes of the above indicated problem. Once the root causes of the problem are understood, the research will propose feasible solutions to the problem. The research will mainly focus on the government's role in cost and time overruns that continue to persist in South Africa's construction industry and how they can be mitigated.

1.1 Background of the study

Construction industry is one of the significant contributing sectors towards the growth of South Africa's gross domestic product (GDP). It is one of the major employers in South Africa, and it is responsible for the development and maintenance of the country's infrastructure. However, for a very long-time, the construction industry has been associated with problems of efficiency, inadequate safety, and generation of large quantities of waste.

These problems have resulted in delays, cost overruns, and high levels of uncertainty in construction industry related projects (Adam et al., 2017; Agren et al., 2011; Heravi & Mohammadian, 2019; Le-Hoai, Dai Lee, & Lee, 2008). Because of this, a number of measures such as robotics and automation, computer technology, and industrialization techniques have been applied to these projects with the aim of reducing cost overruns and delays (Momtazi, 2021). However, in some countries, implementation of these measures has not resulted in significant reduction in cost overruns and delays associated with these projects (Momtazi, 2021). In other countries, significant improvement towards reduction of cost and time overruns have been registered. Examples of these countries that have registered reduction in cost and time overruns include; Portugal, Norway and Malaysia (Miranda Sarmento & Renneboog, 2017; Odeck, 2014; Shehu, Endut, Akintoye, & Holt, 2014).

The reason for the persistent cost and time overruns associated with the projects in construction industry is a lack of a strategy that can refresh traditional techniques of project management (Momtazi, 2021). It has been shown that the above-mentioned solutions can only work in the presence of an effective and responsive project management (Momtazi, 2021). This however, is not readily available everywhere as different administrations show different commitments towards implementation of the control measures (Momtazi, 2021). In some instances, there is total commitment by the government or project administration to implement corrective actions (Momtazi, 2021). Yet there are still persistent cost and time overruns in construction industry associated with these jurisdictions (Momtazi, 2021).

Previous studies also show that the generation of large quantities of waste in construction is one of the major factors causing delays and cost overruns in construction industry projects (Bajjou & Chafi, 2021; Mahfuth, Loulizi, Al Hallaq, & Tayeh, 2019; Nagapan, Rahman, Asmi, Memon, & Latif, 2012; Ndihokubwayo, 2009). This is because it costs money and time to manage wastes generated in construction industry. Studies indicate that waste and its related factors can increase the total cost of a project in construction industry by more than 10% (Bajjou & Chafi, 2021; Mahfuth, Loulizi, Al Hallaq, & Tayeh, 2019; Nagapan, Rahman, Asmi, Memon, & Latif, 2012; Ndihokubwayo, 2009). As a result, waste management and control are critical strategies currently employed in many construction projects around the world to reduce the cost and time overruns (Nagapan et al., 2012; Ndihokubwayo, 2009; Saidu & Shakantu, 2016; Saidu & Winston, 2016).

Notwithstanding the fact that waste can significantly increase project cost, studies show that many project managers in construction industry still perceive waste in terms of physical wastes generated by construction project activities (Momtazi, 2021). Additionally, these managers fail to understand that waste also constitute unnoticeable factors such as non-value adding activities, waiting time, and unused creativity (Momtazi, 2021).

The above discussed problems call for newer and better ways of reducing cost and time overruns in projects in construction industry. One of the ways through which waste can be managed in construction industry is the application of lean principles in construction industry projects (Nagapan et al., 2012; Ndihokubwayo, 2009; Saidu & Shakantu, 2016; Saidu & Winston, 2016). The main aim of lean construction is to minimize waste and maximize customer value (Nagapan et al., 2012; Ndihokubwayo, 2009; Saidu & Shakantu, 2016; Saidu & Winston, 2016).

Lean construction emerged from Toyota manufacturing philosophy where it was referred to as Toyota Production System (Momtazi, 2021; Sarhan, Xia, Fawzia, Karim, & Olanipekun, 2018). Lean principles helped the Toyota company grow to being the biggest car manufacturing in world overtaking the likes of Ford which was the first to implement assembly line principle of manufacturing (Momtazi, 2021; Sarhan et al., 2018).

