UNIVERSITY OF KWAZULU-NATAL

Factors constraining the planning and design process for public health construction projects in KwaZulu-Natal, South Africa

By

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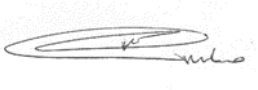
Signed:  04 March 2022

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Abstract

This study investigated the factors that constrain the planning and design process for Public Health construction projects in KwaZulu-Natal, South Africa. Preliminary studies showed that in the KwaZulu-Natal Department of Health, 63% of capital projects overrun their time allocation for the planning and design stages. This resulted in a number of delays in the construction of public health projects. The planning and design stages consist of the project scope definition, concept and design development and documentation of the design. The structure of the project team of the construction projects consists of three groups of experienced Built-Environment Professionals; Department of Health, Department of Public Works and consultants.

A qualitative research method was selected for this study. The study used the semi-structured interviews and a purposive sampling to select respondents. Fifteen experienced professionals who have undertaken public health construction projects in KwaZulu-Natal and had experience with the planning and design process were interviewed. A thematic analysis of data was chosen for this study. This analysis identified eight themes under which findings were discussed. These themes were project appraisal system, definition of project scope, project types, construction procurement, collaboration and communication, training and development, project leadership and technical policies and standards.

The study found deficiencies in the definition project scope, delays in the appraisal of project planning and design deliverables, poor construction procurement practices, ineffective stakeholder collaboration and communication. The study recommends the review of the project appraisal committees with a view to eliminate duplicated process steps. It further recommends the improvement to construction procurement practices to improve the quality and schedule in the appointment of consultants. Training and development is essential in improving skills in the scope definition, procurement and practices of project management. Improvement in the collaboration and communication amongst stakeholders is necessary for enhanced information flow and effective teamwork.

Key words: health infrastructure, project management, project planning and design, project appraisal, project delays

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List of Acronyms and Abbreviations

AIP	Annual Implementation Plan
BSC	Bid Specification Committee
CIDB	Construction Industry Development Board
CCPM	Critical Chain Project Management
CPM	Critical Path Method
DB	Design-Build
DBB	Design-Bid-Build
DOH	Department of Health
DOPW	Department of Public Works
DRC	Design Review Committee
ECI	Early Contractor Involvement
EPC	Engineering-Procurement-Construction
EVM	Earned Value Model
FIDPM	Framework for Infrastructure Delivery and Procurement Management
HIAC	Health Infrastructure Approval Committee
IDMS	Infrastucture Delivery Management System
ISO	International Standards Organisation
IUSS	Infrastructure Unit Support Systems
KZN	KwaZulu-Natal
FIDPM	Framework for Infrastructure Delivery and Procurement Management
NHI	National Health Insurance
PERT	Project Evaluation and Review Technique
PMBoK	Project Management Body of Knowledge
PMIS	Project Management Information System
SIPDM	Standard for Procurement and Delivery Management
TOC	Theory of constraints
WBS	Work Breakdown Structure

Definitions of Concepts

Concepts	Definition
Buffer	See *Reserve*
Critical Path	The sequence of activities that represents the longest path through a project, which determines the shortest possible duration (PMI, 2017).
Earned Value Management	A methodology that combines scope, schedule, and resource measurements to assess project performance and progress (PMI, 2017).
Gate (Control gate)	A control point at the end of a process where a decision is required before proceeding to the next process or activity (Treasury, 2019).
Gateway review	An independent review of the available information at a gate upon which a decision to proceed or not to the next stage process is based (Treasury, 2019).
Implementer	An organ of state that is responsible for the implementation of projects or programmes on behalf of another organ of state (Treasury, 2019).
Infrastructure Alignment Model	A model which encourages project delivery through a multi-year funding of a planning, design, tender, implementation and close-out process of a project thus mitigating underspending of infrastructure budgets (Treasury, 2006).
National Health Insurance	A financing system that will provide all citizens of South Africa with essential healthcare, regardless of their employment status and ability to make a direct monetary contribution to the NHI Fund.
Network Diagram	A graphical representation of the logical relationships among the Project Scheduled activities (PMI, 2017)
Package	Work grouped together for delivery under a single contract or an order (Treasury, 2019)
Principal Agent	A professional service provider appointed by the client to perform a project coordination function.
Process Groups	A logical grouping of project management processes to achieve specific project objectives (PMI, 2017)
Project	A unique set of processes consisting of coordinated and controlled activities with start and end dates, performed to achieve the project objective (Treasury, 2019)
Project Brief	A Project Initiation Report that provides the definition of work to be done including the budget and quality parameters

Project Leader / Manager	The person assigned by the performing organization to lead the team that is responsible for achieving the project objectives (PMI, 2017)
Project life cycle	A management process that the project undergoes from the initiation stage to the close-out stage
Project Phase	A collection of logically related project activities that culminates in the completion of one or more deliverables (PMI, 2017)
Project Schedule	An output of a schedule model that presents linked activities with planned dates, durations, milestones, and resources (PMI, 2017)
Project Scope Statement	The description of the project scope, major deliverables, assumptions, and constraints (PMI, 2017)
Project Stage	*See project phase*
Programme	A grouping of a set of related projects arranged in order to deliver outcomes and benefits related to strategic objectives which would have not been achieved had the projects been managed independently (Treasury, 2015).
Quality	The degree to which a set of inherent characteristics fulfill requirements (PMI, 2017)
Reserve	A contingency allowance for the cost and schedule management (PMI, 2017)
Scope Baseline	The approved version of a scope statement, work breakdown structure (WBS), and associated WBS dictionary, that can be changed using formal change control procedures and is used as a basis for comparison to actual results (PMI, 2017).
Scope Creep	The uncontrolled expansion to product or project scope without adjustments to time, cost, and resources (PMI, 2017)
Work Breakdown Structure	A hierarchical decomposition of the total scope of work to accomplish the project objectives and create the required deliverables (PMI, 2017)

CHAPTER 1: INTRODUCTION AND OVERVIEW OF THE STUDY

1.1. INTRODUCTION

This study investigated factors constraining the planning and design process for public health construction projects in KwaZulu-Natal, South Africa. Such a study is vital as South Africa prepares for the implementation of the National Health Insurance (NHI). The NHI aims to provide equal access to health care services through a single health system. Infrastructure plays an important role in the delivery of health care services. The Department of Health in KwaZulu-Natal has a prescribed process for the planning and design of public health construction projects. However, there was evidence of major delays in the planning and design process of construction projects. Such delays had a negative impact in the provision of quality health services in KwaZulu-Natal. Subject matter experts in the field of public health infrastructure projects participated in a qualitative study aimed at investigating constraints causing such delays. A thematic analysis of the data was conducted. Results from the interviews informed the recommendations for addressing the process constraints in the planning and design of public health infrastructure projects.

This chapter provides the background and the context of the research topic. Furthermore, the study outlines the research problem, problem statement, research objectives and research questions. The merit of the scientific study, research methodology, an outline of the study and the summary of this chapter is provided.

1.2. BACKGROUND

Public Health is a science and art gained through research and experience of preventing disease and improving the health of a community in the most effective manner (Winslow, 1920; Heller and Pattison, 2003). In order to create, improve and sustain a quality Public Health, the public health infrastructure acts a nerve centre for the realisation of this critical public service (Turnock, 2001). The public health infrastructure involves construction of facilities such as hospitals, clinics, nursing colleges, etc. The benefits of construction projects go beyond the healthcare service. The construction projects play a vital role in the social and economic upliftment of a country's society. Such projects increase the country's Growth Domestic Product (GDP), create jobs, develop skills and sustain local business. According to Gunduz and Yahya (2015) corporate organisations and governments use construction projects to pursue and sustain specific development goals. Liu, Gao and Cheah (2016) suggest that countries with increased investments in public infrastructure are likely to realise positive economic returns. However, timeous delivery of construction projects is by far a worldwide challenge (Mpofu, Ochieng, Moobela, and Pretorius, 2017). Failure to manage the risks

that are likely to constrain project success compromises the project's desired outcomes such as timely delivery and project's budgeted cost (Khan and Gul, 2017).

In South Africa, the two social sector departments, Education and Health, receive the lion's share of the infrastructure budget. In KwaZulu-Natal, the Department of Education and the Department of Health were allocated a budget of R2.4 billion and R1.9 billion, respectively, in the 2020/21 financial year (KwaZulu-Natal Treasury, 2020). Both departments implement construction projects in accordance with the Framework for Infrastructure Delivery and Procurement Management (FIDPM), effective 01 October 2019. The FIDPM replaced the Standard for Procurement and Delivery Management (SIPDM), which came into effect on 01 July 2015. The Framework seeks to provide a standardised implementation process for the government's Infrastructure Delivery Management System (IDMS). The IDMS is South Africa's blueprint for the management of infrastructure assets through operations and maintenance, programmes and projects. The IDMS is a model applicable to national and provincial departments inclusive of municipalities for the management of public infrastructure. The IDMS forms the basis for infrastructure units' organisational structures and job descriptions of appointed personnel. Both the IDMS and the FIDPM aim to provide a standard control framework for effective Lifecycle Project Management. The Project Lifecycle starts from Project Initiation and ends with Project Close-out. Figure 1.1 below depicts The IDMS.

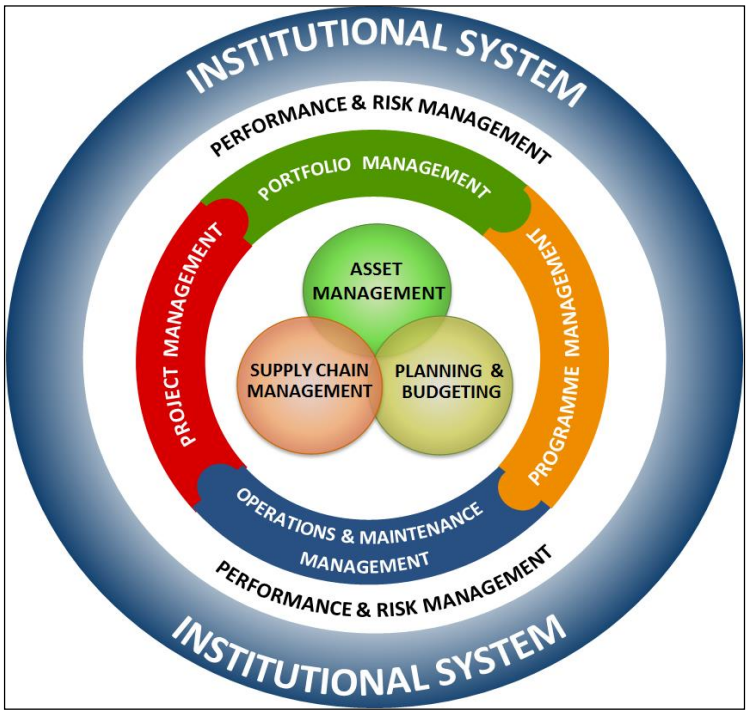

Figure 1 - 1: The IDMS

Source: (National Treasury, 2019: iii)

The processes of the IDMS, like any other system are prone to operational ineffectiveness due to a number of constraints present in a system environment. According to Goldratt (2017), the father of the Theory of Constraints (TOC), the constraint in a project process determines the project duration. This constraint is referred to as a critical path or simply the longest path. According to Goldratt (2017) it is only after the constraint has been identified, that it can be explored or elevated in order to reduce the operational process time or project duration.

The IDMS Project Management process comprises of seven stages. Each stage requires that a deliverable is accepted formally through a gate prior to proceeding to the next stage. This dependency relationship determines the duration of the project. The stages and the corresponding deliverables required at gate approval are summarised in Table 1 - 1 below.

Table 1 - 1: End-of-stage deliverables

#	Stage	End-of-stage deliverable
1	Initiation	**Initiation Report:** Defines the project objectives, needs, acceptance criteria, organisation's priorities and aspirations, procurement strategies.
2	Concept	**Concept Report:** Presents through testing of alternative approaches, an opportunity to select a particular conceptual approach. The ultimate objective is to determine whether the project is viable to proceed to Design Development.
3	Design Development	**Design Development Report:** Develops in detail the approved concept to finalise the design and definition criteria, sets out the integrated developed design, and contains the cost plan and schedule for one or more packages
4	Design Documentation	**Design Documentation Report:** Provides production information that details; performance definition, specification, sizing and positioning of all systems and components that would enable construction (prior to tender).
5	Works	**Works Completion Report:** Completed works, which are capable of being occupied or used.
6	Handover	**Handover Report:** Provides for the handover of the completed works to the user, training and the record of information relating to the completed works.
7	Close-out	**Close-out Report:** Provides a record that both parties have fulfilled all obligations of the contract and close-out report issued.

Framework for Infrastructure Delivery and Procurement Management. (Adapted from Republic of South Africa National Treasury, 2019, p. 12-16).

Figure 1 - 2 below, demonstrates the FIDPM project life cycle stages, control gates for approval (G1 - G7) and the documents that serve as deliverables at each control gate.

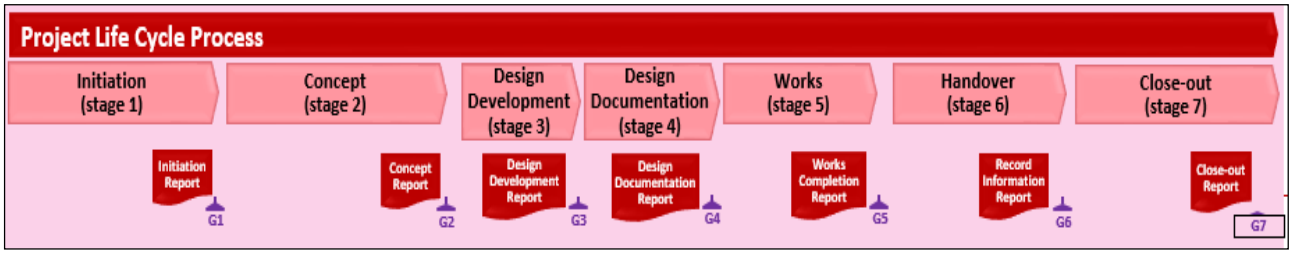

Figure 1 - 2: Control Framework for the Project Life Cycle Process

Source: Republic of South Africa, National Treasury, 2019, p. 3.

The procurement stage has its own lifecycle process in accordance with the chosen project contracting strategy (Republic of South Africa, National Treasury, 2019). The IDMS identifies five public sector Project Contracting Strategies as outlined in Table 1 - 2, below.

Table 1 - 2: Public Sector Project Contracting Strategies

#	Contracting Strategy	Scope
1	Projects not requiring design input	A contractor is appointed to undertake the execution of the work using the specification from the client
2	Management Contracting	A Professional Service Provider (PSP) or contractor is appointed to manage the planning, design, execution and close-out of the project
3	Design and Construct	A contractor is appointed to develop the design and execute the works
4	Develop and Construct	A contractor is appointed to use the supplied concept, develop the design and execute the works
5	Design by Employer	A Professional Service Provider (PSP) is appointed to design; a contractor is appointed to execute the works

Infrastructure Delivery Management Toolkit. Management Companion (Adapted from Republic of South Africa, Construction Industry Development Board, 2012, pp.47- 48)

1.3. OVERVIEW OF THE STUDY

The KwaZulu-Natal Department of Health serves the second most populous province in South Africa. The primary beneficiaries of the health services in KwaZulu-Natal are the uninsured population estimated at 87.6% of the 11 289 086 people of the province (Statistics SA, 2019). The uninsured population requires fixed health facilities to access health care. The fixed health facilities include clinics, hospitals, etc.

The Department of Public Works was appointed by the Department of Health as the Implementer of health capital projects in KwaZulu-Natal. The roles and responsibilities between the two parties were managed through a signed Service Delivery Agreement (SDA). The Department of Public Works used the Design by Employer as a preferred contracting strategy. The use of this strategy was mainly due to the department's limited capacity to design and execute works in-house.

During the project planning and design phase, there were a number of interactive approval processes requiring collaborative effort between the two departments and the appointed Professional Service Providers. This resulted in numerous delays and frustrations during the planning and design project process. These delays placed undue pressure on the later project stages, mainly Procurement and Works stages.

1.4. RESEARCH FOCUS

The research focused on the planning and design process of the KwaZulu-Natal Department of Health infrastructure projects implemented by the Department of Public Works in South Africa. The research also focused on the policies and procedures governing the planning and design of public health construction process. Furthermore, the study investigated whether such procedures affect types of projects differently, e.g. size, complexity, etc. The study further investigated the role of procurement selection strategies and the appointment of professional service providers in construction projects. The study further focused on the training and development aspects, collaboration and communication factors amongst the project team members.

1.5. RESEARCH PROBLEM

Despite numerous interventions, project delays continue to be a prominent feature in construction projects worldwide due to various factors (Agyekum-Mensah, and Knight, 2017). Most construction projects in South Africa do not finish on time due to various delays (Mukuka, Aigbavboa and Thwala 2015). Whilst most studies have concentrated on finding causes or overcoming delays in the

construction stage, limited studies have focused on delay challenges in the planning and design phases particularly in the public sector (Agyekum-Mensah and Knight, 2017).

The national and provincial public health guideline for a capital infrastructure project to progress from Project Initiation to end of Design Documentation is 18 and 24 months, respectively (Treasury, 2006; KwaZulu-Natal Department of Health, 2020). Preliminary studies showed that in the KwaZulu-Natal Department of Health infrastructure projects delayed in the planning and design phase by an average of 21 months (116%) and 15 months (62%) when compared to national and provincial guidelines, respectively (KwaZulu-Natal Department of Health, 2020). Such project delays exacerbated the service delivery backlog and resulted in higher project cost because of price escalation. Media reported community protests (MRCPs) in South Africa escalated from 164 incidents in 2008 to 375 in 2017 due to government's failure to deliver on basic social services like water, schools, clinics, electricity, etc. (Alexander, Runciman, Ngwane, Moloto, Mokgele and Van Staden, 2018). The government in South Africa continues to underspend infrastructure budgets year-on-year because of various planning and implementation delays (South African Institution of Civil Engineers, 2017).

The study investigated factors constraining the planning and design process for construction projects in KwaZulu-Natal.

1.6. AIM OF THE STUDY

This study focused on the Project Management processes based on the IDMS, sector guidelines and policies of the KwaZulu-Natal government. The aim of this research was to understand the factors that cause the delay in the planning and design process of the public health sector infrastructure projects in KwaZulu-Natal. The planning and design process is collaborative between the departments of Health and Public Works in the province. Recommendations identified factors for consideration by the two participating departments in improving the design and planning process of construction projects.

1.7. RESEARCH OBJECTIVES

The objectives of the study are:

i. To identify the constraining factors in the policies and procedures governing the planning and design for public health construction projects in KwaZulu-Natal, South Africa

ii. To explore if factors that constrain the planning and design process affect different project types differently in KwaZulu-Natal, South Africa

iii. To ascertain the training and development level of officials and consultants in the planning and design of public health construction projects in KwaZulu-Natal, South Africa

iv. To identify construction procurement issues that hinder the project planning and design of public health construction projects in KwaZulu-Natal, South Africa

v. To ascertain the effect of stakeholder collaboration and communication in project planning and design of public health construction projects in KwaZulu-Natal, South Africa

1.8. RESEARCH QUESTIONS

The study intended to answer the following research questions:

i. What are the constraining factors in the policies and procedures governing the planning and design for public health construction projects in KwaZulu-Natal, South Africa

ii. Is there a relationship between project constraints identified for the planning and design process and project types in KwaZulu-Natal, South Africa?

iii. What is the training and development level of officials and consultants in the planning and design of public health construction projects in KwaZulu-Natal, South Africa?

iv. What are the construction procurement issues hindering the project planning and design of the public health construction projects in KwaZulu-Natal, South Africa?

v. What is the effect of stakeholder collaboration and communication in project planning and design of public health construction projects in KwaZulu-Natal, South Africa?

1.9. RESEARCH METHODOLOGY

This study used a qualitative research method. The chosen research method provided an in-depth understanding of the factors constraining the planning and design of construction projects with specific to guidelines, policies, procedures and other factors specific to the public health in KwaZulu-Natal. The study used the semi-structured interviews and a purposive sampling to select respondents. Experienced professionals with an experience in the public health construction projects in KwaZulu-Natal were selected and participated in the study. The study was conducted during the Covid-19 pandemic restrictions. This necessitated the use of virtual platforms, Microsoft Teams and Zoom in conducting the interviews. Demographic information was obtained prior to the interviews, confirmed during the interviews and reported under the “Results and Discussion”, however this

information was not used to answer the research questions. Eight themes were identified during the thematic analysis of data. The factors constraining the planning and design of public health construction projects were identified from the themes.

1.10. CONTRIBUTION TO KNOWLEDGE

There are a number of studies that focus on project delays in the construction industry. Construction procurement and construction stages continue to receive more attention compared to the planning and design stage. The study provides a South African perspective on the factors constraining the planning and design the public health construction projects. This study provides officials in the departments of Health and Public Works in KwaZulu-Natal, South Africa, with scientifically determined factors constraining the planning and design of construction projects. If the recommendations of this study are adopted by the two departments, the performance of projects during the planning and design stages will improve.

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1.11. OUTLINE OF THE STUDY

The study comprises of five chapters as follows:

Chapter One: Background and Overview of the study. This chapter provides an overview of the study including research problem and objectives.

Chapter Two: Literature Review. The chapter reviews literature within the area of this study.

Chapter Three: Research Design, Methods and Data Collection. The chapter outlines the research method used in this study. It provides data collection and sampling criteria. It further discusses data validity and reliability.

Chapter Four: Presentation of Results and Discussion. The chapter presents and discusses the results of data collected from the qualitative interviews.

Chapter Five: Conclusion and Recommendations. The chapter concludes the study and provides recommendations for future studies.

1.12. CHAPTER SUMMARY

This chapter provided an introduction, background and overview of the study. The government's methodology in the delivery of infrastructure in South Africa with special reference to Public Health in KwaZulu-Natal was discussed. The Research Focus and the Research Problem were outlined.

The Research Objectives and Questions aimed to give this study its unique contribution to knowledge. The chapter also provided an overview of the Research Methodology and the outline of the study.

The following chapter will discuss the Literature Review that affects the chosen topic in detail.

CHAPTER 2: LITERATURE REVIEW

2.1. INTRODUCTION

The purpose of this chapter is to provide a review of literature that relates to the research objectives of this study. The chapter provides an overview of the project management methodologies, theories, tools, techniques and models. The literature review is discussed under each research objective of the study. The literature is reviewed from a global, South African and provincial perspective. Lastly, the summary of the literature review is provided.

2.2. GLOBAL PROJECT MANAGEMENT METHODOLOGIES, THEORIES, PRACTICES AND MODELS

This section is divided into the following ten subsections that discuss key methodologies, theories, practices and models of project management.

i. Project management methodologies
ii. Theory of constraints
iii. Critical Chain Project Management
iv. Work Breakdown Structure
v. Network diagrams
vi. Critical Path Method
vii. Project Evaluation and Review Technique
viii. Gantt chart
ix. Earned Value Management
x. Risk Register and Issue Log

The first subsection is the project methodologies.

2.2.1. Project management methodologies

The Project Management Institute (PMI) through its Guide to Project Management Body of Knowledge (PMBoK Guide) provides the project management processes necessary for effective project management. The PMI offers a recognised international certification of project managers against the PMBoK Guide. For a number of years, the PMI focused on the predictive methodology project lifecycle. The predictive methodology requires the planning and design to complete prior to a project implementation by a contractor. A predictive methodology in construction projects follows

a Design-Bid-Build (DBB) procurement strategy. It brings a higher degree of certainty on what should be constructed as a result, it is popular in public institutions. Most of the projects within the KZN Department of Public Works are undertaken through this procurement strategy. The PMI has recently incorporated adaptive approach in a form of Agile methodology in their body of knowledge. Agile projects require a high degree of collaboration between the client and the project team since the scope is developed through a number of iterations and a project develops rapidly avoiding the protracted process found in the predictive approach. Feedback from the end-user or customer becomes very critical. Agile methodology is more suited to IT projects and any project where information on the project requirements is limited. Some the projects that follow an accelerated approach where consultants, contractors and client work together to plan, design and construct using a Design-Build (DB) construction strategy can adopt an Agile approach to project delivery. Alternatively, a hybrid can be used whereby, a combination of predictive and adaptive methodologies are used within a project (PMI, 2020).

This study focuses on a traditional predictive methodology. The projects identified in this study were implemented using this project implementation method. Furthermore, the policies and procedures used to implement the projects were also based on a predictive project lifecycle. In this study, the PMBoK Guide is a foundation for the literature review mainly because of its international popularity and its adoption in the South Africa public sector. PMI (2017), referred in this study as the PMBoK Guide, suggests five processes to be followed in the management of the phases or project deliverables.

According to the PMBoK Guide, the project lifecycle phases should consist of five process groups. These process groups are indicated in Figure 2-1 hereunder.

