
# THE MAGNIFICATION OF ENDEMIC CONSTRUCTION INDUSTRY PROBLEMS IN THE IMPLEMENTATION OF MEGA PROJECTS IN SOUTH AFRICA.

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A research report submitted to the Faculty of Engineering and the Built Environment, University of Witwatersrand, in the fulfilment of the requirements for the degree of Master of Science in Building (Project Management).

BUQS7027

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**Date of submission:** 17 October 2019

**Submission Milestone**: Final Research Report

## ABSTRACT

This study aims to identify and investigate the extent of magnification of the endemic construction industry implementational problems in the mega projects within South Africa. South Africa has shown a great deal of interest in mega construction projects to become more economically and socially advanced. South African Government has adopted Mega Construction Projects to upgrade dilapidated infrastructure, as a speedy delivery mode to address the housing backlog and create mega cities. The implementation of Mega Projects in South Africa has been followed by a plethora of problems which causes delays in the delivery of MCP.

This research undertook descriptive research which adopted a mixed methodology strategy based on cross - sectional survey of six registered Project Managers with the South African Council for Project, two registered Consulting Engineers with Engineering Council of South Africa (ECSA), one registered Architect with South African Council of Architectural Profession (SACAP) and seventeen non – registered Project Managers, Professional Resource Teams(PRT) registered within the Gauteng Human Settlement database using questionnaires distributed by email. Total number of 26 were distributed to 12 registered PM, 4 Consulting Engineers, 1 Architect and 8 non- registered PM and 25 responded.

The endemic problems identified with implementation of mega projects and normal projects were time and cost overruns, stakeholder mis- management and unforeseen conditions. The research revealed that in the South African construction industry 72% of the practitioners indicated that the identified problems are magnified in mega projects. 60% respondents showed that cost and time overruns are magnified in mega projects by double to triple which causes delay in the delivery of project objectives. In normal projects, problems are less magnified as they would not exceed 50% of the initial budget and time of the project. Findings based on the respondents, has revealed that MP encounter excessive cost and time overruns due to unforeseen conditions as critical factor that impedes successful delivery of MP in South Africa.

An in-depth cost estimate is minimal at the planning stage of projects. This can be accomplished by developing realistic cost estimate model / tool that can overcome the excessive cost overruns. This proposed tool can be utilised at the planning stage of a project to identify and plan all possible unforeseen conditions to maximise all possibilities to meet project objectives within the set time and cost. Lastly, it is recommended that South African Government enforces integrated governmental relations and community engagement through constant consultation to meet project objectives.

## DECLARATION

I declare that this mini-dissertation is my own independently work and that all the sources that I have quoted have been acknowledged by means of complete references. This research is submitted in partial fulfilment of the requirements of the degree of Master of Science in Project Management at the University of Witwatersrand. This research report has never been submitted before for any degree or examination at any university.

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**PEARL MOALUSI**

## ACKNOWLEDGEMENTS

The Lord My Saviour, who made this opportunity possible and made a way for me when it all seemed impossible. I am now here only because He made a way. I am grateful and will forever praise His Name.

To my loving husband Kagiso Moalusi, thank you for endless support and understanding. Thank you for being there and staying up late when you didn't even understand what I was doing and making sure that I push myself. My family, (Okuhle Bali my daughter, Wilbie Mkhumbuzi(mother) Pumza Zwane (sister) and cousins) whose support was very crucial to me.

A special thank you to my two friends and Ninjas (Lindelwa Mazibuko and Bongekile Kunene), who supported me and pushed me to the limit to ensure that we all complete our studies. Thank you for being accessible and always helpful.

Finally, thank you to Gauteng Human Settlement for affording and funding this opportunity to complete my studies.

# GLOSSARY OF TERMS AND CONCEPTS

**Mega Projects**

Flyvbjerg (2014) defines Mega projects as large – scale complex ventures that typically takes many years to develop, they involve multiple public and private stakeholders, they are transformational, and impact millions of people.

In this study mega projects will be characterised by size as large, enormous projects that are complex and are highly visible.

**Normal / small -medium projects**

According to Project Management Institute (2008), project is temporary in that it has a defined beginning and end in time, and therefore defined scope and resources. And a project is unique in that it is not a routine operation, but a specific set of operations designed to accomplish a singular goal. Project management institute, USA defined project as “a system involving the co-ordination of a number of separate department entities throughout organization, in a way it must be completed with prescribed schedules and time constraints”.

According to Project Management Institute (2008), Project Managers define a project's size based on the total budget of the projects, number of teams and resources involved, number and size of deliverables that will be achieved, complexity of deliverables to be produced and total timeframes for delivery.

In this study normal projects will be characterised as small to medium scale projects.

**Magnification**

According to Oxford dictionary, magnify is to increase the apparent size of, to make more intensify; dramatize; heighten; exaggerate

According to Oxford dictionary, magnification is defined as the degree to which something is or can be magnified; exaggerated.

**Construction industry**

Sector of national economy engaged in preparation of land and construction, alteration, and repair of buildings, structures, and other real property.

https://www.hq.nasa.gov/iwgsdi/Construction.html

## ABBREVIATIONS /ACRONYMS

| | |
|---|---|
| MP | Mega Project |
| MCP | Mega Construction Project |
| SA | South Africa |
| SACPMCP | South African Council and Construction Management Professionals |
| ECSA | Engineering Council of South Africa |
| SACAP | South African Council for the Architectural Profession |
| GFIP | Gauteng Freeway Improvement Project |
| ICJV | Internal Construction Joint Venture |
| JSE | Johannesburg Stock Exchange |
| PMI | Project Management Institute |
| PPP | Private Public Partnership |
| PRT | Professional Resource Team |
| USDG | Urban Settlements Development Grant |
| HSDG | Human Settlements Development Grant |
| NSR | Not So Risky |
| SR | So Risky |
| GDHS | Gauteng Department of Human Settlement |
| MPMM | Method Project Management Methodology |
| SSA | Sub-Saharan Africa |

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# CHAPTER 1: INTRODUCTION

## 1.1. Introduction

Gauteng Province is one of the nine provinces in South Africa. Gauteng province is perceived as a province that offers better life and opportunities for people. Due to these alleged offers, there is a great influx of people from all over South Africa, with an intention to get a better life and better job opportunities. The masses migrating to Gauteng province cannot afford to get suitable accommodation due to disadvantaged socio- economic conditions, which leads to mushrooming of informal settlements (Huchzermeyer, Karam & Maina 2011). According to Agency (2012) states that Census (2001) reported 625 informal settlements in the Gauteng province with approximately 448 383 households in shacks and increased to 452 581 households in shacks as per Community Survey (2007). It is further stated that Gauteng has over 13million people with a population growth of 30% since 2001(Ibid).

Gauteng Department of Human Settlement is one of the government portfolios within the South African government responsible for 'delivery of sustainable integrated human settlements" housing and urban development, New Towns and Smart Cities in partnership with relevant role-players from all sectors of society through: development of suitably located and affordable housing (shelter) and decent human settlements; creating new (post-apartheid) towns and transforming current cities and towns in Gauteng; building cohesive, sustainable and caring communities with improved access to work and social amenities, including sports and recreation facilities'(Settlement, 2012-2019). 'Its primary purpose is the implementation of the constitutional mandate that "everyone has the right to have access to adequate housing' (Settlement, 2012-2019). Census (2011) states that there is over 800 000 people that are in demand of housing.

A need for delivery of housing stock is crucial to address the housing backlog in Gauteng. According to Msindo n.d the National housing backlog in 2014 was 2.3 million with a growing rate of 178 000 million per year. It is further stated that Gauteng Housing backlog was estimated at 600 000 by 2016/2017 (Ibid). Gauteng Department of Housing adopted mega projects as a

speedy delivery mode for 'integrated human settlement and corrective measure to redefine apartheid cities (@thesbu, 2017). Flyvbjerg (2014 :7) emphasizes that if mega projects are done right, they can create and maintain employment, improve on productivity and infrastructure that are not environmentally sound whilst they are known to carry various problems when implemented. (Bruzelius, Flyvbjerg & Rothengatter, 2002) states that though mega projects offer great benefits, a huge inconsistency is inherent within these projects. The inconsistency that are inherent in mega projects varies from cost and time overruns like Sydney Opera House to underused or never even open mega project like Ryugyong hotel in North Korea due to an economic crisis. (Flyvbjerg, (2014), Xulu, (2014) agree that shortfall of benefit is another concern in mega construction projects.

Various literature reveals several problems that comes with the implementation of mega projects. This research intends to identify the common problems found in normal projects and mega projects, investigate the magnification of these common problems in implementing mega projects vis- a vis normal projects.

## 1.2. Background

Given the housing backlog that resulted from apartheid era, housing delivery has been a focus since 1994 to address this backlog. Government (1994 to 2014) reported that 3.7 million subsidised housing opportunities were created, undoubtedly a remarkable achievement'.

Settlement (2019) states that the National Housing Code 2009 sets the underlying policy principles, guidelines and norms and standards which apply to Government's various housing assistance programmes. According to (Settlement, 2019) Government has introduced various programmes which provide the poor households access to adequate housing. 'Reconstruction and Development Program(RDP) is one of the programmes for delivery of adequate and quality housing'(Ibid). News24(2001) wrote that 1.2 million houses built since 1994, off which 80% of those houses were RDP houses. Even though huge number of RDP houses have been provided, there is housing backlog. The government's ability to deliver RDP houses and address the housing backlog has not improved. Africa Check (2015) published that since the 2006/07 peak, housing delivery has declined and in 2013/14, the latest year for which there is data, just more

than 150,000 housing opportunities were provided, comprising of 48,193 serviced sites and 105,936 “houses/units. There is 43% reduction in delivery since the peak seven year ago(Ibid).

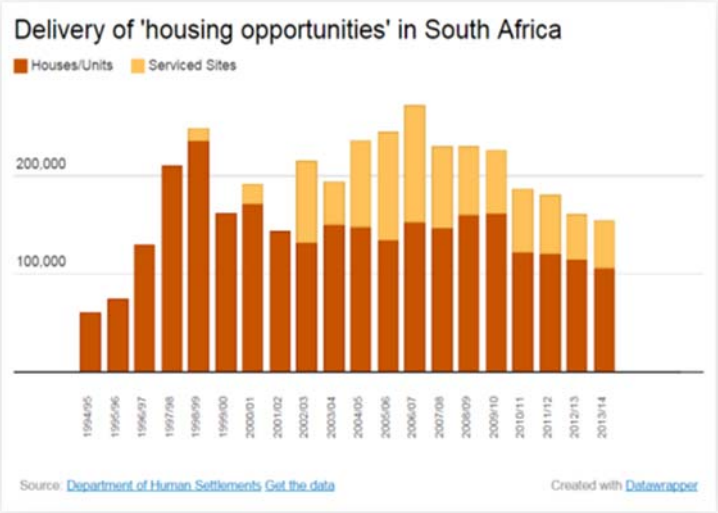



**Figure 1.2 Delivery of Housing in South Africa**

Source: Africa Check (2015)

Department of Human Settlement implemented various normal RDP housing projects that did not yield the intended numbers to address the housing backlog.

Ballard and Rubin (2018) wrote that in 2014, Minister of human settlements, Lindiwe Sisulu at the time, became extremely concerned that house production has been dropping and, a backlog of 2.3 million families have not benefitted. The minister favoured megaprojects which are also mentioned to as catalytic projects, as a way of getting delivery back on track and to create new large cities (Ibid).

South African Government intends to build “new cities” in well located land that strengthens access to jobs, transport, livelihoods and services. Various mega housing projects have been developed which are also called catalytic projects like Bramfischerville, Lufhereng, N2 Gateway and Cosmo City (Ballard and Rubin (2018). Harrison n.d states that housing projects are to shift from small scale projects to mega housing project due to unsuccessful small-scale projects that failed to address the housing backlog. Mega projects are considered to bring high impact socially

and create job opportunities for the beneficiaries by GHDS. Writer (2017) writes that GDHS has committed to the development several Mega Cities as part of the new mandate. The Gauteng Mega Projects include Cullinan Mega City which will yield more than 5000 housing opportunities, Daggafontein Mega City which is expected to yield 17 000 housing units, Goudrand Mega City is expected to yield between 20 000 and 25 000 housing units, John Dube Mega City and Stinkwater Mega City is expected to yield 9 495 housing units(Writer,2018).

This study is key to understand the magnified complexities and peculiarities of mega projects as Gauteng Human Settlement has adopted mega construction projects as a “delivery mode” for new cities. Successful delivery and development of new cities is key to address the housing backlog, bringing economies to the people and to build 1.5million units by 2019 (GDHS, 2014).

## 1.3. Problem Statement

Implementation of Mega Projects like ordinary projects in South Africa has been set by a plethora of problems; establishing the commonalities and peculiarities of the implementation of mega projects vis-a-vis the normal projects have not been investigated in the South African context. Westhuizen, (2007) and Khatleli, (2016) concurs that few mega construction projects in South Africa like the Gautrain and Medupi power experienced several problems like cost and time overruns, and lack of community engagement.

Several studies have been done on the challenges of mega construction problems however, further investigation is required to establish the level of magnification of these problems encountered between mega construction projects and normal projects.

## 1.4. Aim of the study

The research aims to identify common problems in normal projects and MCP and investigate the extent of magnification of the endemic construction industry problems in MCP in South Africa.

## 1.5. Research Objectives

The study is based on the following objectives:

- To identify the common endemic problems in normal infrastructure and MCP in South Africa.
- To investigate the peculiarities of implementing MCP in SA
- To assess levels of magnification of the common problems encountered in ordinary projects.
- To analyse the competencies of the implementers of MCP.

## 1.6 Research Question

To what extent are endemic construction industry problems are magnified in mega construction projects in South Africa?

### 1.6.1 Research Questions

In contrast to the list of objectives mentioned above, this study addresses the following questions:

- What are the common problems in normal infrastructure projects and MCP?
- What stage of construction are the problems identified?
- What are the characteristics of mega projects?
- What is the impact of implementing mega projects?
- Do these common problems magnify in mega construction projects?
- How are these common problems magnified in normal projects?
- Who is implementing MP?
- What are the competencies of MP implementers?

## 1.7. Assumptions of the study

The following assumptions have been made in this study:

• Mega projects are implemented as a necessity.

• There is lack of planning phase for implementing mega projects.

• It is assumed that there is a lack of experience in handling massive projects in SA.

## 1.8. Delineation of the study

The delineations made by this study are as follows:

• Focus on the view of the registered and non-registered project managers with SACPCMP within Gauteng Human Settlement and Professional Resource Teams registered in the Gauteng Human Settlement database that have been involved in MCP.

• Focus on the planning and implementation phases of MCP.

• Focuses on the common problems identified with MCP vs normal projects.

## 1.9. Limitations of the study

The study limitations are:

• Due to time constraints the collection of primary data for the study was limited to the registered and non- registered Project Managers with SACPCMP and Professional Resource Teams within the Gauteng Human Settlement database.

- The research had limited budget and inexpensive procedures were used.

- Primary data collection was limited to the usage of English.

## 1.10. Ethical Consideration

The ethical considerations are as follows:

- Confidentiality and discretion of respondents was observed.
- Full consent from Gauteng Department of Human Settlement was obtained prior the study.
- The respondents were informed of the aim and objectives of the study.
- Any type of communication in relation to the research was done with honesty and transparency.
- Assurance was given to respondents and that the data collected was utilised for this research only.

## 1.11. Rationale of the study

The output of this study will contribute towards improved successful implementation and management of mega projects. The findings could augment the understanding on the peculiar impact of endemic problems between MCP and ordinary projects implemented in South Africa. The study will contribute towards the researcher's career path of being a registered Project Manager with SACPCMP and to have better understanding and management of Mega Construction Projects as the employer (Gauteng Human Settlement) has also announced the construction of mega projects as a delivery mode of the housing backlog and developing mega cities in the Gauteng Province.

## 1.12. Outline of the research study

The research study is outlined in five chapters which are as follows:

Chapter 1: The introduction which covers mega projects in South African context, Background of the study, problem statement, research objectives, research questions, limitations, delineations, ethical consideration and significance of the study.

Chapter 2: Literature review outlines the related reviewed literature. Few of major topics like history of mega projects, mega projects and their nature in South Africa and magnification of problems in mega construction projects.

Chapter 3: Research methodology explains the research methodology, provides research design and research process followed. The study undertakes descriptive research and adopted mixed methods research design.

Chapter 4: Data analysis and findings presents the analysis process of the data and results of the study. Data was analysed based on the frequency and then divided by the total number of respondents and presented as a percentage of possibilities (% = (f/n) x 100).

Chapter 5: Discussions presents discussions of the study

Chapter 6: Conclusion and recommendations for future studies.

# CHAPTER 2: LITERATURE REVIEW

## 2.1. INTRODUCTION

Given that, the construction industry plays a critical role in the socio-economic development in South Africa, mega projects are the solution, hence the rising interest in mega projects. Developing countries such as South Africa strive to operate on an international level, to become more economically and socially advanced (Le-Hoai, Lee, & Lee, 2008). For this reason, more developing countries have shown interest in investing in Mega Projects such as the Gautrain transport network in South Africa and Olympic stadiums in Brazil. Alexander (2015) supports this notion, that countries, particularly those found in the G-20 (countries such South Africa, Brazil and India are part of this G-20) have shown a great interest in mega projects, as they perceive mega projects a way to obtain economic growth and enhance global growth rates.