Lean construction adopts lean principles to keep inventory and work-in-progress at optimum levels by eliminating waste (Momtazi, 2021). In construction industry, lean principles were introduced by the International Group (ILG) in 1993. The ILG describes lean as a construction approach where construction project activities are optimized to minimize waste, reduce, or eliminate time and cost overruns, and maximize value for the project clients (Momtazi, 2021). Regardless of several solutions proposed including lean construction principles, South Africa still experiences huge cost and time overruns in the government sponsored projects (Momtazi, 2021)?

1.2 Problem formulation

Time and cost overruns are problems found in all countries, from the developed to the developing world (Ramanathan, Potty, & Idrus, 2012). It is rare for construction projects to be completed within the schedule and under the budget (Bhargava, Anastasopoulos, Labi, Sinha, & Mannering, 2010; Kavuma, Ock, & Jang, 2019; Ullah, Abdullah, Nagapan, Suhoo, & Khan, 2017; Vaardini, Karthiyayini, & Ezhilmathi, 2016).

Therefore, the built environment role players continue to direct their efforts in interogating the problem of time and cost overruns, seeking to determine the causes and how minimize or eliminate the problems (Ramanathan, Potty, & Idrus, 2012). Even in countries with some of the fastest-growing construction industries such as Malaysia, the sector still lags behind other sectors of the economy due to the inefficiencies caused by time and cost overruns (Ramanathan, Potty, & Idrus, 2012).

As such, numerous studies have been carried out to identify the possible causes of construction project cost and time overruns (Adam et al., 2017; Agren et al., 2011; Le-Hoai et al., 2008; Malebye, 2018; Momtazi, 2021; Tshidavhu & Khatleli, 2020). Consequently, numerous solutions to cost and time overruns experienced in the construction industry have been put forward by previous studies (Adam et al., 2017; Agren et al., 2011; Le-Hoai et al., 2008; Malebye, 2018; Momtazi, 2021; Tshidavhu & Khatleli, 2020). Despite all these efforts, delays and cost overruns still dominate the industry. Even newer projects also experience significant cost and time overruns (Adam et al., 2017; Agren et al., 2011; Le-Hoai et al., 2008; Malebye, 2018; Momtazi, 2021; Tshidavhu & Khatleli, 2020).

In South Africa, time and cost overruns are common but the problem is more pronounced in government funded projects compared to construction projects found in private sector (Mukuka et al., 2015). Government funded construction projects have continued to experience time and cost overruns despite the current efforts by the researchers to propose feasible solutions (Mukuka et al., 2015). For instance, Medupi power station, one of the largest coal power stations in the world, exceeded its scheduled completion time by more than 30 months and experienced huge cost overrun (Lentsoane, 2016; Malebye, 2018; Tshidavhu & Khatleli, 2020; Tshidavhu, 2019). The project was planned to cost R80 billion but ended costing R234 billion which is several times higher than the initial cost (Makondo & Chiromo, 2020; Tshidavhu & Khatleli, 2020; Tshidavhu, 2019). Another project that experienced massive delays and cost overrun was the Gautrain project which was planned to cost R7 billion but ended up costing more than R25 billion which is more than 3 times the original cost (Ayegba, Agbo, & Root, 2020; Ayegba & Root, 2018; Ismail, Pillay, Mabuza, & Xolo, 2014; Oke, Aigbavboa, & Tong, 2018). The project was delayed by more than 2 years (Ayegba et al., 2020; Ayegba & Root, 2018; Ismail et al., 2014; Makondo & Chiromo, 2020; Oke et al., 2018). Another project that experienced similar challenges was the Transnet's pipeline project involving the construction of a pipeline from KwaZulu Natal to Gauteng (Makondo & Chiromo, 2020; Tshidavhu & Khatleli, 2020; Zalk, 2021).

This project was completed 9 years after its scheduled date of completion and costed more R30.4 billion against the budgeted amount of R12.7 billion (Makondo & Chiromo, 2020; Tshidavhu & Khatleli, 2020; Zalk, 2021).