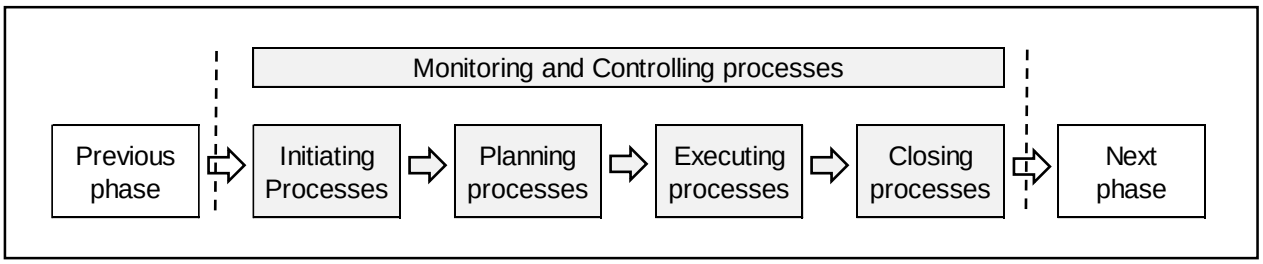


Figure 2 - 1: Project Management Process Groups

Guide to the project management body of knowledge Vol. 6. (Adapted from Project Management Institute, 2017).

The process groups provide a sequence of processes required to initiate, plan, execute and close a phase or project. According to the PMBoK Guide, the initiating processes of a phase can only start after a formal acceptance or approval of the previous phase (PMI, 2017). Similarly, the planning, executing and closing processes require acceptance or approval. The Monitoring and Controlling

Process Groups track progress from the initiating processes until the closing processes. According to Sanghera (2019), the project success is largely determined by how the Scope, Cost and Schedule are monitored and controlled using available resources. Most projects fail due to lack of an effective monitoring and feedback loop process (Shah, 2016). Failure to manage the planning and design phase is likely to create overall project delays Cunningham (2017). Relevant tools to monitor and control the project are discussed later in this chapter.

The PMBoK Guide further suggests ten project management knowledge areas for successful project management. The knowledge areas provide areas of competency a Project Leader needs to lead a project team to a successful delivery of the project deliverables (PMI, 2017). Below are the ten knowledge areas:

i. Project Integration Management
ii. Project Scope Management
iii. Project Schedule Management
iv. Project Cost Management
v. Project Quality Management
vi. Project Resource Management
vii. Project Communication Management
viii. Project Risk Management
ix. Project Procurement Management
x. Project Stakeholder Management

It is critical that a Project Leader is competent in all the project management knowledge areas. Each of the project management theories, practices discussed below helps to improve the outcome of the project deliverables. PMI (2017) suggests that a project plan must have a management plan developed for each knowledge area. For example, Project Risk Management must be administered through a Project Risk Management Plan. This plan is updated throughout the project life. The knowledge areas consist a combination of soft and hard skills. It is critical that Project Leaders are trained on all facets of the knowledge areas. A number of project management theories have evolved over the years. Below is a discussion on the most popular theory of project management.

2.2.2. Theory of Constraints (TOC)

The Theory of Constraints (TOC) was propounded by Eli Goldratt in the late 70s and formally published in 1984 in his renowned novel, *The Goal*. TOC is a Thinking Process (TP) for a system process improvement. The TOC method reduces process time through the identification and

management of system constraints (Ikeziri, Souza, Gupta and de Camargo Fiorini, 2019). This theory suggests that each system, organisation or project has at least one constraint. The constraint determines the performance of the system or the time it will take to complete the task or a process. In a project environment, completing the project faster helps investors achieve the return on investment sooner than later (Izmailov, Korneva and Kozhemiakin, 2016). The knowledge of the project constraints and constraint management tools by Project Leaders improves the ability for the realisation of optimised results in an organisation or project (Šukalová and Ceniga, 2015). According to Goldratt and Cox (2016), certain steps are necessary to improve the system or project process through the elimination of the constraint. These steps are:

i. Identify the constraint (know the limitation in achieving the desired result)
ii. Explore the constraint (optimise the system at the constraint)
iii. Subordinate everything to the constraint (all other processes must align to the constraint)
iv. Elevate the bottleneck (add resources or change approach)
v. Avoid inertia (if no improvement, then go back to step i)

In order to understand delays associated with the planning and design process of public health construction projects, it is critical to understand the limitations of the current planning and design process. According to the TOC, a constraint needs to be identified first prior to developing a plan to resolve it. The research objectives of this study identified the following possible areas of the planning and design of public health construction projects that may be constraining the process thereby requiring identification of constraining factors within each identified area:

i. Policies and procedures
ii. Applicability to project types
iii. Knowledge management
iv. Project procurement
v. Collaboration and communication

This chapter reviews literature in each of the abovementioned areas with an aim to establish if the study findings will collaborate with literature to present recommendations regarding the gap in literature. The following sections discuss the project management methods and practices.

2.2.3. Critical Chain Project Management (CCPM)

Time wastage in a process or project management occurs through a number of ways. Project management allows for the use of a contingency reserve to provide a reserve for time wastage. The method for reducing project duration using contingency reserves or buffers by scheduling, executing

and controlling projects is called the Critical Chain Project Management (CCPM). The Critical Chain is the longest path in the project but with a contingency reserve. The purpose of the contingency reserve is to protect the critical chain from variations and assist the project to finish on time.

The CCPM uses different buffers to mitigate the effect of the above-mentioned contingency reserve wastages. Firstly, all reserves are removed from individual tasks and packaged into various forms of buffers. These buffers are placed at strategic positions along the project activity chain. The CCPM makes use of the following types of buffers to mitigate late completion of phases or projects.

i. Project buffer

ii. Feeding buffer

iii. Milestone buffer

iv. Resource buffer

The project buffer is an aggregate of contingency reserves taken from various project tasks on the critical chain. The size of the project buffer is informed by the level of risk associated with the project. Figure 2-2 below, shows how project buffer is derived from the critical chain. In this instance, the project buffer belongs to the Project Leader whilst the resource teams commit to time allocated to their tasks. The Project Leader uses the project buffer to compensate for any delays in the project schedule.

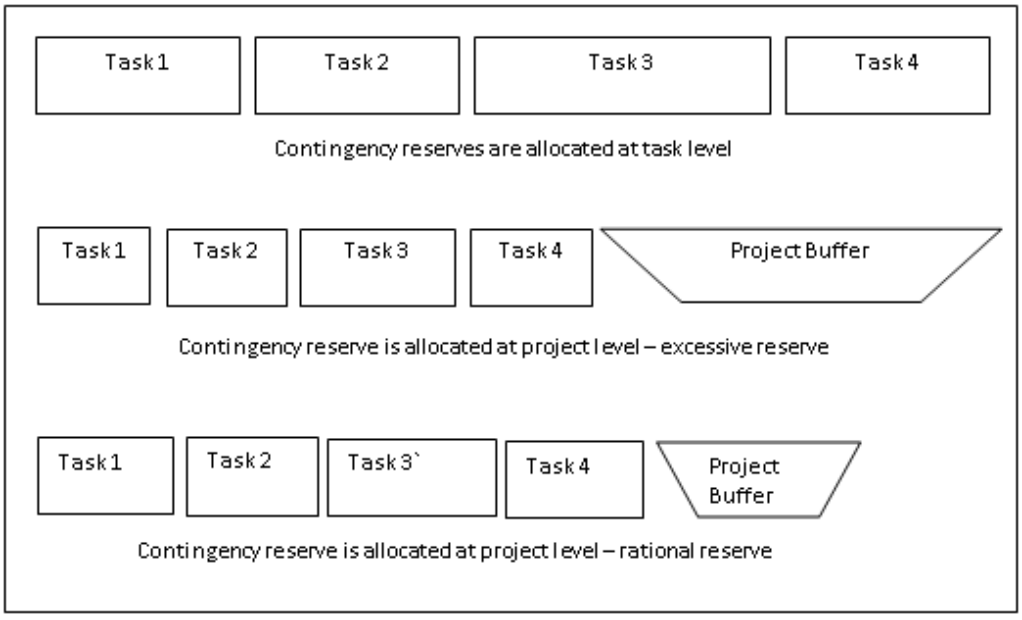


Figure 2 - 2: Use of the project buffer to reduce the project duration

Critical chain: A business novel. (Adapted from Goldratt, 2017).

On the other hand, the feeding buffer is used to prevent the non-critical paths from becoming critical and cause variations in the critical chain. It protects the start time of the successor task, It is positioned where the non-critical tasks meet a critical task. The size of the feeding buffer is aggregated from tasks on the non-critical path taking into account the level of risk exposure. Figure 2-3 below, illustrates how the feeding buffers mitigate variations in the critical chain.

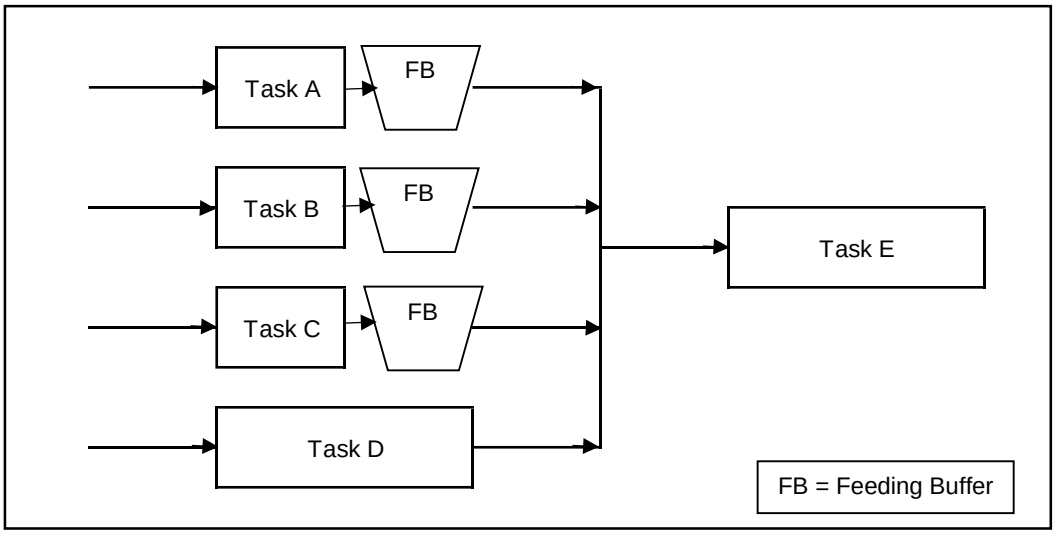


Figure 2 - 3: Feeding buffers used to protect the critical chain

Project management for engineering, business and technology (Adapted from Nicholas and Steyn, 2017).

However, the milestone buffer protects a milestone on a project. It is placed before a milestone in order to facilitate an early finish of a task or project. For example, if a stadium is not ready on the day of the World Cup opening game, a game will not be played; people who booked transport, accommodation and tickets to watch soccer on that day will be disappointed and may need to be refunded for their loss. Therefore, it is critical for the Project Leader to protect the milestone date since a failure to achieve has dire consequences for the client.

Lastly, the resource buffer serves as an early warning drum that prepares the critical task to start as soon as the predecessor task is complete. The resource buffer assists to eliminate delays between tasks that impact project duration.

The CCPM methodology serves as an important game changer in complex project environments like health sector construction projects. This method, if taught properly, can assist in the coordination of Departments of Health and Public Works and the Design Professional Team to reduce wasted time through effective interface management of project appraisal submissions and approval processes. Officials that lead complex projects need to be familiar with such complex methods of managing a

project schedule. The level of knowledge of officials in managing a project schedule will result in positive outcomes.

For various reasons, contingency reserves also wasted and projects experience more delays. It is critical to know the pitfalls of implementing the CCPM in management of the project schedule. According to Goldratt (2017) and Elder (2017), wastage of contingency reserves results from:

i. Bad multi-tasking
ii. Student syndrome
iii. Parkinson's law
iv. Task dependency
v. Roadrunner effect

Below is a discussion on each of the above-mentioned time wastage behaviours.

i. Bad multi-tasking

The involvement of a resource in multiple concurrent projects is one of the major causes of project delays. The delays result in a knock-on-effect and the contingency reserves are wasted, resulting in projects finishing late. According to Goldratt (2017), a resource allocated to multiple tasks or projects, tends to start certain tasks late because of demands or delays in other concurrent tasks. When delays in one project or task negatively affect the other project or task, such occurrence is referred to as bad multi-tasking. The Department of Health's Project Management Information System (PMIS) shows that a Project Leader manages a number of projects at the same time and thereby prone to bad multi-tasking (KwaZulu-Natal Department of Health, 2020). It is important to establish a standard or a guide allocating work to each Project Leader without compromising the project outcomes of each project. It must be noted that in government departments there are a number of unfilled posts that leads to project leaders undertaking more projects than they can manage. In this instance, it may be necessary to group a number of projects into one in order to reduce the number of project teams under each Project Leader.

However, there exists another school of thought advocating for multi-tasking. Advocates of multi-tasking suggest that parallel tasks can benefit concurrent projects since lessons-learnt can be shared amongst those projects resulting in improved overall project outcomes. Fischer and Plessow (2015) suggest that efficient multi-tasking is still possible under certain conditions but requires individuals who adjust well with juggling between strategies. According to Goldratt (2017), a focusing approach to project management helps to avoid bad multi-tasking. In a focusing approach, a project manager focuses on one task at a time thereby eliminating the disturbances that result from multi-tasking. Figure 2-4 below, demonstrates the comparison between multi-tasking and focusing.

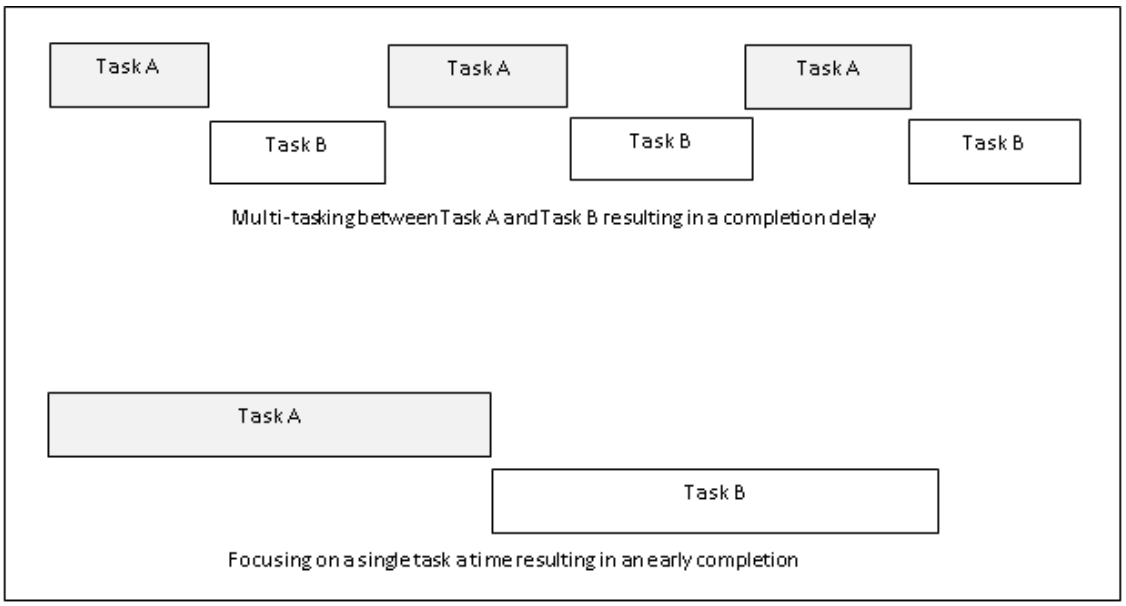


Figure 2 - 4: Multi-tasking vs Focusing (series)

Source: Constructed by researcher

In their study, Fischer and Plessow (2015) found that good multi-tasking requires an uncommon art; most people involved with multi-tasking were easily distracted. Planning and design guidelines within Departments of Health and Public Works were reviewed, however there was no guidance relating to a number of concurrent projects that a Project Leader may be allocated. The matter of workload needs to be investigated as it relates to bad-multi-tasking and delay of project deliverables.

ii. Student syndrome

Contingency reserves are also wasted through a “Student Syndrome” behaviour. The student syndrome is associated with the behaviour of students who, when allocated homework or assignments against a specific deadline, procrastinate working on them. It is normal that students will not attend to their school-work until the last minute. Students have a reputation of wasting whatever extra time they have at their disposal (Nicholas and Steyn, 2017). A number of Project Leaders also fall into this trap. They waste the contingency reserve on the non-critical tasks until those tasks become critical and start falling behind schedule. Figure 2-5 below, shows how Project Leaders behave when the task deadline is afar and how they increase the effort as the task deadline is nearer.

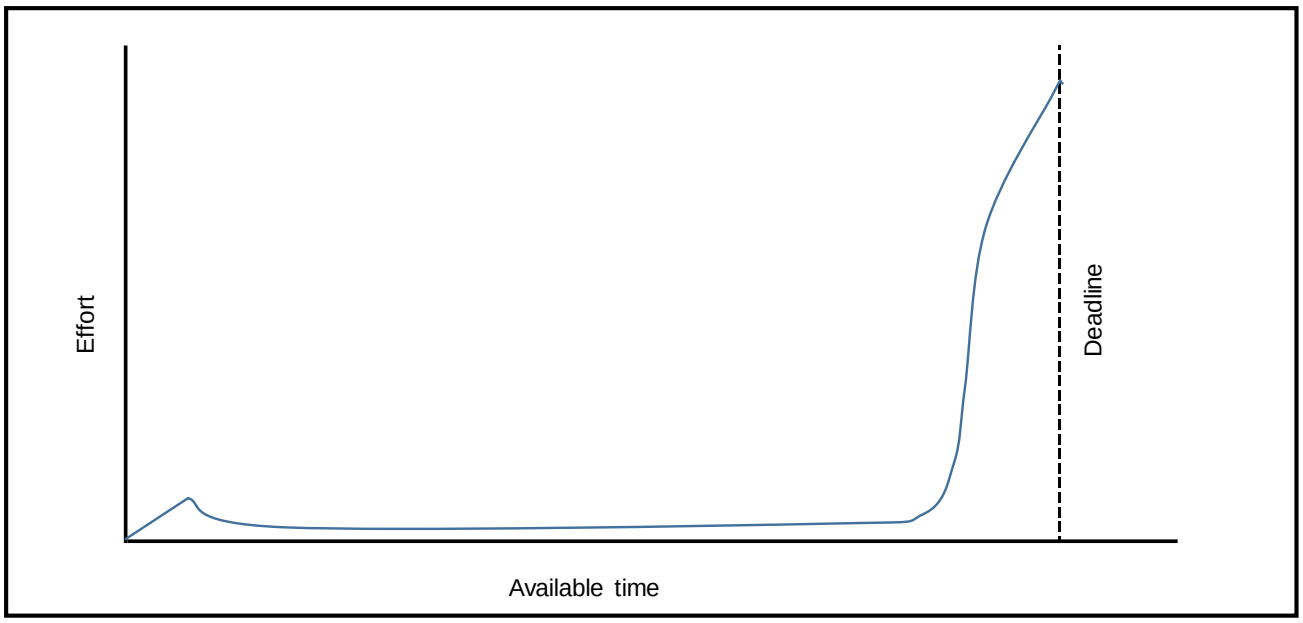


Figure 2 - 5: Student Syndrome

Project management for engineering, business and technology. (Adapted from Nicholas, J.M. and Steyn, H., 2017).

Project management uses different tools and techniques to monitor and control the schedule baseline. Inadequate and ineffective knowledge of tools and techniques to manage a project schedule is a source of project delays (Alotaibi, 2018). A student syndrome can be mitigated through strengthening of the monitoring and control function of the project. Some of the relevant tools and techniques are discussed that can benefit Project Leaders are discussed later in this chapter. These include Critical Path Method (CPM), Project Evaluation and Review Technique (PERT), Earned Value Management (EVM), Risk Register and Issue Log.

iii. Parkinson's law

Parkinson's law refers to a notion that no matter how much time is allocated to a task; the task will generally increase to use it all up. According to Parkinson's law, the task-based contingency computed under the Project Evaluation and Review Technique (PERT) network diagram may not assist the timely completion of the phase or project since work will automatically fill up allocated time (Izmailov, Korneva and Kozhemiakin, 2016). In order to mitigate the effect of Parkinson's law on the project schedule, effective and continuous monitoring and control strategies are necessary. Such strategies may be in a form of weekly or monthly progress reports and performance appraisal sessions. Knowledge of a variety of time management practices will assist the team select the most relevant tool or technique for a specific project type or scenario.

iv. Task dependency

Elder (2017) suggests that contingency reserves are also wasted through task dependency. In task dependency, the wastage occurs when a predecessor task is finished earlier but the successor task is not ready to start. Alternatively, the task on the critical path is delayed due to knock-on delays resulting from non-critical tasks and in some instances; two or more paths may merge at a point resulting in a phenomenon called the merge-point bias. The merge-point bias increases the probability of delays in the start time of the successor task or milestone (Nicholas and Steyn, 2017). Figure 2-6 below shows an example of a merge-point bias.

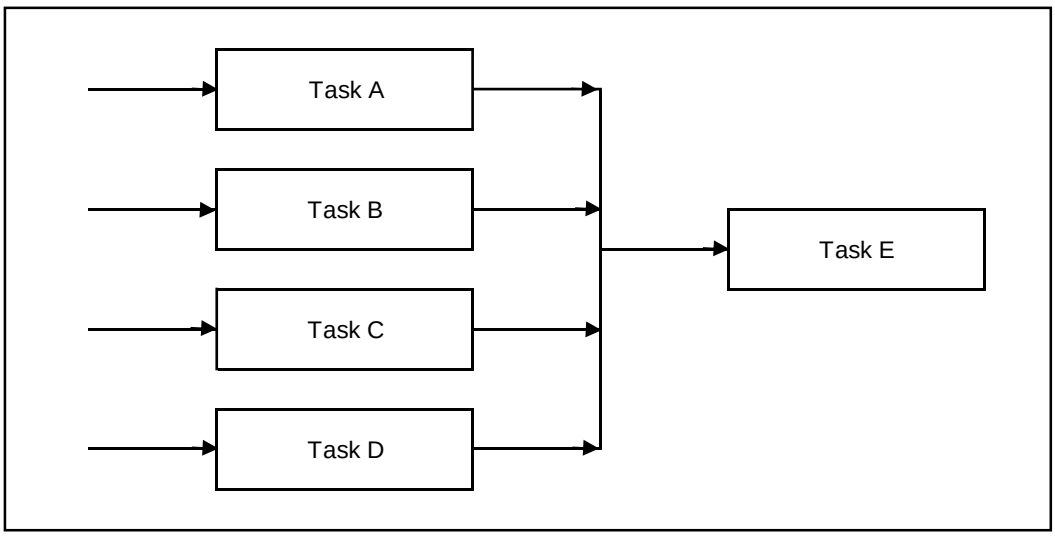


Figure 2 - 6: Merge-point bias (four tasks merging at one point)

Project management for engineering, business and technology. (Adapted from Nicholas, J.M. and Steyn, H., 2017).

In the above diagram, four tasks merge at a start of a successor task. In this instance Task E can only start once Task A, B, C and D are all completed. Any delay in one of the four tasks will delay the start of Task E, thereby wasting any contingency reserve in the project. This phenomenon is highly prevalent in complex project with a number of concurrent activities. To mitigate against a merge-bias point, a Project Leader must consistently monitor the concurrent tasks that have a finish-to-start relationship with a similar successor task. The resource buffer is also effective in mitigating the Parkinson's law effect. Use of project management software can assist a Project Leader identify and monitor a task that is likely to delay a project (Alotaibi, 2018). Complex projects do benefit from the use of project management software such scheduling programs in the management of complex project such as the health sector projects.

v. Roadrunner effect

Lastly, the contingency reserve is also wasted through a "roadrunner" effect. This concept is represented by a mathematical expression, "2 + 2 = 5". The roadrunner effect happens in two ways. Firstly, it occurs if one resource finishes its task but does not alert the next resource that the task is complete so that the following task can start. Secondly, it occurs when one resource finishes its task, approaches the next resource, but the next resource is not ready to start on the task immediately as it may still be busy with something else. Subsequently the next task cannot start straight away resulting in a contingency reserve wasted (Elder, 2017). Interestingly, each resource completed its tasks with its allocated time allocation, but the project was still delayed. This effect is evident in instances where two organisations work together on a project but lack effective communication, collaboration and teamwork. Departments that work together on a process are likely to be delayed by this phenomenon due to the bureaucratic nature of systems and poor communication and collaboration amongst the project team members. Communication and collaboration will need to improve between the Departments of Health and Public Works and Consultants to avoid time lost due to one party not informing the other of progress on a critical activity or task. Similarly, when submissions have to go through a particular process for approval, it is likely that reports may delay on somebody's desk who is on leave whilst other team members assume it was being processed. Aghania, Ramzani and Raju (2019) suggest the establishment of ground rules for the creation of teamwork during the project kick-off meeting as a mitigation for delays between the tasks. They further recommend the scheduling of regular project progress meetings to improve communication and collaboration amongst project stakeholders.