The literature displays that the topic of mega projects has received attention in the last ten years. Literature has demonstrated that the execution of Mega projects is crucial in the development of a country; hence, the importance of this research, stated that though me as (Bruzelius, Flyvbjerg, & Rothengatter, 2002) states projects offer great benefits, a paradox of inconsistency is inherent within these projects.

The literature review will emphasise on the following areas (a) Definition of mega projects. (b) History of mega projects. (c) Mega projects in developing and developed countries. (d) Mega projects in Africa. (e) Mega projects and its nature in South Africa. (f) South African Construction Industry. (g)Normal projects (h) Private Pubic Partnership (i) Magnification of problems in mega construction projects (j) Identifying the endemic problems in normal infrastructure and MCP in South Africa (k) Investigating the peculiarities of implementing Mega projects in South Africa. (l) Assessing levels of magnification of the common problems encountered in ordinary projects (m) Analysing the competencies of the implementers of Mega projects (n) Major findings from literature review.

## 2.2. Background

### 2.2.1. Mega Project Definition

Mega construction projects have become a popular form of work in modern organizations in developed and developing countries. It is therefore not a surprise that mega construction projects have received considerable attention in literature review in recent years.

According to Flyvbjerg (2014: 4) the word Mega is derived from the Greek word Mega which means great, large, vast mighty and important. The concept of a project is described as 'a temporary endeavour undertaken to create a product, service or result' (Schwalbe, Emeritus, & College, 2015). Flyvbjerg (2014) defines Mega projects as large – scale complex ventures that typically cost a US$ 1 billion or more, they take many years to develop and build, they involve multiple public and private stakeholders, they are transformational, and impact millions of people.

Flyvbjerg (2014) further states that they are "a completely different breed of projects in terms of their level of aspiration, lead times, complexity and stakeholder involvement". Zidane and Johansen (2013) quotes that Grün (2004) calls them the 'giants' among the projects and emphasise on the aspect of multi-organizational enterprises (MOEs) and characterizes these by (i) singularity, (ii) complexity, (iii) goal-orientation (technical, financial, time) and (vi) the nature and the number of project owners

### 2.2.2. History of Mega Projects

Since the advent of the Seven Wonders of the World, man has always been fascinated by huge structures. The ancient wonders of the world which were mostly built Before Christ (B.C) are as follows:

- The great pyramid of Giza in Egypt, Africa.
- The Hanging Gardens of Babylon, Iraq.
- The Statue of Zeus at Olympia, Greece.

- The Temple of Artemis at Ephesus, Turkey.
- The Mausoleum at Halicarnassus, Turkey.
- The Colossus of Rhodes, Greece
- The Light House of Alexandria, Egypt

**Figure: 2.1 The Great Pyramid of Giza, Egypt**

'The Great Pyramid of Giza also known as the Pyramid of Cheops is the oldest and largest of the three pyramids in the Giza. It was built as a tomb over a 10- to 20-year period concluding around 2560 BC. Initially at 146.5 meters (481 feet), the Great Pyramid was the tallest man-made structure in the world for more than 3,800 years and is the oldest of the Seven Wonders of the Ancient World, and the only one to remain largely intact'.

Source: https://www.ancient.eu/egypt/

**Figure: 2.2 The Hanging Gardens of Babylon, Iraq**

'The Hanging Gardens of Babylon is one of the Seven Wonders of the Ancient World as listed by Hellenic culture. It is built in the ancient city of Babylon, near present-day Hillah, Babil province, in Iraq. The construction of the Hanging Gardens has also been attributed to the legendary queen Semiramis, who supposedly ruled Babylon in the 9th century BC'

Source: https://www.ancient.eu/Hanging_Gardens_of_Babylon/

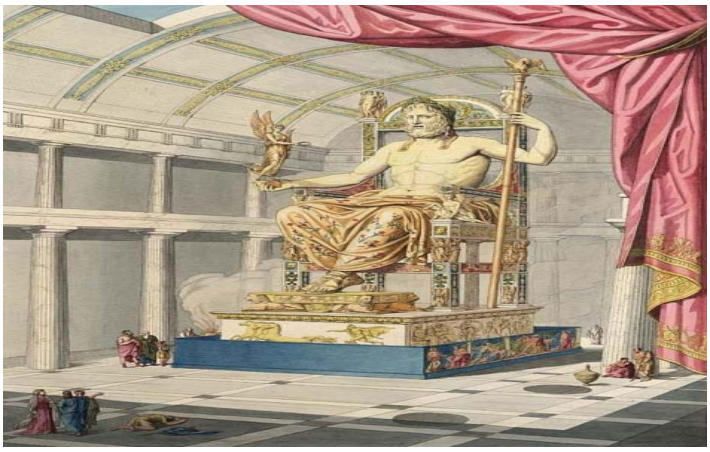


**Figure: 2.3 The Statue of Zeus at Olympia, Greece**

‘The Statue of Zeus at Olympia was a giant seated figure, about 13 m tall, made by the Greek sculptor Phidias around 435 BC at the sanctuary of Olympia, Greece’. A sculpture of ivory plates and gold panels over a wooden framework, it represented the god Zeus sitting on an elaborate cedar wood throne ornamented with ebony, ivory, gold and precious stones(Ibid).

https://www.ancient.eu/Statue_of_Zeus_at_Olympia/

**Figure: 2.4 The Temple of Artemis, Turkey**

The Temple of Diana, was a Greek temple dedicated to an ancient, local form of the goddess Artemis. It was built in the 6th century BCE, and such was its tremendous size, double the dimensions of other Greek temples including the Parthenon. Currently only the foundations and a solitary column stand as a reminder of the site where once stood the greatest temple in the ancient Mediterranean.

Source: https://www.ancient.eu/Temple_of_Artemis_at_Ephesus/

**Figure: 2.5 The Mausoleum of Halicarnassus, Turkey**

Tomb of Mausolus was a tomb built between 353 and 350 BC at Halicarnassus. The Mausoleum was approximately 45 m in height. It was destroyed by successive earthquakes from the 12th to the 15th century, the last surviving of the six destroyed wonders.

Source: https://www.ancient.eu/Mausoleum_at_Halicarnassus/

**Figure: 2.6 The Colossus of Rhodes, Greece**

Colossus of Rhodes, colossal statue of the sun god Helios that stood in the ancient Greek city of Rhodes and was one of the Seven Wonders of the World. It was an enormous 33-metre-high statue.

Source: https://www.ancient.eu/Colossus_of_Rhodes/

**Figure: 2.7 The Lighthouse of Alexandra, Egypt**

Pharos of Alexandria was a lighthouse built by the Ptolemaic Kingdom, during the reign of Ptolemy II Philadelphus (280–247 BC). It has been estimated to be 100 metres (330 ft) in overall height. The lighthouse was a symbol of power, mainly to broadcast the name of Alexandria in the World.

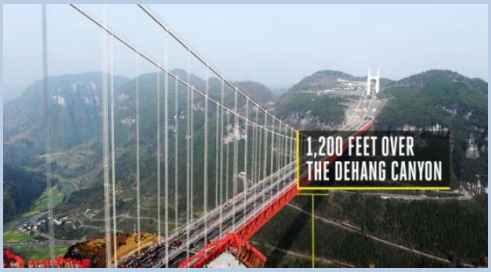
Source: https://www.ancient.eu/Lighthouse_of_Alexandria/

Research on megaprojects has been going on for almost forty years and yet existing literature on the subject confirms that there are a lot of gaps, and a lot of research problems and questions that must be answered, especially regarding the aspect of their huge size and complex nature (Brooke & Locatelli.G, 2015). An example of that project is Taj Mahal in India.

**Figure: 2.8 Taj Mahal, India**

Taj Mahal, India is a spectacular mausoleum where construction began in 1632 and took about 15 years to complete. The opulent, domed mausoleum, which stands in formal walled gardens, is generally regarded as finest example of Mughal art and architecture. It includes four minarets, each more than 13 stories tall.

Source: https://whc.unesco.org/en/list/252

| | |
|---|---|
| **Panama Canal Expansion,**<br>  <br>**Time to build :11 years**<br>**Cost to build: $ 5.25 billions** | **Aizhai Suspension Bridge, China**<br>  <br>**Time to build :5 years**<br>**Cost to build: $ 600 millions** |
| **Marmaray Tunnel, Turkey**<br>  <br>**Time to build :9 years**<br>**Cost to build: $ 4.5 billions** | **Three Gorges Dam, China**<br>  <br>**Time to build :18 years**<br>**Cost to build: $ 22 billions** |

| One World Trade Center, New York | Jubail Industrial City, Saudi Arabia |
| --- | --- |
|  |  |
| **Time to build :9 years**<br><br>**Cost to build: $ 4.5 billions** | **Time to build :9 years**<br><br>**Cost to build: $ 4.5 billions** |

**Figure: 2.9 Six of the top 25 most impressive mega construction projects that are being implemented worldwide in the last five years**

Source: https://www.popularmechanics.com/technology/g2121/the-worlds-25-most-impressive-megaprojects/

Historical performance for megaprojects has been very poor across the globe. MCP's are often over-budgeting and/or behind schedule and, once finished, they deliver less benefits than planned. Statistics reveals that nine out of ten such projects have cost overruns. Overruns of up to 50 percent in real terms are common, over 50 percent not uncommon (Ernst & Young, 2013). Recent examples include: - the cost overrun for the Channel tunnel, the longest underwater rail tunnel in Europe, connecting the UK and France, was 80 percent in real terms; Denver International Airport, 200 percent cost overrun; Boston's Big Dig, 220 percent; the UK National Health Service IT system, 400-700 percent, Gautrain Metro railway in South Africa and lastly an example of the Sydney Opera (Survey, 2013).

Overruns are a problem both in private as well as public sector projects, and things are not improving; overruns have stayed high and constant for the 70-year period for which comparable data exist. Geography also does not seem to matter; all countries and continents for which data are available suffer from overrun. Similarly, benefit shortfalls of up to 50 percent are also common, and above 50 percent are also not uncommon, again with no signs of improvements over time and geography as (Bruzelius, Flyvbjerg, & Rothengatter, 2002).

### 2.2.3. Mega projects in developed and developing countries

Mega Construction Projects represent a strategic option towards achieving sustainable development objectives in developing countries" (Othman, 2013). According to Othman, the governments of these countries implement megaprojects to realise their socioeconomic objectives. These megaprojects entail the construction of infrastructural, industrial, educational, cultural, Transportation, as well as residential projects (Ibid). According to Othman, these projects are commissioned by governments and delivered nationally and internationally by participants that are in partnership with the relevant governments.

In developed countries Mega projects are a demonstration of their might and economic prowess while in developing countries such as South Africa they are a means to address infrastructure backlog and economic competitiveness (Khatleli, 2016). Due to globalisation, developing countries strive to operate on an international level, to become more economically and socially advanced (Le-Hoai, Lee, & Lee, 2008). For this reason, more developing countries have shown interest in investing in Mega Projects such as the Gautrain transport network in South Africa and Olympic stadiums in Brazil. Alexander (2015) supports this notion, that states countries, particularly those found in the G-20 (countries such South Africa, Brazil and India are part of this G-20) have shown a great interest in mega projects, as they perceive mega projects to obtain economic growth and enhance global growth rates.

While the governments of developing countries implement megaprojects to realise socio economic objectives the mistake that most of these developing countries make in most cases is the rapid planning and implementation of mega projects due to a national crisis.

The low performance rate could also be attributed to the fact that mega construction projects are complex in nature; they are risky and time-consuming undertakings that are usually commissioned by government's and delivered by national and international participants with a variety of cultural differences, backgrounds, political systems, and languages. They attract high levels of public attention and political interest due to the substantial cost, direct and indirect impact on the community, environment and budgets (Othman, 2013).

MCP'S unique nature and characteristics also require high design knowledge and technical skills; competent human resources and professional managerial capabilities as well as large-scale investment (Othman, 2014). Developing countries suffer from having shortage in providing these essential knowledge, skills, capabilities, and finance, which ultimately challenge the successful development of MCPs.

### 2.2.4. Mega Project in Africa

"The total demand for infrastructure investment and maintenance from developing countries is estimated at more than US$ 900 billion a year, with greatest needs in Africa and Asia" (Khatleli, 2016: 805). According to Khatleli (2016), Africa's economic growth for 2013 averaged 4% as opposed to the global economic growth of 3%. Africa's economic growth inevitably had a great contribution from the implementation of megaprojects. The present performance picture of the construction industry in Africa is also not a desirable one, uncertain global macroeconomic conditions and domestic challenges have led to lower growth projections for sub-Saharan Africa (SSA) as a whole. Growth in SSA fell to 3.5% in 2015, significantly below the 5-7% average experienced by the region over the last decade. SSA's 2016 growth forecast is even lower at only 1.4%, the first time that the region's growth has been lower than the world average since 2000 (Survey, 2013).

According to the 2016 edition of Africa Construction Trends Report, the total number of construction projects in Africa that had broken ground by 1 June 2016 is 286 and are valued at US$50m or above, collectively, these projects are worth US$324bn. As a region, West Africa had the most number of projects with 92 projects and the most in terms of value at US$120bn. However, South Africa was the single country with the largest number of projects (41) followed by Nigeria (38). A noticeable growth is from North Africa, whereby North Africa saw a significant jump in the number of projects. The number of projects in North Africa increased by 44.8% and the value of projects increased by 195%, signifying an increase of confidence in the region (PWC South Africa, SA Construction Landscape Report, 2016). The Deloitte (2016) confirms Ernst and Young survey report

that South Africa had the most infrastructure projects (with a combined value of close to US$130 billion) in 2013.

**Figure: 2.10**

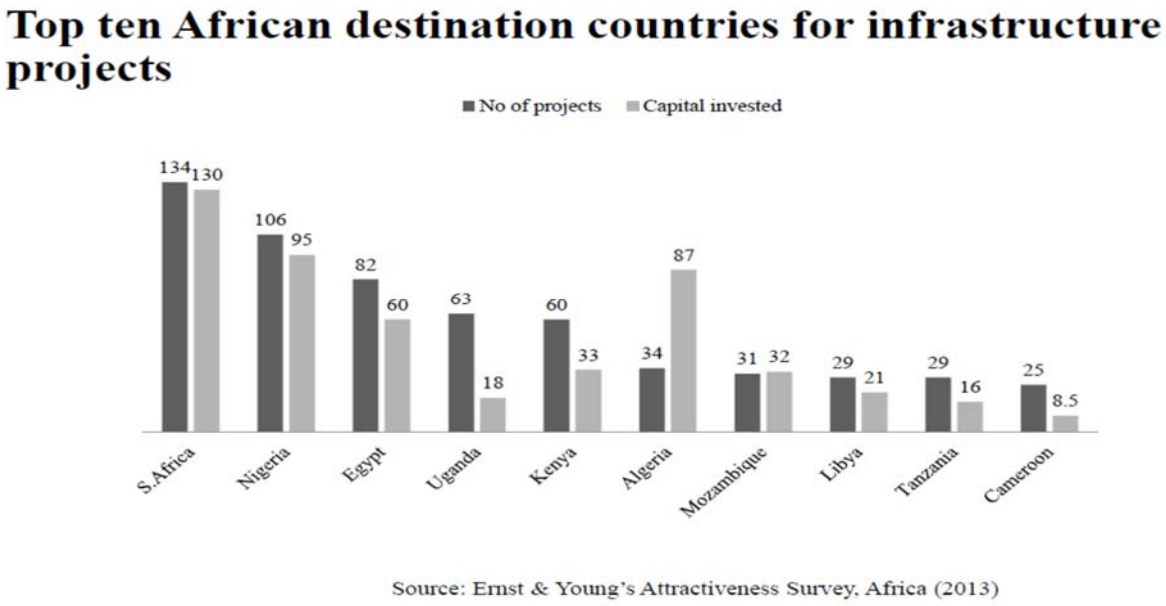



**Figure: 2.10 Top ten African destination countries for infrastructure projects**

### 2.2.5. Mega projects and their nature in South Africa

Mega Construction Projects have a brief history in South Africa; The South African Government uses MCP's as one of its economic vehicle to transform economic landscape while simultaneously creating significant numbers of new jobs and strengthen the delivery of basic services. Numerous megaprojects have been implemented in South Africa to meet different objectives ranging from Energy, Transport and Sport etc. For example, GFIP e-toll project in 2011 to alleviate traffic congestion in Gauteng as well as the construction of stadiums for the 2010 Soccer World cup.

South Africa is not yet at a level of a developed country, MCP's in SA are used to address infrastructure backlog and economic competitiveness (Khatleli, 2016). South Africa is slowly improving to operate on an international level, to become more economically and socially advanced (Le-Hoai, Lee, & Lee, 2008).

Some of the challenges that the country is confronted with in implementing MCP's includes among other things; the skills shortage or skills misplacement, restive labour force, the perceived political interference and influence, the poor level of planning and poor stakeholder analysis and engagement thereof.

According to Khatleli (2016) the implementation of the Gauteng Freeway Improvement Project (GFIP) and Eskom Medupi Coal Plant Project Plant in SA recently resulted in unpleasant repercussions due to lack of meaningful public participation. Other examples of infrastructural megaproject that were recently implemented in SA such as the Gautrain project, and the construction of FIFA stadiums in 2010 (Babatunde and Wang, 2015).

### 2.2.6. South African Construction Industry

Given that, the construction industry plays a critical role in the socio-economic development in South Africa, mega projects are the solution, hence the rising interest in mega projects. It is also important to note that the South African industry is highly established and has delivered quiet massive projects like bridges, airports for the country and for African countries for the past 10 years; furthermore, the industry has the construction resources like material, plant and equipment that are advanced and are as per the international quality standards.