The question is, why are various efforts not effective in dealing with this chronic problem in South Africa? This suggests a need to further explore this problem. This study seeks to probe further into this problem by examining the government's role in the problem. The role of government in public projects has always been significant in funding and offering of supervisory services to these projects (Bygballe, Endresen, & Fålun, 2018; Damoah & Kumi, 2018; Shabbab Al Hammadi, 2016; Zou, Zhang, & Wang, 2007). However, the role of government in impeding the success of corrective measures such as implementation of lean principles has not been exhaustively investigated. A lot of research on lean and cost/time overruns have been directed to contractors and consultants and little on government as the main contributor to cost overruns/time overruns. South Africa, like many other developing countries, should use its resources efficiently so that it can achieve the mandate of improving the quality of life of its citizens (Bygballe et al., 2018; Damoah & Kumi, 2018; Shabbab Al Hammadi, 2016; Zou et al., 2007). Since the government is the sponsor, supervisor and an interested party in public construction projects, public funded projects become susceptible to government associated problems such as political interference, corruption, payment and approval delays (Bygballe et al., 2018; Damoah & Kumi, 2018; Shabbab Al Hammadi, 2016; Zou et al., 2007). This study investigates the extent to which the above discussed factors and or problems hinder the successful implementation of lean construction in South Africa's construction industry projects.

1.2.1 Problem statement

Despite the availability of corrective measures such as lean construction, South Africa's public funded projects have continued to experience significant cost and time overruns.

1.3 Research questions

1.3.1 Main Research Question

Why are various policies not effective in dealing with the chronic cost and time overruns in South Africa's government funded construction projects?

1.3.2 Sub Research questions

To answer the above research, question the following sub research questions will be answered.

i. What government related factors cause persistent cost and time overruns in South Africa's construction projects?
ii. What measures are put in place to mitigate or prevent the persistent cost and time overruns in South Africa's construction projects?
iii. Is lean construction amongst these measures?
iv. What role does the government play in the implementation of lean construction in South Africa's government funded public construction projects?
v. How can lean construction be used mitigate persistent cost and time overruns currently experienced in public construction projects?

1.4 Aim and Objectives

1.4.1 Aim

The aim of the research is to examine the role of government related factors in the implementation of lean construction in the South African construction industry with a view to mitigating persistent cost and time overruns on government funded construction projects.

1.4.2 Objectives

i. To determine government related factors that cause persistent cost and time overruns in South Africa's construction projects.
ii. To examine the adequacy of measures put in place to prevent or mitigate the persistent cost and time overruns in public construction projects.
iii. To determine the role that the government plays or can play in the implementation of lean construction in South Africa's government funded public construction projects
iv. To determine how lean construction can be implemented to mitigate persistent cost and time overruns in public construction projects.

1.5 Research hypotheses

Hypothesis 1 (H1): Government funded construction projects experience more cost and time overruns than private construction projects.
Hypothesis 2 (H2): Government related factors (such as corruption, payment delays, bureaucracy, approval delays, political instability, and others) are major factors that cause persistent cost and time overruns in South Africa's publicly funded projects.
Hypothesis 3 (H3): The current measures or policies of preventing persistent cost and time overruns in publicly funded construction projects are not effective in preventing cost and time overruns in South Africa's publicly funded construction projects.

Hypothesis 4 (H4): Lean construction is one of the measures that is not properly implemented or not implemented in an attempt to prevent persistent cost and time overruns in South Africa's construction projects.
Hypothesis 5 (H5): If properly implemented and with government commitment, lean construction principles (such as Waste Elimination, Supply and People Involvement, Planning and Scheduling, Standardization, Quality, Transparency, Continuous Improvement, and Customer Focus) can prevent or reduce the persistent cost and time overruns currently experienced in public construction projects.

1.7 Research significance

Application of lean principles in construction industry has been hailed for success in many construction projects around the world (Monyane, Emuze, Awuzie, & Crafford, 2020). This is due to several benefits associated with it. Some of these benefits as explained by Monyane et al. (2020), Babalola, Ibem and Ezema (2019), Bajjou, Chafi, Ennadi and El Hammoumi (2017), Ballard (2008) and Ballard and Reiser (2004) are shortened work schedules, improved safety, minimization of waste, customer satisfaction, improved productivity and reliability, cost effectiveness and better quality products. Despite all these advantages associated with lean construction principle, it seems the South African construction industry (especially the publicly funded projects) is not benefiting from lean construction.