Below is the discussion on the allocating resources to a project and the establishment of a project schedule.

2.2.4. Work Breakdown Structure (WBS)

In project management, prior to project scheduling, the work is broken down into small portions known as work packages using a Work Breakdown Structure (WBS). The WBS is not a scheduling method but provides a structured way of coordinating the resource allocation to various elements of the WBS. During the Planning and Design phases, the WBS assists to align the specialist work with the project resource allocation (Zecheru, and Olaru, B.G., 2016). The WBS will inform the procurement process of the professional service providers by identifying the appropriate and competent resources to undertake the design of a project. Failure to identify all required disciplines can lead to project delays. The preliminary studies showed that KZN Department of Health projects without a well-defined project scope resulted in delays since the WBS failed to identify all specialist work to be undertaken. Consequently, the already appointed consultants wait whilst the consultant

to undertake the design of the late scope is being procured. This leads to a merge-bias and dependency delay. Following the finalisation of the WBS is the preparation of the network diagram.

2.2.5. Network diagrams

The network diagram is a presentation of the relationships among various tasks in a phase or project. Each task has a time duration that contributes to the overall completion duration of the phase or project. The typical network diagram is presented on Figure 2-7 below.

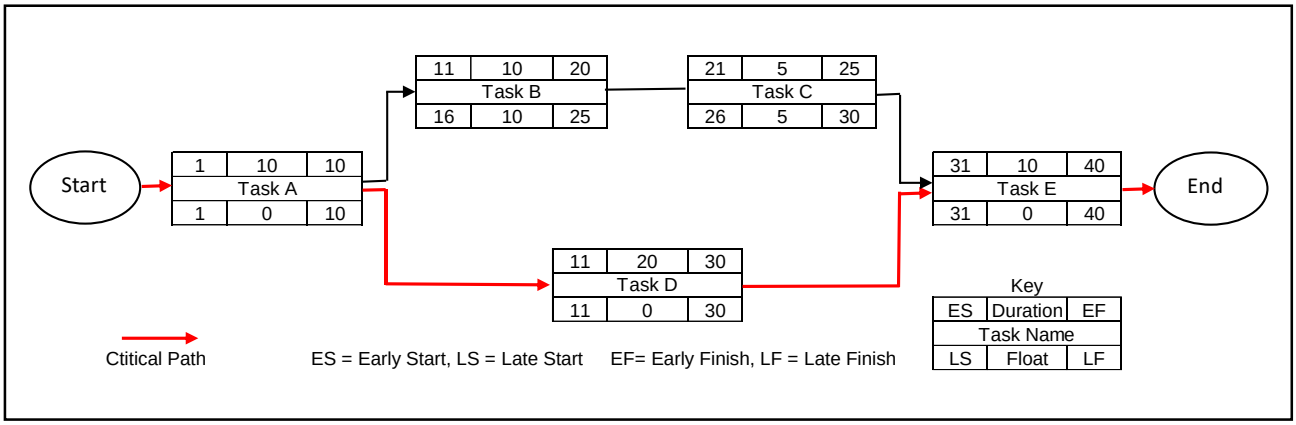


Figure 2 - 7: Typical Network Diagram showing the Critical Path

Source: Constructed by researcher

A network diagram is used to sequence the project tasks and visually show the dependencies amongst the tasks. It provides time duration for each task and indicates the earliest start, latest start, earliest finish and latest finish of each task as per Figure 2 -7 above. The delayed tasks are easily identifiable and the team can proactively work towards getting the project back on track. The network diagram is also an effective communication and collaboration tool where different role-players are involved as is the case with this study. Project Leaders need to have a basic understanding of network diagrams.

2.2.6. Critical Path Method (CPM)

The Critical Path Method (CPM) is one type of a network diagram. The longest path in a project network diagram is referred to as a critical path. It is the only path without a float or time reserve. In Figure 2-10 above, the critical path is Path Start-A-D-E-End represented by a red line. The CPM focusses on the tasks along the critical path to mitigate project delays. However, Goldratt (2017) argues that the CPM does not help in controlling the project schedule since the critical path can be further delayed by a number of factors resulting from the phases or projects not being completed on time. However, the CPM serves as an indicator whether the project is on time based on the approved schedule baseline. Where necessary and practicable, tasks with discretionary dependency can start

earlier than planned, thereby mitigating the encountered delay on the predecessor task. Knowledge of this method by team members is vital for project success.

2.2.7. Project Evaluation and Review Technique (PERT)

The Project Evaluation and Review Technique (PERT) is another form of the network diagram. uses three-time estimates to provide for uncertainty in a phase or project duration. It uses the probability approach to calculate the expected time for the completion of the task using the values for the most likely time to finish a task (M), optimistic time to finish a task (O) and pessimistic time to finish a task (P) (Karabulut, 2017; Akpan and Agadaga, 2020). In PERT, the expected task duration is the weighted average of the three-time estimates computed using the formula,

$$\text{Expected time } (T_e) = \frac{O + 4M + P}{6} \quad (1)$$

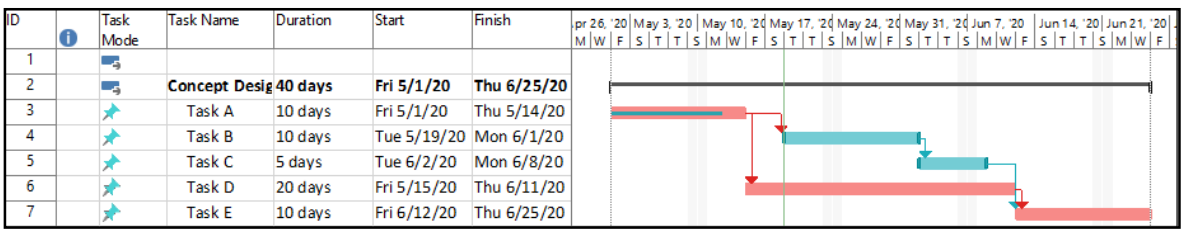
The variance of each task is calculated using the formula;

$$\text{Variance } (\sigma^2) = \left[\frac{P - O}{6}\right]^2 \quad (2)$$

The large variance (σ^2) indicates that the expected time (T_e) is less reliable. The PERT provides a better estimate for a phase or project duration since it caters for uncertainty through the provision of a safety net in each project task. Consequently, the PERT is more reliable compared to the CPM. It is more suited for complex projects which require robust techniques for schedule management.

2.2.8. Gantt chart

The Gantt chart method was invented by Henry Gantt in the early 1900. It is a form of bar chart which consists of horizontal lines representing various activities and their duration. It was only in the late 1990s that the Gantt chart was improved to show the relationship between various activities. It is still the most popular and user-friendly method to date. It also integrates with other project scheduling methods with ease (Sharon and Dori, 2017). Figure 2-8 below shows an example of a Gantt chart.



ID	Task Mode	Task Name	Duration	Start	Finish
1					
2		**Concept Desig**	**40 days**	**Fri 5/1/20**	**Thu 6/25/20**
3		Task A	10 days	Fri 5/1/20	Thu 5/14/20
4		Task B	10 days	Tue 5/19/20	Mon 6/1/20
5		Task C	5 days	Tue 6/2/20	Mon 6/8/20
6		Task D	20 days	Fri 5/15/20	Thu 6/11/20
7		Task E	10 days	Fri 6/12/20	Thu 6/25/20

Figure 2 - 8: Typical Gantt chart

Source: Constructed by researcher through MS Project

The Gantt chart above shows the schedule against each task. It also displays the progress against each task (Task A's completed portion is shaded). For minor and less complex projects, this project scheduling method is sufficient. The downside of the Gantt chart is its limitation to control delays since the critical path does not have a schedule contingency reserve. Nevertheless, a Gantt chart is very popular amongst Project Leaders. The advantage of using the Gantt chart is that it is user-friendly and non-technical project stakeholders can be easily understand it. Most government departments use MS Project software which is very popular in developing and maintain Gantt charts.

2.2.9. Earned Value Management (EVM) Model

The EVM model is a popular method of analysing the project performance using the scope, schedule and cost metrics (PMI, 2017; Bryde, Unterhitzenberger, and Joby, 2018). Figure 2-9 below, shows the relationship between the Project Scope, Cost overrun and the time delay through an Earned Value Management model.

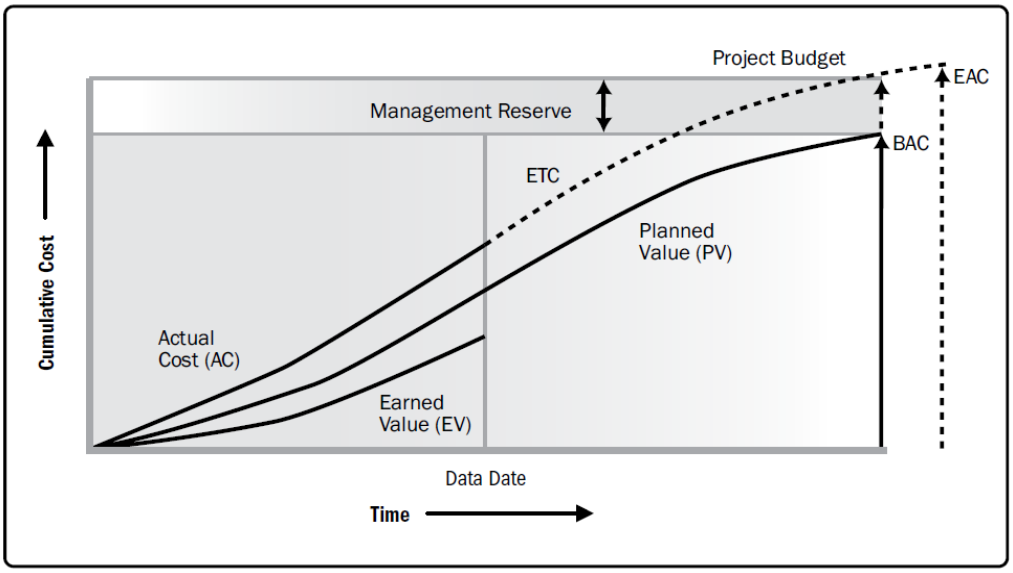


Figure 2 - 9: Earned Value Management

Guide to the project management body of knowledge (PMBOK Guide) (Cropped from Project Management Institute, 2017).

Figure 2-9 shows the Earned Value (EV) being lower than the Planned Value (PV) and the Actual Cost (AC) at a time of progress review of a phase or project. The trend analysis shows that cost Estimate at Completion (EAC) is not only higher that the Budget at Completion (BAC) but the project or phase is now going over the planned completion date. The measure of the Earned Value against the planned and Actual Cost is a good probability indicator of the expected time delays in a project schedule plan. The EVM is highly recommended by the PMI. It provides the project team with a graphic representation of the health of the project. It provides a scientific way of estimating the project

estimated at completion and the estimated end date based on the latest information. Project Leaders in Departments of Health and Public Works will benefit from this method. For example, matters that require attention of management can be timeously discussed and decisions taken.

2.2.10. Risk Register and Issue Log

Risk management is a critical knowledge management area in project management. ISO 31000 (2018) defines risk management as “coordinated activities to direct and control an organisation with regard to risk”. In the management of risk, a Risk Register is an important tool that helps the Project Leader identify, analyse, prioritise and provide risk responses against each prioritised risk. The Risk Register is developed very early in the project and updated throughout the life of the project (Xuan, Moslehpour and Tien, 2019). The Risk Register normally provides the description of a risk, the owner of the risk, the date the risk was identified and the risk response. Regarding the public health construction projects in KwaZulu-Natal, the Risk Register will be developed as part of the Risk Management Plan during the formulation of the Project Brief. This tool is beneficial if we know what may constrain the project and we can analyse the probability and the impact. The factors constraining the planning and design of projects in KwaZulu-Natal, once identified, they would be efficiently managed through a risk register.

Once the identified risks materialise during the project planning and design activities, such risks become issues. These issues need to be managed to avoid negative impact on the project outcomes. In order to manage these issues in a coordinated manner, the issues are recorded and updated in an Issue Log document. Other issues may come outside the Risk Register. The progress in the management of issues need to be shared with stakeholder. According to Mossalam (2020), the Issue Log is a beneficial tool to update stakeholders with progress made in addressing the identified issues. The Issue Log normally provides the description of an issue, the owner of the issue, the date it was logged and progress in resolving the issue. In this study, issues may relate to any area of the study objectives.

In this section, the project management theories, methods, techniques and models were discussed. The project management practices discussed above are not exhaustive. The PMBoK provides a comprehensive list of the generally accepted project management practices. It therefore becomes critical that Project Leaders are familiarised with all tools applicable to each knowledge area of project management. The following section focuses on the South African best practices in project management.

2.3. SOUTH AFRICAN PROJECT MANAGEMENT METHODOLOGIES, PRACTICES AND MODELS

The lack of urgency in the delivery of social infrastructure in general, was identified as a challenge about two decades ago. This was identified through failure of the education sector to meet its target output year-on-year and allocated budgets were underspent (National Treasury, 2006). In his 2005 State of the Nation address, President Thabo Mbeki raised a concern that plans to roll out schools' infrastructure programme in the country was moving at a slow pace. He attributed this to inefficiency in the government system. On 21 April 2006, the Ministries of Education and Public Works issued a joint media statement on progress made on the schools' infrastructure programme. According to this statement, constraints in the delivery of schools' infrastructure were due to the following factors:

i. Poor planning and alignment of planning to the budget cycle perpetuating roll-overs and poor quality in expenditure

ii. Lack of capacity and skills

iii. Inefficient processes for the procurement of professional services

iv. Poor relations and lack of effective communication within departments

The four identified constraints negatively affected the project outcomes. In an attempt to address this problem, the National Treasury developed and rolled out an Alignment Model concept for implementation by the departments of Education, Health and Public Works. The Alignment Model on Figure 2-10 below introduced the following process for project delivery.

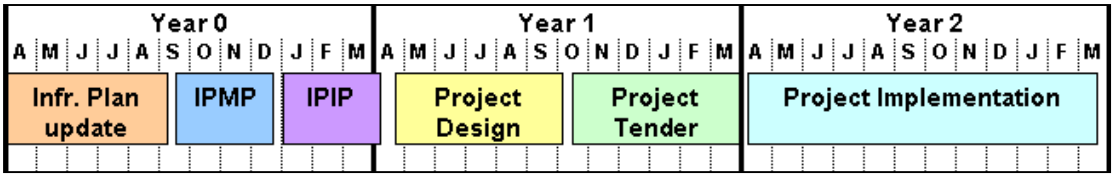


Figure 2 - 10: Alignment Model's Infrastructure Delivery Cycle Process for the South African Education, Health and Public Works Departments

Source: Republic of South Africa, 2006. **Alignment Model for the Infrastructure Delivery Cycle and the Budget Cycle**, Pretoria: National Treasury. p16

The Alignment Model in Figure 2-10 above proposed the following planning and design process for a new capital project:

i. Six months for preparation of a 10-year Infrastructure Plan (IP). This plan outlines the priorities of the client department for the next 10 years.

ii. Three months for preparation of a 3-year Infrastructure Programme Management Plan (IPMP). This plan informs the implementer of the priorities for the next three years. The Initiation Reports for the new projects are to be designed in Year 1 of the Plan and are also issued in the same period.

iii. Three months for preparing the 3-year Infrastructure Programme Implementation Plan (IPIP) by the Implementer. This plan details the implementation strategy, timelines of projects contained in Year 1 of the IPMP.

iv. Six months for preparing the design for the projects in the IPIP followed by the tender process. The total time from project initiation to end of design is eighteen months.

Subsequently, in 2006, the Infrastructure Delivery Improvement Programme (IDIP) was rolled out in the Departments of Health in the country. This was a joint collaboration amongst the National Treasury, Construction Industry Development Board (CIDB), Development Bank of Southern Africa (DBSA) and National Department of Public Works. The National Departments of Health and Education participated as and when required. During the 2006 and 2010, the IDIP Technical Assistants (TAs) assisted departments to work together and training officials in areas of planning of education and health infrastructure. The TAs were composed of built environment and change management specialists with years of experience in their professional fields.

The TAs participated in the development of the Infrastructure Delivery Management System (IDMS) which was published in 2010 by the CIDB. The IDMS became South Africa's methodology in the delivery of infrastructure. It provided guidelines and processes for the public infrastructure portfolio, programme and project delivery management. It also sought to clarify roles of client departments and those of implementers. Although the implementation of the IDMS and other associated interventions have been implemented during the past ten years, the National Treasury (2020) suggests the following three persistent challenges as causes for the reduction in the value of the infrastructure budgets within SOEs, departments and municipalities in South Africa:

i. Lack of capacity and skills to plan properly

ii. Insufficient pipeline of projects

iii. Lack of business confidence

The National Planning Commission (NPC) identified other persistent challenges applicable to planning and design of construction projects in South Africa. The National Planning Commission under the Presidency established various commissions aimed at assisting government to realise the South Africa's National Development Plan targets by 2030. On 6 March 2020, the Infrastructure Planning Commission published a draft paper titled "Public infrastructure delivery and construction sector dynamism in the South African economy" for comment and discussion. The draft paper

acknowledges the programme made through the development and implementation of the IDMS and FIDPM. However, challenges persist. The Infrastructure Planning Commission identified following challenges in planning and design of public sector infrastructure delivery:

i. lack of governance
ii. poor and inappropriate procurement practices
iii. poor delivery management practices
iv. weaknesses in the project identification, assessment and preparation
v. lack of management capacity and proper skills
vi. weak project teams
vii. improper quality control mechanisms
viii. poor decision-making
ix. ineffective stakeholder identification
x. ineffective internal and external communications

This study seeks to investigate the causes of the above-mentioned projects constraints as they relate to research objectives. The next section discusses the literature review relating to the five research objectives.

2.4. LITERATURE REVIEW: RESEARCH OBJECTIVES

This section discusses the literature review with regards to the five research objectives. The subsections emanating from the research objectives are as follows:

i. Policies and procedures
ii. Project types
iii. Training and development
iv. Construction procurement
v. Collaboration and communication

The first subsection is policies and procedures.

2.4.1. Policies and procedures

This section discusses how policies and procedures affect project planning and design of construction projects from a global perspective. It further discusses national and provincial policies, frameworks and procedures that are applicable to the public health construction projects.

Global perspective

The performance of construction projects relies heavily on the quality of coordination or intergration amongst project activities through consideration of processes, people and business environment (PMI, 2021). Policies and procedures in a project environment provide a structured and formal process for project management. They provide for uniformity towards the identification, planning, implementation and closing of projects. According to Papke-Shields and Boyer-Wright (2017), policies and procedures provide a structure to the project planning process and ultimately have a major influence on processes for project planning. PMI (2020) suggests that policies and procedures form part of the Organisational Process Assets (OPAs) and require review through lessons-learnt feedback on an ongoing basis. According to Guarino (2020), policies are a rulebook of an organisation whilst procedures provide a systematic instruction aimed at achieving a desired result. However, Brinkerhoff, Frazer and McGregor (2018) suggest that a rigid policy and procedure environment is likely to harm an organisation. They suggest that a learning organisation must adapt to environmental changes through procedures that have flexibility and promote innovation.

According to Sommer (2016), procedures may be counterproductive and result in delays in the approval process due to signatures that are required to approve the project deliverables. He further suggests that duplicated or unnecessary process steps also create delays within the organisational procedure.

The PMBoK Guide suggests prototyping as a mitigation for scope creep and a protracted design process (PMI, 2017). Time can be drastically reduced where project scope for similar deliverables has been reduced to standard design and only minor site-specific adjustments need to be made. In such instances, the approval of plans and designs is accelerated.

South African perspective

South Africa has a number of policies that define how public infrastructure should be managed in the country. According to the IDMS, the primary policies are in the area of planning and budgeting, supply chain management and asset management. However, there are a number of other enabling policies like Human Resource capacitation, risk management, performance management, etc. Other policies specific to the health sector relate to services like mental health, primary health care, etc. These policies inform the norms and standards for the construction of healthcare facilities in the

country. Officials and built environment consultants that work on health sector construction projects must be conversant with the policies relating to the healthcare services.

Procedures relating to public infrastructure in South Africa are contained in the Framework for Infrastructure Delivery and Procurement Management (FIDPM). The FIDPM provides a framework for the procurement of infrastructure projects in South Africa with an aim to create procurement and delivery efficiencies (Phillips, 2018). The FIDPM project life cycle provides for seven project stages and seven approval gates. According to the FIDPM, a competent person must approve each project stage. The following project stages fall within the focus of the study:

i. Stage 1: Project Initiation Stage
ii. Stage 2: Project Concept Stage
iii. Stage 3: Project Design Development Stage
iv. Stage 4: Project Design Documentation Stage

The FIDPM requires that each project stage be formally approved prior to proceeding to the next stage. The project cost estimates undergo a process of progressive elaboration, updated, and approved with their corresponding stage deliverables. Progressive elaboration refers to a process of improving the accuracy of the project cost estimate as the project progresses and more information about the project is established.

The planning and design must comply with the applicable policies and procedures. If the planning and design project submission fails to comply with policies and or procedures approvals are delayed. A number of factors may cause such delays. This study aims to establish such factors.

Provincial perspective

The KwaZulu-Natal Department of Health must comply with all national policies and procedures. However, there are policies and procedures that are developed at the provincial level. Such policies include but not limited to Infection, Supply Chain Management Practice Notes, Prevention and Control, Design of Engineering Installations and Structural Design.

The project planning and design process is no different to the South African FIDPM process. A Health Infrastructure Approval Policy and the Terms and Procedures for the KwaZulu-Natal Department of Public Works Design Review Committee (DRC), prescribe the procedures for the appraisal of public health construction projects in KwaZulu-Natal. The Health Infrastructure Approval Policy (2019) provides for an establishment of a Health Infrastructure Approval Committee (HIAC). The DRC and HIAC are committees that review planning and/or design at KZN Department of Public Works and KZN Department of Health, respectively. DRC and HIAC presentations require two printed copies of reports submitted to the secretariat two weeks before the DRC or HIAC seating (KZN Department of

Public Works, 2016). However, the two committees, DRC and HIAC perform the same project appraisal function. (KZN Department of Public Works, 2017; KZN Department of Health, 2019). Elimination of competing project appraisal committees may enhance project governance and curb projects delays.

Besides the duplication of project appraisal committees, projects do delay in cases where the scope baseline has changed. The KZN Department of Health HIAC Policy provides for a quicker approval of project submissions in instance where changes to the scope baseline are minor. Major scope changes require more signatures; hence, delays in the approval process (KwaZulu-Natal Department of Health, 2020). According to the HIAC Policy (2019), presentations of projects that exceed a 10% cost estimate deviation from the previously approved stage, require an additional recommendation from the KZN Department of Health's Deputy Director General (KZN Department of Health, 2019). In this case the Head: Health is the approving Authority not the Chief Director: Infrastructure Development. It is critical that the officials and consultants understand this process since it informs the timeframes for the public planning and design of health construction projects. Sharon and Dori (2017) suggest that the fundamental problem with projects failing to meet the planned project schedule is the wrong calculation of activity durations by Project Leaders. Generally, the planning and scheduling deficiencies delay most construction projects. Shar (2016). A Project Leader must develop mitigate strategies against project delays due to appraisal process constraints.

Table 2-1 below, shows the KwaZulu-Natal Department of Health project stages and the corresponding appraisal and approval delegations (KZN Department of Public Works, 2016; KZN Department of Health, 2019).

Table 2 - 1: KZN Public Health project planning and design appraisal process

#	STAGE	APPRAISAL COMMITTEES	APPROVAL AUTHORITY
1	Initiation Stage	HIAC	Chief Director: Infrastructure Development, KZN Department of Health
2	Feasibility Stage	HIAC	Chief Director: Infrastructure Development, KZN Department of Health
3	Design Development Stage	HIAC followed by DRC	Chief Director: Infrastructure Development, KZN Department of Health

#	STAGE	APPRAISAL COMMITTEES	APPROVAL AUTHORITY
4	Design Documentation Stage	HIAC followed by BSC	Chief Director: Infrastructure Development, KZN Department of Health

Source: Constructed by the researcher

The above planning and design appraisal process comprises of four deliverables namely, Initiation Report (Project Brief), Concept Report, Design Development Report and the Design Documentation Report. In instances where the appraisal committees reject the tabled project submission, corrections need to be effected as per the recommendations of the appraisal committee. The revised project report must be submitted, resulting in project delays. A desktop study of KwaZulu-Natal public health projects that served at various design appraisal committees between 2017 and 2020 showed that few projects received approvals on their first submission (KZN Department of Health, 2020). Some of the causes for resubmission are listed hereunder:

i. Unclear project scope failed to guide the design process
ii. Non-compliance with National Health Standards – Infrastructure Unit Support Systems (IUSS)
iii. Non-compliance with building regulations
iv. Failure to address FIDPM minimum standards
v. Proposed project design too costly
vi. Options not clear
vii. Plan to decant operations during construction not clear
viii. Environmental sustainability not considered

The monthly project progress reports showed that other official had high workload compared to others. High workload results in tasks from various projects competing for the limited skills resulting in poor quality project submissions and a schedule slippage across projects (Pinha and Ahluwalia, 2019).