For example, there are 10 cement factories in the country and South Africa is self-sufficient in cement; therefore, this indicates that South Africa can construct and manage complex and mega size projects (Ofori, Hindle, & Hugo, 1996).

According to PWC (2013) there are ten big heavy construction companies in South Africa and these findings are based on the financial results of the top 10 construction companies by market capitalisation on the Johannesburg Stock Exchange (JSE) as per figure 2.11. PWC (2013) further states that market capitalisation reflects the organic growth or regression, merger and acquisition activities and market expectations about the future.

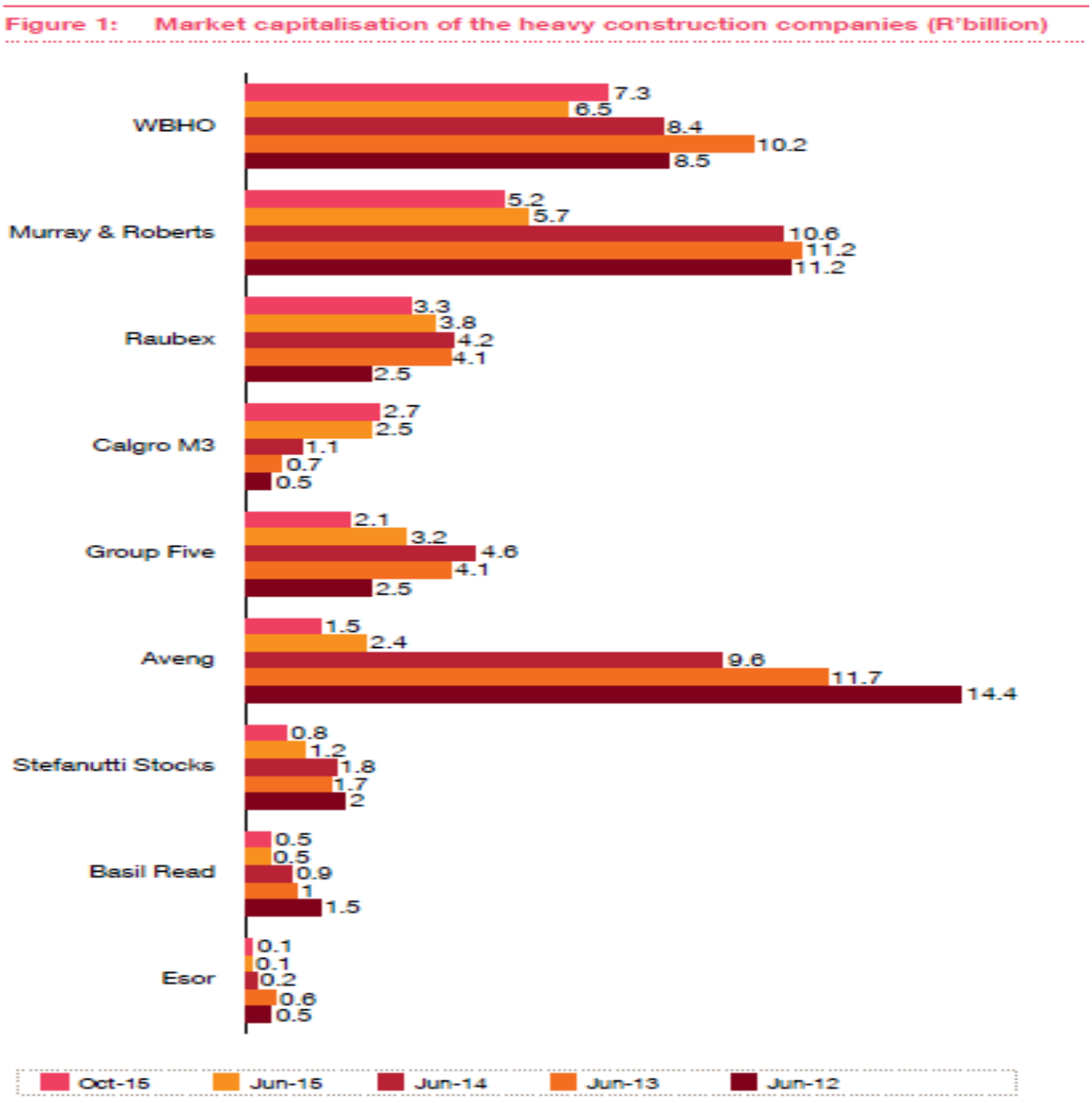



**Figure: 2.11 Ten big heavy construction companies in South African construction industry**

Source: https://www.pwc.co.za/en/assets/pdf/sa-construction-december-2013

Despite the availability of the resources that SA has at its disposal to successfully implement its Mega projects; there are several challenges that can hinder their successful implementation as mentioned in section. According to (Mbachu & Nkado, 2007) for ease of management and control, these challenges can further be categorised as either controllable or non-controllable causes.

Controllable causes have been identified as:

(1) Project characteristics: the level of complexity and technology is the most influential factor constraining successful project implementation

(2) Service providers' being the consultants and contractors' that influence the acts of omission or commission, technical and managerial competence).

(3) Client organisational influences, which are poor, scope, definition, timing and frequency of changes or variations.

Lack of synergy in working together as a team.

Uncontrollable causes are:

(1) Socio-cultural issues (workers' morale to work, Cultural influences: working hours, attitude to work, beliefs, vandalism, and gangsterism).

(2) Risk Management Unforeseen circumstances (site accidents and inclement weather conditions)

(3) Economic and global dynamics (volatility of the exchange rate of the Rand with major currencies and potential global energy crisis and the attendant inflation

(4) Governmental/statutory controls (political controls such as compliance with empowerment/affirmative actions, and other forms of business controls)

(5) Lack of synergy in working together as a team.

### 2.2.7. Normal projects

Project Management Institute (2008), defines project as a system involving the co-ordination of several separate department entities throughout organization, in a way it must be completed with prescribed schedules and time constraints. PMI (2008) further states that "size" is an all -encircling

designation used to quantify the overall extent of the project and this allows projects to be characterised in comparative terms of small, medium or large as per figure 2.12.

In this study normal projects will be characterised as small to medium scale projects.

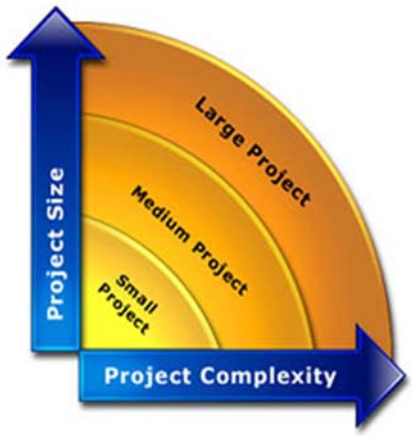



**Figure 2.12**

Source: http://www.mpmm.com/project-sizes.php

Four phases of Project Management Life Cycle : Initiation, Planning, Execution, Monitoring & Control and Closure are applied in managing normal projects. PMI (2008) states that Small projects have unique challenges over larger ones. Because they're small, it's tempting to skip the planning process and start executing the work. This phenomenon is especially true if projects perform tasks similar to previous work, which in turn leads to a natural tendency to skip planning and to start doing the work. Then, essential steps are sometimes omitted, done out of order, or done later than desired. Likewise, costly mistakes can occur when risks are missed by executing too soon. A small project that is not properly planned can ignore critical stakeholders, causing both resentment and rework (Baker, 2018).

Gauteng Human Settlement has been implementing normal projects to ensure delivery of Integrated Human Settlement. However, the problem with small scale projects is that they yield less numbers and does not offer relief to everybody. News24 (2018) states that normal projects are sustainable and effective but fail to address the housing backlog since 1994.

### 2.2.8. Private Public Partnership (PPP)

This sub section focuses on Private Public Partnership (PPP) as it key partnership for South African Government to deliver on mega construction projects.

South African Government took a shift after 1994 that lead to increasing use of mechanisms like Private Public Partnership (PPP), concessions and privatisations (Bruchez, 2014:2). 'PPP's is one of the mechanisms utilised by South African authorities to achieve economic growth of the country by upgrading overloaded infrastructure'. 'PPP's agreement developed in the 1980's introducing the concept of New Public Management that answers to public resource scarcities and globalization'. A PPP unit was formed in year 2000, mainly for procurement and management of PPP's in South Africa(Ibid). This mechanism must facilitate delivery of infrastructure development throughout the country to contribute to social and economic growth, alleviation of poverty and expansion of infrastructure.

Treasury (2004:4) defines Private Public Partnership(PPP) as an agreement between public and private sector in which the public sector will mostly safeguard public values and the private sector is responsible for technical and operational risk in the design, financing, building and operation of a project. Koppenjan (2008) further defines PPP's as a catch all term that means many relationships between the public sector and the private sector. Bruchez (2014) points out that Governments in developed and developing countries utilise PPP's for infrastructure development in the last two decades.

PPP's are viewed to be the answer for implementing public infrastructure projects and mega projects. Koppenjan (2008:2-3) emphasises the motivation for PPP as follows: (i) attracting private investment which means Government believes that PPP will attract private money to enable investment in new and upgrading of infrastructure. Public funds are too limited to achieve all these desires. (ii) More value for money – as PPP contracts include design, building, maintenance and realisation and private sectors can coordinate all these phases, design optimization will lead to better quality and efficiency returns. (iii) Promoting innovation - involvement of private parties in public projects will assist with expertise that government do not have at their disposal for innovative

solutions to be possible. (iv) Better decision making and project management – private parties involvement improves decision making on infrastructure as it forces government to clearly define the project scope.

PPPs are vital for South Africa Government to achieve economic growth. There are 24 PPP projects implemented from 1998 to 2014(Ibid).

### 2.2.9. Magnification of problems in mega construction projects

This sub section focuses on identification of several problems in mega construction projects and covers the extent of problems experienced in MCP that the study will concentrate on.

Literature review reveals that implementation of mega projects in developing and developed countries have inherited several problems. Different sectors have shown a great interest in mega construction projects. Ernst and Young (2013) states that the greatest number of projects fall into the Transport sector (33.6%), Real Estate (22.4%), Energy & Power (21%) and Shipping & Port (8.4%). All these sectors inherit magnified problems with implementation of mega projects like (i) time and cost overruns that are more than 50 percent (ii) corruption (iii) halt /stoppage of a project etc.

Firstly, according to the oxford dictionary, magnification is defined as 'zooming in, enlargement or intensified'. Magnification of problems can be defined as intensification, increasing or enlargement of a problem. Due to the characteristics and peculiarities of mega projects, problems encountered with implementation of these projects are magnified. PMM reveals that larger projects mean enormous project size and project complexity. Brook (2018) and McKenzie n.d stated that cost and time overruns in mega projects are magnified due to uncertainties of estimations, scope creeping, change of designs and labour strikes. Several projects experienced exaggerated time and cost overruns like Sydney Opera House a monumental infrastructure in Australia that initially costed $7 million and ended up costing $1billion which was 1400%, caused by government signing off project prior the completion of designs(Brook,2018). Channel tunnel, the longest underwater rail tunnel connecting the UK to France, ended up costing $11billion which was 80% due to change of designs and scope creeping. 2016 Gorgon LNG project a largest infrastructure project in Australia that initially costed $35billion and was over budget by $15 billion due to labour strikes and major environmental challenges(Ibid). As argued by Flyvbjerg (2014) overruns of up to 50 % are common and over 50 % are uncommon like Channel tunnel.

McQuiston (2017) reported several State building projects that experienced cost overruns between 12% and 48% which are as follows: Westminster Public Safety facility project for construction of public safety field station that initially costs $6.2 million and was over by $767.000 (12%) due to

unsuitable soil conditions and requirements for fire code compliance; Lamoille County Courthouse project in Hyde Park which was to build additional space and renovate the existing courthouse to improve security, initially costed $6.7million and was over $2.1 million(31%) due to change orders by the owner; Middlesex Therapeutic Community Residence project in Middlesex for constructing a temporary seven bed secure residence to provide secure and safe recovery for person in custody of Mental Health, initially costed $1.5million and was over by $732.000(48%).

Secondly, Megaprojects are unique projects where public actors play a key role and are very likely to be affected by corruption (Locatelli et al.,2016). The production of mega-projects in the energy and transport sectors since 2005 coincides with the apparent rise in illegal dealings, with the collusion of politicians and business executives to maintain shared monopolies of power and excessive profits (www.ipsnews.net, 2017). Damoah et al. (2018) states that corruption is the abuse of entrusted power for private gain and as the abuse of public office for private gain. Corruption is particularly relevant for large and uncommon projects where the public-sector acts as client/owner or even as the main contractor. Corruption worsens both cost and time performance, and the benefits delivered. It is one of the major impediments to the development of emerging countries and to further improve the quality of life in developed countries(Ibid). As explained later, corruption is particularly relevant for megaprojects because of their intrinsic characteristics. Mega projects are projects characterized by: large investment commitment, vast complexity (especially in organizational terms), and long-lasting impact on the economy, the environment, and society. Megaprojects and their contexts are mutually interdependent since they influence each other. “The major impact of corruption in infrastructure is usually going to be on what is built where, not how much is paid to build or connect it (Locatelli et al.,2016: 253)”. The characteristics that makes projects to be prone to corruption are:

• Size: this is the most important feature because it is easier to hide bribes and inflated claims in large projects than in small projects.

• Uniqueness: this makes budget costs difficult to compare and therefore, it is easier to inflate.

• Government involvement: public administrators can use their arbitrary power especially where there are insufficient controls on how government officials behave.

• Number of contractual links: each contractual link provides an opportunity for someone to pay a bribe in exchange for the contract awards.

• Project complexity: when projects are very complex, factors like mismanagement or poor design can hide bribes and inflate claims (Locatelli et al.,2016:256).

Therefore, corruption causes at least two major effects, market distortion and worse cost/benefit. Corruption affects projects and megaprojects performance leading to the delivery of works with limited social benefit, poor economic returns and over-cost. Damoah et al. (2018) states that corruption impact on returns on investment and corruption leads to the increment of the

government budget. Various countries that implemented large infrastructure projects have experienced an ordeal of corruption. According to (Damoah et al.,2018) Transparency International Report over the years places Ghana among the most corrupt countries in the World1 and further indicates corruption, inadequate sources of funding and price variation as major factors that lead projects to failure in Nigeria. Several infrastructure projects have been delivered in Italy and most of them were reported as affected by corruption like the Italy High speed train(Ibid).

Thirdly, stoppage / halt of a project is the last identified magnified problem in mega construction projects. Brook (2018) reported on VC Summer nuclear power station in United States of America which was an advanced energy plant. It originally costed $16 billion, construction commence in 2013 and was to finish in 2018. Costs ballooned to $35 billion and completion time was withdrawn to 2020. In 2017 the project was stopped. Brook (2018) further reported on Ryugyong skyline hotel in North Korea, which was designed to have 7500 rooms and five revolving restaurants. Originally costed $1billion and was halted due to economic crisis. This hotel remains the largest incomplete building.

Finally, megaproject can magnify problems to the extent of cost overruns are that over 1400 percent like the Sydney Opera, corruption which varies from bribes to cost inflation in several countries like Italy, Brazil, Ghana and Nigeria that leads to poor economic returns. Project halt, non-viable project like VC Summer nuclear power station in USA and Ryugyong Hotel in North Korea.

### 2.2.10. Identification of endemic problems in normal infrastructure and MCP in South Africa

This sub section concentrates on identifying endemic problems experienced in mega construction projects and normal projects in South Africa.

In adoption of mega projects as an infrastructure “delivery model” for social and economic development objective by the developing countries, there has been an inclination of problems in mega construction projects.

The following problems have been identified in MCP are as follows:

- Time and cost overruns
- Stakeholder mismanagement, Lack of community engagement, Labour strikes and Multi governmental relations

- Unidentified/Unforeseen conditions - Normal infrastructure projects experience their problems during implementation that causes delays to a project. Mbachu and Nkado (2007) categorise these problem as either controllable or non-controllable constraints.

Mbachu & Nkando (2007) identifies the following problems (i) socio-cultural issues (ii) unforeseen circumstances (iii) economic and global dynamics under non- controllable constraints in normal projects. The above-mentioned problems identified in MCP are distinguished in normal projects. The common problems identified in normal infrastructure projects and MCP are as follows:

- Economic and globalisation dynamics = Time and cost overruns

- Socio – cultural issues = Stakeholder mismanagement, Lack of community engagement and Multi governmental relations

- Risk Management Unforeseen circumstances = Unidentified/Unforeseen conditions

### 2.2.10.i Time and cost overruns

Time and cost overruns is one of the major problems faced by implementation of mega projects in developing countries (Sishumi, 2017). Mega construction projects are mostly affected by these overruns. “Time overrun is the time difference between the actual and the initially planned dates of completion” (Singh, 2009: 44). It is the time in which the project is planned to be completed. In the same way “cost overrun is the difference between the actual cost and the initial projected cost of the project” (Singh, 2009:44)

Recent studies (Le-Hoai, Lee, & Lee, 2008, Flyvberg 2014, Westhuizen 2007 and McKenzie n.d) agree that mega projects portray two main concerns which are delays and cost overruns. (Flyvbjerg, 2014) supports the (Le-Hoai, et al., 2008), with the two concerns; however, (Flyvbjerg, 2014), (Xulu,2014), Bejoy (2016), (Bruzelius, Flyvbjerg, & Rothengatter, 2002) all agree that shortfall of benefits is one of the concerns. (Flyvbjerg, 2014) continues to identify the following attributes that have contributed to the delays, the shortfall of benefits and costs overruns as mega projects are deemed to be:

1) risky due to long planning and complex interface

2) often managed by planners and managers that do not have the necessary skills and whom keep on changing throughout the project cycle.

