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EVALUATING THE PROCUREMENT SYSTEMS WITHIN THE DEPARTMENT OF INFRASTRUCTURE DEVELOPMENT FOR BETTER SERVICE DELIVERY

RESEARCH REPORT

Submitted by

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A proposal research report submitted to the Faculty of Engineering and Built Environment, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Science in Building.

Johannesburg, 2018

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DECLARATION

I declare that this dissertation is my own unaided work. It is being submitted to the Master of Science in Building (Project Management in Construction) to the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination to any other University.

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Memory Zvomuya 421992

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ABSTRACT

South Africa is currently faced with the challenge of reducing the huge backlog of infrastructure delivery to communities that were previously disadvantaged. Specifically, the Government needs to deliver school infrastructure to accommodate the rapidly growing student population particularly in areas that have experienced high levels of urban migration. It is generally agreed that there is need to step up the quality of planning, costing and project management, to speed up the delivery process of schools in line with the schools calendar.

This research report critically assesses the characteristics and application of procurement systems currently being utilised by Gauteng Department of Infrastructure Development (GDID) for the delivery of school buildings. GDID utilises three procurement systems; the traditional, the integrated and the management-oriented procurement systems, providing an opportunity to compare the performance of each system within a single organisational context.

A descriptive survey was conducted for school projects with the same prototype design executed within GDID, to identify the external and internal factors that are complimentary or detrimental to the effective implementation of the different procurement systems. Data was collected and the content analysed.

The literature research confirms that different procurement systems have an effect on the total project delivery time, assuming all other variables remain constant. The integrated procurement system was found to be the most suitable procurement system for schools service delivery projects, from initiation to close out, for GDID, given the tight time frameworks. However, due regard should be given to extensive communication with all stakeholders to obtain their buy-in and approvals.

Key works: procurement systems, traditional, integrated, management oriented, schools

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LIST OF SYMBOLS

$\boldsymbol{x}$	Mean
$\sum_{\boldsymbol{n}} \boldsymbol{x}$	Sum of Values
n	Number of Observations

LIST OF ACRONYMS

BAA	British Airport Authority
BBBEE	Broad Based Black Economic Empowerment
BOQ	Bills of Quantities
CEM	College of Estate Management
CIDB	Construction Industry Development Board
CSA	Contract Sum Amount
DPSA	Department of Public Services and Administration
DPTRW	Department of Public Transport, Roads and Works
EIA	Environmental Impact Assessment
EPWP	Expanded Public Works Program
FIDIC	International Federation of Consulting Engineers
GDE	Gauteng Department of Education
GDID	Gauteng Department of Infrastructure Development
GPG	Gauteng Provincial Government
GMP	Guaranteed Maximum Price
IDMS	Infrastructure Delivery Management System
JBCC	The Joint Building Contracts Committee
JRA	Johannesburg Road Agent
MEC	Member of Executive Committee
MDG	Millennium Development Goals
NEC3	Engineering and Construction Contracts 3
OGC	Office of Government Council
PMU	Project Management Unit
PMI	Project Management Institution
RIBA	Royal Institute of British Architects
RICS	Royal Institution of Chartered Surveyors
SCM	Supply Chain Management
UK	United Kingdom
Wits	University of Witwatersrand

CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

Sustainable development and management is a critical component of society (Agumba *et al*, 2003). Moreover regional, provincial and national development is a key challenge to the government of the day in every country across the globe (*ibid.*). South Africa is faced with the challenge of developing infrastructure in previously disadvantaged communities, as well as upgrading the existing infrastructure to cope with the high demand (*ibid*.).

It is evident that the South African government across its entire spheres of national, provincial, as well as local (municipal) is failing in this regard to fulfil this core constitutional mandate (Cairncross *et al*., 1990). The same authors note that the problem is further compounded by rapid urban growth, as a result of demographical dynamics, putting much pressure on the need for services, mainly in the indigents areas (*ibid.*).This is evident in the continued emergence of public protests as an expression of dissatisfaction (White Paper, 1995). These are a perennial matter in local and international news rooms. Many reasons for these protests have been offered, among them are slow service delivery and poor infrastructure.

The infrastructure backlog is currently estimated to be R170 billion, and the South African government is dissatisfied with its infrastructure delivery, according to the Minister of Public Works (Sigcau, 2003). This sentiment has also been echoed by the Chief Executive Officer of National Home Builders Registration Council, Phetola Makgathe (SA, Builder/Bouer, 2004).

In response to the failures in service delivery, the government of South Africa has taken the initiative to transform the public sector into a vibrant and customer focused machinery to improve on service delivery (GDID, 2011). This has seen the restructuring of some of the government departments leading to the establishment of the Gauteng Department of Infrastructure Development (GDID) to manage all government buildings, and free user Departments to focus on their core business and avoid duplication of technical capacities. The function of the department is to implement and provide new structures and maintain, restore and repair existing structures for the Gauteng Provincial Government (GPG). The GDID functions

include the provision, management and maintenance of social services infrastructure, such as, schools, hospitals, roads, water and sanitation (*ibid*).

The constitutional mandate of GDID is drawn from Schedules 4 and 5 of the Constitution of the Republic of South Africa (Act 106 of 1966), which grants all provinces concurrent (shared with National Government) and exclusive (exercised by the Province only) competencies (RSA, 1996). Provincial competencies are in essence legislative competencies on specific functions areas such as public works. The core mandate of the GDID is described as implementing all the GPG Capital Works budget allocations and other small, medium and large scale infrastructure projects that utilise sole or joint GPG financial investments and to maximise the social and economic benefits that can be gained from the GPG property portfolio (*ibid*). In terms of the public service charter, the GDID is mandated to contribute towards service delivery through the provision of Government infrastructure for an effective public sector (DPTRW, 2013).

Broadly, the South African government has to comply with other international requirements such as the universal Millennium Development Goals (MDG) that requires poverty and illiteracy to be halved by 2015 (UN, 2011). Infrastructure provision plays a central role in the attainment of such, with need for more schools. GDE has sent in a request of services to GDID for the construction of new schools to address this backlog. The GDID's responsibilities include, inter alia, procurement of construction projects. GDID is required to deliver schools infrastructure faster and more effectively in line with the school calendars. GDE required GDID to deliver the new schools project within 18 months from initiation to close out stage, as compared to 36 months taken previously (GDID, 2012).

1.2 PROBLEM IN CONTEXT

South Africa is faced with the challenge of developing infrastructure in previously disadvantaged communities, as well as upgrading the existing infrastructure to cope with the high demand. This includes construction of new schools to cater for the growing population. Currently the different procurement system utilised by GDID are not meeting the Client's needs, which is to deliver new school projects within 18 months as compared to the current 36 months. It is the contention of this paper that the requirement to deliver new school projects in 18 months is achievable by selecting a particular procurement method, especially so, by

focussing on the pre-construction stages. It is reasonable to assume that the actual construction duration can be accurately predicted, given the same prototype designs, budget allocation, and competencies and capabilities (skill, experience, finances, etc.) of the appointed Contractor. This, of course, bars natural disasters and strike action and lock-outs by communities, workers and suppliers.

As a government department GDID is inevitably bureaucratic in nature, with each business unit independently executing its functions. This limits the effective use of resources and it introduces distortions into the project delivery process. The bureaucratic practices take centre stage in the overall management style, with centralised and authority-based control, coupled with vertical and top-down management system. This centralised vertical top-down control, with minimal delegation of authority to lower management levels, defines the position of GDID (White Paper, 1995).

Successful building procurement depends upon selecting an appropriate procurement system specifically to match the requirements of the client, contractor and the project (Ambrose, 2000). Thus using appropriate methods of procurement is a priority, and this in turn, has led to the consideration of alternative methods of procurement.

The term procurement comes from the word procure which literally means “to obtain by care or effort”; “to bring about” and “to acquire”. The term system is about “organized method, approach, technique, process or procedure” (Rashid et al., 2006:1). In this context, project procurement is very much concerned with the organized methods or process and procedure of obtaining or acquiring a construction product such as a schools, hospitals, roads, water and sanitation. It also involves arranging and coordinating people to achieve prescribed goals or objectives (*ibid*.).

The development of construction project is fragmented between different organisations that have separate objectives and priorities (Mitchell *et al*., 2011). Depending on the characteristics of the client team, the procurement system may involve third parties (consultants) to support the client objectives of achieving better performance in the project delivery (Alharthi *et al.,* 2014). Inefficient integration between all the parties urges the improvement of procurement in the construction industry (Bankvall *et al.,* 2010).

Project procurement systems currently range from the traditional system, where designs are completed and put out to tender for contractors to price, to the many various systems, such as, turnkey, build-operate-transfer, management contracting, cost-plus contracting, Private Public Partnerships (PPP) and integration system. The reasons for the many variants of project procurement systems arose from the quest for more efficient and speedier project delivery systems and better project performance. The growing complexity of projects led to the recognition that one approach was no longer suited for all projects. There are innovations to the traditional delivery method aimed at meeting the changing demand of clients or customers. The different procurement systems present have brought changes not only to the process and procedure of project delivery but also the aspects of management and organization (Rashid *et al*., 2006).

The GDID, like any other implementing agent, has its own set of rules and policies which tend to be understood, to a greater or lesser extent, by those individuals or firms which supply or purchase any particular product or service. Within GDID a number of different types of procurement methods are generally used. These are the traditional system, the integrated and management-oriented procurement systems. The research focuses on procurement systems that are already in use at GDID, because introducing or recommending a new system is a long winded process which requires approval at different layers of government. This will further delay the new school infrastructure delivery programme. The research zooms in on the pre-construction stage of the different procurement systems, as the physical construction of the school can be reasonably predicted after discounting unforeseen circumstances, as previously stated above.

The separate and cooperative is commonly known as the ‘traditional procurement system’. It is a system where the project development activities that start from feasibility study, preliminary design, documentation to construction and hand over, are carried out sequentially one after another (Rashid *et al.,* 2006). Traditional procurement system has resulted in low levels of client satisfaction, owing mostly to poor cost and time predictability (Challender *et al.,* 2014). It is worth emphasising that time predictability is identified as problem with this method of procurement, which makes a case for this research.

The ‘Integrated procurement system’ combines the responsibility of design and construction of the project (Ashworth, 2001). Both responsibilities are contracted out to a single contracting organisation. This method results in a design which is better suited to the contractor’s construction method, giving lower production cost and shortest contract period (Murdoch, 2008). As is the case with Traditional Procurement System, time is an issue with the Integrated Procurement system. Time, especially in the pre-construction stage, is the focus of this paper.

The ‘Management-oriented procurement system’ gives emphasis on the management of the design and construction of the project (Rashid, 2006). The management of the design and construction of a project is contracted out to a contractor who acts as a management consultant on behalf of the client. This sort of service solves the long standing problem of how to involve the contractor in a meaningful way from the outset of the project (Murdoch, 2008).

While all these types of procurement systems are utilised in the construction industry, the question for this study is their impact on time. An opportunity to shorten the time is presented during the preconstruction stage, since the actual construction is an essentially linear activity with fixed constraints, barring unforeseen circumstances and natural disasters. For GDID, the question is: which one on the currently utilised systems is the most suitable procurement system to use to achieve delivery of school infrastructure in the shortest possible period of time, focusing on the pre-construction stage, while holding cost, quality and other variables constant at an acceptable level of quality and within the budgetary confines? Which procurement system can GDID use to cut the schools infrastructure project delivery time from initiation to close-out, from 36 months to 18 months, without affecting costs and quality, paying particular attention to the pre-construction stage?

1.3 PROBLEM STATEMENT

GDID is faced with a problem of delivering schools infrastructure in more than 36 months. This has created a problem for the Client since schools cannot be delivered timely to cater for the previously disadvantaged communities and the growing population at twice the rate of the current delivery period. Thus, there is a clear need for GDID to identify and utilise the appropriate procurement methods for school infrastructure delivery projects. This requires an evaluation of the three

existing GDID procurement systems to establish which one is best suited for GDID to deliver schools faster. GDID need to reduce the construction period from 36 months to 18 months as requested by the Client. Evaluation involves the systematic collection of information about the activities, characteristic and outcomes of an activity or action, in order to determine its worth or merit (Dart et al, 1998). The duration to execute the whole procurement process, from initiation to close-out, of a school project will be evaluated for each procurement process currently in use in GDID but emphasis will be on the preconstruction stage for reasons previously advanced.

The procurement systems currently in use by GDID are critically analysed on their own merit and evaluated against their individual efficacy to meet the time constraints imposed on GDID to deliver the schools. Further, the systems are juxtaposed and compared against one another and recommendations made on the best system after taking into account the unique GDID operating environment. For purposes of this study, the project variable under scrutiny is time, specifically time taken during the preconstruction stage, while it's assumed that the quality, cost and other (consultants capabilities, contractor capabilities, selection of service providers process, etc.) dimensions remain constant at acceptable levels.