This exploration nature of this study seeks to interview officials and consultants who have interacted with the policies and procedures for project planning and design. Their experience and broad knowledge of other procedures relating to project appraisal will assist in understanding the factors that require attention in order to improve the planning and design of public construction projects in KwaZulu-Natal, South Africa.

The following research objective relates to a relationship between project constraints and project types.

2.4.2. Project types

This subsection discusses literature with regarding the effect of project type in the planning and design of public health construction projects. The project type relate to complexity and size of construction projects. The subsection discusses the global, national and provincial perspectives.

Global perspective

Projects differ in terms of levels of complexity. Project Leaders must consider project types in developing appropriate management strategies for their projects. For example, an office block may be less complex than a specialised hospital. The project type and project size play an important role in determining project success (Demirkesen and Ozorhon, 2017). The PMBoK Guide further suggests that, due to the uniqueness of each project, consideration for risk management must consider size, complexity, level of importance and the development approach of a project (PMI, 2017). Williams (2017) suggests that risk analysis alone will not solve problems associated with complex projects but recommends that the systemic structure of risks be considered carefully since most risks are inter-related. This also suggests that certain risks are caused by other risks and therefore a causal nature of risks require investigation. Although systemic structure of risks is also present on less complex projects, the impact caused by relatedness of risks may be higher on complex projects (Williams, 2017). A Project Leader that possesses good knowledge of risk management is likely to manage complexity in projects successfully.

Hospital construction is complex compared to most other project types. High levels of specialisation, sophistication in systems configurations and the uniqueness of project technology and construction requirements are some of the special attributes of hospital projects (Pang and Shi, 2016). Planning and design of health sector projects normally involve a number of specialist professionals working from different offices and geographic locations. This may compromise effectiveness and efficiency in the project Planning and Design phases as coordination and collaboration may be compromised. Design changes especially in complex and major projects maybe efficiently addressed when professionals from different disciplines meet and brainstorm (Shah, 2016).

Complex projects normally experience complexity in stakeholder landscape that pose a major challenge for the project leader (Eskerod, et al., 2015). The needs and expectations of the stakeholders must be understood to ensure project objectives are met (Heravi, Coffey, and Trigunarsyah, 2015). Failure to manage these expectations may cause a slow iterative process amongst the stakeholders, resulting in delays in the design phase completion (Demir and Theis,

2016). To avoid such unnecessary delays, the stakeholders must be analysed, categorised and efficiently managed (Eskerod, Huemann, and Savage, 2015). Literature also provides a number of proposals on how to manage such challenges using proven technological tools. The PMBoK Guide includes tools like Building Information Modelling (BIM) and Project Management Information System (PMI, 2017). The literature review above, suggests that complex and large projects require a higher degree of attributes as it relates to process and people management.

Most construction projects of the KwaZulu-Natal Department of Health possess this complexity. Effective coordination of stakeholders becomes very critical. General knowledge of involved work packages is necessary for an official or consultant appointed to a leadership position. Davies and Brady (2016), suggest that owing to the uniqueness of each project, it is critical that appropriate personnel who possess the correct skills and experience are deployed in a project.

South African perspective

The South African perspective is no different from the global perspective.

Provincial perspective

Project types refer amongst others to project magnitude, complexity, engineering discipline, maintenance, green field or brown field. Most Public Health construction projects are highly diversified. Some projects are straightforward whilst others are highly specialised. To name a few, major capital projects in this space may include Clinics, Community Health Centres, District Hospitals, Regional Hospitals, Mental Health Hospitals, TB Hospitals, Tertiary Hospitals, Nursing Colleges, Emergency Medical Services Bases, Regional Laundries and Pharmaceutical Depots (KZN Department of Health, 2019). Capital projects that form part of renewal projects include, but are not limited to, Heating, Ventilation and Air-conditioning systems (HVAC), Boilers, Medium Voltage (MV) and Low Voltage (LV) installations, Switchgears, Water Heating Systems, Sewer and Water systems, Standby Generators and Lifts (KZN Department of Health, 2020). In the projects listed on Annexure A, for example, it was found that the planning and design of HVAC projects and Specialised Hospitals (TB and Mental Health Units) took longer compared to other types of projects (KZN Department of Health, 2019). However, there was no indication that complexity and size were considered allocation of a project leader and other support specialist personnel who in most cases are already assigned in multiple projects.

The following research objective relates to training and development of project team members.

2.4.3. Training and development

This subsection discusses the effect of training and development of employees and consultants in the planning and design of public health construction projects. The global, national and provincial perspectives are discussed below.

Global perspective

Training and development refer to organisational activities that provide the workforce with continuous education and learning with an aim to improve their competencies (Sartori, Costantini, Ceschi. and Tommasi, 2018). Skills, knowledge and motivation amongst employees are critical for the organisation's competitiveness in the market. According to Janev, Hadzi-Vasileva and Sofijanova, 2018, training and development of individuals in organisations leads to improved effectiveness in an individual, team and organisation. Furthermore, the training benefits lead to the country's improved economic growth. According to Rodriguez and Walters (2017), training and developing individuals within an organisation leads to job satisfaction and reduce employee frustration. Consequently, a developed employee is likely to stay in an organisation. The development and training must include both hard and soft skills. According to Ibrahim, Boerhannoeddin and Bakare (2017), companies are reluctant to invest in the soft skills training programmes due to challenges of accounting for the benefits attained. However, soft skills provide an individual with improved emotional intelligence, communication and collaboration skills necessary for improved team performance. According to Ludwikowska (2018), training comprises of the following:

i. Training needs analysis,
ii. Training delivery,
iii. Training evaluation, and
iv. Training transfer

Ludwikowska (2018) suggests that investments made by organisations in the various formal training programmes do not often yield desired results due to lack of training evaluation. This also applies to public organisations like government departments. Appropriate tools are necessary to undertake post-training evaluations. The absence of training evaluation results in an ability to manage the organisational knowledge. A successful and sustainable organisation requires an ability to manage its existing knowledge whilst creating and processing new knowledge. Trained and developed individuals have an ability to create new knowledge and to innovate. According to Nonaka (1994), knowledge is created through a continuous interaction of explicit and tacit knowledge. Explicit knowledge is defined as knowledge that is existing in an organisation through books, policies,

procedures, etc., whereas tacit knowledge is information that is found in individuals within an organisation. Such knowledge includes beliefs, experience and behaviour.

Knowledge is continuously created through the lessons-learnt process. Each project is different and lesson learned differ according to experiences of each project. McClory, Read and Labib (2017) suggest that a repository of lessons-learnt provides information across projects on the successes and failures of projects. This prevents reinvention of the wheel and repeat of past mistakes. Solutions from other projects can be used to develop project team members in the various domains of project management. The KZN Department of Health has a web-based system. A lessons-learnt register can be developed, maintained and made accessible to officials from both departments.

South African perspective

In South Africa, different training service providers like universities and private training organisations offer various formal training courses. Through the Division of Revenue Act (Act 9 of 2021) and the HR Capacitation Circular for Infrastructure Units of Provincial Health Departments, National Treasury coordinates the IDMS training for the officials within the health sector (National Treasury, 2021). The capacitation Circular makes provision for the National Treasury and National Department of Health to:

i. Design and implement a community of practice programme (mentorship programme) for built environment professionals in terms of knowledge and skills on how to deal with specific work and governance issues experienced by professionals

ii. Manage the induction process for newly appointed personnel in terms of the IDMS on request by the province

iii. Provide leadership training to senior managers in infrastructure units

Professional bodies require that consultants and built environment officials undergo a continuous development programme and formal training courses are made available. Below is the provincial perspective of the training and development of project team members.

Provincial perspective

The successful implementation of the IDMS, FIDPM, applicable legislation, policies and procedures depends on the development and implementation of appropriate training programmes for officials and consultants. The IDMS project management module is adapted from the PMBoK. Officials and consultants require a good understanding of the PMBoK knowledge management areas. However, it is critical that officials and consultants receive continuous training in both hard and soft skills to improve their knowledge in the planning and design of public health construction projects. There

were no documents available for review on the training and development of staff. The provincial perspective in training and development will be investigated during data collection later in this study.

The fourth research objective relates to the construction procurement issues that relate to planning and design performance. The discussion below discusses procurement legislation, strategies and procedures relating to construction procurement.

2.4.4. Construction Procurement

This subsection discusses the effect of construction procurement in the planning and design of public health construction projects. The subsection discusses the three types of procurement strategies applicable to construction projects. The global, national and provincial perspectives are discussed below.

Global perspective

Project Procurement Management involves the process of identifying, and acquiring goods and services required to achieve project objectives. Procurement of goods and services within the construction industry is referred to as Construction Procurement. Such procurement is carried out on a competitive basis, especially the procurement of public goods and services. With respect to public procurement, other legal, social and economic objectives require consideration other than the cost efficiency. Such objectives may include environmental protection, job creation, and advancement of certain groups (Patrucco, Luzzini, Ronchi, Essig, Amann and Glas, 2017). According to de Araújo, Alencar and de Miranda Mota (2017), the success of projects depends widely on the selection process and an evaluation of a service provider during implementation of the project. Petterson (2018) suggests that the appointment of professional service providers through selection of lowest bidder normally overlooks appropriately experienced firms. Motlhatlhedi and Nel (2019) further suggest that appointed service providers should possess reputation that demonstrates ethical and accountable engineering practices. According to Saad (2018), untrained procurement officials contribute to inefficient procurement of service providers. Lack of operational support exacerbates procurement process challenges (Gurría, 2016).

From a global perspective, the procurement process starts by selecting a procurement strategy that suits the product or service requirements. According to Muhammad, Adamu and Ladi (2015), knowledge of procurement strategies available to public construction sector is limited amongst built environment professionals. They further suggest that knowledge of available procurement strategies will help exploit the bottlenecks that prevent the use of all approved procurement strategies. Eriksson (2017) suggests that the procurement strategy selection coupled with a delivery system must suit the project type, scope and objectives. According to Eriksson (2017), construction procurement

strategies are either Design-Build (DB) or Design-Bid-Build (DBB). The DB procurement strategy brings in the contractor early in the design phase and resulting in consultants and a contractor collaborating in the development a most effective way of delivering a project. The DBB procurement strategy provides for an appointment of the consultants to design and document the design for tendering by contractors. Only when construction estimates against approved detailed details are finalised that a tender for the appointment of the contractor is advertised. The latter has a two-stage procurement process whereas the former only has a one-stage procurement process. However, there are a number of advantages and disadvantages of each procurement strategy.

The DB contracts incorporate a number of specialist contracts like Design and Construct, Develop and Construct, Engineering-Procurement-Construction (EPC), Turnkey and any type of construction contracts where design and construction is under a single appointment. This procurement strategy has gained popularity over the recent years due to the following advantages:

i. Single point of contract responsibility. Contractor designs, procures all required services and perform construction requirement and thus facilitate (Shen, Tang, Yu, Duffield, Hui, Wei and Fang, 2017; Li, An and Dong, 2020).

ii. Engineering design and construction are integrated. This results in the improved design constructability due to early input from the contractor (Shen *et al*., 2017; Li *et al*., 2020).

iii. Cost savings due efficiency gains due to innovation and collaboration efforts between consultants and contractor across phases of the project (Shen *et al*., 2017; Li *et al*., 2020).

iv. Reduced project duration since many activities can happen simultaneously. For example, consultants and contractors are contracted through a single procurement process unlike in a DBB procurement strategy where these are two separate processes and timeframes (Shen *et al*., 2017; Li *et al*., 2020).

However, the DB procurement strategy has its own disadvantages and some may lead to contractors' claims. Some of the disadvantages are listed below.

i. Delays in payments by the client. The delay in one payment affects all parties employed under the DB contract and also progress payments are high in value since such projects adopt an accelerated approach to project delivery (Shen *et al*., 2017),

ii. Scope creep or variation orders by the client. Rigidity and inflexibility to client changes attracts hefty claims (Saaidin, Endut, Samah and Ridzuan, 2016; Shen *et al*., 2017),

iii. Limited employer input. Where a client does not have a second opinion on design, the final product might deviate from the expectations of the client due to consultants and contractor agreeing on designs that suit them best. (Saaidin *et al.*, 2016),

iv. Client's inefficient approval processes. This is normally a problem where a client needs to approve certain activities or deviations. A delay may attract additional cost to the client (Shen *et al*., 2017),

v. Unclear technical specification. The construction team is likely to provide a solution that makes economic sense to them but compromise functionality life cycle cost of an Shen *et al*., 2017),

vi. Unclear scope of works. The client may fail to provide a clear and complete project scope resulting in the DB contractor taking advantage of a client through claims arising from technical understanding of what formed part of original scope (Saaidin *et al*., 2016; Shen *et al*., 2017)

vii. Compromised quality. Consultants fall under the contractor and conflict of interest is likely to compromise the client whereby work not conforming to agreed quality standard is accepted or condoned. (Saaidin *et al.*, 2016).

The overall criticism of the DB procurement strategy is that the client is likely to lose control of the project unless the appointed team under the DB procurement strategy is ethical and honest (Saaidin *et al.*, 2016). In order to mitigate and control risk, most public clients decide to limit their procurement practices to a DBB procurement strategy. The DBB strategy gives the client control since consultants take instructions directly from the client. According to Fernane (2011), the DBB construction provides the following advantages for the public client:

i. Client control design and construction requirements. The client must be satisfied that the design fully addresses the requirements of the project through stage approvals. Consultants appointed by the client must ensure that a contractor delivers in accordance with the approved design and specifications,

ii. Design changes prior to construction are not costly to accommodate since design process is structured and resources are gradually introduced,

iii. Construction only starts when design complete. This avoids unnecessary rework and inefficient sequencing of construction activities,

iv. Maximum fairness, competition and transparency,

v. Easy to implement due to its sequential nature of planning, design and construction. Most public officials and consultants are familiar with it,

vi. Contract award fixes project cost unless there are variation orders, and

vii. Client has control on the quality of deliverables across project stages.

Fernane (2011) identified the following disadvantages in the use of the DBB procurement strategy by the public clients:

i. Client requires substantial resources and capabilities to manage projects.
ii. Higher responsibility to deliver projects since a significant risk remains with the client compared to a DB strategy,
iii. Design errors during the construction phase are a cost to the employer
iv. Construction cost unknown prior to award of tender and may have impact on the employer's financing strategy
v. No leveraging of contractor's expertise prior to construction
vi. Sequential nature of planning, design and construction leads to a long project schedule.

Both DB and DBB procurement strategies have specific strategies that can be used to mitigate the identified risks or disadvantages. Therefore, regardless of the risks, it is a responsibility of the client to choose a correct procurement strategy for a specific situation and use the Risk Management Plan to manage identified risks.

According to Laryea and Watermeyer (2016), limitations associated with DB and DBB procurement strategies can be mitigated by appointing both the consulting team and contractor through separate contracts upfront. In this DBB procurement strategy known as Early Contractor Involvement (ECI), a contractor is appointed through a framework contract. A framework contract allows for the appointment of one or more contractors to undertake construction work of a specified value over a specified timeframe in line with the agreed terms with the client. According to Laryea and Watermeyer (2016), the benefits of the ECI approach are similar to those of the design-build or EPC or turnkey except that the client appoints consultants and contractor separately. However, this approach has its own drawbacks. The disadvantages include:

i. Inadequate time to finalise the pricing of the works in accordance with the detailed design (Mosey, 2009),
ii. An appointed contractor may refuse to take on emergent risks identified prior to construction, resulting in disputes or exorbitant cost implication (Mosey, 2009),
iii. Remuneration method of the contractor on planning and design activities may be a challenge resulting in unnecessary disputes (Mosey, 2009),
iv. Lack of trust and collaboration amongst parties may result in limitations to flow of sensitive information thus affect the project negatively (Mosey, 2009; Rahman and Alhassan, 2012), and

v. Possible disagreements regarding design issues may hinder progress (Rahman and Alhassan, 2012)

vi. Limited knowledge of framework contracts amongst contractors. Actors that are not familiar with this approach may experience collaboration challenges (Rahman and Alhassan, 2012)

vii. Resistance to teamwork and culture change (Wondimu, Hailemichael, Hosseini, Lohne, Torp and Laedre, 2016.)

viii. Contractors appointed based on proven track record and capacity to undertake the work (Wondimu *et al.*, 2016; Rahman and Alhassan, 2012). Use of such contracts in a South African public procurement may be seen as setting aside work for specific large contractors and not providing an equal opportunity to all capable contractors to tender for the work.

Public procurement prescripts in most countries promote a fair, transparent and competitive procurement system. The use of the ECI in public procurement continues to be limited because of its contractor selection procedure (Wondimu *et al.*, 2016). The projects identified in this study were procured using the DBB known as Design by Employer procurement strategy. This is a widely used procurement strategy in government departments. The study seeks to understand the main reason behind the lack of appetite for other approved procurement strategy. Below is a South African perspective of construction procurement.

South African perspective

South Africa has legislative mechanisms that guide the financial activities required for the planning, procurement and implementation of public investments. The Public Finance Management Act (PFMA) No. 1 of 1999 is the main legal framework for managing public finance at provincial, national and State-Owned-Entities level and The Municipal Finance Management Act (MFMA) No. 56 of 2003 is applicable to municipalities. Other applicable legislative mechanisms are contained in the Companies Act No. 71 of 2008 for state-owned entities whilst, the Preferential Procurement Policy Framework Act (PPPFA) No. 5 of 2000 is applicable to government departments.

The FIDPM is an approved delivery and procurement framework for the public sector projects in South Africa. The FIDPM and the CIDB Standard for Uniformity (SFU) provide guidance in the use of procurement strategies relating to construction projects. The provincial perspective below provides a discussion on how DOH and DOPW implement the abovementioned procurement prescripts and procedures.

Provincial perspective

The output of the planning process, the Project Brief, informs the Tender Specification for the appointment of various professional disciplines. The contracting methodologies contained in the

FIDPM provide four alternatives for the appointment of the Design Professional Team at various gates of the IDMS (National Treasury, 2019).

In the 2017/18 financial year, the KZN Department of Public Works moved away from a roster approach in the appointment of design consultants and adopted a competitive bidding process (KZN Department of Public Works, 2019). The project design process has experienced major delays due to the adoption of a full tender process for the appointment of a specialist consultant (KwaZulu-Natal Department of Public Works, 2020). Ordinarily, a specialist consultant was appointed as a disbursement to another existing consultant. The monthly progress reports of public health projects have revealed a number of issues that cause delays in the appointment of Design Professional Team (KwaZulu-Natal Department of Public Works, 2020). These include the following:

i. The pre-screening of tenders taking longer than expected
ii. Committees not forming the quorum and tender committee meetings postponed
iii. The tender appeals process taking longer to be resolved by the Provincial Treasury
iv. Members of the Design Professional Team appointed at different times for the same project and design not starting until all are members appointed

There are instances where the appointed consultants suspended design work because the Provincial Treasury needed to approve cost variation. Since the initial Baseline Cost Estimates are the basis for the appointment of the project Design Professional Team, major changes to the Baseline Cost Estimate and the budget revision may require approval from the Provincial Treasury (KZN Treasury, 2019). The KZN Treasury Practice Note No. 2 of 2019 requires that all services contract cost variation of more than 15% of the original award amount or R15 million value, be forwarded to the Provincial Treasury for approval. This process has led to a number of delays in project design.

In a popular Design by Employer methodology, design can only start once the design consulting team is appointed. The protracted process in the appointment of the Design Professional Team results in a number of delays. The KZN Department of Public Works prefers the Design by Employer contracting strategy as a procurement methodology for Public Health infrastructure projects (KZN Department of Public Works, 2020). It is not clear why the KZN Department of Public Works is reluctant to explore other methodologies. The other South African public sector methodologies include:

i. Management Contracting
ii. Design and Construct
iii. Develop and Construct

The National Treasury discourages the dominance of one methodology over others. The recommendation is to use an appropriate methodology for each project or programme (National Treasury, 2019). Literature advocates for choosing the appropriate procurement strategy for each project. The reluctance to adopt other procurement strategies by the KwaZulu-Natal Department of Public Works require an in-depth understanding during qualitative data collection.

The fifth and last research objective of this study relates to collaboration and communication amongst stakeholders involved in the project. Literature relating to this research objective is reviewed below.

2.4.5. Collaboration and communication

This subsection discusses the effect of collaboration and communication in the planning and design of public health construction projects. The global, national and provincial perspectives are discussed below.

Global perspective

Construction projects require extensive collaborative arrangements amongst different project disciplines and competencies (Larsson and Larsson, 2020). In the health sector, such disciplines include public sector and private sector electrical, mechanical, civil and structural engineering, architectural, quantity surveying and sustainability specialists. Leading and managing collaboration amongst these organisational players is complex and desired synergies are not guaranteed (Vangen, 2017). Different role-players have differing expectations and lack of trust amongst them hinders the collaborative efforts. According to Bond-Barnard, Fletcher and Steyn (2018), the level of collaboration in project teams depends on the:

i. Physical distance between team members,
ii. Level of commitment amongst team members,
iii. Level of conflict amongst team members,
iv. Coordination effort amongst team members,
v. Level of relationship amongst team members and other project stakeholders, and
vi. Type of project team rewards and incentives.

In construction projects, teams can be self-organising, cross-functional, projectised, virtual or co-located. The advantage of co-located teams is the likely achievement of team cohesion due to face-to-face interaction. However, Dulebohn and Hoch (2017) hold a different view regarding the distance

between team members. Their view is that virtual teams can offer more advantages that do not exist within the co-located teams. Such advantages include:

i. Availability of professional skills not limited by geographic location,

ii. Maximised sharing of knowledge because of absence of geographic constraint

iii. Ability to work across time zones throughout the day,

iv. Reduced ravel costs, and

v. Lower overheads and avoidance of relocation costs.

According to Tabassi, Roufechaei, Bakar and Yusof (2017), irrespective of the team organisation type, the project leader has a responsibility to develop and coordinate team members. They further suggest that the team of a manageable size a likely to be effective compared to teams consisting of many members. Gomez (2019) suggests that early project collaboration assists to clear misunderstandings amongst stakeholders. In the early stages of the planning and design of construction projects, such misunderstandings are normally associated with the key project parameters such as scope baseline, cost baseline and the project schedule (Al-Rubaiei, Nifa and Musa, 2018). According to Sommer (2016), the following project planning and design factors are likely to result in misunderstandings or frustrations amongst team members:

- Lack of clarity in the planning and design phase schedules
- Lack of team understanding of rationale in tasks precedence relationship
- Lack of team understanding of each member's task
- Delays in information flow
- Lack of common understanding of design expectations
- Continuous disruptive changes

PMBoK Guide proposes that stakeholders be adequately engaged during the project planning to avoid unnecessary conflict and delays (PMI, 2017). Team collaboration depends on the quality of communication process amongst team members and stakeholders. Communication involves the acquisition, interpretation, sharing of information and feedback amongst people who require it (Zulch, 2014). However, the Project Leader must play a leading role in ensuring that communication is supported by an appropriate leadership style. According to Zulch (2014), project leaders must adapt a management style to suit the situation at hand. Communication is normally a challenge in multi-disciplinary teams since officials come from different professional disciplines. To mitigate the possible conflicts, the design consultants need to collaborate and keep each other informed during the project design process (Brandt, 2017). Conflict can either build or destroy team relationships.

According to Wu, Liu, Zhao and Zuo (2017), care must be exercised when team members communicate informally as this may lead to misunderstandings. In order to mitigate conflict in construction projects, a Project Communications Management Plan must be developed. This plan must clearly state the forms of communication applicable to specific project situations (Pratami, Puspitasari and Haryono, 2017). According to the PMBoK Guide, the primary aim of such a plan is to provide for dissemination of information required in the project and needed by each project stakeholder (PMI, 2017). Some of the commonly used methods of information dissemination include project progress and deliverable reports, emails, presentations, formal correspondence, web-based project information management system (PMIS). The Project Leader is responsible for communicating reliable, timeous and detailed information to project stakeholders (Turner, 2016; Ziek and Anderson, 2015).