3) Having diverse stakeholders from the public to the private sectors with conflicting interests.

4) Having technological and design complexities.

5) Significantly changing the scope of the project over time.

6) Having unidentified risks that are unaccounted for that leads to budget and time insufficient contingencies.

The Project Management Life Cycle has four phases: Initiation, Planning, Execution and Closure. In the planning stage the project team estimates project duration and costs required to complete the project. All these estimates get to be approved by a relevant person in the department. Designs and other project related documents crucial to commence the next phase needs approval from various departments. Singh, (2009) states that coordination of project team and involved departments is key for the project to be delivered and on time and within the cost i.e. approvals from of designs by other departments. In the execution stage of a project, contractor will have a clear idea of the complications and conditions of the project. any unforeseen conditions that a contractor may come across will have an impact on the time and cost overrun of the project.

Due Mega construction projects being implemented in longer period and higher budget than smaller projects, these overruns are inflated. Shane et al., (2009) states that for mega projects to be delivered within the estimated budget, they need a good starting estimate. The governmental department's capacity to plan and develop large scale projects should improve and the extent of time and cost overruns should be minimal over the years.

### 2.2.10.ii Stakeholder mismanagement

Due to the enormity and complexity of mega projects there are multiple stakeholder. (Freeman, Wicks & Parmar, 2004) identifies the stakeholders as Customers, Employees, Local communities, Suppliers and distributors, Shareholders that will have interest and concerns that need to be managed for a successful project. Managers should strive to balance a relationship with the stakeholders and create communities where everyone delivers on the organisation mandate.

Lenfle and Loch (2015), Chung, Kumaraswamy and Palaneeswaran (2009), Othman (2013), Khatleli (2016) and Kennedy, et al., (2014) all agree that stakeholder mismanagement is a problem in the implementation of Mega Projects. Khatleli (2016), McKenzie n.d, Othman (2013) and Bejoy (2016) continues to add lack of community engagement and community unrest that leads to delays and resistance of mega projects. Shane et al., (2009: 224) refers to it as local concerns and requirements which is categorised as "external factors which are those factors over which the owner has little or no direct control over their impact".

The lack of various partnership, integrated governmental relations and multi stakeholder management and community engagement will result in the failures of mega construction projects (Kennedy, et al., 2014). Lenfle and Loch (2015) state that stakeholder conflicts are one of the key basis of project problems and have a negative impact of mega construction projects. Overlooked interest of different parties can result in conflict and parties will no longer work together but against each other. This has a potential of disrupting a project and cause delays(Ibid).

Involvement and constant consultation of various stakeholders is key for more effective management and improved success of mega projects. A dedicated team should always be available to inform and update stakeholders of any crisis and changes in the project. Lenfle and Loch (2015) agrees with formation of a dedicated Steering Committee(SC) to manage the goal objectives, constant consultation and alignment of a project team. All the technical issues should be interpreted in a simpler language for everyone to fully understand the state of the project. Shane et al., (2009) states that the owner needs to consider these external factors when estimating project costs.

### 2.2.10.iii Unforeseen conditions

Unforeseen conditions are an additional problem that affects mega construction projects. Unforeseen conditions are unanticipated condition that disturbs the final price and/or completion time of a contract or project. Giezen (2012) writes that uncertainty is most related to risk which is

possible events, impact and actions might not be as predicted. Due to the complex nature of mega projects, uncertainty becomes enormous. Unlike uncertainty, risk is quantifiable (Ibid).

Shane et al. (2009) mentions unforeseen events and unforeseen conditions as external factors that have an impact on project cost escalation. 'Unforeseen events are unanticipated such as floods, weather related incidents that are typically called acts of God' (Shane et al., 2009). 'Unforeseen conditions are unknown problems which can escalate project cost during planning and design phases such as unknown soil conditions' (Ibid).

Giezen (2012) mentions the three types of uncertainties which are as follows: First type is risk which encompasses uncertainty about the result but there is enough information to make possible estimate. Second type is structural uncertainty where future events have a possibility of happening but there is not enough information to confirm that they will happen. Third type is unknowable, these are not possible of happening. In most projects, only the first type of uncertainty is considered when planning for a project.

These unforeseen conditions contribute to the failure of mega projects. These unforeseen conditions vary from unexpected soil conditions, change of designs, delays in environmental permits, and community or labour strikes. Shunmugam and Rwelamila (2104) states that "unplanned future events" will yield to project delays and not meeting project objectives. McKenzie n.d, Khatleli (2016) and Westhuizen (2007) all agree that unforeseen events are a concern that leads to delay of mega projects. The following projects have reflected the delays caused by unforeseen or unplanned conditions, being the Medupi power station project in South Africa, 2016 Gorgon LNG Australia largest infrastructure project and Gautrain metropolitan transport network in South Africa.

All types of uncertainties should be planned for during the planning phase of the project. Usage of less complex techniques that the project team is familiar with can minimise unforeseen conditions that lead to the delay of mega construction projects.

### 2.2.11. iv. Investigating the peculiarities of implementing Mega Projects in South Africa

Definition of mega projects is what distinguishes them from normal construction projects. Mega projects are defined as complex, enormous and costing over US$1billion. (Flyvbjerg, 2014) defines Mega projects as large – scale complex ventures that typically cost a US$ 1 billion or more, they take

many years to develop and build, they involve multiple public and private stakeholders, they are transformational, and impact millions of people. (Flyvbjerg, 2014) further states that they are “a completely different bread f projects in terms of their level of aspiration, lead times, complexity and stakeholder involvement”.

Complexity, enormity and involvement of multiple stakeholders are the peculiarities that differentiates mega projects from normal projects. Zidane and Johansen (2013) quotes that Grün (2004) calls them the “giants” among the projects and emphasise on the aspect of multi-organizational enterprises (MOEs) and characterizes these by (i) singularity, (ii) complexity, (iii) goal-orientation (technical, financial, time) and (vi) the nature and the number of project owners.

In the South African context, mega projects are peculiar with the same characteristics of being complex, enormous and involving multiple stakeholders. South Africa has implemented mega projects to address the infrastructural backlog and for socio economic development. Khatleli (2016) states that mega projects are mostly linked with a need when implemented. These projects are seen to be beneficial to the public in terms of economic development and end users. The following examples are implemented mega projects in South Africa:

- Gautrain transport network is unique in terms of size and cost. Westhuizen (2017) states that it is a symbolic factor. ‘Gautrain is a first high-speed metropolitan transport network in South Africa that was developed at a cost of nearly R25 billion’ (Westhuizen, 2017:333).
- Medupi power station project is a greenfield coal fire power plant project that is intended to be the fourth largest coal plant in the Southern Africa and a major dry – cooled power station in the world. The construction of Medupi power station is unique due to the size and multiple stakeholder involvement.

### 2.2.10.v. Assessing levels of magnification of the common problems encountered in ordinary projects

Ordinary projects are an organised way to achieve or build a structure. Achieving a project involves project life cycle which is as follows: initiation, planning, implementation and closeout. In a case where any of the project life cycle stages are compromised will result in an unsuccessful project.

Mbachu and Nkando (2007) states that ordinary projects encounter problems which leads to project failure. Normal infrastructure projects have their own problems during implementation that causes delays to a project. The common problems identified in normal infrastructure projects and MCP are as follows:

- Socio – cultural issues = Stakeholder mismanagement, Lack of community engagement, Labour strikes and multi governmental relations
- Economic and globalisation dynamics (volatile exchange rate, inflation and interest = Time and cost overruns
- Risk Management Unforeseen circumstances = Unidentified/Unforeseen conditions

Mbachu and Nkado (2007) categorises the common problems in ordinary projects under the uncontrollable/ external constraints. The common problems under the uncontrollable constrains which are NR contributes 33% to the project failure and the controllable constraints which are risky contributes 67% to ordinary project failures (Ibid). According to (Sriram and Roy,2018) a study carried for 363 public construction projects and found that as the size of construction project work increases, it resulted in significantly higher cost overrun. Another investigation on road projects for cost overruns was conducted and showed that small sized project contributed towards lower cost overrun than larger ones(Ibid). Memon and Rahman (2013) further reports that in Nigeria and Omoregie a minimum average of cost escalation in construction projects is 14%, while in Portugal construction projects faced a minimum of 12% of cost overrun.

It is concluded that the identified common problems in ordinary projects are not magnified as they contribute a low percentage of 33% to project failure and rated not risky. The size of a project significantly has an impact on the cost and time overruns. The risky or magnified problems in

ordinary projects are completely different from the identified common problems which varies from delays of payments by client, lack of technical skills, poor scope defining and shortage of material on site.

### 2.2.10.vi Analysing the competencies of the implementers of Mega Projects

Mega projects are implemented to upgrade the socio and economic development of a country and are used by different sectors to deliver infrastructure, water and energy etc. Mega projects are implemented in partnership with Government and Private sectors which is called Private Public Partnership (PPP).

GPF, n.d states that Gauteng Provincial Human Settlement's mandate is to ensure the delivery of Integrated Human Settlements within the smart Gauteng City Region. For GDHS to achieve its mandate of mega Cities, it becomes necessary to make inter- governmental partnerships to ensure delivery of infrastructure services such as water, sanitation, roads and electricity. GPF n.d emphasises that re- enforced partnerships with private sector, labour and the society will be vital for the successful delivery of GDHS mandate.

PMI (2008) states that there are three dimensions of competencies which are knowledge, performance and personal. A competent project manager is key as it brings project management knowledge and personal behaviour to deliver projects as per the stakeholder's requirements or expectations (Ibid). Udo & Koppensteteineir (2004) states the core competences of a successful PM comprise knowledge of:

- General management skills such as leadership, negotiation, communication, team building and human resource.
- Knowledge of the accepted project management areas including the tools used in those areas such as project scope management, project time management, and project scope management.

- Industry specific management knowledge such as life cycle management and product development methodologies.
- The proven experience competency area includes track record hours of project management exposure, size and complexity of project managed and independent references. Years of experience do not necessary always give a good competency rating

According to (Udo & Koppensteiner, 2004) personal competence of a PM has two pillars which are personality characteristics personality characteristics such as can-do attitude, confidence, enthusiasm, open mindedness, adaptability, and personal integrity. The second pillar contains people management skills such as ability to communicate, ability of motivation, ability to influence and political sensitivity. The political sensitivity attribute is very important for project managers. Projects are multidimensional and are inherently affected by politics. The key is to be aware of politics, to work with them, but not be part of them(Ibid).

According to (B2B News, n.d) a competent PM should achieve project performance metrics. Project metrics essentially are objectively measurable parameters pertaining to the project and play a major role in project control. Traditionally the project metrics were focused on the project deliverable success measurement alone. The key project metrics are:

- Customer Satisfaction Index: customer satisfaction means that customer expectations are met.
- Productivity meaning measuring productivity basically informs you if you're getting significant returns on your investments. Although resources are usually linked to people, this is not always the case.
- Cost Performance - this metric allows you to reduce financial risk and capital cost while being able to allocate capital confidently. An even better measurement method is the CPI Standard Deviation, which shows how accurate your project budget estimation process is.
- Cycle Time cycle time is basically the time it takes to complete the entire project life cycle. Cycle time metrics are based on standard performance. For similar projects, cycle times can be measured to determine a Standard Project Life Cycle Time. Cycle time metrics may also mean measuring the time it takes to complete any process that is included in the project life cycle. ROI depends largely on project cycle time. The faster the cycle time, the faster ROI

comes. Therefore, the shorter the combined cycle time of all projects, the more projects the organization can complete.

- Return on Investment Sources of benefits can come from a variety of metrics such as savings of costs, contribution to profit, and increase in output quantity.
- Cost of Quality this metric covers costs such as those of materials, overhead and labour, which are associated with a product or service's failure to meet customer specifications or expectations
- Schedule Performance even better schedule performance metric is SPI Standard Deviation, which shows how accurate your schedule estimation is.
- Requirements Performance this metrics can measure how project results meet requirements. It can measure requirements, which include both functional and non-functional types. Functional requirements are those that a product is designed to do or in this case, an action it must take. On the other hand, non-functional requirements are qualities that a product must have, which include performance and usability, among many others
- Employee Satisfaction this metrics is designed to help you determine the morale levels of your employees, which it does by giving you one number to look at
- Alignment with Strategic Business Goals One such metric involves measuring the alignment of projects to strategic business goals. This metric is created by conducting a survey of a mix of project management professionals, executives, and business unit managers.

Flyvbjerg (2014) states that mega projects are entirely unique projects to manage. Mega construction projects involve international construction joint ventures (ICJVs) which is more complex than a company of a single contractor.

### 2.2.11. Major finding from literature review

From the theoretical literature review that has been elaborated above, it can be argued that various studies have been conducted on problems in the implementation of mega projects in the South African construction industry and globally. Understandings from various accredited researchers was reviewed and analysed with the view of identifying similarities and contradictions. Major findings emanating from the literature review is as follows: (i) Mega construction projects and normal projects experience endemic construction industry problems (ii) Three major identified common problems with implementation of MCP and normal project are time and cost overruns, stakeholder mismanagement and unforeseen conditions. (iii)The identified endemic problems contribute to the less successful rate of mega construction problems in South Africa and globally.

# CHAPTER 3: RESEARCH METHODOLOGY

## 3.1. Introduction

This chapter reveals the methodology which was used in this study. Dudovskiy (2017) defines methodology as the philosophical framework within which the research is conducted or the foundation upon which the research is based. The methodology articulates the process followed to respond to the research problem(Ibid). This chapter covers the research philosophy, research design, research strategy, sampling, data collection and data analysis.

## 3.2. Research philosophy (pragmatism)

Dudovskiy (2017) states that a research is an activity that involves finding out, in a systematic way, things you did not know.

(Saunders, Lewis, & Thornhill, 2016: 124) defines 'Research philosophy is a system of beliefs and assumptions about the development of knowledge'. Saunders, Lewis, & Thornhill, (2016) further identifies five major philosophies: positivism which involves working with observable social reality to give law-like generalisations , critical realism focuses on explaining what we see and experience based on reality that shape the visible events, interpretivism emphasises that humans are different from physical phenomena because they create meanings, postmodernism emphasises the role of language seeking to question accepted ways of thinking to provide voice to marginalised views and pragmatism which emphasises that concepts are relevant when supported by action . Epistemology which concerns assumption about knowledge(Ibid).

Pragmatism philosophy and epistemology were adopted in this study. This assumption will vary from project-based information, facts that will be interpreted and literature review was adopted for this study which states that ideas are applicable when supported by action (Saunders, Lewis, & Thornhill,2016). This philosophy was adopted because of the realistic outcome that the researcher seeks to attain to address the research question.

## 3.3. Research design

According to (Saunders, Lewis, & Thornhill, 2016) research design is a plan utilised to produce responses to the research problem. The nature of the study will undertake descriptive research which is meant to gain a precise profile of situations or events (Saunders, Lewis, & Thornhill 2016). Descriptive study provides a better and deeper understanding of a phenomenon based on an in-depth study of the phenomenon.

The study adopted mixed methods research design. This research seeks to investigate the extent of endemic construction industry problems are magnified in mega projects. Mixed methods research designs were utilised in this study to gain clear knowledge of the nature of problem. Mixed methods research combines quantitative and qualitative data collection techniques. According to (Saunders, Lewis, & Thornhill, 2016), two methods can be adopted in a single study informed by the researcher's decision to use a mixed method approach on this study. This permits the researcher to interpret the results together to provide a more comprehensive response to the research question in comparison to the use of mono method design(Ibid).

Applied research method "aims at finding a solution for an immediate problem facing a society, or an industrial/business organisation (Saunders, Lewis, & Thornhill, 2016). Below is the research design diagram outlines various stages followed.