For the South African construction industry to benefit from lean construction, the barriers to its implementation need to be identified and solutions to these barriers identified. To this end, several previous studies have attempted to identify barriers to implementation of lean construction in construction industry projects (Monyane et al., 2020). Some of these barriers are: lack of technical capabilities, over reliance on poorly skilled foreign workers, language and education barrier, lack of quality management, inflexible legislation, and financial management (Monyane et al., 2020).

Previous studies, however, have not focussed on in-depth investigation of government's role in the worsening cost and time overruns associated with the projects in the country's construction industry. Only two government associated factors that may hinder implementation of lean construction seem to have been studied a lot are inflexible legislation and financial issues (especially government funded projects). Other sensitive issues such as corruption and bureaucracy have not been given much attention.

This study seeks to bridge this gap by investigating the role of the various government related factors such as corruption and bureaucracy in government departments and their potency to impede the implementation of lean principles in government funded construction projects in South Africa contributing to persistent cost and time overruns.

In terms of practical implications, the study will provide a base and framework for further studies on persistent cost and time overruns in publicly funded projects. The outcomes will be beneficial to public sector clients in terms of completion of construction projects on time and within budget. This is because the major government related factors causing persistent cost and time overruns, and major barriers to implementation of lean construction will be identified. The benefit to the public sector will also be realised upon implementation of the recommendations of this study.

1.8 Theoretical framework

This study aims to develop an in-depth understanding of why despite the availability of corrective measures such as lean construction which have reported success elsewhere, South Africa's public funded projects continue to experience significant cost and time overruns. This requires an in-depth understanding of the main stakeholder's (government) perspective regarding its role in this subject matter and environment which it operates. Furthermore, an in-depth understanding of other stakeholders' perspectives regarding the subject matter and their environment is important in this study. In this regard, this study hypothesizes that the persistent cost and time overruns currently experienced by the South Africa's public funded construction projects is a social product of the interaction between the stakeholders and the environment they live in. This means that the current cost and time overrun is subject to people behavior, change in time, place and culture.

2. METHODOLOGY OUTLINE

2.1 The research paradigm assumptions

A research paradigm is basically a verified research approach or model. It is worldwide view of how research is conducted. It generally entails research ontology, epistemology and methodology. In this study, it is assumed that ontological assumption will lead to epistemological assumption which will in turn lead to selection of the most appropriate method (Ahmed, 2008; Bahari, 2010; Höijer, 2008).

More details have been given as below.

2.1.1 Ontological and Epistemological Assumptions

Ontology often deals with interpretation of reality. It is about understanding how things work and are related in real world setting (Ahmed, 2008; Bahari, 2010; Höijer, 2008). It is also about how people or stakeholders believe and interpret the reality and the world around them (Ahmed, 2008; Bahari, 2010; Guarino, 2009; Höijer, 2008). This means that in terms of ontological perspective, interpretative approach considers social world as a subjective reality and not an objective reality (Ahmed, 2008; Bahari, 2010; Guarino, 2009; Höijer, 2008). Therefore, the social world and factors associated with it are products of interaction amongst the subjects within it (Ahmed, 2008; Bahari, 2010; Guarino, 2009; Höijer, 2008). This study, therefore, hypothesizes that the persistent cost and time overruns currently experienced by the South Africa's public funded construction projects is a social product of the interaction between the stakeholders and the environment they live in. This means that the current cost and time overrun is subject to people behavior, change in time, place and culture.

Epistemological assumption is mainly concerned with how people understand and explain information they know (Ahmed, 2008; Höijer, 2008). It is also concerned with making decision regarding the type of information or data is needed in a research and ways of ensuring that such data is adequate, valid and legitimate. This research has adopted a constructionism epistemological assumption where all knowledge and meaningful reality are constructed from interaction between individuals and their social environment (Ahmed, 2008; Höijer, 2008).

2.1.2 The interpretivist and positivist research philosophy

Interpretivism approach assumes that people have their own opinion, perceptions, understanding and feelings about their environment (Ahmed, 2008; Höijer, 2008). Positivism research philosophy, on the other hand, assumes that data collected from an environment is independent of the subjects (people) in that environment (Ahmed, 2008; Höijer, 2008). It may therefore be concluded that positivist approach is more scientific and is concerned with simple relationships between variables in the environment being studied (Ahmed, 2008; Höijer, 2008). Interpretivist approach, on the other hand, are considered qualitative in nature and hence can be used to gain in-depth understanding of the topic or factor being investigated (Ahmed, 2008; Höijer, 2008).