South African perspective

The Inter-Governmental Relations (IGR) require that Municipalities, Provincial Departments, National Departments, State-owned Companies and Agencies all work together to achieve the set project objectives. Poor stakeholder management can result in poor task co-ordination and lapses in efficiencies resulting in the Roadrunner effect, which has the net effect of lengthening processes unnecessarily. According to Kanyane (2016), public institutions must be held accountable for their responsibility to other government institution.

Effective communication, collaboration and teamwork amongst government institutions are key to good governance and achievement of common goals. Regarding this study, critical departments that must support provinces by collaboration and communicating decisions timeously, include:

i. National Treasury: Confirmation of 3-year budgets estimates and annual budgets. Facilitating the publishing of the Division of Revenue annually. Finalising and communicating the outcome of the assessment of submitted infrastructure plans and associated reports.

ii. National Department of Health: Approval of Annual Implementation Plans. Approval of submitted Clinical Project Briefs (business needs), Concept and Design documents.

iii. Department of Environmental Affairs: Approval of Environmental Impact Assessment Reports

iv. Municipalities Approval of development plans and final drawings. Provision of municipal bulk services in line with the project schedule

v. Eskom and Telkom: Provision of electrical supply and connectivity, respectively

vi. Amafa / Heritage Society: Provision of approvals on heritage protected buildings. Collaborate on proposals to mitigate cost by using alternative materials or products

The role and communication requirements of the above stakeholders must be identified during the stakeholder identification stage and be included in the Communication Management Plan. The provincial perspective of collaboration and communication is discussed below.

Provincial perspective

The health construction projects are multi-disciplinary and complex. It involves coordination of specialised architectural, electrical, mechanical, civil and clinical engineering inputs from diversified designers (Alaloul, Liew, and Zawawi, 2016). Due to a shortage of professionals within the public service, the project leader must rely on the appointed design consultants to provide project design deliverables. Table 2-2 below provides an example of the number of professionals that would form part of the team in a multi-disciplinary capital project.

Table 2 - 2: Typical project professionals in a Public Health infrastructure project

#	Resource Name	KZN Department of Health	KZN Department of Public Works	Design Consultants
1	Project Manager	1	1	
2	Architect	1	1	1
3	Quantity Surveyor	1	1	1
4	Electrical Engineer	1	1	1
5	Mechanical Engineer	1	1	1
6	Civil/Structural Engineer	1	1	2
7	Health and Safety Officer	1	1	1
8	Quality Assurance Officer	1		
9	Health Technology Technician	1		
10	IT Officer	1		
11	Procurement Officer		1	
Sub-Total		10	8	7
Total		25		

Source: Constructed by researcher

The KZN Department of Health team led by the Project Manager facilitates the development and approval of the Project Brief (KZN Department of Health, 2020). The KZN Department of Public Works team led by the Project Manager facilitates the appointment of the Design Professional Team and manages the design outputs. The Design Professional Team led by the Architect, uses the Project Brief to design the project in line with the client's needs and prescribed design parameters. The resource structure in Table 2-1 above shows that for each design discipline, three professionals are required per project. This stretches the few public servants across a number of projects to ensure representation on each project under planning, design or implementation. This results in a sub-

optimal multi-tasking scenario between projects thus causing delays in the achievement of project phase deliverables.

The hierarchy of the planning and design project team in Figure 2-11 below, shows the reporting and coordination relationship amongst the project team members.

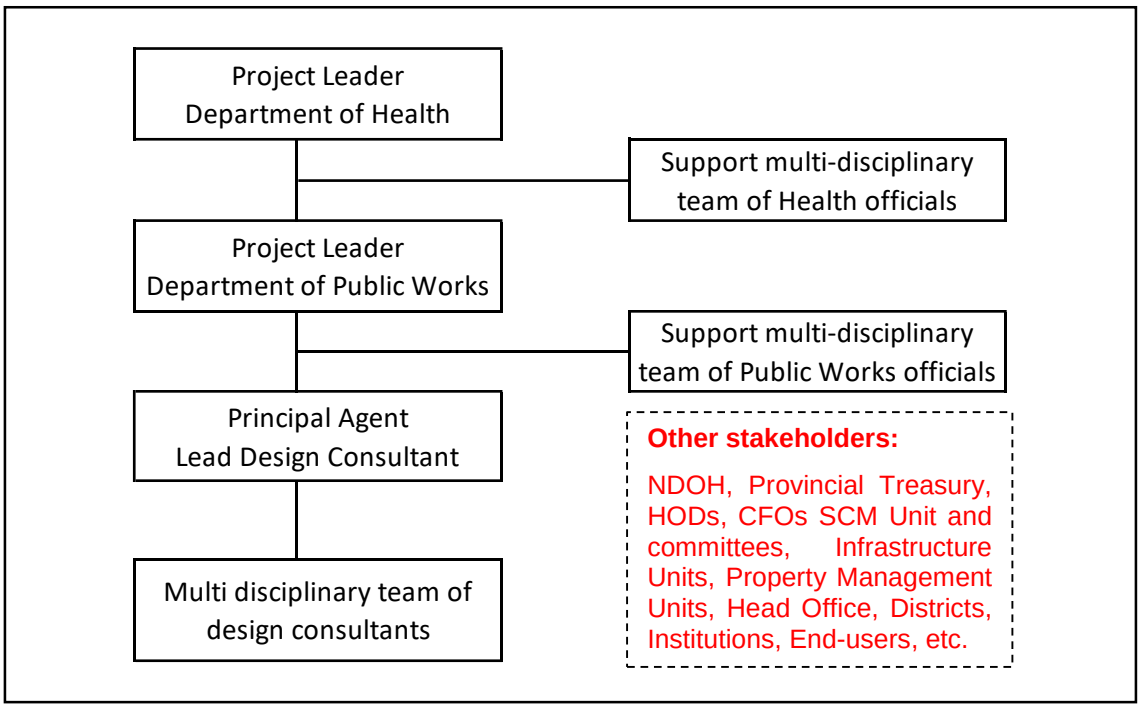


Figure 2 - 11: Hierarchy of the planning and design project team and stakeholders

Source: Constructed by the researcher

Project stakeholders in health infrastructure projects normally include health institutions / end-users, District Office, Head Office Service Delivery Unit, Head Office Infrastructure Unit, Infection, Prevention and Control Unit, Provincial Treasury, Department of Public Works, Local Municipality, Design, and project appraisal committees (KZN Department of Health, 2019). Failure to manage expectations of these stakeholders can delay the project planning and design process.

The above-mentioned stakeholders demonstrate stakeholder complexity, which requires the project leader to manage. The PMBoK Guide encourages scheduling of meetings with stakeholders to discuss progress and plans for the coming days or weeks (PMI, 2017). Covid-19 restrictions have resulted in major disruptions in projects. Some of the design consultants reside outside KwaZulu-Natal and cannot be available for meetings. To avoid delays in decision-making, the PMBoK Guide suggests the use of virtual teams to facilitate ongoing and timely communication (PMI, 2017). The most common platforms for virtual teams include Microsoft Teams, Skype and Zoom.

The following section provides the summary of the chapter.

2.5. CHAPTER SUMMARY

This chapter provided the review of literature. The chapter provided an overview of various project management theories, methods, techniques and models applicable to this study. Each research objective was discussed form a Global, South African and KwaZulu-Natal context. In general, the South African context collaborated with best practices discussed under global perspective. The in-depth review of the literature created a foundation for an exploratory investigation of each research objective.

The next chapter will discuss the research design, methodology and data collection.

CHAPTER 3: RESEARCH DESIGN, METHODS AND DATA COLLECTION

3.1. INTRODUCTION

The purpose of this chapter is to explain how the research design, methodology and data collection strategies were used to answer the research questions. This chapter outlines the aim of the study, research paradigm, research design and methods and study setting. It explains how the respondents were selected, the method used to collect data from them and the analysis of the data. It discusses the measures adopted to ensure validity, reliability, bias and ethical considerations. The chapter summary provides an overview of matters covered in this chapter and introduces the following chapter.

3.2. AIM OF THE STUDY

The aim of this research is to understand the factors that constrain the planning and design process of the public health sector projects in KwaZulu-Natal. The objectives of the study are:

i. To identify the constraining factors in the policies and procedures governing the planning and design for public health construction projects in KwaZulu-Natal, South Africa

ii. To explore if factors that constrain the planning and design process affect different project types differently in KwaZulu-Natal, South Africa

iii. To ascertain the training and development level of officials and consultants in the planning and design of public health construction projects in KwaZulu-Natal, South Africa

iv. To identify construction procurement issues that hinder the project planning and design of public health construction projects in KwaZulu-Natal, South Africa

v. To ascertain the effect of stakeholder collaboration and communication in project planning and design of public health construction projects in KwaZulu-Natal, South Africa

The study intends to answer the following research questions.

i. What are the constraining factors in the policies and procedures governing the planning and design for public health construction projects in KwaZulu-Natal, South Africa

ii. Is there a relationship between project constraints identified for the planning and design process and project types in KwaZulu-Natal, South Africa?

iii. What is the training and development level of officials and consultants in the planning and design of public health construction projects in KwaZulu-Natal, South Africa?

iv. What are the construction procurement issues hindering the project planning and design of the public health construction projects in KwaZulu-Natal, South Africa?

v. What is the effect of stakeholder collaboration and communication in project planning and design of public health construction projects in KwaZulu-Natal, South Africa?

3.3. RESEARCH PARADIGM

According to Guba and Lincoln (1994), paradigm in research is defined as the"basic belief or world view that guides the investigation". This study adopted a constructivism paradigm. The constructivism pholosphy relies on the views of the respondents selected for the research. In order to maximise understanding of the problem being studied, the reseacher made use of an open-ended questionnare to guide a discussion in line with the identified research objectives.

This paradigm assissted in providing the factors constraining the planning and design of public health construction projects from perspectives of three important groups, i.e. Department of Health, Department of Public Works and consultants. This approach mitigated the bias view from the respondents. However, due diligence and objectivity in the interpretation of the views of the respondents by the researcher was of vital importance. Strategies adopted to ensure ethical considerations are discussed later in this chapter.

3.4. RESEARCH DESIGN AND METHODS

Queirós, Faria and Almeida (2017) suggest that scientific research deals with discovering and intepreting truths about a specific reality through systemmatic enquiry. Scientific research can be qualitative, quantitative or mixed i.e. combination of qualitatative and quantitative research methods. Below is short discussion on each research method.

3.4.1. Qualitative research method

Qualiatitive research is a non numerical method used in exploring or in-depth learning of a phenomenon where standard questiions would not be sufficient to capture the detail necessary to provide new knowledge of the phenomena (Luborsky and Lysack, 2017).

This study sought to understand process-speciffic issues in the planninng and design of KZN public health construction projects. Experienced professionals that interact with a prescribed process and

its support systems have knowledge that can be collected, analysed and packaged to provide recommendations for process improvement. This research method provided an opportunity for the respondents to provide and explain their responses beyond existing knowledge.

3.4.2. Quantitative research method

Quantitative research method is a cost effective data collection and analysis process through use of statistical instruments to provide a replicable generalisation of features of a phenomenon. Unlike in qualitative method, the quantitaive method is structured, tests existing knowledge and creates no room for participants to contribute to new knowledge (Eyisi, 2016). This research method was not preferred for this study as the purpose was beyond testing of existing knowledge.

3.4.3. Mixed research method

A mixed research method uses at least one component from both qualitative and quantitaive methods to strengthen the study's validity and its conclusions (Schoonenboom and Johnson, 2017). Consequently, this type of research method is both deductive and inductive.

This method was not chosen because of the time limitation. However, it would have improved the final outcome of the study if the data collected through quantitative method was collaborated through a quantitative analysis. This would have improved the validity and reliability of this study.

3.4.4. Comparison between qualitative and quantitative methods

Choosing an appropriate research method for a study requires knowledge of the advantages and disadvantages of each method (Queirós, et al., 2017). The strengths and limitations of qualitative and quantitative research methods are tabulated in Table 3-1 below.

Table 3 - 1: Strengths and limitations of qualitative and quantitative methods

Dimensions	Quantitative research	Qualitative research
Focus on understanding the context of the problem	Smaller	Bigger
Dimension of group studies	Smaller	Bigger
Proximity of the researcher to the problem being studied	Smaller	Bigger
Scope of the study and time	Immediate	Longer range
Researcher's point of view	External	Internal
Theoretical framework and hypothesis	Well structured	Less structured
Flexibility and exploratory analysis	Lower	Higher

Strengths and limitations of qualitative and quantitative research methods (Queirós, Faria, and Almeida, 2017)

Understanding of the context of the problem through unconstrained exploration data was important to this study. The planning and design process of projects consisted of a number of elements that are interconnected and causal effect amongst them required proper analysis. The study did not just focus on identifying constraints and rank them but views of respondents based on their professional experience were solicited. They were afforded a chance to explain they input do avoid flawed analysis of their responses. However, the proximity of the researcher to the problem being studied required careful consideration during selection of respondents, interviews and data analysis. For example, senior personnel who have many years of experience in their professional fields were selected. The purpose of the study was properly explained prior to interviews and care taken during the interview. The flexibility in the qualitative method assisted respondents to give their views regarding the way the questions were phrased.

3.5. STUDY SETTING

A study setting refers to an environment in which the study was undertaken. The chosen departments were the KZN Department of Health and KZN Department of Public Works. The KZN Department of Health receives an allocation from the Equitable Share and Health Revitalisation

Grant for the construction of new health infrastructure, upgrades, renovation, and maintenance of existing health facilities. The KZN Department of Health is required, through the Division of Revenue Act (Act 9 of 2021), to develop 10-Year, 3-Year and 1-Year Infrastructure Plans for Public Health infrastructure development in KwaZulu-Natal. Following the approval of the 3-Year Infrastructure Programme Management Plan (IPMP), the KZN Department of Public Works develops an Infrastructure Programme Implementation Plan (IPIP). The IPIP, once approved by the KZN Department of Health allows the KZN Department of Public Works to start the implementation of projects. The two departments must work together to plan and design the projects for implementation. The head offices of the two departments are in Pietermaritzburg, KwaZulu-Natal and located only six kilometres apart. The majority of the appointed consultants have offices in KwaZulu-Natal. The implementation of projects is across various districts of KwaZulu-Natal.

The main reasons for choosing these two departments were as follows:

i. The researcher works for one of the two departments and is familiar with the infrastructure policies, processes and role-players involved

ii. The researcher has a healthy relationship with the gatekeepers in both organisations which allows for ease of access to primary and secondary data

iii. There have been limited studies for this phase of project development. The outcome of the study is to likely assist the two departments improve their project delivery processes

3.6. POPULATION AND SAMPLE OF THE STUDY

Population is a set or collection of units that from which a sample will be taken from (Saunders, Lewis and Thornhill, 2016). A sample in a qualitative study is used to select the knowledgeable and adequate respondents to provide in-depth learning of a phenomenon. In relation to the study, the researcher identified the units of the population from a list of delayed projects, Annexure A. This list comprises of 54 project leaders broken down as follows:

i. Department of Public Works: 14 officials

ii. Department of Health: 17 officials

iii. Consultants (PSPs): 23 consultants

The purposive sample targeted fifteen (15) experienced built environment professionals as per Figure 3-1 below.

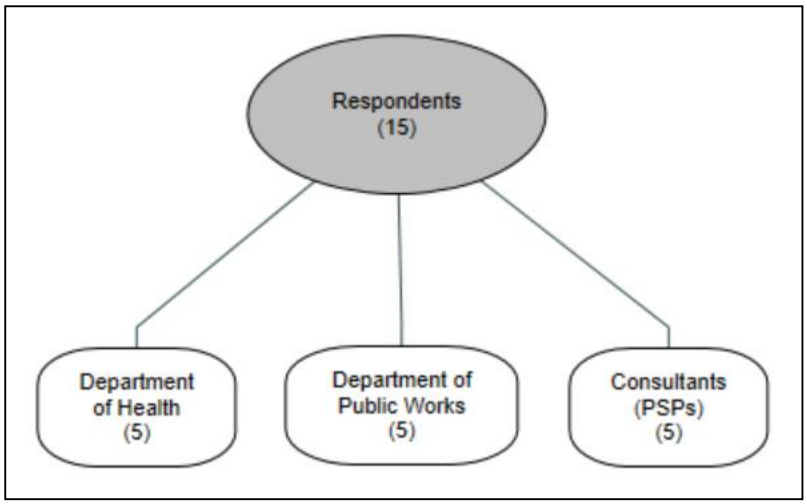


Figure 3 - 1: Study purposive sample

Source: Constructed by researcher

There was an effort to include all Built Environment Professional disciplines. Figure 3-2 below, shows the number of respondents from each professional discipline.

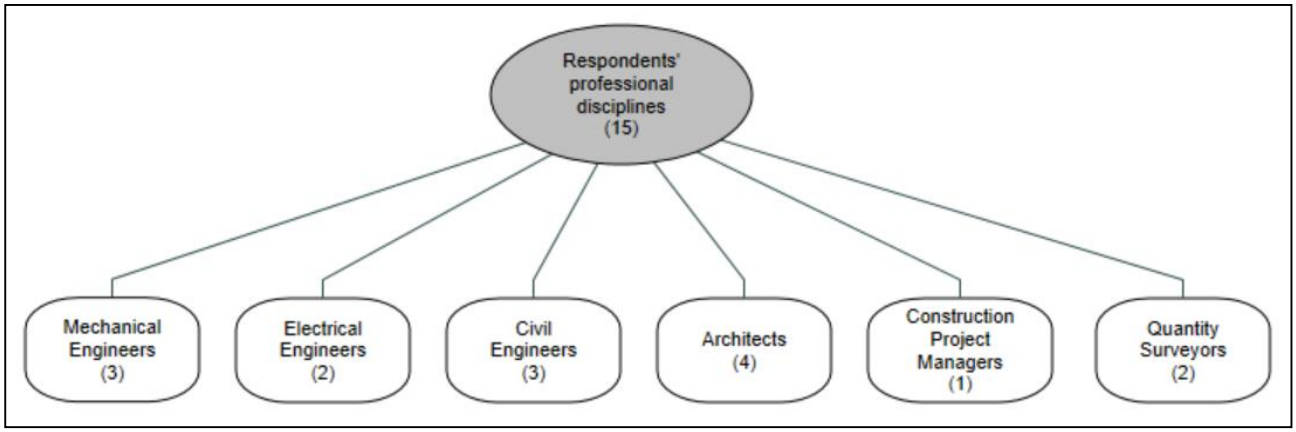


Figure 3 - 2: Respondents per professional discipline

Source: Constructed by researcher

All professionals selected as respondents for this study had appropriate and necessary experience to be participate in this study.

3.7. SAMPLING METHOD

The researcher chose the non-probability sampling over probability sampling. In probability sampling, a unit selected from a population must have a known probability whereas, in non-probability sampling, the probability is unknown or zero (Vehovar, Toepoel and Steinmetz, 2016). A suitable non-probability sample for this study was a purposive sample. In a purposive sample, a

researcher uses judgement to select units according to specific representative criteria to suite the purpose of the study (Vehovar *et al.,* 2016). A purposive sampling was ideal for this exploratory study since it allowed for the selection of the most experienced professionals in each built environment professional discipline. All selected professionals had participated in the planning and design of public health construction projects in KwaZulu-Natal, South Africa.

3.8. DATA COLLECTION TOOL

A data collection tool utilised in this study was a semi-structured questionnaire. The questionnaire guided the researcher on areas needing exploring during the interviews with respondents. Types of responses received from the respondents were a trigger for the probing questions. The questionnaire divided into two sections.

Section A of the questionnaire sought to confirm the demographic information which had been obtained prior to the interview. This information was not used to answer the research questions but merely provided information about the composition of the respondents. Section A comprised the following:

i. Organisation of the Respondent
ii. Professional discipline
iii. Gender
iv. Age
v. Race

The demographics information of the respondents is presented in the following chapter.

Section B of the questionnaire sought to answer the research questions. The data collection tool containing the open-ended questions is attached as Annexure B.

3.9. DATA COLLECTION

The gatekeepers from Departments of Health and Public Works in KwaZulu-Natal gave approval for the collection of secondary and primary data. According to Saunders, Lewis and Thornhill (2016), managers normally favour face-to-face interviews over completion of questionnaires. The collection of the primary data was through the semi-structured virtual interviews. Each interview took approximately one hour through Zoom or Microsoft Teams.

The interviews were audio-recorded (through prior consent) including note taking. Attention was paid to non-verbal communication e.g. tone. Interviews complied with the government regulations regarding the COVID-19 pandemic. Time and length of interview suited each respondent.

3.10. DATA ANALYSIS

This study used a Thematic Analysis method. The main advantage of this research method is the timely coding of data into themes. It allows for structure and summaries development as the data collection progresses (Nowell, Norris, White and Moules, 2017). The research objectives and the semi-structured interviews informed the data collection process. There was continuous analysis of data during the interviews, allowing for the generation of probing questions and themes development. This process involved the keeping of transcripts and progress summaries. The data is stored in password-protected files.

The data set was read and analysed a number of times. This allowed the tagging of data into a number of stories that related to the research questions. Analysis of the coded data that was found useful to answer the research questions was used to develop key patterns. These patterns were organised into themes. These themes represent building blocks of the project planning and design environment and provide a systemic approach to analysing and identifying the constraining factors. The following eight themes were identified.

i. Project appraisal system
ii. Definition of project scope
iii. Project types
iv. Construction procurement
v. Collaboration and communication
vi. Training and development
vii. Project leadership
viii. Technical policies and standards

The above themes are discussed in the next chapter. The findings are presented and discussed under each theme concurrently.

3.11. RELIABILITY AND VALIDITY OF STUDY

3.11.1. RELIABILITY

According to Noble and Smith (2015), reliability is the manner in which the outcomes of the study can be generalised in other settings. It requires the presence of clarity and transparency in the analytical process. It allows another independent researcher to arrive at similar findings. This study involved senior and highly experienced professionals in government departments and consulting firms. These professionals with many years of experience had an appreciation of the objectives of the study.

The approach adopted in the interview was to start with a broad open-ended question about the planning and design process followed up with questions focusing on specific facets of the research objectives. This approach collaborating the initial responses with the related responses later in the interview. The tone confidence or lack of and the facial expression were analysed in order to rate the confidence in the responses. Probing questions were posed to respondents to ensure that provided responses did not have ambiguity. As respondents were being interviewed, common issues became clear and collaborated during the analysis of data.

3.11.2. VALIDITY

Validity of the study refers to the appropriateness of the method, the soundness and transparency of its application and integrity regarding study conclusions (Noble and Smith, 2015). The researcher adopted the following measures towards ensuring reliability and validity of the study as suggested by Noble and Smith (2015):

i. Accounted for the researcher biases that may influence findings
ii. Acknowledged sampling biases and how they reflect on data collection and analysis methods
iii. Ensured sound record keeping with decision trail to account for consistency and transparency
iv. Allowed and included difference in opinion
v. Supported findings with direct quotes (their choice of words) from the respondents
vi. Supported data analysis and interpretations with a clear thought process
vii. Bounced ideas with other researchers to mitigate bias
viii. Invited all respondents to provide feedback on the interview transcript
ix. Used data triangulation to produce a comprehensive set of findings

In a qualitative research, subjectivity is always an issue. The tone and confidence in the responses of the respondents validated their understanding of the questions and provide comfort with the

responses. The researcher was mindful of the pitfalls of such research method and conducted interviews and data analysis with objectivity.

3.12. BIAS

According to Delgado-Rodriguez and Llorca (2004), refer to bias as the “lack of internal validity”. This happens when research findings do not represent the population from where the sample came from, as a result the findings also lack external validity and therefore cannot be replicated in other similar environments. To eliminate bias in this study, there were three groups of respondents selected for this study. The selected respondents were the project leaders in the two participating government departments and the consultants involved in the selected projects (see Annexure A). The selection consisted of a mixture of only experienced and high-ranking officials from different professional disciplines and corresponding directors of consulting firms. Furthermore, the selected respondents represented all professional disciplines.

The other bias risk was in the compilation of the questionnaire. The research questions formed the basis for the compilation of the questionnaire. Independent individuals with knowledge of the collaborative process between the two department and the requirements of the academic research reviewed the questionnaire and provided their comments. The researcher applied due diligence in the interpretation of statements from the respondents. Direct quotes support the analysis of the collected data.

3.13. ETHICAL CONSIDERATIONS

Head (2020) suggests that ethics committees play a pivotal role in deciding whether the study and the research process are within an acceptable ethical standard. The University of KwaZulu-Natal Ethics Committee and the Department of Health Ethics Committee approved the topic and the proposed method for the study. The gatekeepers provided approvals for the collection of secondary and primary data.

Henderson and Esposito (2019) suggest that a researcher must demonstrate sensitive behaviour towards the research participants and the research topic. They further cite interpersonal moral demands as critical success factors in qualitative research. The collection of data took place during the social and economic restrictions resulting from the COVID-19 pandemic. The researcher gave participants an opportunity to choose the virtual interview platform of preference. The researcher introduced properly himself and provided assurance on the anonymity and confidentiality of the data collected. The researcher asked questions with sensitivity. He informed respondents that a copy of the final report would be availed to them.