1.4 PRIMARY RESEARCH QUESTION

The purpose of this research is to answer the following question:

"What is the nature of the relationship between the different procurement systems utiised by GDID for the delivery of schools and the duration of the pre-construction phases of a project".

1.5 SECONDARY RESEARCH QUESTIONS

The following sub-questions have been formulated to answer the research question:

- What are the GDID practices in procurement for new school infrastructure projects?
- How does each of the procurement system perform in the time-domain and how do they compare to each other?
- Given that GDID is a government department, where bureaucracy is essential to the management and organisational structure, can one of the

GDID-adopted processes be identified and recommended to GDID to facilitate delivery of new schools infrastructure within 18 months, or less, as required by its Client GDE, with special attention being paid to the preconstruction stage?

Are there any modifications that can be made to the recommended procurement system, or its implementation, to make it more time-efficient in the GDID operating environment?

1.6 RESEARCH AIM

The research aims to choice among the GDID adopted new school construction procurement system, a method that delivers the project at a faster pace than ever before paying particular attention on the pre-construction stage.

1.7 RESEARCH OBJECTIVES

In order to address the research problem effectively, this research proposes to:

a. To identify the procurement systems utilised by GDID
b. Review the identified GDID procurement systems, individually, and rate their performance with regards to time
c. Choice the procurement system which is most compatible with the GDID bureaucratic environment and which will be able to deliver the whole project, from initiation to close out, in 18 months or less, which is half the current project duration of 36 months.
d. Recommend modifications that can be made to the preferred procurement system, or its implementation, to make it more time-efficient in the GDID operating environment?

1.8 METHODOLOGY

This study provides a positivist research. The aim was to evaluate the different procurement systems used by GDID and choice the procurement system which was most suitable for GDID to deliver a project within 18months. Completed and current GDID new construction schools projects were identified. Qualitative and quantitative data regarding the procurement system and duration of projects was collected and analysed from documents files. Relationships between procurement systems and the activity and the total project durations were established. Discussions were held with Project Managers to get personal perspectives and a

deeper understanding of the procurement processes which cannot be gleaned from passive documents.

The first stage of the evaluation was to establish, in each procurement system, the time taken to execute each activity and if each activity was being executed as per recommended procurement method. The second stage of evaluation was to compare the different procurement systems and recommend the one which delivers the project in the minimum possible time.

The criteria for evaluation of new schools construction is limited to time only.

1.9 IMPORTANCE OF THE RESEARCH STUDY

This study sheds light on how to improve the efficiency of the process of procurement and identifies a strategy for speedy schools service delivery in GDID without compromising on cost and quality. The research provides the GDID top management with insights of the advantages and threats to time during application of procurement strategies.

1.10 ASSUMPTIONS

A number of topics lie outside the scope of this research, and thus a number of assumptions are made:

- All school building projects are similar in scope and have similar budgets and quality standards.
- The land belongs to Gauteng Department of Education or the Republic of South Africa and is zoned for education purposes.
- All the people involved with the planning and execution of the schools project are qualified, skilled and experienced and the selected companies (both consultancies and contracting) have the financial resources to see the project to completion.
- The new schools project are funded by the same sponsor, which is the Department of Finance.

The political interests in the construction of new schools projects in Gauteng are the same, with one view, which is to complete the new schools in the shortest possible time.

1.11 LIMITATIONS OF THE RESEARCH

The following limitations apply to this research:

- Given the wide range of projects undertaken by the department under study GDID, the scope of study shall be limited to construction of new school projects only with the same budget, scope of work and quality requirements.

- This study only looks into procurement systems being utilised within GDID on new school projects. Other alternative methods and other projects run by GDID will not form part of the study. Other alternative methods are only mentioned in brief for completeness's sake.

This study focus on time taken for delivery of the whole project from design stage to close out stage, and not quality, cost and other issues.

1.12 ETHICAL CONCERN

During the research most of the information will be collected from GDID database and project files. It is important to note that the responses will be entirely voluntary. Anonymity of research participants will be upheld to protect the security and trade secrets on GDID. Participants have the right to accept that information they provide will be treated confidentially and if published, will not be identified as theirs (Newell, 1995).

This research will adhere to the framework and policies of the School of Construction Economics and Management, University of Witwatersrand (Wits) Research Ethics Committee. Any data for research publication purposes will be treated with anonymity unless permission is granted for it to be used otherwise. In addition, the data obtained will not be used for either commercial purpose or made available to third parties without express written consent from the participants. The data emerging from the study will be made available to all participants on request (Wits, 2012).

1.13 JUSTIFICATION

In terms of the public service charter, GDID is mandated to contribute towards service delivery through the provision of Government infrastructure for an efficient public sector (GDID, Annual Performance plan for the financial year 2010-2011,

2010). GDID's vision is people-focused thus delivery is aligned to current demand and to some extent future needs. In executing its mandate, the department aims to promote the development of the less developed parts of the province and redress economic disparities as well as creation of decent jobs and job opportunities (GDID, 2011). In response to the dire needs of politicians and making education accessible to the youth of South Africa, this paper focus on the possibilities of using the procurement systems as a means and only way of addressing issues of reducing time, ensuring equity between schools provision to communities and speeding up the delivery of much needed school infrastructure to accommodate the rapidly growing student population. This study develops a strategic method to deliver new school projects in the shortest possible time. The research endeavours to identify areas to compress the procurement process. The research also derives a broad understanding of the impact of using certain procurement systems in service delivery by GDID.

1.14 RESEARCH OUTLINE

The research report structure presented in this document will flow logically from one part to the next in order to maximise reader comprehension of the various topics presented. Given the diverse nature of the respective literature reviews, the order of presentation is such that the reader is equipped with a deeper understanding of each review presented (Watkins, 2006). The research report structure shall take the form of five chapters as elaborated on below.

Chapter 1: Introduction - In this chapter, the research approach consists of a review of the background, scope and context of the research. The objectives and problem statements are discussed. The idea behind the project justification is also presented.

Chapter 2: Literature Review - Chapter 2 focusses on the conceptual framework of the research. This chapter deals with the literature review relevant to the research problem with a view to identify a procurement system to be used within the Gauteng Department of Infrastructure Development to facilitate service delivery (procurement of new schools in the shortest possible time), its advantages, disadvantages and limitations. This forms a foundation upon which empirical evidence was obtained. Psychological contracts related matters are explored as a basis for setting a background for interviews.

Chapter 3: Research Methodology - This chapter provides details of the research methodology employed to answer the objectives formulated in Chapter One. Chapter Three also explores methods used to gather information concerning the research. The development of the measurement instruments, the collection and coding of the data and the statistical techniques used to gather, process and analyse the data are outlined.

Chapter 4: Results and Analysis - The chapter presents, analyses and interprets the results.

Chapter 5: Conclusion and Recommendations - The concluding remarks and recommendations of the research topic are discussed in this chapter. Recommendations for further research work are also presented.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

The introduction of different “fast-tracking” project procurement systems is an attempt by the industry to provide a better deal to its clients or customers, who are increasingly insisting for “better value for money” from their projects in term of cost, time and quality (Rashid, 2006). The different project procurement systems present different methods, process and procedure of designing and construction of projects for the client (Rowlinson, 1987). These different systems also prescribe the variation of the organizational structure of the project teams in term of role, responsibility and authority (Murray, 1998). So how do the different procurement systems affect the project performance given that the method, process, procedure and organization vary according to the systems?

This chapter reviews the literature on different procurement systems and their attributes and how each of them affects the time performance within on the pre-construction stage and the total project duration the Gauteng Department of Infrastructure Development new schools service delivery programme.

2.2 PROCUREMENT SYSTEMS

They are many procurement systems, as will be highlighted later, being used in the construction industry nowadays (Boudjabeur, 1997). However the focus of this paper is only on the types of procurement systems that are commonly used in the Gauteng Department of Infrastructure Development as stated in the CIDB (2010). The aim is to choice a procurement sytem which can deliver a school in 18 months, The procurement sytem must provide the shortest possible duration during the pre-construction stage. The procurement systems listed in the CIDB are the separated and cooperative system commonly known as the Traditional System, Integrated and Management Oriented procurement systems. GDID is using any of these procurement system proposed by the CIDB on school project without a particular reason for choice.

The parameters for the measurement of project performance are cost, time and quality (Chitkara, 2005). GDID is primarily concerned with the duration of the project from start to project occupation by the client. In this research consideration is given to only one element; time.

Masterman (1992) referred to previous work describing “the amalgam of activities undertaken by the client to obtain a building” as a “building procurement system”. Murray (1998), recommends that this term should be adopted within the construction industry to describe, the organisational structure adopted by the client for the management of design and construction of a building project. Procurement comes from the word procure which literally means “to obtain by care or effort”; “to bring about” and “to acquire”. System is about “organized method, approach, technique, process or procedure” (Rashid, 2006).

In view of the current practises in South Africa there are different approaches to the procurement of building projects (CIDB, 2010). The procurement method includes:

- A management structure that may involve in-house personnel, an expert advisor from an accredited agency or the private section and other service providers.
- Contracting arrangements for design, construction, maintenance or operation activities and subcontract arrangement (*ibid.*).

Selecting an appropriate procurement method will assist in obtaining best value for money, cash flow rates, timeliness, quality of design and quality of contract (*ibid.*).

The participants in a construction project constitute a multi-organisational body generally including a client, designers, specialist consultants, project managers and contractors. The path followed to deliver the project differs from one project to another (Love, 2002). Typically, this is a procurement method that stipulates the form of contractual arrangements between participants or parties to the contract. One part of procurement method may result in a project having a longer duration than another. Non-traditional procurement methods commonly referred to as fast tracking procurement methods are subject to less time than the traditional methods. For one to choose a procurement system they have to understand the project performance (*ibid.*).

2.3 PERFORMANCE

Performance has been described as “the degree of achievement of certain effort or undertaking”. It relates to the prescribed goals or objectives which form the project parameters (Chitkara, 2005). From project management perspective, it is

all about meeting or exceeding stake holders' needs and expectations from a project. It invariably involves placing consideration on three major project elements that is time, cost and quality (PMI, 2013).

Keeling (2000), states that project was defined in the past as "the completion of an activity within the constraints of time, cost and performance". He points out that changing circumstances, have resulted in a change to the understanding of what a successful project is, therefore the definition has changed. A successful project is one which is completed:

- Within the allocated time period
- Within the budgeted cost
- At the proper performance or specification level
- Within acceptance by the customer or user
- Within minimum or mutually agreed upon scope changes
- Without disturbing the main work flow of the organisation, and
- Without changing the corporate culture (*ibid.*).

In the United Kingdom, common factors recognised in successful projects include (Keeling, 2000):

- Commitment by the parent organisation, client and the project manager to:
    1. Establish activity schedules and control procedures
    2. Establish budgets and control of expenditure
    3. Technical goals and milestone linked to time.
- Organisation structure suited to the nature of the project
- Team participation in planning and determining methods schedules and budgets
- Absence of legal encumbrances
- Minimising the number of bureaucratic public or government agencies involved and
- Enthusiastic public support

In today's highly competitive and uncertain business environment, the client who is the major stakeholder, wants speedier delivery of their project with early start of construction work, certainty of performance in terms of cost, quality and time, value for money for their investment, minimal exposure to risk and early confirmation of

design and price or cost (Egan, 2002). Although many tend to focus on the elements of cost, quality and time, all others are also important parameters of project performance. The elements of quality and cost are held constant. The quality and cost of the projects is within the acceptable standard by the Client. This research deals with time.

In order for the time aspect of a project to be attained it will involve planning, scheduling and controlling of the program. Planning of work over the anticipated duration requires a full appreciation of the resources needed and resources available (CIOB, 2008).

A project is not an activity or task divorced from the main stream activities and tasks of the organisation in which it takes place. It arises from the service delivery needs to coordinate and intergrate activities systematically within the public service (Regenesys, 2013).

South African Government main objective is to deliver infrastructure to the nation. According to Pravin Gordon (2012) expansion in infrastructure investment is one of the central priorities of the 2012 budget. The Government needs to deliver school infrastructure to accommodate the rapidly growing student population. There is need to step up the quality of planning, costing and project management, so that infrastructure is delivered on time and on budget (Gordon, 2012). In his bugdet speech in 2014, Gordon continues to emphasis that there is need to accelerate public infrastructure investments and also professionalise the public service and overhaul procurement and supply chain management (Gordon, 2014). Thus GDID need to choice a procurement system that can deliver schools in 18 months.

2.4 MANAGING TIME

Time in contract management is an important factor to most clients and often a major criterion upon which a project is assessed (McCaffrey, 2011).

Project sequence is a finite, time-ordered and interrelated set of tasks. The project end date may not be known for a long time, but it is assumed that it will end and it is expected to end. A project manager has to recognise that the time sequence is a key factor. Time presents a framework for the management of the project sequence and also a driving force behind the project (Healy, 1997).