Since this study intends to have an in-depth understanding of the role government plays in the persistent cost and time overruns in the South Africa's construction industry and the in the implementation of lean construction, stakeholder opinion, feelings and perception on the construction industry is important. As a result of this, interpretivist research philosophy is considered appropriate and hence will adopted.

2.2 Research method and approach

This study aims at using both qualitative (through case study and interviews) and quantitative research (through survey) approaches. This study proposes to apply interpretive approach through qualitative research methodology to have an in-depth understanding of why South Africa's public funded projects have continued to experience significant cost and time overruns despite the availability of many corrective measures some of which have proved to be successful elsewhere. An in-depth understanding of why South Africa's public funded projects have continued to experience significant cost and time overruns despite the availability of many corrective measures will not need quantitative data (which is aimed at determining simple or casual relationship between factors) but rather high quality in-depth qualitative data. Such data can only be obtained via interpretive paradigm via qualitative research. The qualitative research (through interviews) will be carried out in a multiple of South African Provinces, and results compared. As such, it is a type of multiple case study research.

Quantitative research will be used to determine if lean construction principles (such as Waste Elimination, Supply and People Involvement, Planning and Scheduling, Standardization, Quality, Transparency, Continuous Improvement, and Customer Focus) can prevent or reduce the persistent cost and time overruns currently experienced in public construction projects.

2.3 Proposed sampling technique

This research is proposed to be both qualitative and quantitative in nature. As such, two sampling techniques will be used: non-probabilistic sampling and random sampling. The non-probabilistic sampling (also known as non-random sampling) will be used in the interpretive (qualitative) part of the study while random sampling will be employed in the positivist (quantitative) part of the study (Etikan, Alkassim, & Abubakar, 2016a; Etikan & Bala, 2017; Etikan, Musa, & Alkassim, 2016b; Khalefa & Selian, 2021; Mason, 2010; Rozalia, 2007; Taherdoost, 2016; Tongco, 2007).

In qualitative research, more weight is often given to the value and richness of the collected data rather than the size of the sample (Etikan et al., 2016a; Etikan et al., 2016b; Khalefa & Selian, 2021; Mason, 2010; Taherdoost, 2016; Tongco, 2007).

Also, to ensure that time is saved during data collection while ensuring that richer and more useful information is collected, the study proposes to employ two sampling techniques: purposive sampling and snowball sampling.

While applying purposive sampling technique, the research will only include the empirical material and participants with relevant information regarding the topic of study. Therefore, only participants with wealth of information about the inner workings of South African government will be included in the study. This means that the participants will be selected based on following criteria: their domain, age, experience and level of knowledge in the inner working of the government, project management and construction management, among other criteria which will be decided later.

The study also proposes to use snowball technique of sampling. This where participants who will be selected to participate in the first round of the interviews will be asked to help the research recruit more participants especially those who will meet the inclusion criteria (Dragan & Isaic-Maniu, 2013; Ghaljaie, Naderifar, & Goli, 2017; Handcock & Gile, 2011; Johnson, 2014; Parker, Scott, & Geddes, 2019; Sedgwick, 2013). The selection of the participants using snowball technique will be continued until a saturation point is met. Also, during secondary data collection, relevant reference materials from set of archival data sources will be reviewed for any relevant information (Dragan & Isaic-Maniu, 2013; Ghaljaie et al., 2017; Handcock & Gile, 2011; Johnson, 2014; Parker et al., 2019; Sedgwick, 2013).

2.4 Proposed sample size

In the first part of the study (qualitative part), sample size will not in important. This is because the first part of the study will be qualitative research, and in qualitative research, the most important is the quality of data collected and not quantity of study (Flick, 2018; Hennink, Hutter, & Bailey, 2020; Hesse-Biber & Leavy, 2010; Merriam, 2002; Pathak, Jena, & Kalra, 2013; Silverman, 2020). Furthermore, it is very difficult to get a large number of high-quality participants in qualitative research, and such sample size tends to be small in qualitative research than in quantitative research (Hennink et al., 2020; Merriam, 2002; Silverman, 2020).