3.14. CHAPTER SUMMARY

This chapter outlined the aim of the study, research design and methods, providing comparisons between the qualitative and quantitative methods. The chapter explained the study setting, population and the study sample. It discussed the sampling method, construction of the instrument, data collection and analysis. It further addressed validity, reliability, bias and ethical considerations of the study.

The following chapter will discuss the results of the data collection process.

CHAPTER 4: PRESENTATION OF RESULTS AND DISCUSSION

4.1. INTRODUCTION

The purpose of this chapter is to present the results of the qualitative research and discussion of findings. Fifteen respondents participated in the semi-structured interviews. Part A of the questionnaire confirmed the demographic information of the respondents whilst Part B of the questionnaire focused on the research questions. The main research objective was to determine the constraining factors in the planning and design process of Public Health projects in KwaZulu-Natal with a view to reduce the process time. Analysis of responses followed a thematic approach consistent with the research literature review. The chapter provides the linkage between the responses and the research objectives. It provides the outcomes of the study findings and discussion in relation to other recent studies. The chapter summary provides an overview of matters covered in this chapter and introduces the final chapter.

4.2. THE DATA COLLECTION OVERVIEW

This qualitative study initially planned for 15 respondents to participate in the interviews and all 15 respondents did participate giving a 100% response rate. Initially, the plan was to interview all respondents face-to-face. However, due to risks associated with the COVID-19 pandemic, innovative ways of interviewing respondents were sought. Fourteen respondents were interviewed using Microsoft Teams whilst one respondent was interviewed using the Zoom virtual platform.

The questionnaire comprised of two sections. The first part of the questionnaire, Section A, addressed the demographics whilst the second part of the questionnaire, Section B, addressed the research questions. All interviews were voice recorded. Note taking during the interviews assisted with a speedy thematic analysis. Eight themes were identified and discussed in this chapter.

4.3. DEMOGRAPHICS OF RESPONDENTS

Section A of the questionnaire consisted of quantitative data sought to present the demographics of the respondents. The demographics information was obtained using the following tools:

i.	Organisation of the Respondent:	HIAC Records (Department of Health, 2020)
ii.	Professional discipline:	HIAC Records (Department of Health, 2020)
iii.	Race:	Known to the interviewer and observation
iv.	Age group:	Confirmed during interview
v.	Years of service within current organisation:	Confirmed during interview

The demographics were as follows:

i. Organisation of the Respondent

Five respondents participated from each respondent group; namely KZN DOH, KZN DOPW and Consultants.

ii. Professional discipline

Five Professional disciplines participated in the interviews. These disciplines consisted of the following number of respondents based on the type of consultants' appointments on projects:

- Architects (4)
- Mechanical Engineers (3)
- Civil Engineers (3)
- Electrical Engineers (2)
- Quantity Surveyors (2)
- Project Managers (1)

iii. Race

The race was identified prior to the interview. The race representation of the respondents interviewed was as follows:

- African (7)
- White (5)
- Indian (2)
- Coloured (1)

iv. Age

The age group was confirmed at the interview. The distribution is as follows:

- 20-35 (1)
- 35-50 (9)
- Above 50 (5)

v. Gender

There gender representation was also determined during the sampling. The gender distribution was as follows:

Male (12)

Female (3)

vi. Years of service in current organisation

Regarding the consultants, all participants were directors in their firms as a result; they have the highest number of years with the same organisation. The Department of Health has the least number of years of service, as their organisational structure is far younger than that of the Department of Public Works. Years of service were confirmed during interview. This was between 3.5 and 33 years.

4.4. RESULTS AND DISCUSSION

This section deals with the analysis of the responses to questions that sought to answer the five research objectives. The following eight themes were identified during the analysis of the responses from the respondents:

ix. Project appraisal system

x. Definition of project scope

xi. Project types

xii. Construction procurement

xiii. Collaboration and communication

xiv. Training and development

xv. Project leadership

xvi. Technical policies and standards

The results and discussion are presented under each theme below.

4.4.1. Project appraisal system

The project appraisal system consists of all steps that the project undergoes from Project Initiation stage until the end of the Project Design Documentation stage. Three main organisational documents inform the appraisal system.

i. Framework for Infrastructure Delivery and Procurement Management

ii. Health Infrastructure Approval Policy

iii. Terms and Procedures for the KwaZulu-Natal Department of Public Works Design Review Committee

The majority of the respondents described the current system as quite low in efficiency, ineffective, frustrating, bureaucratic, terrible, unnecessarily, extremely, and ridiculously long. The respondents identified the following constraining factors in the system:

i. Lack of administrative capacity resulting in the backlog of HIAC approvals and delays in the process,

ii. Rigidity. A report which has an honest mistake is not provided with provisional approval,

iii. Inexperienced officials at HIAC delaying the approval of the project,

iv. New officials lacking background of the previous discussions and decisions delaying the next stage approval process,

v. Unnecessary rejection of a submitted report due to only one discipline is lacking,

vi. Project Leaders not providing sufficient feedback to the design team,

vii. Duplication of the activities and lack of standardisation between the HIAC and DRC committees,

viii. Inadequate delegations at committee level or appropriate officials,

ix. inconsistency in the team formation that reviews various stage reports A report which has an honest mistake is not provided with provisional approval,

x. Lack of provision for accelerated appraisal of priority or emergency projects.

Regarding the level of efficiency most respondents were of the view that procedures needed review taking into consideration the factors raised during the interview. Respondent 9 stated that;

> "*The low level of efficiency creates frustration between role-players and stakeholders. Stakeholder expectations are not met. You keep reporting to stakeholders, but the project does not move to site. During these delays, existing officials exit the department and new officials take over the project. This creates a break in the planning process. New updates in legislation you must revisit the planning stages to accommodate new compliance requirements."*

A majority of respondents indicated that the administration of decisions by appraisal committees was a major cause of delays. A majority of respondents suggested that there was duplication of functions between the HIAC and DRC. Their view was that HIAC and DRC extended the planning and design process unnecessarily. In some cases, the two committees did not agree on decisions taken by the other committee. Consequently, a majority of respondents proposed that the committees merge into one joint committee.

Respondent 11 stated that,

> *"Parallel processes for HIAC and DRC. DRC has a different format as minimum requirements, which vary from HIAC. You have to change formats to suite each committee. Often DRC disagrees with a design that HIAC approved. Consultants vent frustration and some motivate for extra fees for duplicated work and resubmissions. It would be better to go back to a Joint Plans Approval Committee structure (JOPAC) to avoid one-step forward and two steps back"*

Respondent 14 said,

> *"The duplication creates an unnecessary obstacle on the project. Every professional has his/her own professional judgement; if two professionals review the same issue, you inevitably have differing views. Simplify the process and give a decision-making responsibility to a board or person."*

There was a concern that DRC and HIAC members change across different approval stages. The inconsistency in the team formation that reviews various stage reports resulted in delays and re-work. For example, a different Electrical Engineer will review the report at Stage 2 as compared to Stage 3. This created inconsistencies and delays, as the new Electrical Engineer tends to question previous approval decisions.

Emphasizing the inconsistency in the membership of the appraisal committees, Respondent 14 said,

> *"Projects are dynamic and evolve through stages and certain officials who sit on appraisal committees do not have a background of how the project has evolved. They come in cold and at times have not read the reports tabled by the Consultant or Project Team; hence the Committee loses its efficiency."*

Some respondents mentioned that some of the meetings did not meet the quorum due to members attending to other critical activities resulting in project appraisal delays. These process constraints are consistent with literature. Sommer (2016) highlighted the delays in approval process, lack of common understanding of design expectations and duplicated /unnecessary process steps as some of the constraints in the planning and design process. Power to control seems to be the reason for the duplications in functions of the committees. Improving collaboration and trust amongst the two

departments would assist advance teamwork approach towards project appraisal. The Departments of Health and Departments of Education in the country are the forerunners in the implementation of the IDMS and the FIDPM. However, in KwaZulu-Natal only the Department of Health has its own committee that independently reviews design documents in projects undertaken by the KZN Department of Works. According to respondents, each committee required each professional representative from each department. Training of officials across the board on health norms and standards may overcome the need for duplication of resources in a single committee. Private sector does not have a liberty to duplicate resources. The elimination of duplicated professionals in committees may reduce the cost and free up time for use in other important activities.

HIAC and DRC policies and procedures provide a structure of the delegations for approving various reports. Respondents suggested that limitation on delegations meant that a number of projects required further signatures at Senior Management level. The suggestion was to trust the professional judgement of the members of the appraisal committees. However, additional approval requirements were applicable only to projects that had excessive changes to scope and budget. Respondents mentioned that drastic changes to cost estimates required approval from a number of senior officials within the Department of Health. Projects also required approval by the Provincial Treasury. This created a major delay. It is recommended that the delegations be revisited by both departments and ascertain if delegations can be increased at the committee or infrastructure units level. However, the requirements of the Provincial Treasury regarding additional approvals may require the two departments to engage with the Provincial Treasury to find a common ground on ways to mitigate delays associated with drastic increase of cost estimate. The Departments of Health and Public Works need to improve the investigation and definition of project scope and cost estimation of such scope of works. Training of officials in the development of project brief and developing an accurate cost estimate should mitigate this problem. This study also recommends that the two departments establish a database of cost norms and update it on a regular basis.

Respondent 05 said,

> *"Project leaders don't bother measuring the quantities for a project in order to arrive at an accurate project estimate. They use estimates that were compiled two years ago and most times things had changed"*

Respondents also complained that emergency projects that required urgent prioritisation received the same level of response and timeline as the rest of the other projects. They said that failure to prioritise urgent projects places service delivery at risk.

In emphasizing this problem, Respondent 13 said,

> *"A report was tabled at one of the appraisal committees (HIAC) pointing out the emergency nature of an installation that could bring down the air-conditioning for the hospital, including another transformer in its vicinity if it failed, and could also cause fire at the hospital. The response was that it could not be declared as an emergency during the design process. Only projects identified as emergency during the identification stage could be declared as emergency."*

Respondent 11 said,

> *"One emergency contract took three years to implement. Documentation was completed timeously but the delays were largely due to Department of Public Works SCM challenges."*

This study recommends an establishment of an accelerated appraisal process for all emergency and urgent projects. Such projects can be delegated to competent personnel outside appraisal committees and tabled on committees later for noting.

Finally, this study recommends that one committee with representatives from both departments is established. Terms of reference must be developed considering the constraining factors raised in this section. Amongst other improvements the new committee must

i. Ensure that people appointed in the committee have appropriate experience. A team charter is developed to guide the conduct of members. Members must be developed on critical requirements for public health construction projects.

ii. Provide clear comments on projects requiring resubmissions and establish timeframes for resubmissions. The committee must also consider provisional approvals where only minor corrections are required,

iii. Improve the checklists of all stage approvals using a lessons-learnt register. Workshop officials and consultants on the latest checklists.

iv. Accept compromise on existing engineering installations as perfections may not always be possible to achieve. It may not be cost-effective to design for perfection on an old building. Rational designs should suffice.

v. Undertake performance reviews at close out stages of projects and update the lessons-learnt register.

The next section discusses the definition of project scope.

4.4.2. Definition of Project Scope

The management of the project scope is critical to the success of any construction project. Clearly defined project scope increases the probability of success in any project. Respondents unanimously agreed that scope of most projects was incomplete, unclear and undefined. This resulted in major disruptions in the latter stages of the planning and design of public health construction projects. These disruptions proceeded to the construction stage, causing major scope creep problems. The findings relating to project scope were consistent with those of Saaidin *et al*., 2016 and Shen *et al*., 2017 where they found that unclear project scope causes problems in the project life cycle including construction. Al-Rubaiei, Nifa and Musa, 2018 recommended that a scope baseline be clearly defined so that progress on the project can be measured against it. Furthermore, the findings are consistent with the view of the Infrastructure Planning Commission that there are weaknesses in the project identification, assessment and preparation of projects.

The respondents identified the following problems associated with project scope in the planning and design of public health construction projects.

i. Unclear Problem Statement by KZN Department of Health
ii. Unclear Project Brief by KZN Department of Health
iii. Inadequate stakeholder engagement in the definition of project scope
iv. Delay in preparing and approving Project Brief
v. Lack of knowledge of type of work by Project Leader
vi. Inaccurate project estimates
vii. Lack of involvement in scope development and validation by KZN Department of Public Works
viii. Lack of scope confirmation by the appointed consultants prior to developing a Project Concept
ix. Inadequate project investigations

The respondents acknowledged the uniqueness and complexity of Public Health infrastructure projects owing to the varying end-user needs. Managing complex stakeholder groups created a challenge for the project planning and design process as a number of scope changes kept disrupting the achievement of the project milestones.

Respondent 8 stated that:

> "*Initiation and concept stage gaps can hamper the progress, resulting in additional work identified for inclusion in the scope of work. Getting approval from the client*

to execute additional work results in delays. Sometimes the project scope requires PSP appointment on Electrical Engineering, but suddenly the project scope expands to Civil Engineering".

Most respondents rated the KZN Department of Health project planning and design process as longer in duration compared to private sector, public entities and other government departments. Respondents said that public health projects were more complex compared to projects in other government departments. This finding is consistent with what was highlighted by Pang and Shi (2016) regarding sophistication in systems configurations and the uniqueness of project technology and construction requirements of health sector projects.

Respondent 03 said,

> *"Public Health infrastructure is more complex because it involves too many stakeholders. Other departments like Education are not so complex. Apart from multiple stakeholders, there is also special and hierarchical complexity where some stakeholders are not in the same location, hierarchical complexity emanates from different units and their hierarchies. Furthermore, the interconnectivity of elements, individuals and as a whole affect the planning and design (meaning involvement of National Department of Health, Infection Prevention and Control Unit, District Services, Budget Office and Department of Public Works)".*

Respondent 10 amplified the above opinion by adding,

> *"Other sectors like Education or Arts and Culture are simple and straight forward. Complexity of some of the health projects is high. Other sectors you do not need specialists like Medical gas, Electrical and Mechanical requirements, and Infection Prevention and Control requirements."*

Respondents said that the unclear Problem Statement made it very difficult to understand the critical requirements of the Project Scope and results in design problems later. An unclear Project Brief failed to articulate the end-user needs correctly. The lack of clarity in the Project Brief attracted additional scope, resulting in the review of previously approved stages. In most cases, additional approvals were required from Senior Management at Department of Health as well as the Provincial Treasury for the adjustment of the consultants' fees prior to a project proceeding to the next stage.

Currently, the Department of Health develops the Project Brief without any input from the Department of Public Works. However, there is an expectation that the Department of Public Works will undertake a Project Scope clarification and confirmation exercise prior to the appointment of consultants.

However, this is not the case, hence the uncontrollable scope creep during the design process, resulting in stakeholder frustrations, and schedule and cost overruns.

In emphasizing the above contributing factors to the project delay, Respondent 06 said,

> *"There is lack of communication and lack of detail in the Project Brief. The Brief must address failures that have occurred in the building or system before and why they occurred and how such failures were addressed. If the Brief is weak, this becomes a problem with approvals to include additional scope and this delays the approval process. Consultants need to ensure options related to the brief. Sometimes increasing the scope results in arguments."*

Respondents pointed out the inadequate stakeholder engagement resulting from stakeholders not attending meetings and the inconsistency and undefined stakeholder group. The unavailability of stakeholders delayed the Scope Validation process. The Scope Validation in the KZN Department of Health requires many signatures and this delayed the approval of the Project Briefs. Such delays are consistent with findings of Sommer (2016) where he highlighted the delay of the Scope Validation approval owing to the unavailability of people to sign documents. Respondents said that the delay of the finalisation of the Project Brief affected the timeous procurement of consultants. The respondents proposed the following improvements in the management of project scope.

i. Timeous preparation of the Project Brief by the Department of Health
ii. A Project Team as opposed to only the Project Leader should formulate this Project brief
iii. The Project Leader must have knowledge of the type of work to be performed
iv. The Project Brief should sufficiently address the problem statement, decanting requirements and services
v. Measured quantities should form the basis of the Project Cost Estimate
vi. The Department of Public Works should be involved in the formulation of the Project Brief
vii. The appointed consultants should prepare an Inception Report prior to the development of the Concept Report. . This document should close the gap between the Project Brief and the Concept Report
viii. Adequate time is required during project preparation. Investigate, define and plan the project analytically
ix. Politics put undue pressure on projects, they must be eliminated.

The lack of collaboration between DOH, DOPW and end-users in the development and validation of the project scope seem to be a source of most problems. As outlined in the FIDPM, the Project Brief

in which the project scope is defined informs the Concept Report that is the next stage of project planning and design. A good Project Brief gives a project a good start. The gap raised by the respondents regarding the Inception Report needs to be considered. An Inception Report provides an opportunity for the consultants to undertake initial project investigations and confirm the project scope. It eliminates any misunderstandings between the client and consultants. Although such a phase deliverable is not in the FIDPM, it will benefit the client to consider reviewing the policy to include the Inception Report.

Capacitation of Project Leaders in the definition of the project scope and development of project briefs needs a special attention. Project leadership is discussed later in this chapter. The following section addresses the impact of constraints on project types.

4.4.3. Project types

The construction projects in the KZN public health sector range from small to large, simple to complex, single disciplinary to multi-disciplinary. It was not clear whether the project types were affected differently by environmental constraints. The majority of the respondents said that a relationship existed between project constraints and project types. Below are some of the comments from the respondents regarding project types:

i. Smaller projects are quicker, whilst bigger projects require more time to plan and design.

ii. Engineering projects are easier than to building projects due to the number of role-players involved.

iii. A roof renovation project although smaller in value may be more complex than another higher value project of simpler nature due to the type of investigations required.

iv. Projects requiring National Department of Health peer review take longer.

v. A project with a single discipline moves faster than a project with multiple disciplines.

vi. Green fields are normally straightforward than projects within operational health facilities since there is no accommodation of services required (decanting plan).

Respondent 05 emphasized that,

> *"Experience is linked to the project you are doing. Smaller projects will require less experience as opposed to bigger projects. However, there is an attitude of not taking smaller projects seriously, hence they fail."*

The finding and literature seem to confirm that the project type and project size play an important role in the achievement of project success as highlighted by Demirkesen and Ozorhon (2017). It is recommended that the type and size of a project be taken into consideration when appointing a

Project Leader and the consultants. It is recommended that both departments collaborate in identifying projects that may require an accelerated process for stage approvals. However, it is critical that monitoring and control systems are in place to avoid undesired outcomes at the end of the project. The planning and design timeline standards need to be reviewed to take into consideration a project type and magnitude. Where prototype designs are already in place, timelines must be adjusted accordingly. Process steps for green and brown field projects need to be mapped and special requirements like environmental studies and municipal submissions of development plans on green fields considered.

The next section discusses constraining factors associated with construction procurement.

4.4.4. Construction Procurement

A number of challenges associated with construction procurement continue to haunt service delivery across departments and municipalities in the country. This study found that observations by the Infrastructure Planning Commission of poor and inappropriate procurement practices and poor delivery management practices are consistent with the findings of this study. A number of challenges mentioned in this section suggest that an effort is required to find a lasting solution for these perpetual problems.

A majority of respondents mentioned that members of the project consulting team were not appointed simultaneously. This lack of coordination in the appointment of consultants delayed the design activities of the project. A majority of respondents said that the inefficient procurement of consultants resulted from the appointment of inappropriately skilled officials in the procurement committees. They mentioned that some of the procurement committees consisted of members that did not comply with the requirements of the FIDPM. This is consistent with literature review as articulated by Saad (2018) where he highlights the use of untrained procurement officials as a cause for inefficiency. Contrary to Gurría (2016) who suggests that procurement implementation is negatively affected due to lack of operational guidance, the FIDPM provides a clear guidance on the Construction Procurement, however according to the respondents, the guide is ignored.

A majority of respondents said that the current tendering system of awarding the lowest bidder is not effective. Literature also supports this finding. According to Petterson (2018), the appointment of professional service providers through selection of lowest bidder normally overlooks appropriately experienced firms. The importance of compensating the design consultants fairly for the work done was also emphasized since; most consultants offered high discounts in order to secure KZN Department of Health contracts during tender stage and failed to deliver.

Respondent 08 said,

"Quality of Consultants appointed is sometimes questionable. Some poor Consultants are appointed repeatedly. Sometimes Consultants are appointed on a BEE policy for work they cannot handle. The tender system is one of the contributing factors. Consultants are encouraged to give a discount whilst their portion of the work is only 1-2% of the life cycle cost of the project. When fees are cut by 35-40%, a consultant can only give you an 85% job."

The majority of respondents said that the current competitive tender system could work if certain considerations are incorporated in the procurement process. They believed that transparency in the awarding of tenders was necessary. The following considerations in the current competitive tender system were proposed:

i. Department of Health must issue a Project Brief for new projects at the beginning of the 4th Quarter of the preceding year. This will remove undue pressure on projects planned for implementation in the following year,

ii. Facilitate simultaneous appointment of all professional disciplines through sufficient identification of project scope. Sufficient scope also prevents delays associated with variation orders that later require a Provincial Treasury approval,

iii. Consultants must compete on price and functionality. Evaluation criteria should consider resources within the firm to validate capacity. Evaluate Curriculum Vitae (CVs) of personnel assigned in the project. Consider post-experience in relation to the type of work, magnitude and public health projects,

iv. Evaluate Consultants at the end of the design stage and construction completion stage to rate their performance. Use this evaluation report in the awarding of future tenders. Introduce a point system that will penalise consultants

v. A lead consultant must appoint other disciplines but observe compliance and any targets set by the client. This would solve the current delays associated with the uncoordinated timing of the appointment of all professional disciplines resulting in merge-bias effect resulting from task dependency (Goldratt (2017) and Elder (2017),

vi. Align and monitor administrative activities that delay decision-making after tenders have closed,

vii. Technical personnel (in line with FIDPM requirements) should undertake risk and technical evaluation whilst SCM personnel review compliance,

viii. Choose appropriate procurement strategy for the project.

ix. Explore establishing an SCM team for Department of Health projects. The feasibility of this proposal will depend on availability of resources.

In the evaluation of the above proposals, the KZN Department of Public Works has a responsibility to empower previously disadvantage groups like women, Africans, people with disability. Other initiatives include providing opportunities to youth companies. There must be a balance between experience and empowerment. Targeted groups should not be overlooked only because they do not have necessary experience. This is consistent with a suggestion by Patrucco *et al.* (2017) that project objectives like job creation, advancement of certain groups must be considered in the evaluation criteria of procurement tenders. Proper risk identification needs to be undertaken and both these competing requirements require consideration and risk responses implemented. Partnerships through joint ventures and other forms of professional collaboration are some of the strategies that can be encouraged to mitigate the negative effect of inappropriately skilled and experienced firms and individuals in construction projects.

Respondents also proposed the establishment of a database of prequalified consultants. This database would allow new entrants to join whilst in place. They recommended the updating of the database on a regular basis e.g. staff exited, staff joined and performance on completed projects.

Respondent 15 said,

> *"A point system may be a good idea. Consultants that do badly must get points deducted on a Treasury database. The database of consultants must allow new firms to join at any time. Sometimes consultants awarded work far too big for their capacity and they fail. Base awarding of work on experience of individuals within a firm. That is how legal and medical fields work."*

The prequalification of consultants requires further investigation. However, consultants will still need to compete for work in line with Provincial Treasury practice notes.

The construction procurement strategies were discussed with the respondents. Most respondents said they were aware of various contracting strategies. They indicated that they normally use Design by Employer, a form of Design-Bid-Build (DBB) construction procurement strategy but only used the Design and Construct, a Design-Build (DB) construction procurement strategy on the COVID-19 intervention projects for the first time. The lack of in-depth knowledge of various forms of procurement strategies amongst officials and consultants is consistent with the suggestion by Muhammad *et al*. (2015) that use of all procurement strategies is prevented by the limitation in knowledge of procurement strategies available to public sector by built environment professionals.

Most respondents used a Design by Employer contracting strategy, their view was that the DBB construction procurement strategy works and there was no need to consider other strategies. They

mentioned that it had more advantages over the other the DB construction procurement strategies. Some of the advantages mentioned were:

i. Popular, efficient, tried and tested

ii. Eliminates many risks. By the time you tender, you know what you are building

iii. End-of-design stage addresses the project brief

iv. Provides independence as custodianship of the design is with the Department.