All construction projects require basic information concerning time to be included. At a minimum, the client need to know when a project will start and when it should be completed and as projects grow larger and more complex, the client needs to know things like what happens if the contractor is delayed, if information is not provided at the correct time and what sanctions can be imposed by the employer if work is not completed at the proper time (McCaffery, 2011).

Healy (1997) concluded that an important factor to be noted here is that output from one phase becomes the input objective for the next phase. As the project proceeds there is a build up of greater detail in control of time and, hence, progressive elaboration is needed.

According to The Chartered Institute of Building (CIOB, 2008), the bigger picture of project management is to ensure that, as far as possible, work is carried out effectively and efficiently with maximun time management to meet the genuine needs of the client.

Timing is a vital aspect at the start of a project life cycle. Timing will be very unclear but an overall target start and finish date may be set (Reiss, 1992). Once the project has been confirmed and signed for, actual start and finishing times are set. Depending with the procurement system being utilised, this generally makes the end of the pre-construction planning stage. There is need for GDID to choice a procurement system which has a shortest possible time in pre-construction stage.

2.5 PARAMETERS OF TIME

The date upon which negotiations between the employer and the professional team marks the existence of the project. Again the date upon which negotiations between the employer and the contractor are finalised marks the point at which the contract comes into existence, and therefore the starting date for the parties' obligation to each other under the contract.

McCaffery (2011), emphasised that there should be an acknowledgement of issues such as design, pre-construction planning and programming, prefabrication, establishment of the contractual supply chain and the mobilisation of resources before work actually begins on site. These activities carry a time. It is therefore of paramount importance that construction Client considers time when making

strategic decisions when selecting the procurement system to be used in the implementation of a particular project.

2.5.1 Start date

We must discriminate in construction projects between the date of commencement of the contract, the date from which works may commence and the date upon which the contractor is permitted access to the site. These latter dates may be affected by a number of factors for example issues to site ownership, access, pre-construction works by the employer (McCaffery, 2011).

Under the JBCC (2007) range of contracts, the issue is dealt with by including in the contract a date for possession of the site or date upon which the contractor will be given access to the site. The JBCC commentary by (Finsen, 2005) state that there may be more than one start date where a project relates to construction on more than one site at different times. This date is generally given in the tender documentation although it may occasionally be left to be agreed, and the contract requires the contractor to thereupon begin construction of the works (Baccarini, 1996). Contractual provisions such as payment may be linked to that date (Finsen, 2005).

The NEC3 (2005), Engineering Construction Contract defines three separate dates:

- The contract date is the date the contract comes into existence
- The starting date is the date upon which works begins on site
- The access date(s) is the date upon which the contractor will be allowed access to the site.

Payment provisions in NEC3 are related to the starting date, and both starting date and access dates are given by the employer in the tender documentation. (NEC3, 2005).

In the FIDIC (2005), red book the commencement date may be included in the tender documentation or alternatively must be set by the engineer within 42 days of receipt by the contractor of the letter accepting his tender, giving the contractor at least seven days' notice (clause 8.1).

In most contracts the employer is required to give possession of the site by dates stated in the contract and the contractor is required to commence work ‘as soon as is reasonably possible’ after the stipulated commencement date (Nagel, 2011).

Timely access to the site is plainly important for construction projects. Failure by the employer to grant access by the due dates will have serious consequences in terms both of time and money. It is of paramount importance to distinguish between granting possession of the site and providing a right of access (McCaffery, 2011).

2.5.2 End Date

In most contracts, completion of the contract will be the point at which all of the parties have fulfilled their obligations to each other and the contract is therefore discharged (Nagel, 2011). In the case of construction work, discharge will usually occur when the works are fully completed and the employer has paid the final bill (*ibid*). Also, in a typical contract for the supply of goods, the purchaser would not take possession of the goods until they were complete, and payment would typically be made in full on delivery (Ireland, 2007).

Major construction contracts, however, differ from these general arrangements in a number of ways.

- There is a need to distinguish between completion of the contract and completion of the work.
- Payment is conventionally made by instalments of various types as the work proceeds
- The employer typically takes possession of the works before they are fully complete
- The employer may take possession of the works in sections at different times
- The employer is given the right to unilaterally change the contract works during the course of the contract and mechanism is therefore required to change the previous agreed contractual completion date (McCaffery, 2011).

Given the above, a distinction must be made between the date the contract works are required to be complete, often called the date for completion, and the date work is deemed to be sufficiently complete for the employer to take possession,

generally called the date of practical completion or the date of substantial completion (McCaffery, 2011).

The state of completeness is usually decided by the contract administrator. The contract administrator determines whether the works are in a fit state to be taken over by the employer (McCaffrey, 2011). There will inevitably be some items that are incomplete, perhaps some defects to be made good, but the guiding principle is whether or not the works can be safely used by the employer for the purposes for which they were designed (*ibid*).

The date of practical completion is important for a number of reasons, including:

- It marks the start date of the defects liability period
- It marks the start of the period of final measurements
- The first half of the retention fund is released
- The employer takes responsibility for insuring the works
- It marks the end of a period for which liquidated damages may be deducted (McCaffery, 2011).

The JBCC (2007), states that the responsibility for the completed work commonly passes to the employer immediately upon issue of the certificate of practical completion unless there are contractual provisions to the contrary. The FIDIC, (2005) Red Book incorporates a separate taking over procedure under which the employer undertakes to take possession of the works within a specified period after practical completion.

McCaffery (2011) suggested that when the contractor completes early, that is, in advance of the contractual completion date. The employer generally has no option but to take over the works. The NEC3 (2005) provides for the employer to defer taking over the works until the contractual completion date. The NEC3, (2005) commentary, states that the contractor remains responsible for the security of the works and insurance until taken over by the employer.

According to Baccarini (1996) and cited in McCaffery (2011) it is general principle that the contract administrator is required to certify practical completion as soon as, in their opinion, the works, are practically complete, and that the contractor's responsibility for the works terminates at that time.

2.6 STRATEGIC DECISIONS MADE BY CONSTRUCTION CLIENTS

Strategic decisions made by a construction Client are usually complex and made with some uncertainty (Mintzberg, 1976). They also vary across the whole life cycle of a construction project and are viewed as serving a particular purpose and in the long-term critically affect the performance. Cheng *et al.,* (2008) believed that there exist a number of strategic decision making models in the construction industry which outline the processes and decision points involved in the delivery of construction projects (Cheng *et al.,* 2008). Landmark reports have identified a lack of properly structured processes and client focus amongst other aspects as key inhibitors to the performance of the construction industry (Egan, 2002).

Cheng *et al*., (2008) recommended that a holistic view of the construction process should be taken to help eliminate these inhibitors and improve performance, for example, construction consultants and contractors. Successful delivery requires an integrated process in which different stages of project including design, construction, occupancy and maintenance are considered as a whole (*ibid.*).

Strategic decisions made by a client throughout the project cycle can be broadly categorised based on the timing or stages and the subject of the decisions (Phillips, 2000; Cheng *et al*., 2006). There are various versions of these construction project stages and project processes, including the RIBA's Plan of Work, (Phillips, 2000), the Generic Design and Construction Process Protocol by Kagioglou *et al*., (2000) and bespoken processes developed by large client organisations' such as BAA (1995) and (OGC,2003a). Although these models all aim to co-ordinate the whole project stages in one way or another, the RIBA Plan of Work, which sets out the design and construction process in a simplified linear fashion, is the most well-known model framework and most widely implemented in the UK construction industry. Amongst various models, the underlying process has however arguably remained broadly the same and can be broadly divided into pre-design, design, tender, construction, occupancy and maintenance and disposal stage (Nelson *et al*., 1999), (Hughes, 1997).

An important factor realised by Gidado (2000) in his paper information flow in design and build was the clear indication that practitioners do not take pre-construction planning seriously. Most of the constraints identified are as a result of poor planning and bad estimation of time, cost and effort required. A change in

attitude is necessary if any system is to work effectively. There must clearly defined strategies, procedures, hierarchical structures, deliverables, channels of communication, and roles and responsibilities within teams. A good team will deliver a project on time in line with the market situation (Gidado, 2000).

2.7 MARKET SITUATION

Depending on the market situation, buildings to be delivered to professional clients mostly are seen as part of a commercial production process, or of a real estate portfolio (Otter et al., 2001). This implies that every day the building is not yet available, the client or owner might face a certain loss. However due to the complexity of modern buildings, throughput time often is increasing as well in terms of the duration of the design as well as the construction process. Until recently fast-tracking processes concentrated mainly on the construction process and concurrent engineering (*ibid*).

Nowadays the awareness is growing that fast-tracking also should have evidential consequences for the earlier phases (*ibid*). This concerns the demand for a fast-tracking customised form of specification of the building design. Especially in cases of complex building projects in which a lot of design professionals and advisors are involved, this requires a lot of professional, managerial communication and team skills of all project participants, as well as specialised methods, techniques and instruments. Besides that in fast-track projects, legal authorities and formal public law procedures often are becoming critical. In fast-track literature most attention is given to reducing throughput time by parallel processing (Otter et al., 2001).

2.8 THE PROCESS OF CONSTRUCTION

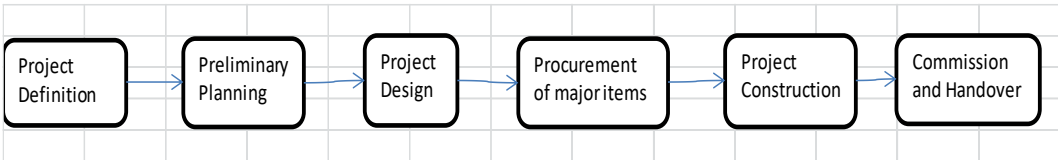

Figure 2. 1: The Total Process of Construction

The process of construction or flow of activities is the same (Rashid , 2006). The flow of activities of the different procurement system have to a certain extent, indicated the effect of the different procurement systems on the project

performance, especially on the duration of the project developed and the starting point of construction. They also show the allocation of duties and responsibilities between the client, design and construction consultants and contractors (*ibid.*).

2.9 TYPES OF CONSTRUCTION PROJECT PROCUREMENT

The strategy should be developed from an objective assessment of the client's needs and project characteristic (McCaffery, 2011). A best-fit solution is looked for, with an informed client making the decision based on sound judgement, giving due regard to the identified criteria and the acceptable distribution of risk (*ibid.*).

They are four procurement paths used in the construction industry, each having its own variations (McCaffery, 2011):

- Traditional;
- Design and build;
- Management; and,
- Design and manage.

Masterman (1996), classifies project procurement systems into several categories based on the relationship and critical interaction between design and construction responsibilities. The categorization of the various procurement systems are as follows:

1) Separated and Cooperative System
2) Integrated System
3) Management Oriented System

The different category and sub-classification of construction project procurement systems can be shown in figure below

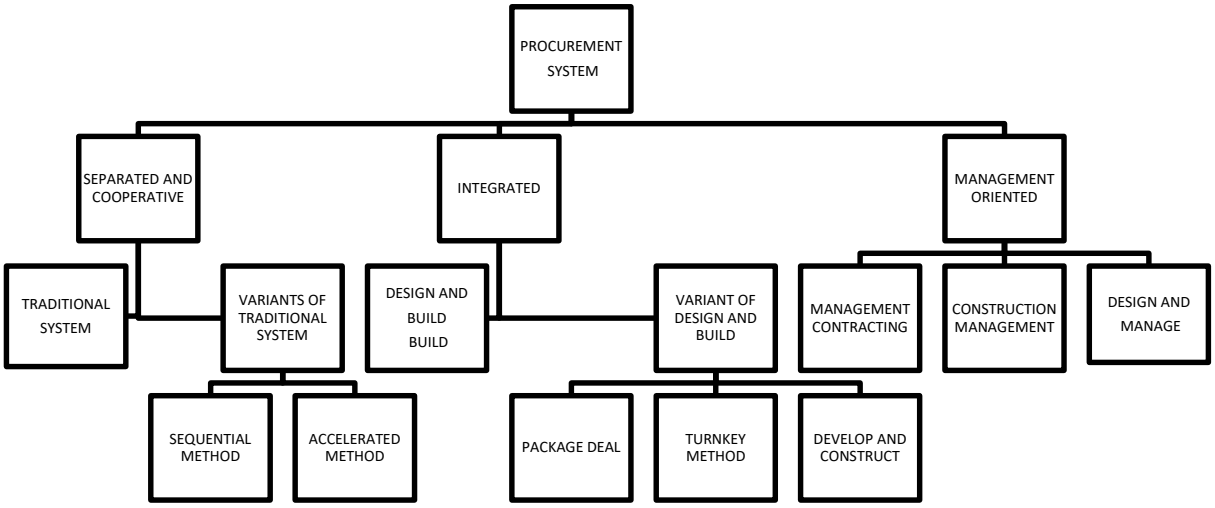

Figure 2. 2: Category of Building Procurement Systems Source: Masterman (1996)

Masterman (1996) procurement system clarification is more comprehensive as it encompasses the McCaffery path above. The research will follow Masterman's categorisation of procurement methods. A detailed comparison, contrast and recommendation to GDID will be bases on these three methods.