For the quantitative part, the proposed or the expected sample size will be between 200 and 500. This number is expected to be sufficient for statistical analysis.

2.5 Proposed Data Collection Methods

2.5.1 Semi-structured interviews

Since this research seeks at having an in-depth understanding of why South Africa's publicly funded projects tend to experience more cost and time overruns when compared to private construction projects, it had been proposed that qualitative study through interviews will be utilized in data collection. The study proposes to use both semi-structured and structured interviews in the collection of data.

Semi structured interviews will be used for qualitative research which seeks to have an in-depth understanding of why South Africa publicly funded projects continue to experience heavy cost and time overruns. These types of interviews often enable the researchers to closely interact with the participants. Such an interaction enables the researcher gain deeper opinions, feelings and perspectives of the participants regarding the matter (problem) being studied (Bryman, 2017; Roulston & Choi, 2018; Swain, 2018). This type of interview (semi-structured) is also the most preferred type of data collection in qualitative studies (Hawkins, 2018; Nathan, Newman, & Lancaster, 2019; Swain, 2018). This is because of in-depth information regarding the matter being studied can be obtained with relatively short period of time (Hawkins, 2018; Nathan et al., 2019; Swain, 2018).

Structured interviews will be used when seeking solutions to identified problems. This will first entail carrying an intensive archival (secondary) study to find solutions that have been successful elsewhere (Hawkins, 2018; Nathan et al., 2019; Swain, 2018). The appropriateness of these solutions will be subjected to expert options through interviews which will entail structured questions.

2.5.2 Participant observation

Other than through interviews, it is planned that data will also be collected through the participant observation. This will involve taking part in a number of construction projects as an intern and observing the activities associated with the project such approval procedures, implementation of policies, implementation of lean principles, and attitude of the various individuals involved in the construction projects.

2.5.3 Grey literature and narrative literature

Other than participant observation and semi-structured interview, the researcher also proposes to employ grey literature (official documents) and narrative literature (published research) to collect the necessary data. Grey literature are generally secondary data sources used in collection of research data (Ferreras-Fernández, García-Peñalvo, & Merlo-Vega, 2015; Haddaway, Collins, Coughlin, & Kirk, 2015; Mahood, Van Eerd, & Irvin, 2014; Pappas & Williams, 2011; Schöpfel & Farace, 2010). The proposed grey literature that will be used in the study include

i. Construction industry (South Africa's construction industry) related magazines and feedbacks
ii. National and Provincial documents related to projects in construction industry
iii. Technical rand company reports and reviews

2.6 Data analysis

Immediately after appropriate data have been collected, data analysis process will commence. This will involve thematic analysis of the qualitative data. This will involve identification of specific patterns or themes within the responses to the interview questions (Alhojailan, 2012; Braun & Clarke, 2012; Clarke & Braun, 2014; Joffe, 2012; Riger & Sigurvinsdottir, 2016; Terry, Hayfield, Clarke, & Braun, 2017; Vaismoradi, Jones, Turunen, & Snelgrove, 2016). Thematic data analysis is flexible and can generate an in-depth data that is generally easy to interpret. Additionally, it is appropriate for qualitative type of studies especially in situations where an in-depth understanding the matter being studied is needed (Vaismoradi & Snelgrove, 2019).

Thematic will be carried out in 6 stages. Stage one will involve becoming familiar with the data; stage two will involve decoding the data; stage three will involve identification of the common patterns within the responses to the interview questions; stage four will involve reviewing the identified themes; stage five will involve defining the identified patterns and themes; and the last stage will involve reporting the finding. The first stage of thematic analysis (being familiar with the data) mainly involves grouping the collected responses into themes (sub-topics) reflected in the data or those that are related to the objectives of the research (Alhojailan, 2012; Braun & Clarke, 2012; Clarke & Braun, 2014; Joffe, 2012; Riger & Sigurvinsdottir, 2016; Terry et al., 2017; Vaismoradi et al., 2016; Vaismoradi & Snelgrove, 2019).