Most of the respondents were of the view that the DB construction strategy came with higher risks for the Department of Public Works. Regarding the Develop and Construct, Design and Construct or Turnkey solution, the respondents commented as follows:

i. Accountability is weak and the Department is immensely exposed

ii. The Department does not have a representative in a project

iii. More opportunity for collusion between contractor and consultants

iv. Consultants may leave the project prior to completion and leave the Department exposed

v. Temptation to alter things especially if Department needs are not clear

vi. Accounting for quality is compromised since consultants appointed by contractor

vii. Exposed to too many variations, especially to non-standard design like renovations

viii. The contractor rushes to start building even if design not completely ready

Respondent 13 said,

> *"I was involved in Management Contracting where I managed somebody else's design. If the design was wrong, you may end up re-designing due to overlooked design matters. This would result in the Client paying twice for the design."*

Respondent 04 said,

> *"The Project Leader must be committed to try something new and solve problems in a different way. It requires an ownership culture and a paradigm shift. Design by Employer is a default way of minimising risk. If we want to implement projects faster, we need to be comfortable with risk. However, you need to create an iceberg (body of knowledge) behind you that supports you."*

Respondent 08 said,

> *"Contract forms are like a tool box in your garage. Each tool has its own application. Design by Employer works. End of design stage you have a project that addresses*

a project brief. However, this should not be the default option. Analyse the type of project to see if an alternative contract form is not more appropriate then select the appropriate contract form. Each contract form has its pros and cons. You need to understand each contract form and understand their strengths and limitations and adopt the best suited accordingly."

The following observations from the interviews are worth mentioning:

All respondents were unaware of the Early Contractor Involvement (ECI) procurement strategy and had not used it. Consultants were uncomfortable with working for the contractor as opposed to working for the client and therefore favoured the DBB construction procurement strategy. The officials felt that there was room for new strategies depending on the urgency and type of projects. This study recommends that workshops on different types of construction procurement strategies be arranged for officials and consultants. Such workshops may assist in consultants and officials understand the advantage of each strategy as outlined by Saaidin *et al*. (2016), Shen *et al*. (2017) and Li *et al*. (2020). The workshops must also share pitfalls of each procurement strategy and propose measures necessary to mitigate them. Alleviation of fears regarding other procurement strategies may pave a way for the selection of a most appropriate construction procurement strategy to suit the project at hand.

The next section discusses collaboration and communication amongst project stakeholders.

4.4.5. Collaboration and communication

Communication and collaboration amongst stakeholders is an important area of project management that requires improvement. A majority of respondents suggested that more improvement in the relations amongst the two departments was still required.

Respondent 02 felt very strongly that,

"Sharing of information is not flowing, as it should be. Most interaction happens a week prior to monthly review meetings. There must be a continuous exchange of information so that both departmental officials are on the same loop. A gap in communication sometimes results when an official in one department is not familiar with the type of work that is being designed. It is much easier if Project Leaders are leading projects that are predominantly their disciplines."

Respondent 06 felt strongly that,

"The truth is that there is a big problem. This was not the case in the past. Most recently there are problems as most newly appointed staff have not worked in the

health environment, lack skills, and have an ego. In the past, officials had a lot of experience. Staff do not contribute very well and hinder the process."

The respondents mentioned that the KZN Departments of Health and Public Works have a number of new and junior officials. According to some respondents, these officials were not trained to manage collaboration amongst the two departments. Consequently, the officials failed to advance the attributes of team collaboration as outlined by Bond-Barnard *et al.* (2018). This study recommends that a training programme focusing on new and junior officials is developed and offered on an ongoing basis. Such a programme must integrate officials from both departments. Furthermore, the holding of Government Departments accountable for their responsibility to each other as advocated by Kanyane (2016), needs enforcement. There is a need to improve trust and interaction amongst the two departments, notwithstanding the workload amongst officials, which may limit such interaction.

The other critical area of communication and collaboration is amongst officials and consultants. By the very nature of the Design by Employer contracting strategy, professional service providers are an extension of officials. Their role is to support the officials in solving service delivery challenges. Most respondents suggested that the collaboration and communication was acceptable amongst consultants and officials. However, problems arose when consultants and officials in the Department of Health discussed project issues outside the Department of Public Works' lines of communication. The dangers of such informal engagements collaborate the finding by Wu et al. (2017) which suggested that informal communication was a source of conflict in projects.

The other most important communication and collaboration is between the project team and other stakeholders especially, end-users. The project team only consists of built professionals that plan and design projects, however stakeholders are affected by decisions of the professionals. Heravi et al. (2015) suggests that quality project planning can only take place once the needs and expectations of stakeholders are understood. A majority of the respondents emphasised complexity of public health construction projects as a main challenge regarding integration of the planning and design process. The varying opinions and thoughts of stakeholders delayed decision-making especially on complex matters. The finding is consistent with literature. According to Demir and Theis (2016), the slow iterative process amongst stakeholders results in delays within the design phase. The Project Leader must use his/her influence to manage competing expectations of stakeholders. The challenges associated with the management of stakeholders indicates a need to capacitate project leaders on conflict resolution.

Projects with many stakeholders experience more challenges in meeting the quorum for the planning and design meetings. Most stakeholders are very busy and do not prioritise project meetings. Geographic distances amongst stakeholders played a role in the postponement of meetings. In most

cases, the Projects Leader tends to focus on other projects whilst waiting for stakeholders to meet, resulting in more project delays. There was little evidence that virtual meeting platforms were explored to encourage busy and geographically dispersed stakeholders to attend meetings without travelling to a meeting venue as suggested by Dulebohn and Hoch (2017).

Respondents mentioned that sometimes the role and interests of stakeholders were not clear and this impacted communication negatively. Respondents suggested that unclear stakeholder roles caused projects to take one-step forward and two-steps back. As highlighted by Eskerod et al. (2015), complexity in stakeholder landscape creates a major challenge for the Project Leader. Understanding the organogram of the health institutions helps the Project Leaders in communicating with the correct officials at the institutional level. According to Eskerod et al. (2015), this problem can be mitigated by analysing, categorising and efficiently managing the stakeholders. This study recommends that Project Leaders develop a Project Communications Management Plan that clearly state the forms of communication applicable to specific project situations as suggested by Pratami et al. (2017). Most respondents did not develop such plans in their projects.

Respondent 09 said,

> *"Arguments start when specifications relating to sizes of service space in line with the size and locality of the facility. The back and forth prior to the agreement on the contested design detail can take about six months. Sometimes health districts do not agree with decisions made by Department of Health officials (infrastructure unit) at head office. All three parties; Consultants, Department of Health and Department of Public Works must be in sync before the project moves to the next stage. This crucial interaction results in delays."*

Communication and stakeholder management are not a strength of most technical people. It would benefit both departments to develop their built environment professionals in the soft skills as suggested by PMI (2017). The consultants that interact with stakeholders should also improve their soft skills. Team building workshops and use of tools like a Team Charter would improve teamwork amongst projects. According to PMI (2017), Project Leaders are ultimately responsible for facilitating teamwork amongst stakeholders. A development programme that teaches Project Leaders different leadership styles and how to switch styles to suit the situation as suggested by Zulch (2014) should be explored.

The next section discusses training and development.

4.4.6. Training and Development

As suggested by Sartori *et al.* (2018), training and development refer to organisational activities that provide workforce with continuous education and learning with an aim to improve their competencies.

There was evidence that such organisational activities are minimal resulting in poor management of construction projects.

Project management consists of various useful tools and techniques as outlined in literature. The aim of the tools is to assist Project Leaders manage projects successfully. A majority of respondents did not use any formal management techniques or tools in the monitoring and controlling of the planning and design process. A majority of respondents lacked knowledge of time management tools and techniques like Network Diagrams, TOC, CCPM, PERT and EVA. Their knowledge was only limited to Gantt charts. Failure to use project management tools and techniques by consultants and officials is evident by the extent of delays experienced in the majority of projects. According to Shar (2016), most delays result from the planning and scheduling deficiencies. Such deficiencies include wrong calculation of activity durations as suggested by Sharon and Dori (2017) and failure to manage risks and issues as outlined by PMI (2017). The weakness in the management of the project schedule affects the annual budget allocations and results in disruptions in the outer year project implementation plans.

Emphasising the importance of monitoring the Project Schedule, Respondent 01 said,

> *"The value creation process in the project is not monitored. Planned project cash flows are not achieved. If it were private sector, delays would make it difficult to realise return in investment."*

Training of officials and consultants on project management techniques and tools must be addressed as a matter of urgency. Project management is a science and therefore projects must be managed using proven scientific solutions. Avoidable delays in projects burdens the state with unnecessary additional costs. Setting aside a budget for developing built environment officials on project management best practices must not be regarded as additional cost on projects. However, an opportunity cost of not providing such training must be a driving factor.

Respondents also mentioned that Project Leaders in both departments did not review the design reports prior to presentation at the appraisal committees. Obvious mistakes and gaps in the documents resulted in the unnecessary disapproval by the appraisal committees. Limited knowledge by consultants and officials created gaps in the submissions and resulted in further delays in the approval of stage deliverables. Limited knowledge of health norms and standards resulted in non-complying concept and design reports. There was a concern over a number of younger professionals who do not possess the sufficient experience to provide leadership in projects or serve on project appraisal committees creating frustrations in the approval process of design reports.

Respondent 13 said,

"The process itself is good. Some officials do not understand the process properly. The FIDPM gives you points to consider but not in detail. Sometimes the officials return the design submission with comments that show lack of understanding. Both PSPs and Officials must be workshopped."

Respondent 02 said,

"Public Works do not review documents prior to submission to Department of Health, as a result unnecessary mistakes are not picked up prior to client reviewing the report. A number of Department of Health Project Leaders do not understand the IUSS and other design policy documents. This results in some of the projects failing to meet the policy requirements and not being approved at HIAC. Consultants do not understand end-of-stage deliverables thus failing to present a report that adequately addresses requirements of the stage."

The constraining factors raised by respondents are consistent with literature. Mallawaarachchi and Senaratne (2015) suggested that an experienced, well-trained and competent design team is able to facilitate efficient decision-making process. Well-trained and experienced consultants are able to provide designs that satisfy requirements of regulatory agencies like municipalities, South African Bureau of Standards (SABS), Department of Labour, Sector Standards body, etc. Officials suggested that some consultants delayed the projects as they failed to interpret the scope and develop the concept that is acceptable to the departments.

Sommer (2016) highlighted the need for the common understanding of design expectations. In order to achieve this common understanding officials and consultants must be trained on the requirements for planning and design of public health projects.

Respondent 04 provided these detailed reasons for the inadequate appraisal,

"I am not sure where the DRC comes in. When it comes to National Department of Health approvals, there is no integration. They look at planning and design requirements differently. Misunderstandings and lack of effective communication creates frustration. Sometimes the National Department of Health does not agree with end-users and this creates even more problems."

Most respondents indicated that ongoing training similar to courses they attend for Continuous Professional Development (CPD) is necessary. Respondents suggested that the following areas of focus required attention:

i. HIAC and DRC policies

ii. Theory and practical training (e.g. case studies)

iii. Induction or orientation programme for new officials or consultants

iv. Soft skills to complement the hard skills

v. Changes to legislation, systems, norms and standards (e.g. IUSS, FIDPM)

vi. KZN Health Department Policy documents (once updated)

Respondent 15 said,

> *"There are certain projects that require IUSS requirements and you may need training in those requirements. An open training will be a good idea"*

Respondent 01 said,

> *"There are instances where I need better understanding of concepts and reasoning behind certain logic in the FIDPM e.g. procurement stages, maintenance and equipping aspects of projects."*

This study proposes that various training programmes aimed at the skilling of the officials and consultants in the suggested areas of focus be developed and made available. Officials need to be trained on all facets of project management, health and construction industry requirements and provincial policies, standard operating procedures and approved prototypes. Training and development must also target the appraisal committee members to improve understanding of their role. This study further recommends the establishment the communities of practice with an aim to facilitate knowledge sharing between these two departments. This can be extended later to facilitate knowledge sharing across provinces and sectors. It is recommended that a mentorship and shadowing programme be established to capacitate the new and young professionals. National Treasury (2021) also suggests communities of practice and mentorship for the IDMS implementation across departments.

The next section discusses project leadership issues.

4.4.7. Project leadership

Respondents suggested that the high workload prevented Project Leaders to focus on projects allocated to them. It was reported that officials in the two departments did not even have sufficient time to read and provide necessary input in the design reports prior to tabling at project appraisal committees. A majority of the officials said that high vacancy rates resulted in Bad multi-tasking as officials failed to cope with the workload. Goldratt (2017) suggests that a resource allocated to multiple tasks or projects, tends to start certain tasks late because of demands or delays in other parallel tasks. According to Goldratt (2017), delays emanating from Bad multi-tasking result in a

knock-on-effect and the contingency reserves are wasted, resulting in projects finishing late. This study recommends that a guideline for workload calculation be developed and used in the allocation of work to Project Leaders.

However, as discussed earlier, there are still many inefficiencies in the management of projects. Whilst the issue of high workload exists, the departments must avoid creating unnecessary positions that result in an unjustifiable cost to the state. Effective use of artificial intelligence tools like PMIS will go a long way in providing effective programme management capability without increasing human resources. Standardisation also prevents development of the same deliverable repeatedly. Capacitation of project leaders will improve the project leadership capacity in the two departments.

Respondent 07 said,

> *"Assumptions are made about skills and competencies of officials. It is assumed that disciplines like quantity surveying, engineering and architecture come armed with project management knowledge. Not much training is provided for these disciplines. There must be repetitive training to equip officials. Training is required on the life cycle for IDMS. New recruits need to know they are empowered. Identify skills gaps in Project Leader and provide support through a mentoring person who will impart their experience and knowledge."*

The IDMS provides for a performance and risk management capability in projects, programmes and portfolios. Ultimately, project leadership role in general, has more to do with risk and performance management. Project leaders must develop a competency to monitor consultants during the planning and design of projects to ensure the achievement of project milestones as agreed upon with the team.

The next section discusses technical policies and standards

4.4.8. Technical policies and standards

The Department of Health in KwaZulu-Natal has design policies and standards that guide the consultants in the design of health facilities. These documents guide design of engineering and building installations. Respondents mentioned that the last update was in 2011 and most people who used to update these documents in the Department of Health have since retired. The lack of updated documents resulted in the delays in the design process. The standard layout drawings of the clinics and community centres also required review. PMI (2017) suggests prototyping as a mitigation for scope creep. Prototyping involves amongst others, creation of standard layouts and specifications to speed up the concept and design process.

Respondents emphasized a need to standardise certain aspects of the planning and design requirements in order to provide simplicity and uniformity.

Emphasizing on the standardisation, Respondent 12 said,

> *"Mechanical and Electrical are exposed to lots of issues than other people. The Department of Health policy documents were last updated in 2011. Those policies are an important tool. Standards and specification assist everybody as they set uniform standard requirements. New people need a guide."*

Respondent 05 said,

> *"Infrastructure design policies are outdated. Stakeholders are not involved in the identification of uncompliant materials, finishes, etc. resulting in gaps in the planning documents."*

The Department of Health must consider appointing officials from both departments to review the outdated policies for engineering installations, specifications and standard layouts. This will save both time and cost and create certainty in quality parameters.

The As-Built drawings are vital in an organisation since they provide the layout and the design of the building showing all latest improvements. As-Built drawings play a pivotal role in the development of the Concept Report for the project. However, most of the As-Built drawings are not easily accessible or not available at all. This causes delays in the design of required improvements to the existing infrastructure since consultants require to produce As-Built drawings from scratch. Mallawaarachchi and Senaratne (2015) suggested that availability of sufficient site information prior to design assist to curb projects delays. As-Built Drawings form part of the initial site information necessary to undertake design on existing buildings. The lack of a well-functioning library for this critical resource causes problems in the planning and design of projects. Both departments must develop a long-term strategy to reproduce as-built drawings for the public health facilities in KwaZulu-Natal. There are innovative ways of scanning buildings and reproducing drawings in a short space of time. This comes at a cost; however, As-Built drawings are necessary not just at project management level but for asset management activities on a daily basis.

4.5. CHAPTER SUMMARY

This chapter provided an overview of the demographics of the respondents that participated in the study. This was followed by an analysis and the discussion of responses emanating from research interviews. The thematic analysis identified eight themes that stood out from the data gathering process. These eight themes aligned with the five research objectives. The discussion in each theme identified a number of factors that constrain the planning and design of the public health construction projects in KwaZulu-Natal. The main observation across the themes was a need to review the current

project appraisal system, improve project preparation, capacitate of officials and consultants in the project management knowledge areas, soft skills and best practices.

The themes interact and relate with each other and should not be considered from a silo perspective. For example, training and development, and definition of project scope affect all other themes. This supports a suggestion by Williams (2017) that the impact caused by relatedness of risks may be higher on complex projects. Throughout the discussion, it was evident that the exploitation of the constraining factors requires a holistic approach.

The following chapter provides the conclusion and recommendations of the study.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1. INTRODUCTION

Chapter 4 presented results and further discussed the findings. The purpose of this chapter is to conclude this study and provide recommendations for future studies. The chapter presents the conclusion, which summarises the research objectives and findings. The chapter further presents implications and limitations of the study, recommendations to solve the research problem and recommendations for future studies. The summary provides an overview of the achievements of this study.

5.2. CONCLUSION

Preliminary studies showed that in the KwaZulu-Natal Department of Health, 63% of capital projects were delayed between Project Initiation Stage and Design Documentation Stage (KwaZulu-Natal Department of Health, 2020). This study sought to identify constraints in the planning and design process of these projects with an aim to propose improvements. The study consisted of five project objectives. Below is the summary of findings.

5.2.1. To identify the constraining factors in the policies and procedures governing the planning and design for public health construction projects in KwaZulu-Natal, South Africa

The National Treasury's Framework for Infrastructure Delivery and Procurement Management forms the basis for the appraisal requirement of projects by professionals at the Department of Health in KwaZulu-Natal. The Department of Health established the Health Infrastructure Approval Committee that provides approval for all end of stage deliverables. However, the Department of Public has its own procedure for the appraisal of projects that they implement for all departments in KwaZulu-Natal. The two committees seem to compete and duplicate the appraisal steps of the project stage deliverables. This study recommends the creation of a joint committee that will comprise an even representation from both departments. Furthermore, the departments must explore creating more than one committee to spread the workload. However, each committee must appraise a project from Inception Stage until the end of the Design Documentation Stage. Members of the committees must be trained in all facets of project planning and design of public health construction projects. It is highly recommended that departments consider a formal addition of an Inception Report deliverable as part of the consultants brief. The Inception Report will minimise misunderstandings and harmonise officials and consultants prior to spending resources on the Concept Report.

It was also found that a number of delays in the design process result lack of updated design policies and standard layouts or prototype design. The standard design concepts, engineering and building and specifications shorten the design time of construction projects. The recommendation is to update these critical organisations process assets whist identifying other areas of development.

The study also found that insufficient delegations delayed the approval process of the project submissions as more signatures were required. It is recommended that the current delegations be reviewed to give more responsibility to the project appraisal committees.

5.2.2. To explore if factors that constrain the planning and design process affect different project types differently in KwaZulu-Natal, South Africa

The study revealed that some projects are complex compared to others. It also revealed that some projects are smaller whilst others are larger in magnitude. However, some smaller projects are sometimes more complex than larger projects. It was also clear that green field projects have limited permissions and therefore take longer to complete the planning and design phases compared to brown field projects. Examples of constraints associated with the green field projects are the Environmental Impact Assessments, planning and negotiation for bulk services, etc. Furthermore, projects with prototype designs have less constraints relating to stakeholder disagreements. This study recommends that the two departments develop a schedule of project types, identify constraints associated with each project type, and propose a schedule that guide teams on the planning and design timelines. Such project profiling should also form a basis for allocating a project to a most capable Project Leader. Workload calculation should also take into consideration project size and complexity.

It was also found that emergency projects are governed by the project appraisal steps and schedule guidelines similar to any other projects. It is recommended that the emergency and urgent type projects are treated with urgency they deserve. A guideline that aimed at the exploiting process bottlenecks must be developed for such projects and included in the necessary policy documents.

5.2.3. To ascertain the training and development level of officials and consultants in the planning and design of public health construction projects in KwaZulu-Natal, South Africa

The IDMS, FIDPM, IUSS, to name a few, are public sector best practices in the management of public infrastructure in South Africa. It was evident that even the most experienced professionals do not have a full knowledge of these critical guidelines. Furthermore, there are other documents that are referred to in the guidelines that officials and consultants must familiarise themselves with. These include CIDB's Standard for Uniformity, PMBoK, procurement prescripts, asset management policies, South African National Standards, etc. The PMI recommends various project management

tools and techniques. This study recommends that all officials undergo an in-depth training on the best practices and all associated documents mentioned above.

Throughout the interviews, the respondents complained about the unclear, incomplete and undefined project scope. This seemed to be a source of many problems across the project lifecycle. The scope creep disrupted cost and schedule baselines and caused major frustrations amongst project stakeholders. This study recommends that formal training on project preparation be provided to all officials within both departments that manage projects. However, the officials from the Department of Health must take a lead since the compilation of Project Briefs is a responsibility of the Department of Health in terms of the IDMS.

The two departments have their own policies and standards that govern planning and design of projects. It is recommended that a structured training and development programme on these policies and standards be developed for in-house personnel and consultants. This study further recommends that mentorship programmes and community of practice forums be established to facilitate sharing of knowledge. The establishment of the lessons-learnt register is highly recommended. Learning from past experience will improve performance.

5.2.4. To identify construction procurement issues that hinder the project planning and design of public health construction projects in KwaZulu-Natal, South Africa

Construction procurement consisted a number of constraints that hindered progress in projects. Constraining factors identified included the:

i. delay in the appointment of consultants,
ii. appointment of unskilled and inexperienced consultants,
iii. failure to appoint the full project team of consultants simultaneously,
iv. lack of knowledge of advantages associated with alternative procurement strategies
v. appointment of inappropriate officials on procurement committees
vi. emphasis on price than functionality criteria

The FIDPM and the CIDB Standard for Uniformity provide guidelines on all matters raised above. There seems to be reluctance to follow these guidelines. It is recommended that these guidelines are workshopped with relevant decision-makers with an aim to align all construction procurement with these public sector guidelines. The Department of Public Works must be encouraged to review the appointment of officials to procurement committees. Only appropriately skilled officials must serve on the procurement committees. The Department of Public Works must consider the establishment of the pre-qualified panel of consultants. However, the National Treasury regulations

regarding competitiveness, fairness and transparency must be adhered to. The panel would assist the Department of Public Works with a prior evaluation of the skills, experience and capabilities available in each organisation on the panel. This information would also assist in programmes aimed at collaborating an experienced consulting firm with a less experienced consulting firm that belongs to a target group for empowerment. A workshop for the officials on the alternative construction procurement strategies is highly recommended. This will assist the Department of Public Works to consider all approved construction procurement strategy for future projects.

5.2.5. To ascertain the effect of stakeholder collaboration and communication in project planning and design of public health construction projects in KwaZulu-Natal, South Africa

Weak communication and collaboration hinders progress. Communication and collaboration between the two departments require further improvement. Team building initiatives and establishment of joint committees will go a long way in improving the collaboration. The senior officials in both departments must play a leading role in the creation of such an environment. The communication between the project team and its stakeholders also needs to improve. It was found that meetings are postponed or ineffective due to failure of stakeholders to attend meetings. It is recommended that use of virtual meeting platforms be explored in order to reduce travel times and encourage busy stakeholders to attend meetings.

Officials and consultants must be empowered with soft skills to help them deal with stakeholder issues in a constructive manner. It is recommended that all built environment professionals that interact with stakeholders undergo a special training programme to develop them in soft skills. In project management, communication is a rock bed of all success. Good communication yields better collaboration. Improved communication and collaboration will facilitate a good atmosphere for the definition of project scope and the engagement in the following planning and design activities.

5.3. IMPLICATIONS OF THIS RESEARCH

This study focused on the pre-tender stage with a view to provide information on delays that exist outside contractor procurement and construction phase. The study addressed the gap that exists in the research of project life cycle delays. The focus on internal processes, skills, attitude, internal coordination, etc. will assist organisations of a similar nature to review their policies and standard operating procedures with a view to improve efficiency. If the planning and the design processes yield the required quality and efficiency, the succeeding project phases/stages are likely to benefit from the already set tone and culture.

The Departments of Health and Public Works in KwaZulu-Natal and their team of consultants showed a high interest in making the study a success. The recommendation is to present the results and recommendations of the study to the two departments with a view of igniting a need to implement the recommendations of the study.

5.4. LIMITATIONS OF THE STUDY

This study focused on planning and design factors in the Public Health infrastructure projects in KwaZulu-Natal. The type of projects and the size of budget may differ with other organisations and therefore some of the recommendations may not apply outside this research setting. The study also focussed on the implementation model where the Department of Public Works is the Implementer. The outcomes may not be consistent in cases where other alternative implementing agents are used.

The KwaZulu-Natal, considering their own project planning and design environment, formulated sector specific policies. Consequently, other provinces and public sector organisations have their own specific policies that may not be constrained by similar factors. However, the testing of the factors identified in this study may assist in conducting a similar study in other public sector organisations that utilise implementing agents to manage their infrastructure projects. There are factors that relate to public sector projects in general. These may easily be replicated across the public service.