2.9.1 Separated and Cooperative System

Murdoch (2008), states that the basic defining characteristics of separated and cooperative system commonly known as the traditional system is that the contractor agrees to produce what has been specified in the document. In summary, the client, the appointed design and cost control consultants prepare the tender document and then a main contractor is appointed (McCaffery, 2011). Masterman (1996), also concurs that in the traditional method, the complete working drawings or design has to be prepared by the designers before tender and construction activities can take place. Murdoch (2008), conclude that the result is that the contractor has no responsibility for the design.

The use of the standard project documentation is essential to the smooth functioning of this approach. This includes standard forms of contract, methods of measurement and co-ordinated project information (McCaffery, 2011).

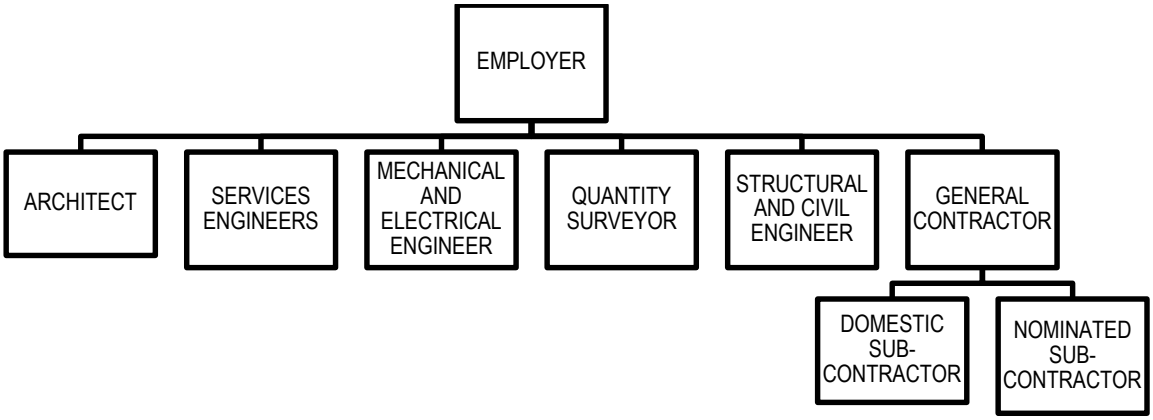

Figure 2. 3: Traditional Method

According to the Royal Institute of Chartered Surveyors (RICS, 2010) annual survey of construction contracts, the Traditional route is the most commonly used path. However, it does need adequate time for all procedures if the project is to be successfully completed. This method is time consuming.

The traditional path is sub-divided into two sub-categories (McCaffery, 2011):

- Traditional System; and,
- Variants of the Traditional Systems. The Variant System is further sub-divided into:
  - (i) The Sequential Method, and
  - (ii) The Accelerated Method

Under the sequential method or a single stage tendering approach, the building owner will appoint a team of consultants to act on his behalf to produce construction drawings, specification and tender document and to administer the tendering processes to select a contractor. Once selected and awarded the contract, the contractor will carry out the project based on the drawings and specification prepared by the client's consultants (*ibid*).

The accelerated method can be considered as an innovative approach to speed up the selection of contractor and commencement of construction (Rashid, 2006). The contractor becomes part of the design team by tendering either in competition or by negotiation on partially complete information (McCaffery, 2011). In this instance, the successful contractor assists the design team with the completion of the design and then gets on with the construction process (*ibid*).

The consultant with significant input will be in direct contract with the Employer. This lead designer may be an architect or an engineer. The Client must choose a lead designer to supervise the works. It is important that the employer is clear about the kind of person that is needed and must use careful selection procedures (Rashid, 2006).

Characteristics of the tradition system defined by Franks (1991), are that:

- The architect has considerable freedom to conceive and develop the design without excessive time or economic pressures, provided the cost ceiling is not exceeded and the client's requirements are generally satisfied.
- The design should be fully developed before bills of quantities and, subsequently, tenders are prepared. If not, excessive variations and disruptions of the works are likely to occur
- The need for the design to be fully developed before tenders are prepared leads to an 'end-on' design/build arrangement. Frequently, such an arrangement requires a longer overall project period than is necessary if both design and construction are able to proceed concurrently.
- As the length of the project period increases, so does the project cost because the client usually incurs financing charges on the sum which he has invested in land purchase, interim payments to the contractor and other members of the building team.
- The separation of the design and construction processes tends to foster a 'them and us' attitude between the designs and contractors which reduces the team spirit that experience has shown to be vital for the satisfactory conclusion of a building project (Franks, 1991).

Rashid, (2006) commented that due to the linear or sequential approach, the traditional procurement system has been identified as the slowest project delivery approach. However, this approach is more preferable because it provides clear accountability and better design and construction control by the client. Since the pre-contract stage of this is longer, more time is available for the client and project team to scrutinise and review the design before construction (*ibid*).

The disadvantage of the traditional system is that lines of communication between the parties tend to be tenuous and interests of all may suffer as a consequence

(Franks, 1998). He further states that the traditional system has been proven to be unsatisfactory for some large and complex projects which require advanced management systems, structures and skills (*ibid*).

One significant problem with the accelerated route is that it is extremely difficult for the contractor to give a lump sum price on partially completed information. Projects of this type are therefore most often let on the basis of some form of cost reimbursement (McCaffery, 2011). The accelerated traditional method is likely to be successful if a project office is created in which the whole project team works together. Otherwise the need for speed will prevent the proffessions and the contractor from having the time to make well considered inputs in the right sequence (*ibid*).

2.9.2 Integrated System

Design and Build and turnkey project procurement system are called 'fast tracking' project delivery system where the design and construction are integrated. The design free pre-tender process allow for earlier construction date (Rashid, 2006). As a single entity responsibility for both the design and construction, the contractor is able to control not only the construction time but also the time reserved for the design of the project. Thus reducing the overall contract duration.

The Design and Build system provides the necessary multi-disciplinary approach and integration because it forms a designer-contractor team at an early stage in the process, and thus, it vests authority, and some responsibility, for both the design and construction with one organisation, the contracting side of the industry from initial briefing to the production of the finished building (Boudjabeur, 1997).

One of the advantages claimed for the Design and Build procurement method is that it can facilitate early contractor involvement in the design process (Franks, 1998). Architects work under sub-contract by the main contractor from varying stages in the design process (Greenwood *et al.,* 2004). Hughes *et al*., (2006) suggest that the value of projects executed through Design and Build exceeds that of work performed under traditional system. They state that 46% of UK construction outputs are associated with Design and Build while 37% is attributed to traditional methods (Hughes *et al.,* 2006).

Integrated design is a key element of integration team working. The integration method is characterised by interdisciplinary working within integrated teams (Emmitt, 2007). Elvin (2007) affirms integrated method as being incremental, proceeding in stages as the project progresses, the example of an integrated architect, engineering and construction team is offered (Evans, 2007). Working together they can define a structural system sufficiently in order to make key purchasing decisions but also employ various strategies to keep the design as open and as flexible as possible to accommodate high levels of speed, uncertanity and complexity and change in todays's projects (*ibid*).

Walker (2009), state that integrated procurement system are a means whereby a group of organisations provide clients with a one stop shop for the whole product or servise life cycle. Murdoch (2008), continues to say this single-point responsibility also means that the contractor is not relying on other firms for the execution of design for the supply of information. By removing these blocks to effective communication, experience has shown that programmes and budgets are more likely to be adhered to, and the speed of building is likely to be quicker (Murdoch & Hughes, 2008).

The Integrated Procurement Method offers a Guaranteed Maximum Price (GMP). The Client feels reassured that they are not signing a blank cheque (Murdoch *et al.,* 2008). As an incentive all the saving made by completing the project for a price below the GMP is given to the Contractor. The price is governed by the Contract Sum Amount (CSA). There is no need for Bills of Quantities. However the CSA can be presented in the form of the Bill of quantities or activity list for the purposes of payments. Valuations of employers change instructions can be applicable (*ibid*).

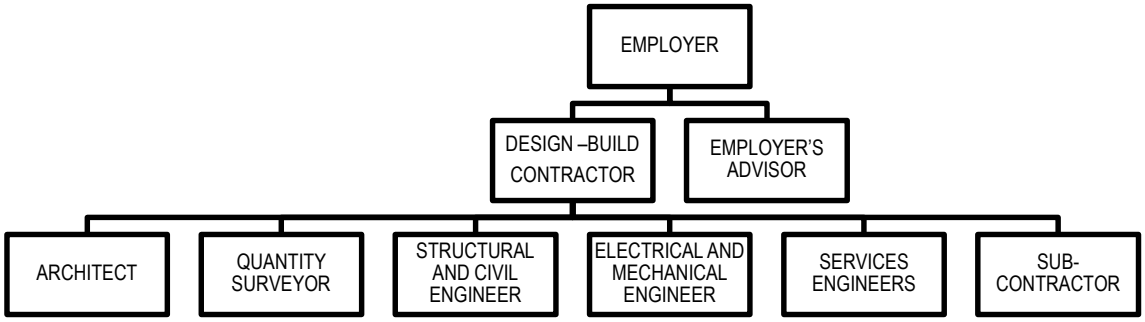

Figure 2. 4: Contractual Relationships in Integrated System

The characteristics of the integrated procurement systems are as follows:

- It provides for a single point responsibility so that in the event of a building failure the contractor is solely responsible. There can be no question of 'passing the buck' between the architect and builder as has so often been the case in the past with the traditional system. The client's interests are safeguarded in this respect.
- The client has direct contact with the contractor. This improves lines of communication and enables the contractor to respond and adapt more promptly to the client.
- The contractor is responsible for design, construction planning, organisation and control. These activities can proceed concurrently to a greater extent than is generally possible using the traditional system.
- The design and develop components are often readily available so that manufacturing time is minimum and construction time may be correspondingly reduced because manufacture of components and work on site can proceed concurrently.
- The integrated nature of the team improves communication between designer and builder which encourages prompt decisions
- A prompt response in the event of materials or manpower shortages
- The nature of the contract tends to reduce changes (variations) from the original design and disruption of the works is less likely to occur
- The reduction of changes and disruption produces time and cost savings which benefit the client.

- The total project completion time is reduced.
- Time savings reduce the employer's financial charges, inflation has less effect and the building is operational sooner which, in a commercial context, produces an earlier return on the capital invested (Franks,1991).

As a procurement system integrated system offers many different combinations of priorities (Murdoch, 2008). GDID utilises mostly the Develop and Construct integrated procurement system. Rashid (2006), define Develop and Construct as another of the integrated procurement approaches which is very much similar to Design and Build. However, in this case, the contractor is still given the responsibility for both the design and construction of the project. The difference is that, under this method the client's design consultants prepare the concept sketches or designs and pass them to the contractor who will develop them and produce the working drawings. The contractor will then construct and complete the project based on what it has developed and produced (Rashid, 2006).

Murray (1998) notes that team work involves the effective co-operation of people in activities that are directed towards a common goal. The whole point about teamwork is that the performance of the group as a whole is better than would be the normal sum of the individual comprising the group (Gabriel, 1991). Gabriels paper 'Teamwork – Fact and Fiction' identifies the beneficts derived from synergy, and suggests that there is a limited time for which the synergy of a team can be maintained.

The project success can be obtained by the concept of the empowered team member whereby the team takes responsibility and accountability for meeting the project goals (Murray *et al.,* 1998).

Murdoch (2008), states that a client whose highest priority is speed should appoint a Develop and Build contractor with a record of success in hitting such targets. There are numerous ways of configuring the priorities for a project. The client should make explicate decision about these before inviting contractors to respond with their proposals. (Murdoch, 2008) further noted that, it is essential that the client takes an opportunity to look at previous work by the contractor and also speak to previous clients of the contractor.

On Develop and Build system Murdoch (2008), confirms that there are opportunities to overlap the design and construction process and thus to make an early start on site. This is attractive to GDID because there is need to start spending the budget within a short time of the money being allocated. Murdoch (2008) further states that the appeal of an early start on site is that they (clients') can spend some of the budget before the money is withdrawn in favour of other departments with the urgent needs.

According to Murdoch (2008) the benefit of fast tracking is that the overall construction process can be speeded up by not delaying construction until the whole of the design is completed. There is a single point of responsibility. Single point responsibility means that the contractor is responsible for ensuring that the project is completed on time. Any delays beyond the control of the employer would be at the risk of the contractor.