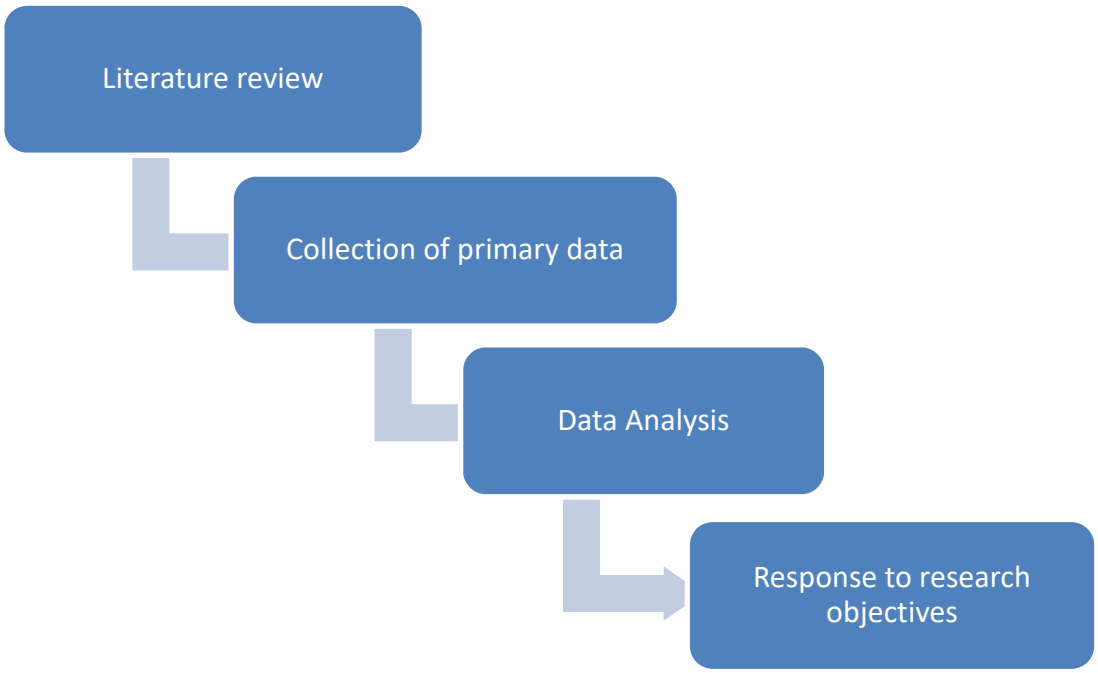



**Figure 3.1 Research design process**

## 3.4. Research Strategy - (survey by questionnaire)

### 3.4.1. Data Collection and method/ strategy

According to (Saunders, Lewis, & Thornhill, 2016) research strategy is a plan to accomplish a set goal. He further describes a research strategy as a methodological plan how a researcher will answer his/ her research question(Ibid). Different strategies are identified as follows: experiment, survey, archival and documental research, case study, ethnography, action research, grounded theory and narrative inquiry(Ibid). This study adopted survey by questionnaires as a suitable research strategy.

According to (Dudovskiy, 2017) data collection is a process of collecting information from all the relevant sources to find answers to the research problem, test the hypothesis and evaluate the outcomes. Data collection methods can be divided into two categories: secondary methods of data collection and primary methods of data collection. The study utilises both primary data and secondary data. Primary data which is new data collected that never existed hence it was never

published, whereas secondary data is a type of data that has already been published in books, newspapers, magazines, journals, online portals (Dudovskiy,2017).

The study concentrated on 12 registered PM with South African Council for Project and Construction Management Professions (SACPCMP), 4 Consulting Engineers registered with ECSA, 1 Architect registered with SACAP and 8 non- registered Project Managers within Gauteng Human Settlement and Professional Resource Teams(PRT) registered in the database of Gauteng Human Settlement. A questionnaire was distributed by email to all project managers and PRT project managers within Gauteng Human Settlement database. Follow up reminders were sent weekly by email. 26 questionnaires were sent out and 25 responses were received, which gave an effective response.

The key advantages for utilising semi structured questionnaires for data collection include their inexpensive price, time can be saved, and respondents do not feel pressured, therefore can answer when they have time, giving more accurate answers and access to potential participants. The participants were given one month to complete the form, the closing date was then extended by three weeks, allowing the participants a total of seven weeks to complete the questionnaire. The questionnaire took about 25 minutes complete.

The questionnaire was divided into two aspects which are section one: general information and consent of a participant and section two: the questions related to responding of the study's objectives. Section 1, which comprises of questions one to ten was mainly exposing the profile and to determine the level of exposure and experience the participant had working the construction industry. The duration and nature of mega and normal projects the participants were involved in. Section 2, which comprises of questions eleven to twenty-two are linked to themes and objectives of the research. The identified themes were endemic problems, peculiarities of mega projects, magnification of problems and competency.

**Section 1 – General information of the participant and consent**

The first section of the questionnaire captured the general profile data of the participants and required them to consent to participate in the research questionnaire.

The data collected in this section encompassed the following:

- Participant giving consent to participate in the questionnaire

- The participant job tittle and if registered or non-registered with SACPCMP
- Years of experience of the participant
- Which sector does the participant work
- Indicating number of mega projects and normal projects has the participant has been involved in for the past 5years
- Indicating if the mega and normal projects experienced any problems.
- Indicating the nature of the projects and duration of the projects the participants have been involved in.

**Section 2 – Magnification of endemic problems in implementation of mega projects in South Africa.**

The participants had to indicate at what stage of construction are the identified endemic problems experienced. The primary data collected in this section were considered to reflect the construction industry as the participants are professionals in the field of project management, construction management, consulting engineers and architects delivering projects across South Africa from both public and private sectors. The participant's perception if the identified endemic problems are magnified in mega and normal projects based on their experience and exposure to the construction industry. A further insight if South African construction industry have competent mega project implementers and if the delivery of mega projects can improve in South Africa.

### 3.4.2 Sampling design

According to (Dudovskiy,2017) sampling is a specific principle used to select members of population to be included in the study. Saunders, Lewis, & Thornhill (2016) further clarifies it as the full cases from which a sample is taken is called population. The study focuses on the target population of registered and non- registered project managers of Gauteng Human Settlement and PRT within the Gauteng Human Settlement database. 'Target population is defined as the population that is the actual focus of the research' (Saunders, Lewis, & Thornhill, 2016:275).

According to Saunders, Lewis, & Thornhill (2016) sampling technique enables you to collect data from a specific group rather than all possible cases. There are two sampling techniques which are probability and non- probability sampling. According to Dudovskiy (2017) probability sampling which refers to every member has a known chance to participate in the research, while non – probability refers to sample group members are selected non-randomly; therefore, in non-probability sampling only certain members of the population has a chance to participate in the study. Saunders, Lewis, & Thornhill (2016: 302) states that homogeneous sampling technique focuses on one sub group where all sample members are the same in term of occupation, level in an organisation's hierarchy. The study adopted non – probability sampling and homogeneous sampling technique as the research was targeting a group of registered and non – registered project managers of Gauteng Human Settlements and PRT within the Gauteng Human Settlement database for the resource of primary data for the research.

### 3.4.3 Reliability

Reliability is the way on which an assessment tool produces constant and reliable results. In this study the participants were taken from the GDHS project managers and GDHS database of PRT's.

The study confirmed reliability through transparency and by clearly documenting the flow and processing of the data showing a record that anyone that may wish to test its principles will get the same answers as the researchers.

### 3.4.4 Validity

Validity is to measure whether the researcher really measured what the study claims to measure. In this study validity was ensured by the researcher's valid data collection and analysis. Research methods used ensured that data recording was correct, and interpretation of data was logical as it was essential to increase reliability and validity in mixed methods.

### 3.4.5 Data Analysis

According to Dudovskiy (2017) data analysis is a manner that the researcher will clarify on how the collected primary data will be analysed. The researcher familiarised, organised and studied the responses thoroughly until familiar with raw data. Collected data was analysed using Microsoft word and excel programme. According to (Saunders, Lewis, & Thornhill, 2016) quantitative data is both primary and secondary data which varies from simple counts such as frequency of occurrence to more complex data. Data was evaluated based on the frequency and then divided by the total number of respondents and presented as a percentage of possibilities. The formula used to show frequency is % = (f/n) x 100

f – frequency in this formula is the number of times the item appears

n – total number of items in data

This chapter validated that the research objectives were designed in terms of the methodology, research philosophy, research design, research strategy, sampling, data collection and data analysis. Research findings and discussions are presented in the next chapter, Chapter 4.

# CHAPTER 4: ANALYSIS OF DATA AND FINDINGS

## 4.1. Introduction

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Firstly, this chapter presents the data analysis for mixed methodology (quantitative and qualitative data). Secondly, the chapter presents the findings based on the data collected and in response to the identified codes/ themes of the study.

## 4.2. Analysis of data

### 4.2.1. Section 1 (General Information of participants and consent)

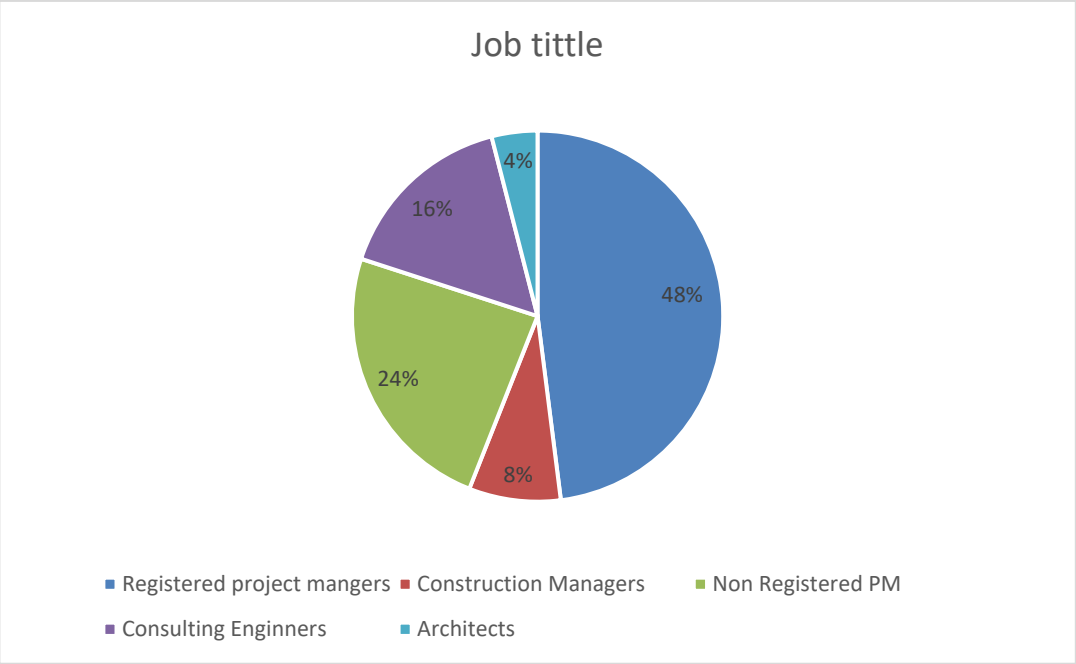
This section presents the general information of the participants, which is section 1 of the questionnaire. This study focuses on the 25 registered and non-registered project managers with SACPCMP, construction managers and consulting engineers from public and private sectors that have been exposed to mega construction projects. The final size was 13 respondents from Gauteng Provincial Human Settlement and 12 respondents from private consulting companies to make the total of 25 respondents.

The information revealed that all 25 respondents gave their consent to participate in the questionnaire. 6 of the respondents are Project Managers, 12 are registered project managers, 2 are construction managers, 4 are civil engineers and 1 is an Architect. Information displays that eleven out of twenty-five respondents have 5 – 20 years and 10-20 years working experience. One out of twenty-five have less than 5years and lastly 2 have more than 20years. Majority of the respondents have worked in both private and public-sector construction projects and the rest of respondents have worked in public sector. Twenty respondents have worked between 1-3 MCP and five respondents have worked in 3-6 MCP in the past 5 years. Majority of the participants indicated they worked on MP that experienced problems with project duration of 2-6 years. Most of the respondents specialises in Building projects (16) of the sample, followed by respondents specialising in Civil (8) and lastly was Electrical (1).

**Table 4.2.1 Summary of data collected Section 1 (n = 25)**

4.2.1a Job tittle

| Job tittle | Respondents | Percentages |
|---|---|---|
| Registered Project Managers | 12 | 48% |
| Construction managers | 2 | 8% |
| Non-registered project mangers | 6 | 24% |
| Consulting Engineers(civil) | 4 | 16% |
| Architects | 1 | 4% |
| TOTAL | 25 | 100% |




Out of twenty-five responses, 48% of the respondents are registered PM, with SACPCMP followed by 24% of respondents are non-registered PM, 16% of respondents are registered Consulting Engineers with ECSA, 8% of respondents are construction managers and 4% of respondents is an Architect.

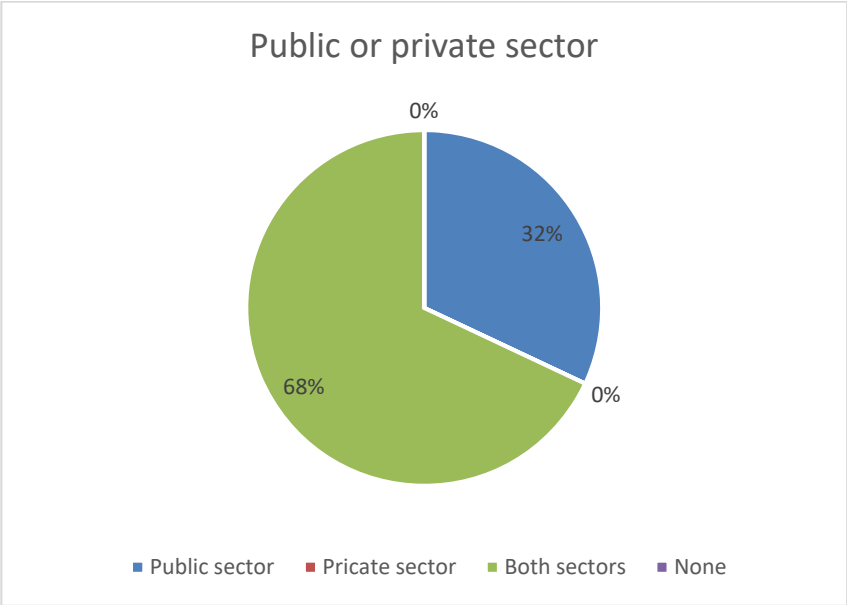
4.2.1b Years of experience

| Years of experience | Respondents | Percentage |
|---|---|---|
| Less than 5yr | 1 | 4% |
| 5-10 yrs | 11 | 44% |
| 10-20yrs | 11 | 44% |
| More than 20yrs | 2 | 8% |
| TOTAL | 25 | 100% |


Out of twenty five responses, 44% of reponsents had 5-10 years of experience and another 44% had 10-20 years of experience, followed by those less than 5years indicating 4% and lastly 8% of respondents with more than 20 years of experience.

4.2.1c Public or private sector

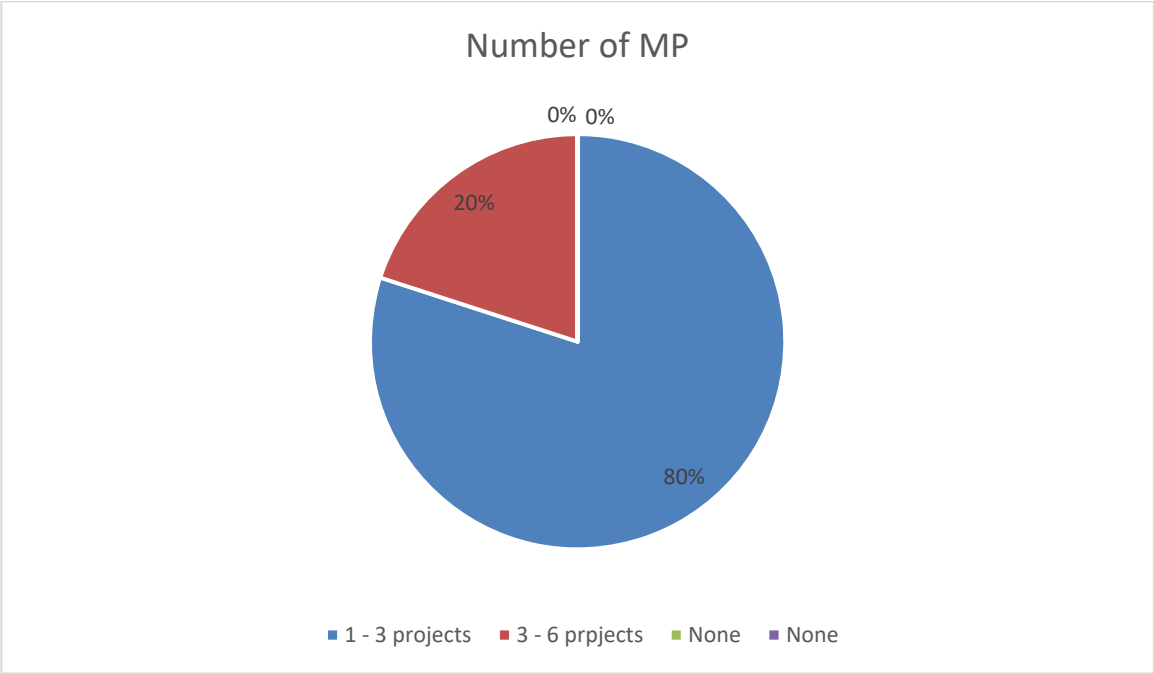
| Public or private sector | Respondents | Percentage |
|---|---|---|
| Public sector | 8 | 32% |
| Private sector | 0 | 0% |
| Both sectors | 17 | 68% |
| TOTAL | 25 | 100% |




Most of the respondents sixty eight percent(68%) had projects in both private and public sector, followed by 32% of reponsents that worked in pulic sector.