5.5. RECOMMENDATIONS TO SOLVE THE RESEARCH PROBLEM

The recommendation is to arrange a workshop and present the results and recommendations of the study to the two departments that are the focus of this study. The summary of recommendations are listed hereunder.

i. Dissolve the existing project appraisal committees and replace them with a joint project appraisal committee comprising of appropriately skilled officials from both departments. More than one committee may be necessary to spread the workload. Members of the committee(s) must be trained in all facets of project planning and design of public health construction projects.

ii. Update the HIAC policy to include an Inception Report deliverable as part of the consultants terms of reference

iii. Update the engineering and building policies, specifications and standard layouts. Identify other opportunities standardisation.

iv. Review the existing delegations by giving more responsibility to the project appraisal committees

v. The appraisal policies and delegations must consider project types

vi. Develop a workload calculator to manage the allocation of project to Project Leaders

vii. Officials must undergo an in-depth training on applicable policies, standard operating procedures, project management best practices and soft skills and project preparation skills

viii. Establish mentorship programmes and community of practice forums to facilitate sharing of knowledge. Establish the lessons-learnt register to learn from past experience

ix. Workshop officials on relevant on construction procurement public sector guidelines especially the alternative construction procurement strategies

x. Review the appointment of officials to procurement committees. Only appropriately skilled officials must serve on the procurement committees.

xi. Explore the establishment of the pre-qualified panel of consultants

xii. Explore use of virtual meeting platforms to reduce travel times and encourage busy stakeholders to attend meetings

The above recommendations will require support from senior management from both departments. Implementation of appropriate change management strategies together with the above recommendations will influence positively the desired outcomes. Regular monitoring of the implementation of the recommendations will assist with identifying areas requiring further attention.

5.6. RECOMMENDATIONS FOR FUTURE STUDIES

This qualitative study only involved the senior professionals within the Department of Health and Public Works and consultants. Most respondents were familiar with the environment because of the seniority in the organisations. Having identified the factors that constrain the planning and design process, there was not enough time to undertake a quantitative research based on those factors and undertake a much more inclusive sample, which would include junior and new personnel in the organisations. Testing of these factors within a representative sample would provide a reliable prioritisation of these factors by respondents. Such a study is highly recommended.

Other areas of focus recommended for future studies are:

i. The effect of Knowledge Management in project planning and design

ii. The impact of the FIDPM in the project planning and design process

iii. The benefits of technology in the appraisal of projects

5.7. SUMMARY

This chapter presented the conclusion, implications and limitations of the study, recommendations to solve the research problem and recommendations for future studies. The data collected from the respondents assisted in answering all research questions. This chapter concludes this study.

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APPENDIX A: HEALTH INFRASTRUCTURE APPROVAL COMMITTEE: PROJECT TRACKING RECORD UP TO 31 MARCH 2020

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

#	PROJECT NAME	DATE IDENTIFIED	LAST APPROVED IDMS STAGE	DATE APPROVED	TIME LAPSED BETWEEN IDENTIFICATION TO END OF LAST DESIGN STAGE
56	56	56	56	56	46
1	Addington Hospital: Replacement of chiller	31-Aug-17	Stage 4	07/01/2020	35
2	Bethesda Hospital: Assessment and installation of mechanical ventilation in TB complex	1-Apr-16	Stage 6	6/22/2018	27
3	Catherine Booth Hospital Electrical Maintenance and Upgrade	3-Apr-17	Stage 6	8/27/2018	17
4	Cato Manor: Regional laundry proposed Remedial work	1-Apr-16	Stage 6	8/26/2018	29
5	Ceza Hospital: Assessment and installation of HVAC system, Male / Female / Maternity / OPD / ADMIN	1-Apr-16	Stage 6	5/3/2019	38
6	Church of Scotland Hospital: Renovate existing space for Mental Health Unit and upgrade all ablutions	1-Feb-16	Stage 3	11/30/2018	51
7	Cwaka Clinic: Upgrade and additions	11-Nov-15	Stage 3	5/26/2016	53
8	Driefontein Clinic: Sewer upgrade system	3-Jan-17	Stage 3	3-Jan-17	39
9	Dundee Hospital: Upgrade of air-conditioning systems	1-Apr-16	Stage 4	9/3/2018	30

#	PROJECT NAME	DATE IDENTIFIED	LAST APPROVED IDMS STAGE	DATE APPROVED	TIME LAPSED BETWEEN IDENTIFICATION TO END OF LAST DESIGN STAGE
10	Dundee Regional Laundry: Refurbish Service Equipment and procurement of new equipment	1-Apr-14	Stage 6	9/21/2018	54
11	Dundee Regional Laundry: Refurbishment of two boilers equipment	1-Apr-16	Stage 6	9/21/2018	30
12	Dundee Regional Laundry: Building works	30-Mar-14	Stage 6	11/12/2019	68
13	Ekhombe Hospital: Staff Accommodation	1-Apr-16	Stage 4	5/15/2019	38
14	Ekhombe Hospital: walkways	1-Apr-16	Stage 6	12/19/2019	45
15	Ekubungazeleni Clinic: Sewer upgrade	1-Apr-16	Stage 6	14-Feb-20	47
16	Emmaus Hospital: Assessment and optimization of internal roads and replacement of roofs	30-May-17	Stage 6	10/12/2018	17
17	Upgrade and additions of existing building to house a new EMS college	1-Apr-14	Stage 4	11/2/2018	56
18	eThekwini Maintenance Hub Upgrade and addition to existing buildings	1-Apr-16	Stage 4	22-Jun-18	27
19	G J Crookes Hospital: Replacement of roofing & plumbing	5-May-15	Stage 5	1/15/2020	57
20	Grey's Hospital: 1600 KVA Transformer replacement with larger unit	1-Apr-16	Stage 5	7/18/2019	40
21	Grey's Hospital: Restoration of HVAC System Phase 1	1-Apr-16	Stage 3	5/18/2017	49

#	PROJECT NAME	DATE IDENTIFIED	LAST APPROVED IDMS STAGE	DATE APPROVED	TIME LAPSED BETWEEN IDENTIFICATION TO END OF LAST DESIGN STAGE
22	Greytown TB Hospital: extraction Fan Installation for wards 12 & 13	1-Jun-16	Stage 5	7/10/2019	37.80
23	Inanda Newton A CHC : Replace collapsing retaining wall, repair/replace collapsing boundary wall	15-Sep-15	Stage 6	10/26/2018	38
24	King Dinuzulu Hospital Replacement of chiller	1-Apr-16	Stage 6	7/12/2019	40
25	King Dinuzulu Hospital: Level 1 Mental Health Unit	3-Apr-17	Stage 6	10/19/2018	19
26	King Dinuzulu Hospital: complex roof repairs	24-Apr-18	Stage 6	7/26/2019	15
27	King Dinuzulu Hospital: New helistop and parking	31-Jan-16	Stage 5	7/11/2019	42
28	King Dinuzulu Hospital: New Psychiatric Hospital Phase 2 (Completion Contract)	1-Apr-16	Stage 3	4/18/2016	49
29	King Dinuzulu Hospital: New TB Complex (Completion Contract)	1-Apr-16	Stage 4	3/23/2020	48
30	Ladysmith Hospital: Sewer reticulation	1-Apr-16	Stage 4	9/18/2019	42
31	McCord Provincial Eye Hospital Administration block, Sinikithemba Building	1-Apr-16	Stage 6	10/12/2018	31
32	McCord Provincial Eye Hospital Doctors Accommodation	11-Nov-13	Stage 6	10/12/2018	60
33	Mseleni Hospital: Assessment and Restoration of HVAC system supplying theatre and Hospital	1-Apr-16	Stage 6	10/19/2018	31

#	PROJECT NAME	DATE IDENTIFIED	LAST APPROVED IDMS STAGE	DATE APPROVED	TIME LAPSED BETWEEN IDENTIFICATION TO END OF LAST DESIGN STAGE
34	Murchison Hospital - Replace theatre A/C plant	5-Jun-15	Stage 6	7/19/2019	50
35	Newcastle Hospital: Assess, design and install automated HVAC system at NICU	1-Apr-16	Stage 5	7/30/2019	41
36	Newcastle Hospital: Installation of package HVAC units to operating theatre 1, 2, 3, & 5	1-Apr-16	Stage 5	10/4/2019	43
37	Newtown A CHC: Replacement of retaining wall and security fence	5-Sep-15	Stage 6	10/28/2018	38
38	Ngwelezane Hospital: construction of new orthotics and prosthetics centre and parking	7-Jul-17	Stage 3	11/16/2017	33
39	Nkonjeni Hospital : Maternity complex pregnant mothers lodge	2-Apr-13	Stage 6	10/8/2019	79
40	Ntambanana Clinic: Contraction contract	9-Jun-14	Stage 6	9/2/2018	52
41	Osindisweni Hospital: proposed new MDR- TB Decentralised Unit	1-Apr-10	Stage 5 - NDOH	10/02/2020	128
42	Clinic repairs	1-Apr-16	Stage 5	12/18/2019	45
43	Port Shepstone Hospital: New Psychiatric wards	15-May-12	Stage 5 - NDOH	12/14/2018	80
44	Prince Mshiyeni Memorial Hospital: Refurbishment of 3.5 ML Main water Storage Reservoir	1-Apr-16	Stage 5	10/19/2018	31
45	Prince Mshiyeni Memorial Hospital: MV switchgear replacement	1-Oct-16	Stage 4	1/6/2019	28

#	PROJECT NAME	DATE IDENTIFIED	LAST APPROVED IDMS STAGE	DATE APPROVED	TIME LAPSED BETWEEN IDENTIFICATION TO END OF LAST DESIGN STAGE
46	R K Khan Hospital: MV and LV switchgear	1-Oct-16	Stage 5	2/24/2020	41
47	R K Khan Hospital: Replacement of 2 cooling towers	12-Oct-15	Stage 3	7/21/2016	54
48	Richmond Chest Hospital: Replacement of water and sewer reticulation	1-Apr-16	Stage 4	12/3/2019	45
49	Rietvlei Hospital: Upgrade of water and sewer system	1-Apr-16	Stage 3	4/5/2017	49
50	Sokela Clinic: Clinic expansion to include hast unit and midwife obstetric unit (MOU)	13-Apr-16	Stage 4	12/20/2019	45
51	St Aidan's Hospital: Assessment and upgrading of the central air-conditioning	1-Apr-16	Stage 3	7/19/2016	49
52	St Aidan's Hospital: Replacement of collapsing boundary wall.	1-Apr-16	Stage 6	8/2/2018	28
53	St Apollinaris Hospital: Reconfigure existing building to provide for Neonatal Nursery	3-Mar-14	Stage 3	10/23/2017	74
54	Stanger Hospital: 28 bedded new psychiatric facility	20-Jul-11	Stage 5 - NDOH	12/7/2018	90
55	Umzimkhulu Hospital : New Forensic Ward & New observation ward and seclusion ward: Brief	1-Apr-10	Stage 3 - NDOH	9/28/2018	122
56	Wentorth Hospital: Investigate and Implement Fire & Emergency Services	1-Apr-16	Stage 3	10/26/2018	49

APPENDIX B: QUALITATIVE RESEARCH

Semi-Structured Interview Schedule

Semi-Structured Interview Schedule on factors constraining the planning and design process for public health construction projects in KwaZulu-Natal, South Africa	No.

Section A: Demographics

(This section confirms data obtained prior to interview)

1. Which organisation do you come from?

KZN Department of Health	
KZN Department of Public Works	
Private Sector Professional Service Provider	

2. Which professional discipline do you come from?

Management	
Mechanical Engineering	
Electrical Engineering	
Mechanical Engineering	
Civil/Structural Engineering	
Project Management	

Architecture	
Quantity Surveying	
Other (specify)	

3. Gender

Male	
Female	

4. Age

20 - 35	36 - 50	Above 50

5. Race

Black	White	Coloured	Indian	Other: please specify

Section B: Semi-Structured Questions

Q1: How long have you been with this organisation?

Q2: In your experience, how would you describe the level of efficiency and the duration of the planning and design process of public health infrastructure projects in KwaZulu-Natal?

Q3: How does the planning and design duration for public health infrastructure projects compare with other sectors or departments you may have worked with?

Q4: What in your experience, are the contributing factors to delays in the planning and design of public health infrastructure projects in KwaZulu-Natal?

Q5: How can the planning and design appraisal process be improved?

Q6: In your opinion, do you believe projects presented at the design committees (HIAC and DRC) are sometimes rejected unduly?

Q7: In your opinion, is there any duplication amongst design appraisal committees (HIAC, DRC)?

Q8: Are you adequately appraised on the planning and design requirements for public health projects?

Q9: Do you believe you need training in the planning and design of health projects? If so, please elaborate.

Q10: How can the procurement of professional service providers (consultants) be improved?

Q11: What time management technique do you use to monitor and control the planning and design phase of your projects?

Q12: How would you rate the relations and communication between departments of Health and Public Works regarding the planning and design process?

Q13: How would you rate the relations and communication between officials and professional service providers regarding the planning and design process?

Q14: Do you think a relationship exists between project constraints and project types (e.g. size, engineering, maintenance, green/brown field) as it relates to planning and design?

Q15a: Are you aware of alternative contracting strategies approved for public sector projects (Design by Employer, Develop and Construct, Design and Construct, and so on)?

Q15b: If yes, what is your opinion on the Department's bias towards Design by Employer?

Q16a: Are you familiar with the requirements of the Framework for Infrastructure Delivery and Procurement Management (FIDPM) with regards to planning and design?

Q16b: Do you think you need training on the FIDPM?

Q17: Do you have any other ideas on how to reduce the planning and design time for public health projects in KwaZulu-Natal?

Section C: Interview Schedule

Respondent ID	Interview Date	Time slot
001	18-Aug-20	18h30-20h00
002	17-Aug-20	13h00-14h30
003	20-Aug-20	10h00- 11h30
004	18-Aug-20	10h00- 11h30
005	19-Aug-20	10h00- 11h30
006	13-Aug-20	9h00-10h00
007	13-Aug-20	12h00-13h00
008	15-Jul-20	9h00-10h00
009	17-Jul-20	10h00-11h30
010	12-Aug-20	8h00-9h00
011	13-Aug-20	16h00-17h00
012	14-Aug-20	7h30-8h30
013	16-Aug-20	10h00-11h00
014	16-Aug-20	16h00-17h00
015	16-Aug-20	19h00-20h00

APPENDIX D: INFORMATION SHEET AND CONSENT TO PARTICIPATE IN RESEARCH

Date:

Greeting:

My name is Mbongiseni Gcaba, researcher and student at the Graduate School of Business and Leadership at the University of KwaZulu-Natal,
GSB Block,
54 Ground Floor,
Westville Campus,
UKZN, Durban,
Telephone Number: 033-940 2555 / 083 628 1419
Email: 200001853@stu.ukzn.ac.za

You are being invited to consider participating in a study that involves research. The aim and purpose of this research is to understand the factors that cause the delay in the planning and design process of the public health sector projects in KwaZulu-Natal. The process involved the Departments of Health and Public Works in the province. The study is expected to enroll 5 participants from the Department of Public Works, 5 participants from the Department of Health and 5 participants from the professional service providers that work with public health projects in KwaZulu-Natal. It will involve the following procedures.

- Each participants will be interviewed through Zoom or Microsoft Teams
- A semi-structured interview schedule with 20 open-ended questions has been prepared
- There may be follow up questions where necessary

The duration of your participation if you choose to enroll and remain in the study is expected to be approximately 25 minutes. This is an unfunded study.

We hope that the study will provide public officials with scientifically determined factors that are likely to constrain projects from achieving their project milestones. The awareness of these factors amongst public officials and consultants will assist improve the team collaboration in mitigating them.

- Due to strict conditions regarding COVID-19 safety protocols, you may choose to be interviewed through an agreed virtual software (Zoom or Microsoft Teams)
- We may record the interview in order to save time during the interview

This study has been ethically reviewed and approved by the UKZN Humanities and Social Sciences Research Ethics Committee (approval number _____).

In the event of any problems or concerns/questions you may contact the researcher at (provide contact details) or the UKZN Humanities & Social Sciences Research Ethics Committee, contact details as follows:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION

Research Office, Westville Campus
Govan Mbeki Building
Private Bag X 54001
Durban
4000
KwaZulu-Natal, SOUTH AFRICA
Tel: 27 31 2604557- Fax: 27 31 2604609
Email: HSSREC@ukzn.ac.za

Participation in this research is voluntary (and that participants may withdraw participation at any point). In the event of refusal/withdrawal of participation you will not incur penalty or loss of treatment. Your withdrawal will only require us to find a substitute in order to ensure validity of the study. Should you can feel uncomfortable with participating or answering further questions feel free to inform me any time.

No costs are expected to be incurred by participants as a result of participation in the study. No medical treatment is required as part of this interview. However, we are aware that time is money for which we are grateful for your participation. There are no incentives or reimbursements for participation in the study.

Your input in the study will remain anonymous. No names and positions will be used in the study that may link you to any statement you say. The data will be collected and stored as follows:

i. The questionnaires do not carry names but only codes assigned to each participant
ii. Voice records will be stored in a password protected file and password protected computer
iii. Hard copy information will be kept with the supervisor at UKZN in lockable safe
iv. Soft copies will be kept with the supervisor at UKZN google drive and backed up on external hard drive stored in the supervisor's safe.
v. Data will be destroyed once the minimum storage period agreed with UKZN has lapsed

---

CONSENT

I …….. have been informed about the study entitled “Factors constraining the planning and design process for public health projects in KwaZulu-Natal” by Mr Mbongiseni Gcaba.

I understand the purpose and procedures of the study. I have been given an opportunity to answer questions about the study and have had answers to my satisfaction.

I declare that my participation in this study is entirely voluntary and that I may withdraw at any time without affecting any of the benefits that I usually am entitled to.

I have been informed about any available compensation or medical treatment if injury occurs to me as a result of study-related procedures.

If I have any further questions/concerns or queries related to the study I understand that I may contact the researcher at

Name of Researcher and Student Contact Details: Mbongiseni Gcaba, GSB Block, Ground Floor, Westville Campus, UKZN, Durban, Telephone Number: 033-940 2555 / 083 628 1419, Email: 200001853@stu.ukzn.ac.za

Supervisor Contact Details: Dr Bhasela Yalezo, GSB Block, 54 Ground Floor, Westville Campus, UKZN, Durban, Telephone Number: 031-260 7429, Yalezob@ukzn.ac.za

If I have any questions or concerns about my rights as a study participant, or if I am concerned about an aspect of the study or the researchers then I may contact:

HUMANITIES & SOCIAL SCIENCES RESEARCH ETHICS ADMINISTRATION
Research Office, Westville Campus
Govan Mbeki Building
Private Bag X 54001
Durban
4000
KwaZulu-Natal, SOUTH AFRICA
Tel: 27 31 2604557 - Fax: 27 31 2604609
Email: HSSREC@ukzn.ac.za

I hereby provide consent to:

Audio-record my interviewYES / NO

_____ _____
Signature of Participant **Date**

_____ _____
Signature of Witness **Date**
(Where applicable)

APPENDIX E: ETHICAL CLEARANCE, GATEKEEPERS LETTER AND TURNITIN REPORT

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

04 November 2021

Mbongiseni Godswill Gcaba (200001853)
Grad School Of Bus & Leadership
Westville Campus

Dear MG Gcaba,

Protocol reference number: HSSREC/00001659/2020
Project title: Factors constraining the planning and design process for public health projects in KwaZulu-Natal
Amended title: Factors constraining the planning and design process for public health construction projects in KwaZulu-Natal, South Africa

Approval Notification – Amendment Application

This letter serves to notify you that your application and request for an amendment received on 28 October 2021 has now been approved as follows:

- Change in title

Any alterations to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form; Title of the Project, Location of the Study must be reviewed and approved through an amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

All research conducted during the COVID-19 period must adhere to the national and UKZN guidelines.

Best wishes for the successful completion of your research protocol.

Yours faithfully

.....
Professor Dipane Hlalele (Chair)

/dd

Humanities & Social Sciences Research Ethics Committee
UKZN Research Ethics Office Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001, Durban 4000
Tel: +27 31 260 8350 / 4557 / 3587
Website: http://research.ukzn.ac.za/Research-Ethics/

O

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

DIRECTORATE: OFFICE OF THE HOD

330 Langalibalele Street, Pietermaritzburg, 3200
Private Bag X9051, Pietermaritzburg, 3201
Tel: (033) 395 2799 Fax: (033) 345 0792 Email: Samantha.foulkes@kzn.health.gov.za
www.kznhealth.gov.za

OFFICE OF THE HEAD: HEALTH

Reference: 9/2/3/R
Enquiries: Dr SC Tshabalala
Tel No: (033) 395 3176

Mr B Gcaba
c/o Department of Health

Dear Mr Mbongiseni Gcaba,

RE: PERMISSION TO CONDUCT RESEARCH

This letter serves to grant Mr Mbongiseni Gcaba (200001853) of the University of KwaZulu-Natal, permission to conduct research for his research topic titled **"Factors constraining the planning and design process for public health projects in KwaZulu-Natal"** with Department of Health. Please note that for the purposes of interviewing the employees, you will approach them directly and participation is on a voluntary basis.

The study should be conducted within the parameters of good research and ethics as laid down by the University and include confidentiality and anonymity where necessary.

You are requested to engage with the Departmental Ethics and Research Committee with regards to ensuring all necessary processes as per Departmental Policy is adhered to prior to commencing with your research.

Best wishes for your research.

Yours sincerely

DR SC TSHABALALA
HEAD: HEALTH
KWAZULU-NATAL

Date: 06/05/2020

KWAZULU-NATAL PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

DIRECTORATE:
Health Research & Knowledge Management

Postal Address : Private Bag X9051, Pietermaritzburg
Physical Address: 330 Langalibalele Street
Tel: 033-395 2805/3189/3123 Fax: 033-394 3782
Email address: hrkm@kznhealth.gov.za
www.kznhealth.gov.za

NHRD Ref: KZ_202007_033

Dear Mr M. Gcaba
(UKZN/DoH)

Approval of research

1. The research proposal titled **'Factors constraining the planning and design process for the public health projects in KwaZulu Natal'** was reviewed by the KwaZulu-Natal Department of Health (KZN-DoH).

   The proposal is hereby **approved** for research to be undertaken at the Infrastructure Unit of the Department of Health.

2. You are requested to take note of the following:
   a. *All research conducted in KwaZulu-Natal must comply with government regulations relating to Covid-19. These include but are not limited to: regulations concerning social distancing, the wearing of personal protective equipment, and limitations on meetings and social gatherings.*
   b. *Kindly liaise with the facility manager BEFORE your research begins in order to ensure that conditions in the facility are conducive to the conduct of your research. These include, but are not limited to, an assurance that the numbers of patients attending the facility are sufficient to support your sample size requirements, and that the space and physical infrastructure of the facility can accommodate the research team and any additional equipment required for the research.*
   c. *Please ensure that you provide your letter of ethics re-certification to this unit, when the current approval expires.*
   d. *Provide an interim progress report and final report (electronic and hard copies) when your research is complete to* ***HEALTH RESEARCH AND KNOWLEDGE MANAGEMENT, 10-102, PRIVATE BAG X9051, PIETERMARITZBURG, 3200*** *and e-mail an electronic copy to hrkm@kznhealth.gov.za*
   e. *Please note that the Department of Health shall not be held liable for any injury that occurs as a result of this study.*

For any additional information please contact Mr X. Xaba on 033-395 2805.

Yours Sincerely

Dr E Lutge

Chairperson, Health Research Committee

Date: 07/08/2020

Q

public works
Department:
Public Works
PROVINCE OF KWAZULU-NATAL

Private Bag X 9041
PIETERMARITZBURG
3200
Tel: 033-355 5562
Fax:033-355 5683
Enq: S Shabangu
EMAIL:
head.works@kznworks.gov.za

OFFICE OF THE HEAD OF DEPARTMENT

ATTENTION: Mr Mbongiseni Gcaba,

TownHill Office Park
35 Hyslop Road
Pietermaritzburg
3200

Dear Mr Mbongiseni Gcaba

PERMISSION TO CONDUCT RESEARCH

This letter serves to grant Mr Mbongiseni Gcaba (200001853) of the University of KwaZulu-Natal, permission to conduct research for his research topic titled "Factors constraining the planning and design process for public health projects in KwaZulu-Natal" with Department of Public Works.

Please note that for the purposes of interviewing the employees and consultants, you will approach them directly and participation is on a voluntary basis.

The study should be conducted within the parameters of good research and ethics as laid down by the University and include confidentiality and anonymity where necessary.

Best wishes for your research.

Yours sincerely

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Dr G.G. SHARPLEY
HEAD OF DEPARTMENT

DATE: 29 April 2020