One of the most distinctive features of construction projects is the overall duration of the process (Murdoch *et al*., 2000). Since a single construction project typically constitutes a large proportion of a clients' annual expenditure and a large proportion of a contractor's annual turnover, each project is individually very important (*ibid*). Many developments and refinements to procurement methods have been connected with the desire to reduce the duration of projects. Much of the process of construction is essentially linear. Briefing, designing, specifying and constructing must follow one from the other. If these steps can be overlapped, then the overall time can be reduced significantly, provided that there is no need for re-work due to changes and wrong assumptions, in which case too much overlapping can slow the process and cancel any gains to overlapping (Murdoch *et al*., 2000).

A prominent feature of the Integration Procurement Method is that construction construction is allowed to start on site before design is completed. The limitation of this practice is that the client may have to commit at an early stage to contractual and financial arrangements which they might prefer to consider only when design was completed (Boudjabeur,1997).

The disadvantages of the Design and Develop system noted by Murdoch, (2008) is that too much overlapping will give rise to problems from the need to revise early design decisions, as the design is refined. If the project has already started on site by the time that these revisions are made, work may have to be undone before

further progress can be made. In extreme cases, this can lead to fast tracking taking even longer to complete than a traditional system.

The emergence of the Integrated Procurement Method as a major method of procuring building had been met by a lack of acceptance by some professional within the industry (Ndekugri,1994). Integrated Procurement System implies major changes in roles, relationships and responsibilities. This Integration Procurement System has made lead professionals to feel stripped of their powers. The control of the project swings from the architect to the contractor. (Boudjabeur,1997).

Furthermore, Griffith (1998), informs us that Design and Build is not without its limitations. With the contractor being responsible for the design and construction elements of the building, (Griffith,1998) argues that the client is at risk where the contractor does not fully appreciate the full risk associated with design. Similarly, the client is at risk if the contractor does not have full indemnity insurance cover.

Boudjabeur, 1997, founds that after the initial success of Integrated Procurement System, there was an explosion of firms claiming to be Integration specialist. However, it was obvious that some of these so called “specialist” were not capable of taking on the sole responsibility for large projects and simply did not have the resources to produce the quality product that the client required. Boudjabeur, 1997) further notes that changes of the client’s requirements once the contract has been signed are found to be more expensive both indirect and in disruption costs if the contractor’s building sequence is affected.

Murdoch,2008 also noted that variations, that is changes to clients requirements are a constant source of problems. They are one of the most frequent cause of claims and often lead to litigious disputes. The client who wishes to reverse the right to alter requirements during the fabrication process should not use Integration Procurement Method. The process demands early agreement between employer’s requirements and contractors’s proposals. A change in either of these documents makes the agreement awkward. The valuation of variations can be difficult without a comphresive contract sum analysis, and the employer’s insistence on time and cost targets is less convincing if the requirements are altered (Murdoch *et al.,* 2008). Therefore, a client who needs to retain the right to make variations should either consider an alternative procurement method, or shoud consider allowing the Integrated Procurement Method contract to be completed on its original basis,

making variations the subject of additional contracts after the conclusion of the project. The limited scope for variations and changes is thus a weakness of the Integrated Procurement Method (*ibid.*).

It takes the responsibility for both design and construction on to the contracting side of the industry that is the main contractor (Boudjabeur, 1997). There is ample evidence that the Integration Procurement Method is growing in popularity and is satisfying the inspiration of many clients and as a method of procurement, the Integration Procurement Method has firmly established itself in the U.K construction industry (*ibid.*).

2.9.3 Management Oriented Procurement System

Rashid (2006), describes Management Oriented Procurement System as a system that gives greater emphasis on the management and integration of the design and construction of projects. Under this system, the management of the design and the construction of the project are contracted out to a contractor who acts as a management consultation on behalf of the client. The construction itself is commissioned to many specialists or sub-contractors who enter into contract with either the management contractor or the client. This procurement approach that was introduced based on the conception that a builder or contractor has more expertise to manage the design and construction of a project. As management consultants, the appointed contractor does not itself, carry out the design or construction of the projects. Its main responsibility is to manage the design and construction by the design consultants and the many specialist contractors respectively (*ibid*).

There are three types of procurement methods that fall under the category of Management Oriented Procurement System, they are;

- Management Contracting
- Construction Management
- Design and Manage

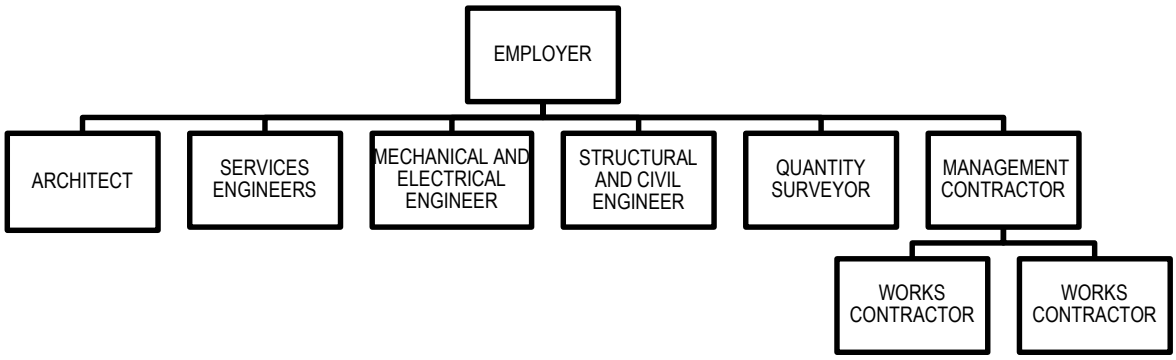

Figure 2. 5: Contractual relationships in Management Contracting

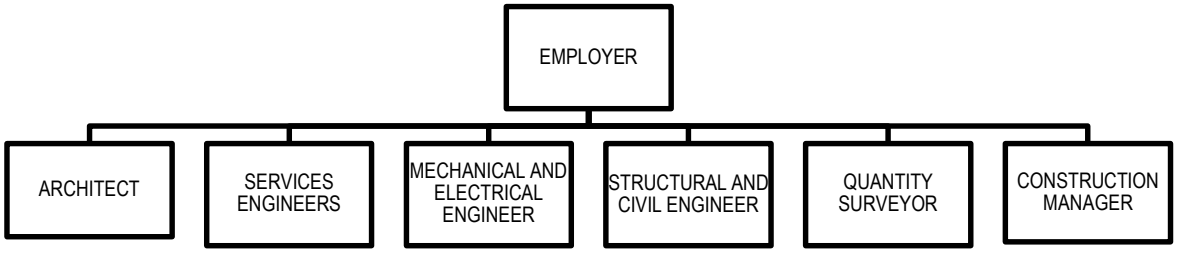

Figure 2. 6: Contractual relationships in Construction Management

Management Contracting and Construction Management Contracting are forms of fast-tracking procurement approach whereby a contractor is contracted and paid a fee to manage, procure and supervise the construction of a project rather that to build the project. The actual construction works are contracted out to many package or specialist contractors (Rashid, 2006). Under this arrangement the Management Contractor is employed as a construction consultant to be part of the client's team. The main difference between Contract Management and Construction Management Contracting is that in the former, the package contractors are in contract with the management contractor. In the latter, the package contractors (specialist sub-contractors) are in contract with the client or builder owner (*ibid*).

Rashid (2006) noted that under the Design and Manage system, a single organisation or firm is commissioned to be responsible for designing the project and managing its construction. The firm does carry out the work itself, but it is contracted out to a member of specialist sub-contractors or package contractors,

who enter into contract with the client. A design and manage firm or company is engaged as a consultant for the client and become a member of the project team (*ibid*).

As mentioned by Rashid (2006) the Management Contracting and Construction Management Systems have the knowledge, experience and competency to better manage the design and construction of a project. It is a factor that allows for more efficient and effective coordination of works, materials, manpower and plants, thus making construction time shorter compared to other procurement systems. This is especially so, given the fact that the same management contractor is able to manage and contribute towards the development of the design. It allows the management contractor to improve build ability or constructability (*ibid*).

At the same time, the system also allows for early start of construction compared to the Traditional system. Rashid (2006), says the preparations of simple or basic tender (bidding) documents and the shift of the process of systematic and detailed design to construction phase, allow for an early start of construction. As pointed earlier, under these two systems, the detailed design is carried out either by the consultants or package contractors during the construction stage. All these factors brought about a considerable reduction of the overall project time compared to the traditional or even the Integrated Procurement System (Rashid, 2006).

The characteristics of the Management Oriented Procurement System are as follows:

- Work can commence as soon as design proposals have been accepted by the client and drawings have been approved by the local authority.
- The management contractor is appointed much earlier than would be possible with the Traditional System. He is able to become a member of the design team and contribute his construction knowledge and management expertise.
- The ‘them and us’ attitudes are reduced and lines of communication are improved.
- Contracts are entered into near the time of commencement of the works making firm-price tenders possible.

- Lines of communications between clients and specialist contractors are shorter than with the traditional system.
- The client is enabled to make prompt decisions which can be implemented without delay. It makes possible a prompt response by the client to unforeseen site problems and by the contractors to changes required by the client.
- The total project completion period is reduced by parallel working.
- A reduced project completion period produces a corresponding reduction in financing charges on the sum invested in land purchase, interim payments to contractor and other members of the building team. Inflation has less effect.
- Client takes delivery of the building more quickly because the project completion period is reduced and thus obtains a return on their investment more quickly (Franks, 1991).

The disadvantage of the Management Oriented Procurement System is that the architect may have less time to develop the design because he is under greater pressure from client, contractor and sub-contractors. The design may suffer as a result (Franks, 1991).

Research conducted by Moshini *et al*., (1995), and supported by Murray (1998), has indicated that the level of sophistication of the various participants, particularly work packages contractors can have implications for coordinating mechanisms. Coordination of tasks in the construction management process especially by using sophisticated computerised scheduling and process accounting systems that are often beyond the comprehension of many subcontractors is often seen as dysfunctional.

Moshini (1995), notes that the negative impact of coordination on project performance in building industry in general may partially be attributed to a particular deficiency of any temporary multi-organisation namely that it lacks an effective mechanism for project feedback.

2.10 COMPARISON OF PROCUREMENT SYSTEMS

Franks (1991), concludes that the procurement systems as described are subject to greater variation. The clients need is very important. Selecting the most

appropriate procurement path is largely a matter of determining which performance requirements head the client's list of priorities. Time is the most important parameter of project performance in the GDID schools service delivery programme. It has been stressed that in today's highly competitive and uncertain business environment, clients are demanding better value from their investment. They want their project to be completed on time.

The use of the various project procurement systems shows that the construction in now trying to meet the clients' needs. This is because the different procurement methods will have effect on the time of the project. Each project procurement system has its own peculiarity in terms of the pretender and post tender activities and processes, divisions of risks between clients and contractors and the effectiveness of the project monitoring and control (Rashid, 2006).

Traditional Procurement method requires a need to design and specify the whole of the works before inviting tenders. The literature review showed that Traditional method is generally the slowest method. This overall slowness often leads to techniques for starting on site early such as the letting of early enabling contracts, like demolition or earthworks being held until designs are complete. Another technique to speed progress is to leave much of the detailed design until after the contract has been let by including large provisional sums in the bills of quantities, a bad practice that should generally be avoided (Murdoch *et al.,* 2000). Other procurement methods are inherently quicker simply because they enable an early site start. Since an Integrated Procurement System contractor will be undertaking design, early assumptions are fairly safe. Further, Integrated Procurement System is generally used for projects that are straight forward. Management Oriented System can be very quick because the relationships are conducive to quick working and overlapping.

2.11 CONCLUSION

According to Rashid (2006), it is very important at the very outset of the project to carefully consider all factors when selecting the most appropriate procurement approach for a construction project. This is because each procurement system has its own feature and peculiarities that will have effect on the time of the project. The literature has reviewed that the characteristics of procurement systems are being followed and adhered to by GDID on its execution of new schools' projects. The

literature reviews also revealed that different procurement methods have effect on the time of the project. It is possible that the choice of procurement system should be able to meet the client's characteristics for delivering the school projects within the period of 18 months.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter provides details of the research methodology employed in this research project. This sections analyses the different possible methods considered for the research, the various pros and cons for each method, and the method eventually selected and the reasons thereof. There are a range of factors that influence overall project time apart from the procurement system used. It is important to control for these factors before proceeding with the measurement of variables.

The methodology describes the practical way in which the whole research project has been organised (Oliver, 2004). According to Walliman (2005), a plan of action must be developed that shows how the problems will be investigated, what information will be collected using which methods, and how this information will be analysed in order to arrive at conclusions and develop recommendations. Research projects synthesise and analyse existing theory, ideas, and findings of other research, in seeking to answer a particular question or to provide new insights (Fellows *et al.,* 1997).