4.2.1d Number of MP involved in the past 5yrs

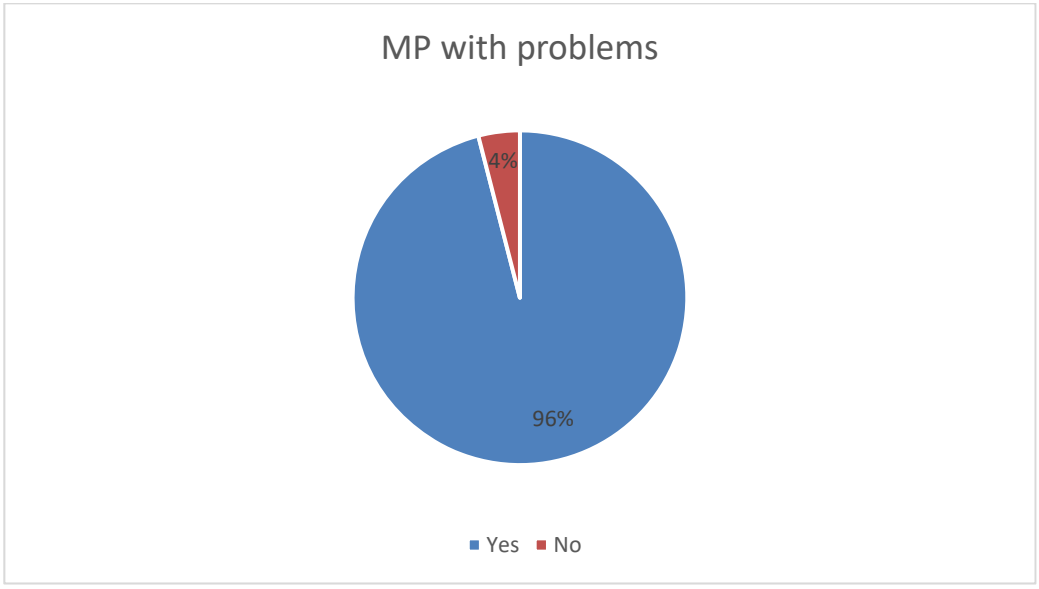
| Number of MP | Respodents | Percentage |
|---|---|---|
| 1-3 | 20 | 80% |
| 3-6 | 5 | 20% |
| TOTAL | 25 | 100% |




Out of twenty five responses, 80% of the repondents were involved in 1-3 MCP in the past 5 years and the rest 20% of the respondents were involved in 3-6 MCP.

4.2.1e Mega projects experiencing problems

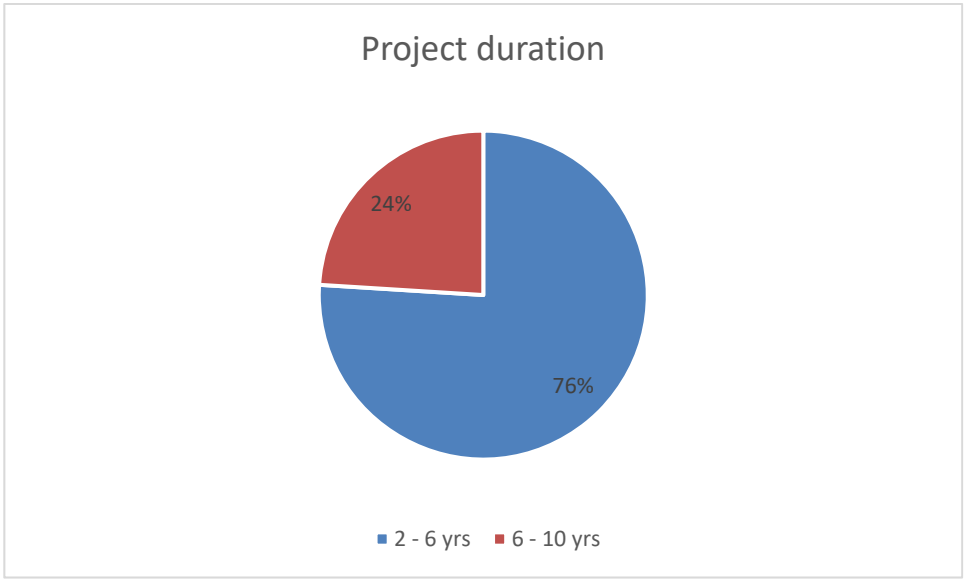
| MP with problems | Respondents | Percentage |
|---|---|---|
| Yes | 24 | 96% |
| No | 1 | 4% |
| TOTAL | 25 | 100% |




Ninty six percent of the respondents were in involved in MCP that experienced problems and 4% were not exposed in MCP with problems.

4.2.1f Project duration

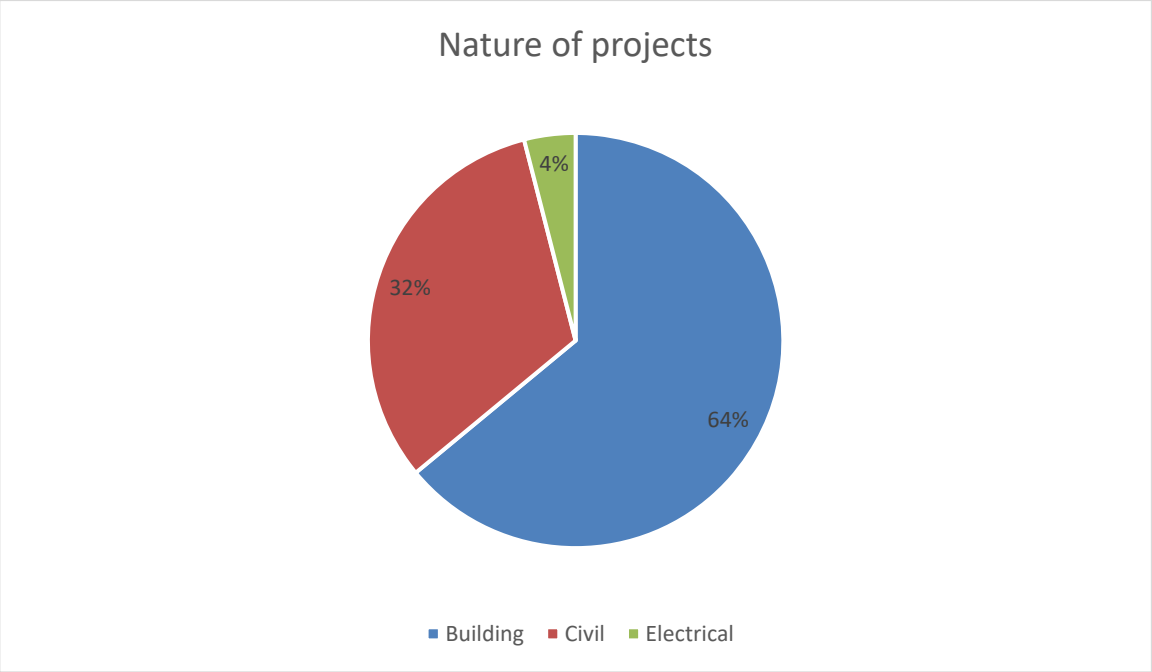
| Project duration | Respondents | Percentage |
|---|---|---|
| 2 -6 yrs | 19 | 76% |
| 6 – 10 yrs | 6 | 24% |
| TOTAL | 25 | 100% |



Out of twenty five responses, 74% of respondents were involved in projects with duration of 2-6years and 24% were invloved in projects with duration of 6-10years.

4.2.1g Nature of projects

| Nature of project | Respondent | Percentage |
|---|---|---|
| Building | 16 | 64% |
| Civil | 8 | 32% |
| Electrical | 1 | 4% |
| Total | 25 | 100% |




Most of the respondents specialises in Building projects at (64%) of the sample, followed by respondents specialising in Civil works at (32%) and lastly was Electrical at (4%).

## 4.3. Section 2: Data Analysis: Magnification of endemic problems in implementation of mega projects in South Africa

In section 2 of the questionnaire, presents the views of the participants on the extent of the magnification of the endemic problems in mega construction projects versus the normal projects. This section will present the findings of the respondents which are classified as follows:

- Endemic problems
- Peculiarities of Mega Projects
- Magnified problems
- Competency

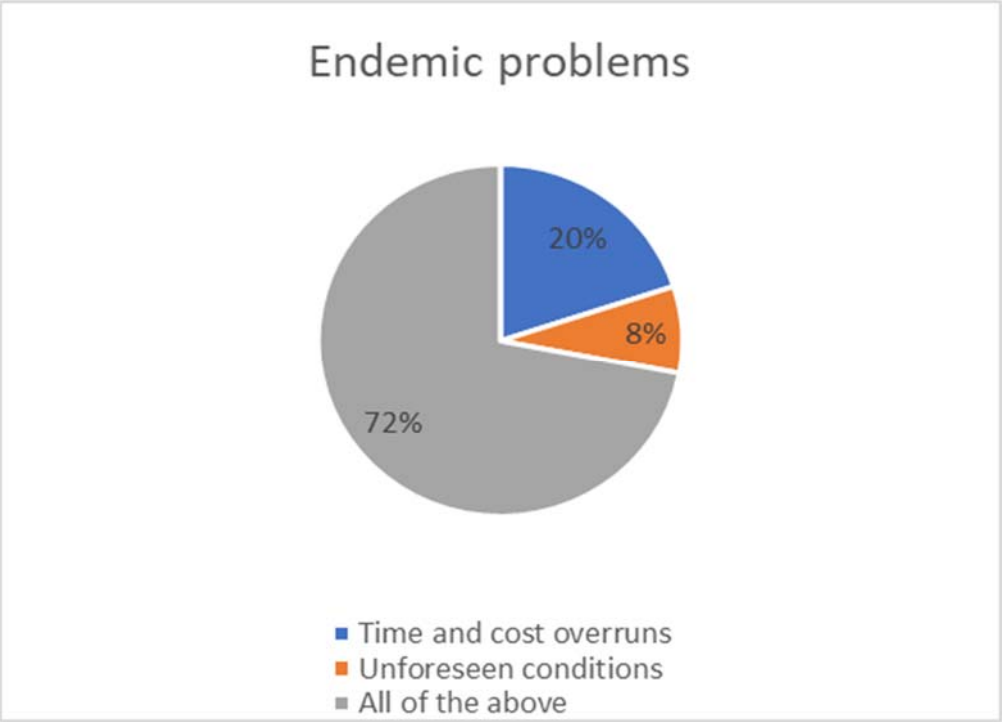
### 4.3.1. Endemic problems

Many of the participants in the research agreed with the endemic problems identified in mega projects and normal projects as they have been involved and have experience in both the mega construction projects and normal projects. Many participants agreed with all the identified endemic problems in mega construction projects and normal projects and that these problems are experienced at execution stage.

Eighteen out of twenty-five participants agreed that all the identified problems are common in mega projects and normal projects, 5 participants identified time and cost overruns and 2 participants identified common problems as unforeseen risk management. Seventeen out of twenty -five participants responded that these problems are experienced at execution stage whereas 8 participants identified all the stages of the project.

Table 4.3.1a: Endemic problems

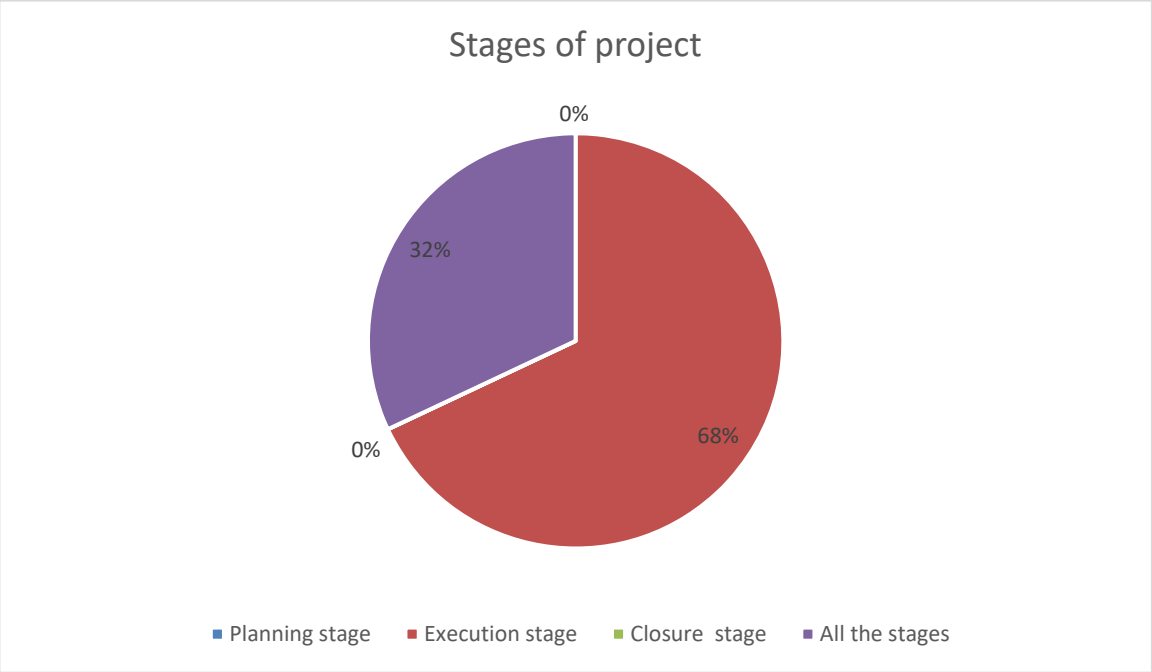
| Endemic problems | Respondents | Percentage |
|---|---|---|
| Time and cost overruns | 5 | 20% |
| Unforeseen risk management | 2 | 8% |
| Stakeholder mis management | 0 | 0% |
| All the above problems | 18 | 72% |
| Total | 25 | 100% |




Seventy-two percent of the respondents concured that all the identified endemic problems are experinced in MCP and normal projects, followed by 20% of respondents agreed with time and cost overruns and lastly 8% identified with unforeseen risk management as the endemic problems between MCP and normal projects.

Table 4.3.1b: Project stages with identified problems

| Project stages | Respondents | Percentages |
|---|---|---|
| Planning stage | 0 | 0% |
| Execution stage | 17 | 68% |
| Closure | 0 | 0% |
| All the above | 8 | 32% |
| TOTAL | 25 | 100% |




Sixty-eight percent of respondents identified the execution stage as the stage where identified problems manifest and lastly 32% says all the identified problems manifest in all the above-mentioned stages of a project.

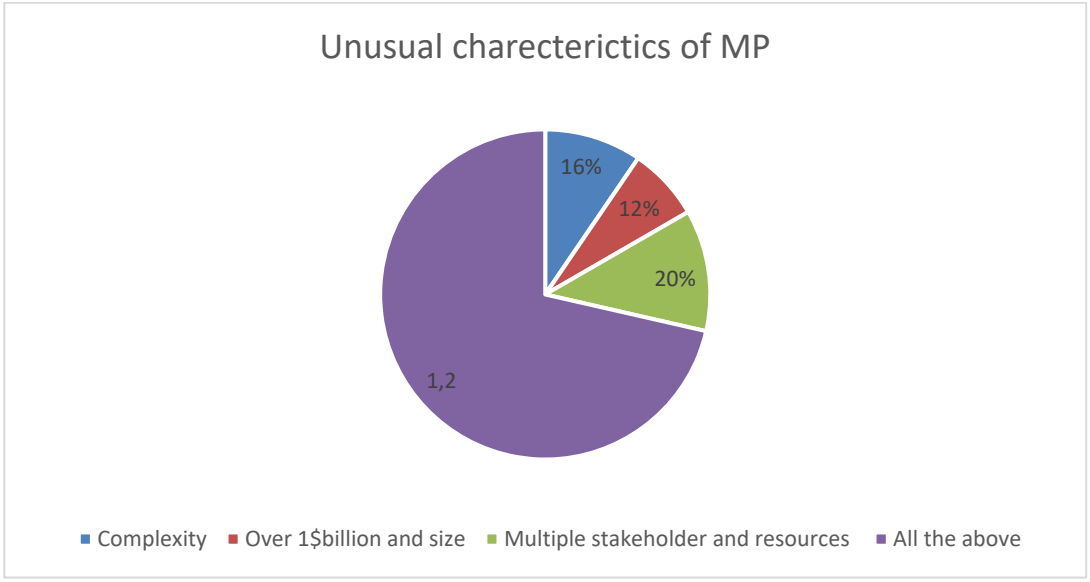
### 4.3.2. Peculiarities of Mega projects

Many of the participants agreed with the identified peculiar characteristics of mega projects and reasons behind mega construction projects in South Africa.

Some participants acknowledged the multiple stakeholder and human resource management, 4 participants acknowledged complexity and 1 participant acknowledged over $1billion and size. Many participants acknowledged that socio and economic development, infrastructure backlog and political decision are the reasons behind mega construction projects.

Table 4.3 2a: Unusual characteristics of MP

| Unusual characteristics of MP | Respondents | Percentage |
|---|---|---|
| Complexity | 4 | 16% |
| Over 1$billion and size | 3 | 12% |
| Multiple-stakeholder and resources | 5 | 20% |
| All the above | 13 | 52% |
| TOTAL | 25 | 100% |



Out of twenty-five responses, 52% agreed with all the identified unusual characteristics of MP, followed by 20% that pointed out multi-stakeholder and resources, 16% chose complexity and lastly 12% agreed with over 1$billion and size.