However, when we have a large quantity of data, it may be very difficult to analyze qualitative data via thematic analysis method (Alhojailan, 2012; Braun & Clarke, 2012; Clarke & Braun, 2014; Joffe, 2012; Riger & Sigurvinsdottir, 2016; Terry et al., 2017; Vaismoradi et al., 2016; Vaismoradi & Snelgrove, 2019). For quantitative data, statistical analysis will be used including both descriptive and inferential analysis (Bergin, 2018; Bryman & Cramer, 2012; Ong & Puteh, 2017). A summary of the study's methodology is given in table 1.

Table 1- Methodology outline summary

	Methodology Aspect	PROPOSED INFORMATION AND MOTIVATIONS
1	Research Paradigm	Pragmatic paradigm, as there are many ways to obtain or gain knowledge (Kaushik & Walsh, 2019)
2	Approach	Mixed Method (Qualitative research through case study and interviews, and quantitative research through surveys)
3	Methodology	A Survey
		Interviews
4	Target Population and sampling frame	Stakeholders in the construction industry
		Construction industry policy makers
		Project managers, contractors, government agencies and other stakeholders
5	Sampling Methods	Quantitative data: Random sampling (quantitative data); The expected sample size should be between 400 and 500 units of study.
		Qualitative data: Non-probabilistic sampling Purposive sampling and snowball sampling
6	Data collection	An interview guide for conducting interviews (collection of qualitative data) A questionnaire for conducting surveys for quantitative data
		Yes, a pilot study is going to be conducted.

		The questionnaire is going to be administered via survey monkey.
7	Methods of data analysis	The qualitative data will be analysed using themes and the quantitative data is going to be analysed utilising statistical analysis using SPPS and MS excel for descriptive and inferential statistics.
8	Ethics	The ethical considerations taken into account are as follows: Ethics approval from UFS Confidentiality, voluntary

3. ETHICAL CONSIDERATIONS, ASSUMPTIONS, LIMITATIONS AND SCOPE

3.1 Ethical consideration

Ethical consideration is one of the most important aspects of any study involving people. The proposed study will involve collection of certain sensitive information regarding the current status of public construction projects in South Africa. Such information may expose the participants to unwanted consequences. To protect the participants, the research will be conducted under strict guidance of the University ethics guidance. This will involve non-disclosure of the personal information of the participants and will not collect any personal information from participants. Such personal information may include but not limited to: their real names and nick names, national identity card number, social security number, driver's license number, their current position in the organization, name of the entity they are working with, email addresses, and other personal information. The participants will be kept anonymous. Additionally, information collected will be used for the purpose of the current research, and nothing else.

A letter of consent will also be sent to the interviewees prior to the conduction of the interviews. It is only after they give their consent that interviews will be conducted with them. The letter of consent will inform the participants of the freedom of withdrawal from the interview at any time without giving any prior notice. Additionally, it will give the participant freedom to ask any questions regarding aspects of the interview process that they are not comfortable with. The participants confidentiality and anonymity will also be confirmed by the letter of consent.

3.2 Key Assumptions

The following are main assumptions made by the study:

I) It is assumed that either lean construction is poorly implemented in public projects or is still less popular in South African government funded projects.

II) Another significant assumption in the study is that there is a lack of knowledge of and limited application of lean tools in public construction projects in South Africa.

III) It is assumed that findings of the study applies across the entire South Africa's construction industry.

IV) All information provided by the interviewees will be considered to be true and a true reflection of the environment they operate.

V) Government contributes significantly towards the persistent cost and time overruns currently experienced in South Africa's construction industry.

3.3 Limitations of the Scope

One drawback for the study is that due to ongoing corona virus pandemic, it will be difficult to reach many potential participants as there is fear of face-to-face interviews. Because of this, only few people might be willing to participate in the study which may make quantitative research difficult. To counter this effect, the research proposes to exploit the opportunities provided by virtual meeting platforms, and social media platforms. As such, both virtual and face to face interviews will be carried out. It is, however, important to note that face-to-face interviews will be carried out under strict COVID-19 safety protocols. The findings of the study may not be sufficient to capture views of all the relevant stakeholders affected. To reduce this effect, the results of the study were complemented with data from other researchers and reports from government as well as non-government entities. These secondary sources will be evaluated to ensure that the most accurate data and findings are used and documented in the research.