GDID is faced with a problem of delivering schools infrastructure in more than 36 months. This has created a problem for the Client since schools cannot be delivered timely to cater for the previously disadvantaged communities and the growing population at twice the rate of the current delivery period. There is need to identify the kind of data that will be required to study the problem, and also what kind of analysis would be most appropriate to analyse the data (Walliman, 2005). The problem investigated in this study is the potential of different procurement methods on construction projects' impact on the overall time performance of these projects. It is anticipated that the choice of the appropriate procurement system may lead to saving time and improvement in overall project performance. The aim of the study is to evaluate the different procurement systems used by GDID and choice one which enables GDID to deliver the project at a faster pace than ever before. Completed and current GDID new construction schools' projects are identified.

In order to considerably address the research question, aim and the objectives of this research, suitable data collection and analysis means were considered. The

approach seeks to establish in each procurement system, if each activity was being executed as per recommended. And thereafter compare the different procurement systems and choice the one which delivers the project in the minimum possible time. The research aims to choice among the GDID adopted new school construction procurement system, a method that delivers the project at a faster pace than ever before paying particular attention on the pre-construction stage.

A two stage data collection and analysis process was undertaken. The first stage involved writing a letter to the Head of Department to seek approval to undertake the project. The second stage involved requesting a list of Project managers involved in new schools' projects from the Director. The research then requested files from the Project Managers to allow the researcher to review historical and current data of projects particularly related to procurement.

3.2 RESEARCH STRATEGY

A research strategy is a plan of how a researcher will go about answering the research question (Saunders et al, 2012). It is a methodical link between the selected philosophy and the subsequent choice of methods used to collect and analyse data (Denzin, 2005) (As cited by (Saunders et al., 2012). The key to research strategy is that coherence is achieved between the objectives and questions of the study, and the research design. Research strategies are not mutually exclusive for the different philosophies and as such it is not necessary to attach labels to strategies for their own sake, or link research elements in order to appear methodically aloof (Saunders et al., 2012).

In designing the research approach to this study, the quantitative approach was largely used because it is the intention of this research to be deductive and focus on using data to test a theory. It is the objective of this study to deduce the impact of the selected procurement method on project duration.

It is the norm for the survey research strategy associated with quantitative research to use questionnaires. Questionnaires would have been used to determine the opinions, attitudes, preferences and perceptions of GDID project managers on procurement methods and their effect on their performance in delivering new schools construction projects. However, in this study, it was deemed that there was

sufficient documented data on completed projects to render questionnaires superfluous.

From a purpose research design perspective, this study can be defined as explanatory. It seeks to establish causal relationships between variables of procurement systems stages for construction of new schools and how one can be used to influence the other. The emphasis is on studying a situation or a problem in order to explain the relationships between variables (Saunders et al., 2012). It must be noted, though, that it also has elements of descriptive studies. The study seeks to gain accurate profile of events, persons or situations, which is descriptive research design (*ibid*) However, this study goes beyond describing the situation as it goes on to explain the relationships.

The case study research strategy was used for this study. Case study research designs involve looking at a small group, project, institution or company (Mancosa, 2015). This study looks at a small group of GDID new schools projects.

The case study strategy is used when one wishes to gain a rich understanding of the context of the research and the process being enacted (Eisenhardt & Graebner, 2007)(As cited by (Saunders et al., 2012). This study explores different types pf procurement systems utilised at GDID for the construction of new schools in the GDID context. Many case study designs use a mix of both qualitative and quantitative methods to collect and analyse data (Yin, 2009) (As cited by (Saunders et al., 2012). The methods of gathering data include interviews, observation, documentary analysis and questionnaires (Saunders et al., 2012). Documentary analysis were used in this study.

The research strategies that was used is the archival research. Archival research makes use of administrative records and documents as the principal source of data (Saunders et al., 2012). The data was originally collected for administration of the organisation. When these data are used in an archival research strategy they are analysed because they are a product of the day to day activities (Hawkin, 2000). They are, therefore, part of the reality being studied rather than having been collected originally as data for research purposes (Saunders et al, 2012).

There are more research strategies that could have been used but were discarded because they did not address the research questions and objectives. These

include action research, grounded theory and narrative inquiry (Saunders at el., 2012).

3.3 METHODOLOGICAL APPROACHES

The methods of collecting data impact upon the analyses which may be executed and subsequently, the results, conclusions, values and validity (Fellows *et al*, 1997). To improve the validity of the research findings, the triangulation approach was adopted for data gathering. This approach consists of combinations of qualitative and quantitative methods strengthened with the literature review.

A letter was written to the Head of Department to seek approval to undertake the project. Project managers involved in new schools' projects were identified through enquiry to the Director. A full access of the files of projects was then obtained, this allowed the researcher to review historical and current data of projects particularly related to procurement. It was also possible to consult the Project Managers of the new schools' projects to verify clarity and obtain information. Discussions were held with project Managers to get personal perspective and a deeper understanding of the procurement processes which cannot be gleaned from passive documents.

3.3.1 Qualitative Method

The qualitative approach seeks to gain insights and understanding people's perceptions of 'the world.' The beliefs, understanding, opinions, views of people are investigated (Fellows *et al*, 1997). Qualitative methods in this study seek to obtain the perception of construction industry stakeholders relative to the impact of procurement system on project performance. According to Bodgan and Biklin (1998), qualitative research has the following characteristics:

3.3.1.1 Natural setting of qualitative research

Qualitative data has the natural setting as the direct source of data, and the research is the key instrument. Data were collected from construction project data sheet and project reports (Bodgan *et al*, 1998).

3.3.1.2 Meaning is essential for qualitative research

Meaning is of essential concern to the qualitative approach. The investigation seeks to know personal experience of participants or the opinions from the experts into the field. Experts included top management personnel from construction

contracting companies knowledgeable of issues related to the procurement systems (Bodgan et al,1998).

The expert opinion method was chosen mainly due to the problems associated with collecting sensitive data from GDID without exposing secrets. According to Delbecq *et al*.,1975, the fact that the experts work in isolation during tender document formulation means that the better quality ideas are created, the experts actually have a chance to generate these ideas and do not have to react to the ideas of other participants (Delbecq *et al*., 1990). This method is also suited to participants who are geographically dispersed and might not be practicable to bring them together (Critcher et al., 1998). Unlike with the monkey puzzle, the experts are forced to think through the problem before putting their responses on paper. Therefore there is equality of participation by all participants as all ideas and judgements are eventually pooled together (Evans, 2007).

The advantage of anonymity is that participants can freely express their judgements and opinions without fear of being labelled or going against the organisational values, thus giving an honest opinion without peer pressure or intimidation (Delbecq *et al.,* 1990). The participants can revise their initial responses in the light of other expert responses, without public exposure.

However, in this method there is no opportunity for getting verbal clarifications and this has the disadvantage of creating possible communication and interpretation difficulties. The pooling of ideas and adding of votes can also mean that some conflicts are not necessarily resolved. Critics like Sackman, 1975, argue that the Delphi method is scientifically suspect (Sackman, 1975). According to Delbecq *et al*.,1990, the criticisms levelled against the Delphi method are mainly due to the fact that it straddles the divide between quantitative and qualitative research. However, it is not quantitatively rigorous but is the best alternative when data is scarce and the resources for a large scale model are not available. The Delphi Method can identify and specify issues on which there is the greatest difference of opinion and solutions to problems that were not considered before.

3.3.2 Quantitative Methods

Quantitative methods focus attention on measurements and amounts (more and less, larger and smaller, often and seldom, similar and different) of the

characteristics displayed by the people and events that the researcher studies (Thomas, 2003). Quantitative data included quantifying the duration of the project.

3.3.2.1 Data collection method

There are two types of data that can be collected *viz*; *primary data*; and *secondary data*. Primary data are those data which are collected for the first time, hence they have to be original in character, while secondary data are those data which have already been collected by someone else and have already been passed through the statistical process (Kothari, 1995).

3.4 SECONDARY DATA

Secondary data include both quantitative (numeric) and qualitative (non-numeric) data and are used principally in both descriptive and explanatory research (Saunders *et al.*, 2012). The secondary data in this research is in the form of literary sources covering relevant topics of the subject matter. Two distinct literature studies were adopted as proposed by Melville and Goddard (1996), namely a preliminary and a full literature study (Melville et al., 1996).

3.4.1 Preliminary literature study

A preliminary literature study allowed a feel for the topic to be acquired and the issues involved, and an understanding of how the proposed research would fit into it. A preliminary literature provided an understanding of the background and key concepts of the research study and the basis upon which the problem statement was formulated.

3.4.2 Full literature study

A literature review is a critical and in-depth evaluation of previous research allowing anyone reading the paper to establish why you are pursuing this particular research programme Experiment-Resource, 2013. It demonstrates an individual's ability to identify the significant information and sketch existing knowledge. It helps fill in the gap in the research that the work will address, and generates a rationale or justification for the study (Raphael, 2011). A full literature study is part of the research process itself rather than part of the preparation for research. Such a literature review demonstrates that a researcher is knowledgeable of the area under investigation, shows how previous research studies support the current one

and generate new research ideas through discovering what was left behind by others.

The literature examined was reviewed in Chapter 2. This formed the basis of the secondary data. The literature reviewed supported the topic from international perspective. The secondary data used was compiled mainly from textbooks, published and unpublished journals, conference proceedings, periodicals, theses and dissertations. According to Melville & Goddard (1996), these are the most reliable sources of information and are the most referenced in scientific reporting. Copies of these documents were obtained from the Witwatersrand (Wits) libraries and electronically from websites.

3.5 PRIMARY DATA

The method used for primary data collection was the documentary analysis. This was preferred over the observation method and the interview method for the brief reasons discussed below.

The observation method involves the systematic observation, recording, description, analysis and interpretation of people's behaviours (Saunders et al., 2012). This was not possible because:

- It would entail the researcher attaching herself to individual project managers for the duration of each project which was impossible since some of the projects were completed before the research was initiated.
- It would mean the researcher attaching herself to all new schools projects in the sample.
- The researcher is also a project manager. The employer would still expect the researcher to perform on her projects besides doing the research.
- The costs would prohibitive.

The research interview is a purposeful conversation between two or more people, requiring the interviewer to establish rapport, to ask concise and unambiguous questions, to which the interviewee is willing to respond, and to listen attentively (Saunders et al., 2012). It can be seen from the definition that this is a lengthy process, which time the researcher simply did not have. Further, it would have been extremely difficulty to synchronous the free times of the researcher and the 'sample' new schools project in order to conduct the interviews.

The documentary analysis is used in research projects that also collect primary data. Documentary data can be used on its own or with secondary data (Saunders et al., 2012). This was most suitable as the study involved business history research within an archival research strategy. The documentary data included text material such as notices, correspondence, minutes of meetings, reports to shareholders, dairies all of which the information was found on the project files.

3.5.1 Exploratory study

The research aims to choice among the GDID adopted new school construction procurement system, a method that delivers the project at a faster pace than ever before paying particular attention on the pre-construction stage. The exploratory study was to determine whether the topic of procurement system was worth for research. The preliminary findings suggested that delay of projects accrued as a result of procurement method and thus the need for a further study of the phenomenon.

3.5.2 Sampling

The objective of sampling is to provide a practical means of enabling the data collection and processing components of research to be carried out while ensuring that the sample provides a good representation of the population (Fellows *et al*., 1997). Walliman (2005) indicated that sample should be free from bias. Otherwise, the type of selected sample will greatly affect the reliability of subsequent generalisation. Sampling strategies are categorised into two main groups, namely probability and non-probability sampling (Blaxter *et al.,* 2001).

3.5.2.1 Probability sampling

Probability sampling is also known as random sampling. In random sampling, each member of the population has an equal chance of being selected (Fellows *et al.,* 1997). The advantage of this method is that it is free from bias. The disadvantage is that the selected sample may not have provided the relevant expected information or may not be willing to provide the required information. In this survey a list of all new schools construction projects done in GDID was compiled.

3.5.2.2 Non-probability sampling

Non-probability sampling is also known as non-random sampling. Although non random sampling is viewed as providing a weak basis of generalisation, it is a useful method for certain studies (Walliman, 2005). Given the nature of required

data to be gathered from the field and the anticipated cooperation of selected participants, a non-random sampling method was judged to be the most suitable. The purposive sampling methods were adopted.

3.5.2.3 Purposive sampling

Purposive sampling consists of handpicking supposedly typical or interesting cases (Blaxter *et al.,* 2001). According to Walliman (2005) and O'Leary (2004), purposive sampling is labelled as "theoretical sampling". It is a useful sampling method consisting of getting information from a sample of the population that one thinks knows most about the subject matter (Walliman, 2005). O'Leary (2004) indicated that there is a growing recognition that non-random samples can credibly represent the populations, given that the selection is done with the goal of representativeness in mind. Furthermore, "purposive" highlights the importance of conscious decision-making in non-random sample selection (O'Leary, 2004). This method was used to select the project to which were used on this research.

Saunders *et al.,* 2012 states that with purpose sampling you need to use your judgement to select cases that will best enable you to answer your research questions and to meet your objectives. For this reason it is sometimes known as judgement sampling. It is often used when working with very small samples such as in case study research and when you wish to select cases that are particularly informative (Neuman, 2005).