### 4.3.3. Magnified problems in MP and normal projects

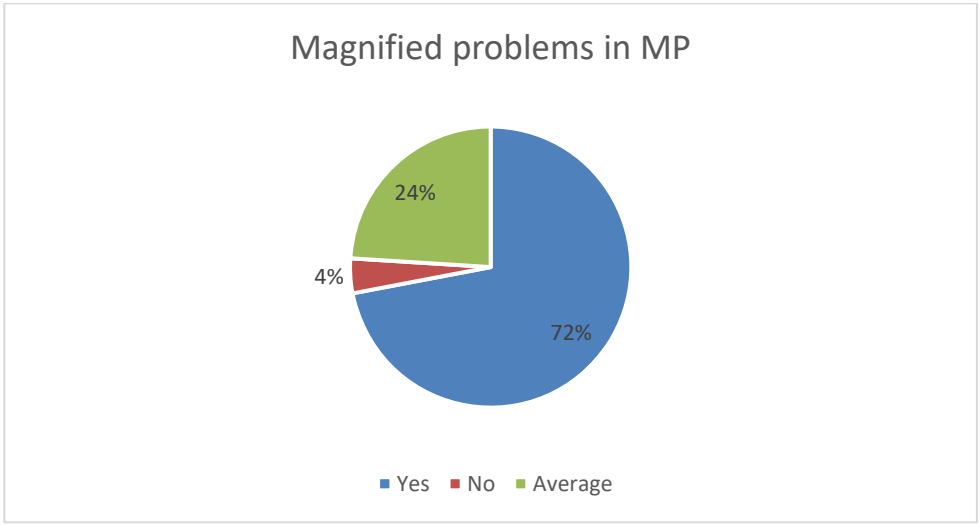
Many participants in the research agreed that the identified common problems are both magnified in mega projects and normal projects. Endemic problems are more magnified in MP rather than normal projects. The extent of magnification of these problems will lead to more than 50% of the initial time and cost overruns in MP and less than 50% in normal projects.

Seventy-two percent of the participants agreed that the common problems are magnified in mega projects, 24 participants stated that the magnification is average, and 4% respondents did not agree. Many participants stated in their own words that the cost and time overruns in mega projects are more than *double to triple which causes delay in the delivery of project objectives. Participants R1, R3, R5-R8 stated that mega projects cost overruns are exceedingly high and exceed the allocated budget for the financial year in GDHS. To accommodate these projects in terms of budget, it requires the Department t phase them into smaller portions which frustrates the Developers.*

Some of the participants acknowledged all three levels as project failure, time and cost overruns and project rejection as the level magnification in mega projects, few participants mentioned that common problems caused project rejection in mega projects.

Table4.3.3a: Magnified problems in MP

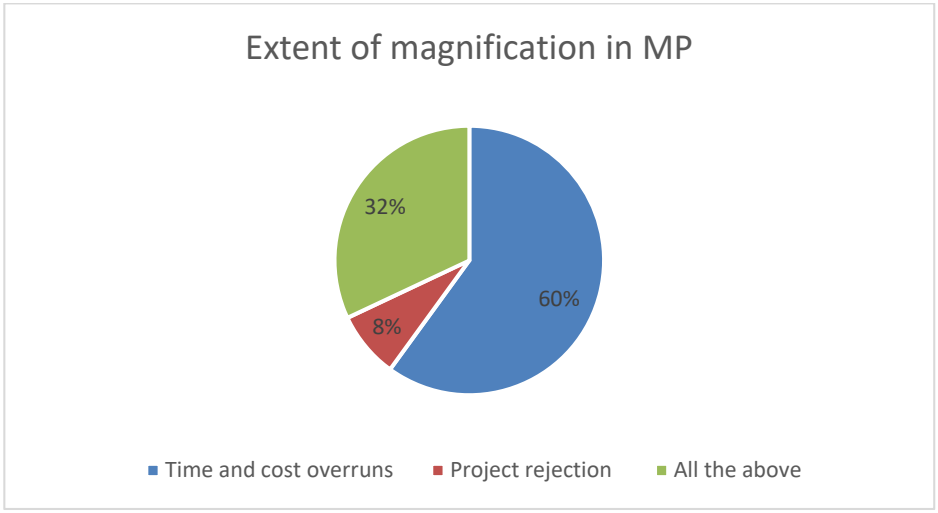
| Magnified problems in MP | Respondents | Percentage |
|---|---|---|
| Yes | 18 | 72% |
| No | 1 | 4% |
| Average/Moderate | 6 | 24% |
| TOTAL | 25 | 100% |




Seventy- two percent of the respondents concur that the identified problems are magnified in MCP, followed by 24% respondents that says these problems are average (meaning moderate) and lastly 4% of respondents do not agree with identified problems as magnified in MCP.

Table 4.3.3b: Extent of magnification in MP

| Extent of magnification | Respondents | Percentage |
|---|---|---|
| Project failure | 0 | 0% |
| Cost and time overruns | 15 | 60% |
| Project rejection | 2 | 8% |
| All the above | 8 | 32% |
| TOTAL | 25 | 100% |



Out of twenty- five respondents, 60% identifies cost and time overruns as the level of magnification in MCP, followed by 32% that says all the above mentioned are the extent of magnification and lastly 8% that identifies project rejection.

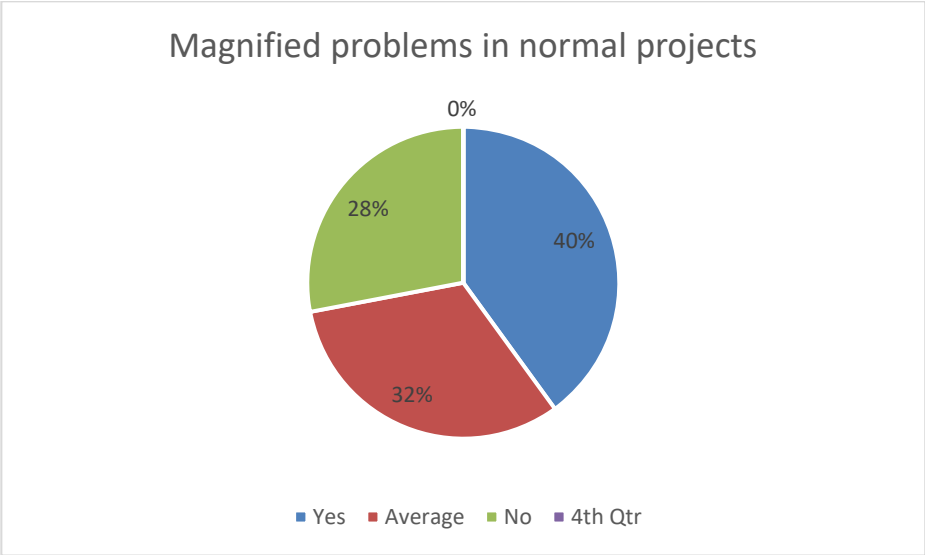
**Magnified problems in normal projects**

Ten participants agreed to common problems being magnified in normal projects to the level. Eight participants agreed to average of magnification of these common problems in normal projects and seven participants did not agree that the common problems are magnified in normal projects. Majority of the participants were in general agreement that cost, and time overruns were *less magnified in normal projects as they would not exceed 50% of the initial budget and time of the project. Respondents R1-R8 stated in their own words that the cost and time overruns in normal projects are less magnified as they get to be less than 50%. In GDHS, RDP projects cost overruns are more by 10% of the initial project cost when including variation orders. In some cases, due to less expenditure and delivery of projects, budget is returned to National Treasury.*

Few participants agreed that all the problems encountered in normal projects caused cost and time overruns, project failure and project rejection.

Table 4.3.3c Magnified problems in normal projects

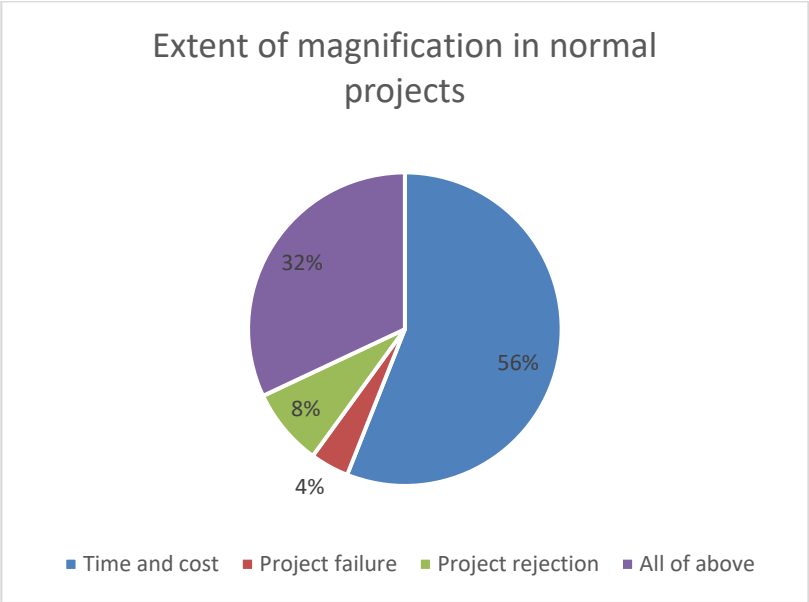
| Magnified problems in normal projects | Respondents | Percentage |
|---|---|---|
| Yes | 10 | 40% |
| No | 7 | 28% |
| Average /Moderate | 8 | 32% |
| TOTAL | 25 | 100% |




Forty percent of respondents says identified endemic problems are magnified in normal projects, followed by thirty-two percent of respondents says the problems are moderate and lastly 28% says the identified problems are not magnified.

4.3.3d Extent of magnification in normal projects

| Extent of magnification in normal projects | Respondents | Percentage |
|---|---|---|
| Project failure | 1 | 4% |
| Cost and time overruns | 14 | 56% |
| Project rejection | 2 | 8% |
| All the above | 8 | 32% |
| TOTAL | 25 | 100% |



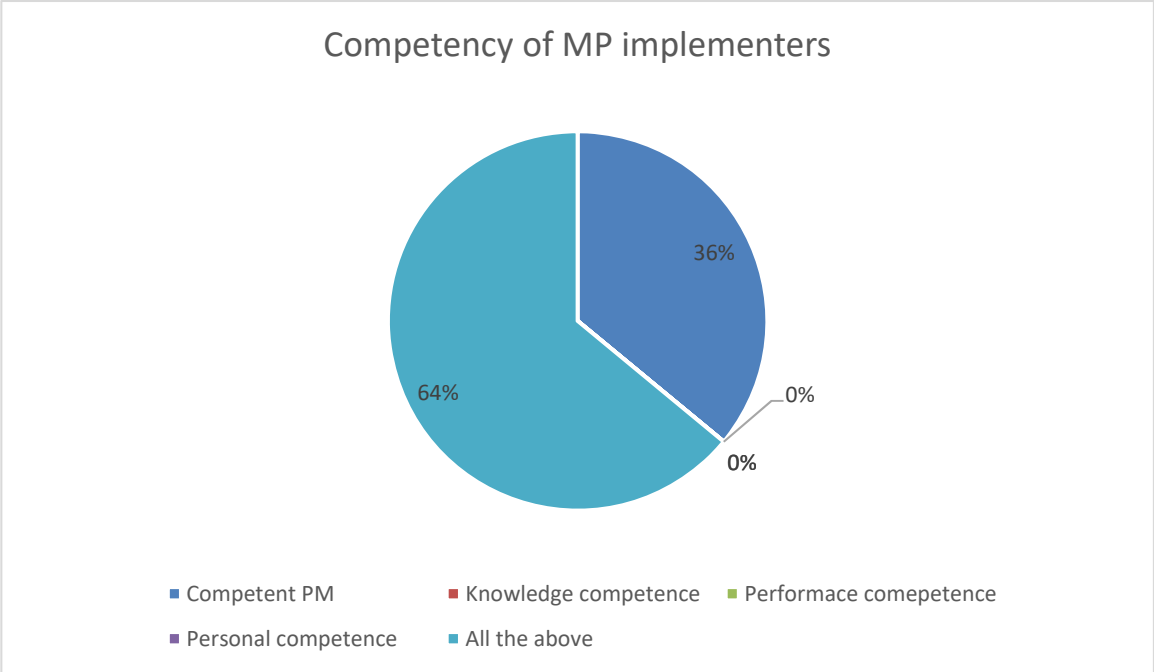

Fifty-six percent of respondents identifies cost and time overruns as the extent of magnification in normal projects, followed by 32% of those who says all the above are the level of magnification, whereas 8% of respondents identifies project rejection and lastly 4% agrees with project failure.

### 4.3.4. Competency

Many of the participants agreed that Private Public Partnerships (PPPs) are implementers of mega projects and that the competencies of a mega project implementer should be a competent project manager, knowledge, performance and personal competencies. Many participants have a view that South African Construction Industry has competent mega project implementers and that the successful delivery of mega projects will improve in South Africa.

Table 4.3.4a: Competency of MP implementers

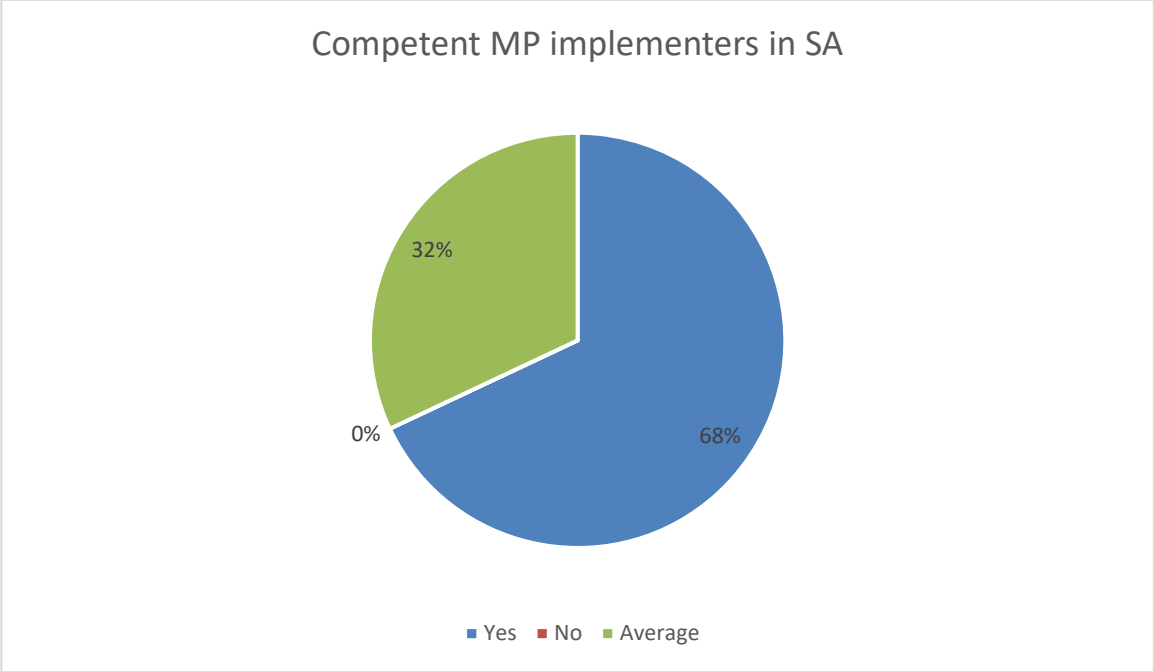
| Competencies of MP implementers | Respondents | Percentages |
|---|---|---|
| Competent PM | 9 | 36% |
| Knowledge competence | 0 | 0% |
| Performance competence | 0 | 0% |
| Personal competence | 0 | 0% |
| All the above | 16 | 64% |
| TOTAL | 25 | 100% |




Out of twenty-five responses, 64% of respondents says all the above makes are competencies of a MP implementer and lastly 36% of respondents agree with competent PM to be competency of MP implementer.

Table 4.3.4b: Competent MP implementing in SA

| Competent MP implementers in SA | Respondents | Percentages |
|---|---|---|
| Yes | 17 | 68% |
| No | 0 | 0% |
| Average/Moderate | 8 | 32% |
| TOTAL | 25 | 100% |




Sixty-eight percent of the respondents says South Africa has competent PM and 32% says South Africa has moderate competent PM.

**Table 4.3 Summary of data collected Section 2**

| | |
|---|---|
| Theme 1: Endemic problems<br>(Question 11 and 12) | • 18 out of 25 participants agreed to all common problems identified in mega and normal projects<br>• 5 out of 25 participants agreed to time and cost overruns,2 participants agreed to unforeseen risk management. |

| | |
|---|---|
| | • 17 out of 25 participants agreed that these problems occur at the execution stage.<br>• 8 out of 25 participants acknowledged that these problems occur in all the stages of a project. |
| Theme 2: Peculiarities of mega projects<br>(Question 13 and 14) | • 13 out of 25 participants agreed that complexity, over $1billion, multiple stakeholder and human resource involvement are the peculiar characteristics of a mega project.<br>• 4 out of 25 participants acknowledged complexity, 5 acknowledged multiple stakeholder and 3 acknowledged over $1billion and size.<br>• 15 out of 25 participants agreed to socio and economic development, addressing infrastructure backlog and political decision as the reasons behind mega construction projects in South Africa.<br>• 4 out of 25 participants agreed to socio and economic development, 5 agreed to infrastructure backlog and 1 agreed to political decision. |
| Theme 3: Magnified problems<br>(Question 15 – 18) | • 18 out of 25 participants agreed to common problems being magnified in mega projects by more than *50% of the initial cost and time overruns that will cause delay in delivery of the project*, 6 participants agreed to these |

| | |
|---|---|
| | problems being average and 1 participant did not agree.<br>• 15 out of 25 participants agreed that the level of magnification caused by these problems in cost and time overruns would be *double or more.* 8 participants agreed to project failure, time and cost overruns and project failure to be the extent of magnification and 2 participants agreed to the rejection of the project.<br>• 10 out of 25 participants agreed that common problems are magnified in normal projects, 8 participants agreed to these problems being average and 7 did not agree.<br>• 14 out of 25 participants agreed that the level of magnification caused by these problems would be less than *50% of time and cost overruns* in normal projects. 8 participants agreed to project failure, time and cost overruns and project failure to be the extent of magnification and 2 participants agreed to the rejection of the project,1 participants agreed to project failure. |
| Theme 4: Competency<br>(Question 19 – 22) | • 19 out of 25 participants agreed that Private Public Partnership are the implementers of mega projects, 6 participants agreed to public sector being the implementer of mega construction projects.<br>• 16 out of 25 participants agreed to competencies of a mega project implementer |

| | |
|---|---|
| | should be a competent project manager, knowledge, performance and personal competencies, 9 participants agreed to competent project manager.<br>• 17 out of 25 participants agreed that South African Construction Industry has competent mega project implementers, 8 participants agreed to having moderate competent mega project implementers.<br>• 23 out of 25 participants agreed that the successful delivery of mega projects will improve in South Africa, 2 participants agreed that it is moderate. |

In section 2 of the data collected pertaining to the four identified codes of the study, demonstrates that majority of respondents are in cognisant of mega construction projects implemented in South Africa and the endemic problems that they bring especially at the execution stage. Data collected demonstrates that the all respondents are concurring with the multiple stakeholders, multiple human resources, complexity as characteristics of mega projects in South Africa. The identified endemic problems are magnified *double or more in cost and time overruns that will cause delay to meet the project objectives* in mega construction projects. In normal projects the problems are less magnified as the cost and time overruns are *less than 50% of the initial project cost and period* in South Africa. Finally, responses form the respondents were in general agreement that PPP within the South Africa Construction Industry has a potential of implementing successful MP.