Sensitive nature of the topic and information required might involve collection of participant personal information as such information will be used in the inclusion and exclusion of research participants. Such information may include their age, portfolio, organisation, experience, knowledge and designation. Enquiring such personal information may prevent a participant from freely participating in the study. It is, however, important to note that such information will not be revealed to third parties as privacy will be top priority during data collection.

This finding of this research will depend on the data collected from the participants through interviews and surveys. This means that accuracy of the collected data and results of the study will depend on the participants' willingness to provide accurate information.

3.4 Scope of the Study

The research will focus on delays and cost overruns in the South Africa's public construction projects. These projects will be chosen at random in various provinces. The focus will be on the delays and cost overruns right from the planning phase by the client, procurement, execution phase and completion. The study cover the role played by government in delays and cost overruns. Costs and delays after completion that are not contained in the construction contract specifications will not form part of the study. Lean principles will also be covered in the study.

In terms of the empirical study, it will cover only publicly funded projects within South Africa. Additionally, only big projects will be considered in the study as they are ones that experience most time and cost overruns and government has much control over them.

4. PROPOSED THESIS STRUCTURE

The study will have 6 chapters. It will begin with an introductory chapter that introduces the broad topic of the study, providing a brief background. It then identifies problem, provides the problem statement, aim, objectives, research questions and significance of the study. It also states the scope, limitations, key assumptions and ethical considerations of the study.

Chapters 2 and 3 will be about literature review. Chapter 2 will discuss about general construction industry, public sector demand and investment in the construction industry and challenges in construction and public sector. Chapter 3 will focus on cost and time overruns in the construction industry, lean construction and how lean construction can be used to reduce cost and time overruns in construction industry.

The fourth chapter will present the Conceptual and Theoretical framework of the study.

The fifth chapter will discuss the methodology and the research design used in the collection of data. The chapter will cover the quantitative and qualitative approaches used in the data collection and how it will be conducted. The methods used, including questionnaires, interviews, document analysis and the case studies of two public construction projects per province, shall be discussed in this chapter

The sixth Chapter will present the findings, the analysis and discussion. The analysis will be will by themes or content analysis for qualitative data and statistical (via SPPS and excel) for quantitative data.

Chapter 7 will cover the conclusions and recommendations from the research. It also includes areas for further study. The chapter addresses the potential implications of the results obtained in the construction industry. It also includes the reflections of the researcher on the entire research experience.

5. THE RESEARCH PROGRAM

Activities	Duration(days)	Start Date	End Date
Identify Research Problem	12	09/02/2021	21/02/2021
Formulate the Research Questions	20	26/02/2021	17/03/2021
Methodology	20	04/04/2021	24/04/2021
Review of Literature	70	01/06/2021	09/08/2021
Preliminary Research Survey	21	27/08/2021	17/09/2021
Clarify the Research Problem	15	24/09/2021	10/10/2021
Define Important Terms	22	15/10/2021	06/11/2021
Define the Population	10	26/11/2021	06/12/2021
Develop the Research instrument plan	40	16/01/2022	26/02/2022
Collect Data	80	01/03/2022	20/06/2022

Analyse the Data	40	20/06/2022	20/06/2022
Present the Findings	30	22/08/2022	03/10/2022
Submission of a draft research report	1	05/10/2022	05/10/2022
Review with supervisor and submission of final document	25	10/10/2022	11/11/2022

6. RESEARCH BUDGET

Budget Item	Cost	Sub-Total
Personnel/Labour Personal Assistant Transcriber Total Personnel Expenses	 R18 000.00 R10 000.00	 R28 000.00
Travel Expenses Airfare Lodging/accommodation Total Travel Research Equipment Mobile Cell phone Digital Recorders Total Equipment Expenses	 R8500.00 R5500.00 R3500.00 R3000.00	 R14 000.00 R6 500.00
Research Materials Papers, pens, cherts, markers Participant Honorariums Gifts Refreshments Total Material Expenses Publication Printing and Binding Application for Journal Publishing Total Publication Expenses	 R500.00 R3000.00 R2500.00 R2000.00 R500.00 R400.00	 R7 500.00 R900.00

Other Expenses	R1000.00	R1 000.00
TOTAL ESTIMATED COSTS		R57 900.00

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