The information gathered using various methods of data collected was analysed in order to answer the following research objectives:

a) To identify the procurement systems utilised by GDID
b) Review the identified GDID procurement systems, individually, and rate their performance with regards to time
c) Identify a procurement system which is most compatible with the GDID bureaucratic environment and which will be able to deliver the whole project, from initiation to close out, in 18 months or less, which is half the current project duration of 36 months.
d) Recommend modifications that can be made to the preferred procurement system, or its implementation, to make it more time-efficient in the GDID operating environment.

The approach was to investigate how a number of completed projects under investigation were procured. The particular emphases were on the early integration or otherwise of members of the contractors' design other than the traditional system.

3.5.3 Target Population

The target population was the new schools construction projects done in GDID. This was a list of all schools projects executed by GDID at the time of the survey between the year 2008 to 2015. Only four projects were done and completed before the study was initiated, however only two projects had files with information. The expectation of the other eleven projects was that the results will be available as the projects were being executed. The research was done during the execution of these projects. Of the eleven schools projects, one project is still under construction. The delay is due to community interference. Two schools projects were dropped from the survey. The community forced occupation of the schools before the projects were completed. The total number of the new school project in this study is ten which represent the sample.

The sampling type used was the purposive/judgmental non-probability method (Mancosa,2015). The sample selected comprised only of new school schools project. This was deliberate because for one to rigorously examine time performance and procurement issues, one has to start from stage one, design development through construction to stage 6, project handover. Only new schools projects done from start to finish meet the criterion for the researcher to fully investigate the relationship between time performance from design stage to close out stage and procurement system utilised. It is for this reason that the other non-probabilistic methods, namely, quota sampling, snowball sampling, self-selection sampling and maximum variation sampling were not used. It is, again, for the same reason that the probability method (simple random sampling, systematic random sampling, stratified random sampling, cluster sampling and multi-stage sampling) were discarded for this research (Saunders et al., 2012).

3.6 DATA ANALYSIS

Data analysis encompasses the compilation and interpretation of the data collected. Analysis depends on the nature and form of the data recorded. Since the analyses have been recorded using qualitative and quantitative approaches,

the analysis was done accordingly. Whether it is qualitative or quantitative data, the main rule of any form of analysis is to move from raw data to meaningful understanding (O'Leary, 2004).

3.6.1 Qualitative Analysis

The analysis of qualitative data consists of abstracting from the raw data all points that a researcher considers to be relevant to the topic under investigation. Qualitative data is analysed thematically. Thematic analysis can include analysis of words, concepts, literary devices, and/or non-verbal cues (O'Leary, 2004). During the interview, especially a semi-structured one, interviewees are not always straight forward to the point. The researcher may have some few basic questions but often the conversation takes direction upon the response of the interviewee (*ibid*).

Mark *et al*., (2012) state that in qualitative research, meanings are principally derived from word not numbers. Since words may have multiple meanings as well as unclear meanings, it is necesary to explore and clarify these with great care. This indicate that quality off qualitative research depends on the interaction between data collection and data analysis to allow meanings to be explored and clarified (*ibid*) .

Existing theory that the type of procurement system utilised is a function that can be used to improve time performance in the construction project is used. The characteristics of effective procurement system, as laid out in literature for each procurement stage, are tested on new schools projects in the form of data gathered.

The data collected from the each school were put into a tabular form for each activity. The information gathered for each activity was tabulated and thereafter bar graphs were used to pictorially illustrate the information. The Excel software package was used for tabulating and graphing the responses. Patterns and trends within and among activities were manually identified due to unavailability of computer aided qualitative data analysis software (CAQDAS) and explained by superimposing these findings against the literature review. Conclusions were then drawn and recommendations made.

The non-standardised data for the research was large in volume and complex in nature (Saunders *et al.,* 2012). The qualitative data research was confronted by a mass of paper or electronic files that need to be explored, analysed, synthesised and transformed in order to address the project objectives and answer the research question (*ibid*). The data collected was summarised, condensed and categorised in such an order that it made sense of the data. It was then linked to categories that provided structures to answer the research question.

3.7 VALIDITY AND RELIABILITY OF THE RESEARCH INSTRUMENT

3.7.1 Validity

Validity is referred to as the correctness or credibility of a description, conclusion, explanation, interpretation, or other sort of account (Maxwell, 2003). In terms of measurement procedures, validity is the ability of an instrument to measure what it is designed to measure (Kumar, 2005). In fact, the research is concerned with investigating a hypothesised causal relationship between an independent variable and dependent variable. If such a relationship is found, inferences are drawn about the population and, perhaps, a variety of circumstances in which the relationship may apply beyond those of the particular study carried out (Fellows *et al.,* 1997). Therefore, validity is premised on the assumption that what is being studied can be measured or captured, and seeks to confirm the truth and accuracy of this measured and captured data, as well as the truth and accuracy of findings or conclusions drawn from the data (O'Leary, 2004).

Validity is concerned with the extent to which a research actually measures what it intended to assess (Saunders et al., 2012). Data was collected and compiled from a Government Organisation. While organisations argue that their records are reliable, there are often inconsistent and inaccurate *ibid*. In this study, the researcher had to examine the method which the data was collected. The person responsible for the data was discovered. Additional information was obtained to assess the validity of the source.

The data is valid to a greater extent as GDID's continued existence depend on the credibility of its data.

3.7.2 Reliability

Reliability is premised on the notion that there is some sense of uniformity or standardisation in what is being measured, and that methods need to consistently capture what is being explored (O'Leary, 2004). An instrument is proven reliable if it provides the same results on repeated trials. A research instrument is reliable if it is consistent and stable, and, hence, predictable and accurate. Data compiled from the reports was examined carefully. A clear explanation of the technique used to collect the data was established.

A detailed assessment of the validity and reliability will involve you in an assessment of the method used to collect the data for all secondary data (Dale *et al.,* 1988). Mark *et al.,* (2012), concurs that these may be provided as hyperlinks for internet-based data sets. Alternatively, they may be discussed in the methodology section of an associated report. Your assessment will involve looking at who were responsible for collecting or recording the information and and examining the context in which the data were collected. From this you gain some feeling regarding the likehood of potential errors or biases. In addition, you need to look at the process by which the data were selected and collected or recorded (*ibid)*.

3.8 LIMITATIONS AND DELIMITATIONS OF THE STUDY

Limitations are factors, usually beyond the researcher's control, that may affect the results of the study or how the results are interpreted (Mancosa, 2015). Work commitments of the researcher made it impossible for the researcher to observe the construction of new school in order to evaluate the effect of procurement methods on their time performance and also some of the projects were completed before the project was initiated. The cost of following different new schools construction, on their different project locations, was prohibitive. Given the wide range of projects undertaken by GDID the scope of the study was limited to construction of new school projects only, with same drawings, budget and scope of work. The study focuses on time taken for delivery of the whole project from design stage to close out stage because it represent a complete project procurement life cycle. The political interest on the Gauteng area is deemed to be the same, which is delivering schools at the least possible time and as such was not considered to be a limiting factor for the purpose of the study. The qualification and experience of project team, consultants and contractors were not taken into

consideration as the primary focus of the study is to establish the relation between procurement system and duration of the project, holding other variables constant.

The study focus on time taken for delivery of the whole project from design stage to close out stage, and not quality, cost and other issues. The study actually looks into procurement systems being utilized within GDID on the new schools' projects. Other alternative methods and project run by GDID did not form part of the study.

Delimitations are the limitations the researcher deliberately impose (Mancosa, 2015). The study looks only at the effect of different types of procurement methods on time performance yet performance is also affected by other managerial functions, such as planning, organising, leading, co-ordinating experience, competence level and political interest. This was done because of time and cost implications. It could well be that the impact of the excluded managerial functions, experience, competence level, political interest are greater than those of the selection of the appropriate procurement system and therefore need to be studied. Sufficient supply of qualified and experienced technical personnel will not be looked at. Sufficient supply of workers at skilled, semi-skilled and non-skilled levels will not be considered. Sufficient and timely supply of materials will not be considered. Sufficient and timely supply of plant, equipment and tools is set to be done properly in all the projects. Availability of land for construction purposes is constant. All projects have land. Reduction of unnecessary red tape and artificial administrative obstruction will be considered at the degree at which it affects the project. The impact will be discussed in comparison to the different types of procurement and its impact on time.

The period of study was restricted between the periods of 2008 to 2015. The new schools' projects currently being executed might render the findings obsolete.

Only new schools' construction projects which had started and completed were considered for this study because they are the ones which had undergone the whole procurement cycle. It is possible that ongoing projects which had not completed the whole project cycle could have offered some insights on how to improve GDID time performance through procurement system from design stage to close out stage of a new schools project.

3.9 CONCLUSION

This chapter set out to describe the methodology used to undertake this study. It went through the research philosophy, research strategy, target population, data analysis, validity, reliability, limitations and delimitations among other things. This was overlaid against literature review and the justification for the choices made was presented.

CHAPTER 4: RESULTS AND ANALYSIS

4.1 INTRODUCTION

The data gathered during the study was analysed using various methods described in Chapter 3. This chapter analyses the data obtained from the results and provides an interpretation of the results collected. A summary of the findings are therefore presented in this chapter.

4.2 EXPLORATORY STUDY

4.2.1 AIM AND METHODOLOGY

This research is about the impact of procurement methods on project performance (time). It started with an exploratory study conducted from September 2012 to March 2015. A comparative analysis of procurement methods was done on fifteen completed projects. Empirical data in the form of records of procurement methods was obtained from the GDID data base. The organisation kept comprehensive records including reports, and details of the person who planned and managed the projects. The study identified the different impacts caused by use of different procurement methods. Subsequently their impacts on time were quantified. The schools under study were of the same budget and scope. The designs for the new schools project were that of generic drawings (Annexure 5).

John Murdoch (2008), comments that it is basically unrealistic, if not impossible, to develop an ideal procurement system. Many projects suffer from inadequate or inappropriate procurement decisions. The industry lacks a sensible and systematic policy for choosing appropriate procurement systems.

4.3 RESEARCH APPROACH

During this research, it was decided to incorporate a model of procurement system phases, distilled from the relevant literature reviewed into the data collected. This allowed for a comprehensive assessment of the application of procurement systems based on the information gathered. It must be noted that project procurement is made out of distinct phases with clear activities with finite times attached to the activities. It therefore becomes necessary to examine the start date of each activity of each stage of the procurement methods and their individual contribution to the total project duration. Detailed information on procurement systems was provided in the literature review and will be used in the model below:

- Initiation phase is when the project is identified and its feasibility tested;
- Design, planning and working drawings phase is when the drawings and specifications for the project are prepared;
- Bill of Quantities (BOQ) preparation, tendering and final stage is when the documentation and appointment of the contractor is done;
- Implementation or construction phase is when the building is physically being constructed; and
- Handover or close out phase is when the completed structure is handed back to the client (Healy, 1997).

Each project was analysed using the above model. However, for the purposes of this study, where focus is on time reduction, emphasis was placed on the pre-construction stage, since the actual physical construction is an essentially linear activity with fixed constraints, barring unforeseen circumstances and natural disasters.

The design for the schools project under analysis was the same in all the schools for a primary school and for a secondary school. The scope of work was made up of an Administration Block, Grade R (in primary schools), 24 Classrooms, 2 Science Laboratories, 2 Multipurpose Classrooms, Computer Room, a Library, a Canteen, a Guard House, Sports Facility Building (with change rooms, bathrooms and toilets), Soccer / Rugby Ground, Combination Courts (netball, tennis, volleyball courts), the internal fence which was mesh diamond fence and the school boundary fence which was concrete palisade fencing.

The generic schools project drawings are shown in Appendix A.

4.4 PROJECT TIME

The among the GDID-adopted new school construction procurement systems, the research aims to identify and recommend one which enables GDID to deliver the whole project, from initiation to close-out, but focussing on the preconstruction stage, at a faster pace than ever before, while holding costs, quality and other variables constant at an acceptable and desired level.

Many reports, as indicated in Chapter 2, Literature Review, states that the traditional system, and the various integrated and management oriented options

can all give good project times but on average, the use of non-traditional routes tends to produce overall times shorter than those produced by the traditional routes. The following case studies provide the project timeframes which demonstrate the relative times of the procurement options. The stages are outlined as follows:

1. Design Development
2. Planning Approval
3. Working Drawings
4. Tender Documentation
5. Tendering Stage
6. Final Stages
7. Construction Stage
8. Commission and handover

4.4.1 The Design Development Stage

The Design Development activity involved agreeing on client requirements and preferences, assessing user needs and options, appointing consultants who assisted with project brief, objectives, priorities, constraints, risks, assumptions and strategies in consultation with the client. This activity also included finalisation of the project concept and feasibility. This entailed developing the approved concept to finalise the design, outline specifications, cost plan, financial viability and programme for the project (CIOB, 2008). For the purposes of this research, the activity start date is as marked on the professional's letter of appointment. The date which the client puts on the appointment letter of the consultants is the start date of the design development stage. The activity ends on the date when the design development report is signed by the Accounting Officer of the Implementing Department/Agent.