# CHAPTER 5: DISCUSSION

This chapter discusses the findings from the data analysis in Chapter 4 and connect it to the literature review in Chapter 2.

The research study is set out to investigate the extent of the magnification of the endemic construction industry implementational problems in the context of mega projects versus normal projects. Our findings suggest that endemic construction industry problems are magnified in MP versus normal projects.

The study is based on four objectives which are as follows

i) To identify the common endemic problems in mega construction projects and normal projects in South Africa
ii) To investigate the peculiarities of implementing mega construction projects in SA
iii) To assess levels of magnification of the common problems encountered in mega projects and ordinary projects
iv) To analyse the competencies of the implementers of mega construction projects.

## 5.1. Identify the common endemic problems in mega construction projects and normal projects

All respondents demonstrated by their responses that they are fully aware of the implementational problems in the context of mega projects and normal projects. Many participants agreed to time and cost overruns, stakeholder mismanagement/ social cultural issues and unforeseen risk management as the common problems in the implementation of mega projects and normal projects.

(Le-Hoai, Lee & Lee, (2008), Flyvberg 2014, Westhuizen (2007) and McKenzie n.d) agree on the notion that mega projects expose two main concerns which are time delays and cost overruns. Latest studies (Lenfle & Lonch (2015), Othman (2013), Khatleli (2016) and Kennedy et al (2014) concur that stakeholder mismanagement is a problem in mega construction projects due to their size and

complexity. (Kennedy, et al., 2014) states that lack of integrated governmental relations and multi stakeholder engagement will add to the failures of mega construction projects. According to (McKenzie n.d, Khatleli (2016) and Westhuizen (2007) agree that unforeseen events are a concern that leads to delay of mega projects. South African study conducted by (Mbachu and Nkado, 2007) categorises time and cost overruns, stakeholder mismanagement and unforeseen conditions as uncontrollable (external) constraints in normal projects which are not risky(NR).

Various studies conducted, and data collected have display the identified endemic problems between mega projects and normal projects as the problems leading to mega construction failure. The data collected, and latest literature reviewed concur to the identified common problems in the implementation of mega construction projects and normal projects. The nature of mega construction projects which is complex and enormous makes it prone to endemic problems.

## 5.2. Investigate the peculiarities of implementing mega projects in South Africa

Many participants demonstrated with their responses that complexity, enormity and involvement of multiple stakeholders are the peculiarities that differentiates mega projects from normal projects

'Mega projects as large – they take many years to develop and build, they involve multiple public and private stakeholders, they are transformational, and impact millions of people' (Flyvbjerg, 2014:3). Flyvbjerg (2014) further states that MP's are a completely different bread of projects in terms of their level of aspiration, lead times, complexity and stakeholder involvement. Khatleli (2016), Westhuizen (2007) indicate that mega projects are mostly linked with a need and are seen to be beneficial to the public in terms of socio-economic development when implemented like Medupi power station and Gautrain.

Based on the literature review and findings above assumed that Mega projects are peculiar due to their unusual characteristics. South Africa like most developing countries adopted mega construction projects to address its infrastructure upgrade, housing backlog and other country's needs. Unusual characteristics of MP in South Africa have an element of the above-mentioned characteristics with community unrest(strikes) and project rejection.

## 5.3. Assess levels of magnification of the common problems encountered in ordinary projects

Mega construction projects have been implemented in developing countries in the past years with the aim of addressing economic and social growth. In a case of South African government, Department of Human Settlement has adopted mega construction projects to address the housing backlog after the 1994. Normal projects have been implemented however these projects do not seem to close the socio - economic gap that the country seeks to achieve and address the 1994 housing backlog. Achieving a project involves project life cycle which is as follows: initiation, planning, implementation and closeout. In a case where any of the project life cycle stages are compromised will result in an unsuccessful project.

As per the study research results of theme 3: magnified problems, many participants agree that the common problems that have been identified are less magnified in normal construction projects. Several participants demonstrate that these endemic problems are magnified *less than 50% in terms of cost and time overruns*.

Participants *R1, R2, R3 – R8 stated cost and time overrun in normal projects are less than 40% of the project and within the 10% of the project variation. In GDHS, RDP projects which are implemented in a one financial year do not exceed 10% in cost overruns. The budget of these projects ends ups returned to National Treasury due to non-expenditure and delivery of project objectives*.

According to Mbachu and Nkado (2007) problems that are rated Risky and contributes to project failure or delay in normal projects are listed as project characteristics which refers to the level of technology, service providers being consultants and contractors that influence technical and managerial competencies and finally client organisational influences which refers to poor scope definition and variations.

Findings demonstrates that the level of magnification for time and cost overruns in normal projects is less than 50%. Normal projects are less complex and use designs which makes them easy to manage and complete successfully.

Mega projects are complex and enormous, the bigger the size of the project the more it is prone to problems which will be magnified. Due to the multiple resources and stakeholders that are required in mega construction projects, the endemic problems are magnified. Findings demonstrates that time and cost overruns are more than 50% of the planned cost and time. Literature further reveals that in MP corruption is extreme and halt of projects. According to (Flyvbjerg, 2014) cost escalate between 50-100% of the initial project estimations due to the delays of unforeseen conditions and lack of stakeholder management.

## 5.4. Analyse the competencies of the implementers of mega construction projects

Many participants agree that implementers of mega construction projects are competent due to the Private Public Partnerships (PPPs). Several participants agree that competencies of the implementer should be a competent project manager, knowledge, performance and personal competency.

PMI (2008) states that three dimensions of competencies which are knowledge, performance and personal. Udo and Koppensteiner (2004) emphasises the knowledge like general management skill (leadership, communication etc) personal attributes like personal characteristics (can-do attitude, confidence etc) that a competent PM must have. (B2Bnews) states and defines ten project management success metrics to be achieved by a competent PM. A competent project manager is key as they bring project management knowledge and personal behaviour to deliver a project as per the stakeholder's requirements or expectations (PMI,2008). "A project organisation which lays out the responsibilities and tasks of the project team as well as the communication and coordination between multiple stakeholders is vital" (Baba, Makhdumi, Farrukh, 2017).

Flyvberg (2004) states that mega projects are entirely unique projects to manage. Mega construction projects involve international construction joint ventures (ICJVs) which is more complex than a company of a single contractor. Mega construction projects like FIFA world cup stadiums and Gautrain have demonstrated competency of implementers as they were finally

completed regardless of the ICJVs partners and incorrect information / unforeseen conditions that led to cost and time overruns.

South African Construction Industry has a potential of improving and to be fully competent mega construction implementers due to the track record and various projects that have been delivered as a country. Taking lessons from previous problematic problems will assist in minimising project failure.

# CHAPTER SIX: CONCLUSION

In this section of the study, firstly a brief conclusion will be presented mainly on the objectives of the study which are as follows: (i) identify the common endemic problems in mega construction projects and normal projects in South Africa (ii) investigate the peculiarities of implementing mega construction projects in SA (iii) assess levels of magnification of the common problems encountered in mega projects and ordinary projects (iv) analyse the competencies of the implementers of mega construction projects and secondly propose recommendations for the future research studies.

## 6.1. Identify the endemic problems in mega construction projects and normal projects in South Africa.

The identified endemic problems as time, cost overruns, stakeholder mis management and unforeseen conditions have been identified by various authors (Flyvbjerg,2014; Khatleli,2016; Westhuizen, 2007; Mbachu and Nkado, 2007 and Lenfle and Loch, 2015). With reference to the findings

of this research, it is revealed that the endemic problems as being encountered in both normal and mega projects. The highest ranked problem was cost and time overruns in both normal and mega projects. Findings reveal that the identified common problems have been encountered in both mega construction and normal projects during the implementation stage. Findings further reveal that endemic problems in MCP have instigated into excessive time and cost overruns compared to normal projects which delays the completion within the set time and budget.

Thorough cost estimates that will include developing realistic cost estimate models can overcome the excessive cost overruns. Government needs to properly quantify mega projects over its entire life cycle and properly plan to deliver within the reasonable and realistic timeframes. Thorough multiple stakeholder engagement is key and sustain their support during the project life cycle through good communication and diplomacy to minimise problems.

## 6.2. Investigate the peculiarities of implementing mega construction projects in SA

Mega construction projects are peculiar due to their big scale of delivery, cost over $1billion and transformation of landscape. Gauteng Human Settlement has adopted mega housing to fast-track the housing delivery backlog. Mega housing projects are to bring sustainable integrated human settlements that are closer to economies. Most of the available greenfield land to accommodate

these mega housing projects are on the urban edge which disadvantages the idea of bringing people closer to amenities and job opportunities. Several mega housing projects have been built like N2 Gateway, Cosmo City etc. Mega projects bring large scale of economies.

Due to the enormity of mega construction projects and involvement of multiple stakeholders, comprehensive planning, effective project management and co-ordination is essential. Strengthening of inter-governmental relations is essential to delivering successful MCP's as per the mandate of Gauteng Department Human Settlement to "building cohesive, sustainable and caring communities with improved access to work and social amenities, including massive infrastructure development with enormous commercial, industrial components featuring schools, sports and recreation facilities, hospitals and transport hubs"(Writer, 2018).GDHS should invest in acquiring land that is closer to job opportunities to achieve integrated mega cities and sustainable human settlement (Shane, et al., 2009).

## 6.3. Assess levels of magnification of the common problems Encountered in mega projects and ordinary projects.

Due to the nature of mega projects being complex, enormous, transformational and impacting millions of people, the extent of the endemic problems in the implementation of MCP's is magnified. Findings reveal that the extent of magnification of time and cost overruns in MCP's are exorbitant as they are *double and more the initial project cost and period* that delays the projects from meetings its objectives. In normal project the extent is less magnified *which is less than 50% of the initial project cost and period* which does not drastically affect the completion of a project. Literature revealed the same pattern of excessive cost and time overruns in several MCP's and less on ordinary projects which contributes about 33% (Mbachu and Nkando, 2007).

Literature further reveals that that understanding and realisation of external factors in the planning phase of the project is key to develop strategies to attend to them (Shane, et al., 2009). The findings further reveal that the endemic problems are magnified in MCP's as their successful rate is low.

## 6.4. Analyse the competencies of the implementers of mega construction projects

Success of a project does not only depend on proper planning and organisation of a project. It also is dependant of the competency of the project implementors. Mega projects involve multi stakeholders and international construction joint ventures(ICJVs) which will require competent personnel to manage and coordinate to ensure delivery of the project objectives. PMI states that a competent project manager is vital with project management knowledge and personal behaviour to deliver stakeholders expectations. The study and literature reveal that all the competencies mentioned in the PMI are key for mega project implementers. A competent project manager should be involved in the early/ planning stages of the project.

South Africa has a greater chance of improving to achieve successful delivery of MCPs if it enforces the PPP, inter-governmental and departmental relations and the society. (GPF, n.d) concurs that

strong partnership with private sector, labour and rest of society will help in the government's efforts to deliver the Mega Cities vision.

Literature review further reveals that early involvement of contractors in the planning phase of a project permits them to participate in the design process, planning and become familiar with the site conditions (National Academy Press n.d).

## 6.5. Recommendations

Based on this study, it can be determined that the identified endemic construction industry problems are encountered in both mega and ordinary projects during the implementation stage, it is further acknowledged in the finding that the cost and time overruns problem is highly magnified in MP versus normal projects. Unforeseen conditions are another factor that leads time and exorbitant cost overruns in South Africa.

Findings based on the respondents, has revealed excessive cost and time overruns due to unforeseen conditions as critical factor that impedes MP in South Africa. An in-depth cost estimate at the planning stage of projects is minimal. This can be accomplished by developing realistic cost estimate model / tool that can overcome the excessive cost overruns. This proposed tool can be utilised at the planning stage of a project to identify and plan all possible unforeseen conditions to maximise all possibilities to meet project objectives within the set time and cost.

To remedy stakeholder mismanagement, it is recommended that South African Government enforces integrated governmental relations and community engagement through constant consultation to meet project objectives.

## 6.6. Areas for future research

The current study was undertaken to fill in a gap pertaining to identifying and investigating the extent of magnification of construction industry problems with the implementation of mega projects versus the normal projects.

Future research could embark on further investigating the magnification of problems encountered in mega projects versus the normal project as this study may have not reflected all aspects of magnification due to limited time and case studies.

Further study on intense project planning in implementation of mega construction projects. The purpose of project planning involves clear definition including the clarification of scope, resources, responsibilities, and plans. This activity is dedicated to establishing a firm foundation and planning the work to be done. Thorough project planning with risk mitigation plans for unforeseen events and conditions should be fully researched as these unforeseen conditions are one of the main problems that lead to time and cost overruns of mega projects.

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# 8. ANNEXURE 1 - QUESTIONNAIRRE

**RESEARCH STUDY QUESTIONNAIRE: MAGNIFICATION OF ENDEMIC PROBLEMS WITH IMPLEMENTATIN OF MEGA PROJECTS IN SOUTH AFRICA.**

**BY: PEARL MOALUSI**

**PARTICIPANTS PROFILE**

1. Do you give the consent to participate in the questionnaire?
   *Select one*

a) Yes
b) No

2. Please indicate your job title

a) Construction Manager
b) Registered Project Manager(SACPCMP)
c) Not Registered Project Manager
d) Consulting engineer

3. Please indicate relevant experience in the current position

a) Less than 5 years
b) 5 – 10 years
c) 10 – 20 years
d) More than 20years

4. Does your company do work for public or private sector

a) Public

b) Private

c) Both

5. Indicate the number of mega projects you have been involved in over the last 5years?

(Mega projects defined to be over $1billion)

a) 1 – 3
b) 3 – 6

6. Indicate the number of normal projects you have been involved in over 5years?

(Normal projects defined to be less than 10 million rand)

a) 1- 3
b) 3- 6

7. Did the mega project indicated above experienced any problems?
a) Yes
b) No

8. Did the normal projects indicated above experienced any problems?
a) Yes
b) No

9. What was the duration of the projects
a) 2 – 6yrs
b) 6 – 10yrs
c) 10 – 15yrs

10. What was the nature of these projects (mega and normal)
a) Building
b) Civil
c) Electrical
d) Other

**SECTION 2: MAGNIFICATION OF ENDEMIC PROBLEMS IN IMPLEMENTATION OF MEGA PROJECTS IN SOUTH AFRICA.**

11.2 *Select one*

11.2.1 What are the common problems identified in mega and normal projects

a) Time and cost overruns

b) Stakeholder Mismanagement/ Socio Cultural issues

c) Unforeseen risk management

d) All of the above

e) None of the above

12. What stage of construction are these problems identified

a) Planning Stage

b) Execution stage

c) Closure

d) All of the above

e) None of the above

13. What are the unusual characteristics of mega projects?

a) Complexity

b) Over $1billion and size

c) Multiple stakeholder and human resource involvement

d) All of the above

14. What are the reasons of implementing mega projects in South Africa?

a) Socio and economic development

b) Address infrastructure backlog

c) Political decision

d) All of the above

15. Are the identified common problems magnified in mega projects?

a) Yes

b) No

c) Average

_____

_____

16. What is the level of magnification of the common problems encountered with implementation of normal projects?

a) Project failure

b) Cost and time overruns

c) Project rejection

d) All of the above

_____

_____

17. Are the identified common problems magnified in normal projects?

a) Yes

b) No

c) Average

18. What is the level of magnification of the common problems encountered with implementation of normal projects?

a) Project failure

b) Cost and time overruns

c) Project rejection

d) All of the above

_____

_____

19. Who are the implementers of mega projects?

a) Public Sector

b) Private sector

c) Private Public Partnership

d) None of the above

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20. What are the competencies of a mega project implementer?

a) Competent project manager

b) Knowledge competence

c) Performance competence

d) Personal competence

e) All of the above

21. Does South African Construction Industry have competent mega project implementers?

a) Yes

b) No

c) Average

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22. Will the successful delivery of mega projects improve in South Africa?

a) Yes

b) No

c) Average

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# 9. ANNEXURE 2 – ETHICS CLEARANCE