4.4.2 Planning Approval Stage

The Planning Approval activity entailed submission of drawings and specification to the user client and relevant stakeholders. It involved obtaining User Client's consent. Thereafter the professional consultant team had to submit and obtain approval from Local Authorities/Municipalities. The start of the Planning Stage was denoted by professional consultants, or their representative, submitting design

drawings to the local municipality. The activity ended on the date when the approval was received from the municipality.

4.4.3 The Working Drawing Stage

The detailed working drawings stage included the preparation of necessary documentation for effective and timely execution of the project. The documents include drawings and specifications (Maritz & Sigle, 2012). Working drawings are more detailed drawings which specify the infrastructure, equipment and materials to be used and their relative spatial arrangement to assist the Contractor during construction. It is a departmental requirement that projects can only continue to the detailed working drawing stage once design development stage report has been signed by the Accounting Officer. The date when the design development stage report was signed signified the start date of the detailed working drawing stage. For the purposes of this research, the date of the signing of the design development report was taken as the start date of the detailed working drawings stage. The activity end date is dependent on the type of procurement system that is being utilised but it usually runs throughout the construction stage.

4.4.4 The Tender Documentation Stage

The Tender Documentation activity sets out all the work to be done in sufficient detail according to a standard system. The activity helps in giving a clear idea of the character and cost. Everything of consequence in respect of costs, shown on the drawing or described in the specification is embodied and nothing is left to assumption (Maritz & Sigle, 2012). The Tender Documentation Stage culminates into the Tender Document, which prospective tenderers use to submit their bids.

It is a departmental requirement that projects can only continue to the tender documentation stage once the design development stage or project execution plan report has been signed by the Accounting Officer of GDID and the User Client GDE. The date when the project execution plan report was signed off signified the start date of the tender documentation stage. This is a very important control gate because it confirms the release of funding for the project. For the purposes of this research, the dates on the design development stage / project execution plan report were taken as the start date of the tender documentation stage. This activity ended the day when the projects were advertised.

4.4.5 The Tendering Stage

During this activity, tenders were floated to obtain a contractor who assumed responsibility for the execution of the construction works under the supervision of a professional team. Tenders can either be competitive or negotiated.

Competitive tendering was used on most projects, mainly to obtain the best possible price. An advanced level of detailed design is required as it is in the interests of all parties to have as much information as possible available during the tender stage. The aim of the tenderer is not just to obtain work, but to obtain it at a price that will enable completion of the project according to specification, on time and for a reasonable profit (Maritz & Sigle, 2012).

A more radical approach to the selection of the contractor is offered via negotiation. This is where contractors are asked to bid for a project on the basis that, if they build this one satisfactory, others of a similar type will follow and the same bill rates will be used. Experience has shown that negotiation is one of the most effective ways of selecting a contractor for non-traditional approaches. In these cases, the deal is negotiated as the relationship develops. It seems that the single most important factor of such a relationship between the employer and the contractor is familiarity. They have worked together before, and they expect to work together again in the future (Murdoch & Hughes, 2000).

The tenders were advertised in the local newspapers, government bulletin and e-tender. Alternatively, Government invites bids from service providers on their pre-selected panel members. The date when the advertisement appeared in the newspapers was taken as the start date of the tendering stage. The activity ended on the date stated in the advertisement as the closing date.

4.4.6 The Final Stage

In the Final Stage activity, the bids submitted by tenderers were evaluated and reports on the submitted bids were generated. The successful bidder was recommended and appointed. The tenderer was then asked to submit performance bonds, insurances, programme of works and any other required information. The professional team verified the documents. The contract document was signed and construction work was ready to commence. The date when the advertisement for the tender was closed was taken as the start date of the final stage. It was on this date that the bids were announced and the adjudication of tenders began. In this

research, the closing dates of the bids were taken as the start date of the final stage. The activity ended when the contractor was handed over the construction site to commence construction works.

4.4.7 The Construction Stage

At this stage the professional team is responsible for the management and administration of the construction contracts and processes, including the preparation and coordination of the necessary documentation to facilitate effective execution of the work. The contractors' obligation is to construct the works in accordance with the conditions of contract as outlined in the contractual documents within the required time (Maritz & Sigle, 2012).

GDID uses the NEC3 and JBCC contract document. Both contracts state that a contractor should be issued with an access or handover certificate to commence the works on site. The date on this certificate was taken as the start date of the construction stage. For the purposes of this research the start date of the construction stage was the date on the access or handover certificate. The end date is when the contractor issues a notification that the works are complete.

4.4.8 The Commission and Handover Stage

Commission and handover is the process of managing and administering the project closeout, including preparation and co-ordination of the necessary documentation to facilitate the effective operation of the project (Maritz & Sigle, 2012).

This was the date when the works were deemed complete. For the purposes of this research the start date of the commission and handover stage is the date when the contractor issues a notification of completion of works and end when the contractor is issued with a completion certificate.

4.5 CASE STUDY

The tables below illustrate the project durations of the traditional, integrated and the management oriented procurement systems.

The data was obtained from GDID data base. GDID specialises in construction of new schools. Some of the data cannot be more that indicative but the study provides a reasonably reliable basis for time comparison. The aim is to identify and

recommend a procurement method which enables GDID to deliver the whole project, from initiation to close-out, but focussing on the preconstruction stage, at a faster pace than ever before, while holding costs, quality and other variables constant at an acceptable and desired level.

The tables indicate the time plan for the different procurement systems. They show the actual pre-contract stage design period prior to commencement of the construction period. The time plan is done so as to:

e. Review the identified GDID procurement systems, individually, and rate their performance with regards to time

f. Identify a procurement system which is most compatible with the GDID bureaucratic environment and which will be able to deliver the whole project, from initiation to close out, in 18 months or less, which is half the current project duration of 36 months.

Recommend modifications that can be made to the preferred procurement system, or its implementation, to make it more time-efficient in the GDID operating environment.

4.5.1 Project A (Forty-five Months)

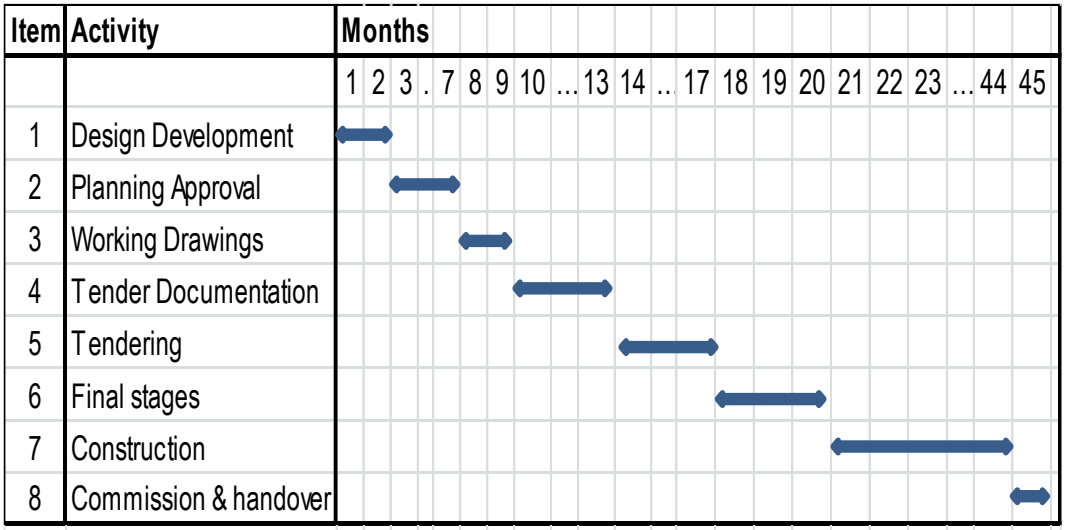

Figure 4. 1: The Process of Project A

The Summary of Project A (Traditional Procurement Method)

1. Design Development = 2

2. Planning Approval	= 5
3. Working Drawings	= 2
4. Tender documentation	= 4
5. Tendering	= 4
6. Final Stages	= 3
7. Construction	= 24
8. Commission and handover	=1
Total Duration of Project A	= 45

The construction timetable for project A indicates that the project commences with Design Development. Consultants were appointed in March 2008. The Design Development was completed at the beginning of May 2008. The Design Development process took two months. The drawings were sent to the Client for approval. Client approval took two months and thereafter the drawings were sent to the Municipality for approvals. This process took three months. The Client and Municipality Planning Approvals stage took a total of five months. Consultants received a notification granting permission to commence stage three at the end of August 2008. Franks, 1991 stated that the architect has considerable freedom to conceive and develop the design without excessive time or economic pressure, provided the cost ceiling is not exceeded and the Clients requirements are generally satisfied.

The consultants then prepared Working Drawings. This was done in two months. The following stage was the Tender Documentation activity, which took a period of four months. Approvals were sought and granted by the client to commence with the Tendering Stage. The Tendering Stage included advertising, site brief and closing of tenders. The Tendering Stage took a total of two months. A tender adjudication report was prepared with recommendation on the successful contractor for appointment by the Client. Approval was granted by the Client to appoint one of the recommended tenders. The Tendering Stage was followed by the Final Stage activity. The Final Stage included submission of pre-requisites

documents such as performance bonds, insurance bonds and signing of the contract.

Submission by the contractor and authentication by the consultants of pre-requisites documents, such as, performance bonds and insurance bonds submission took two months. The signing of the contract was done in one month. The Final Stage took a total of three months. The site was handed over to contractor in November 2009. The construction period was from November 2009 to November 2011. The construction period was twenty-four months. The project was completed, commissioned and handed over to the Client in December 2011. Commission and hand over to the Client was done in one month.

The flow of events was sequential. This project followed the Traditional Procurement Method. Activity 1 was done to the end before activity 2 could commence. The documents were submitted to the Client for approval. Once the approval was received the professional team proceeded to the next activity. This sequence of first obtaining approvals for one activity before the next activity could commence was done throughout the project execution. The school was completed in forty five months, which is more than twice the expected period of delivery of eighteen months from initiation.

What is important to note from the above results is that the preconstruction stage took more than the time required to complete the whole project. The preconstruction stage took twenty months, whereas the completed project was required to be handed over to the User Client in eighteen months. Project A demonstrates that the use of the Traditional Procurement Method in its current format is unsuitable for completion of the whole project in the required eighteen months.

The design development stage is affected by the competence of the design team. This indicates the department may need to be more rigorous in their selection of the design team. Since the designs also have to be approved by the department, the department needs to reduce its turnaround time for approvals of the designs. Rashid, 2006 stated that the Client must choose a lead designer to supervise the works. The writer further states that it is important that the employer is clear about the kind of person that is needed and must use careful selection procedures. Design development is further affected by the bureaucratic hierarchical nature of

the department. It depends on the availability of the office bearers and their work rate. The solution to this problem could be setting the standard response times to each office bearer, or alternatively, delegate the function to the lowest technically competent government official.

The Planning Approval stage took five months. The Planning Approval stage, just like any other activity in the Traditional Procurement Method, lies on the critical path, and as such, there is need to explore methods of reducing the duration. This period involved obtaining approvals from the Client and the Municipality. There is an opportunity to reduce this duration by having constant follow up by GDID. Early involvement of all stakeholders in the project, particularly the Municipality can also facilitate approvals. Involving stakeholders and obtaining their buy-in can assist in having them prioritising the project. It is critical for project success to identify the stakeholders early in the project or phase and to analyse their level of interest, their individual expectations, as well as their importance and influence (PMBOK, 2013).

The Tender Documentation Stage took four months. This activity was affected by the competence of the appointed consultants and approvals as described in Design Developments Stage. The same methods recommended in reducing the time can be implemented on reducing the Tender Documentation Stage.

The Tendering Stage took four months. This is much longer than Public Finance Management Act (PFMA) prescribed period of twenty eight days (unless a motivation is submitted and approved for a shorter period). The lengthy period taken for this activity is indicative of the communication problems between the technical section and the supply chain management section of GDID. As recommended in the Design Development Stage, this can be resolved by early involvement of all stakeholders and also by delegating approvals to the lowest competent level government official.

The Final Stage Activity took three months. The Final Stage activity involves evaluating, reporting and recommending the successful bidder. The successful bidder was then asked to submit performance bonds, insurances, programme of works and any other required information. The professional team verified the documents. The contract document was signed and construction work was ready to commence. The period is affected by the time taken to do the evaluation,

obtaining approvals of the recommended contractor by GDID and the Client, and by submission of the contractual documentation by the Contractor.

The findings show that the evaluation period can be reduced by the appointment of competent Consultants. The approvals stage can be accelerated by delegating approvals to the lowest competent government office and/or by setting standard turn-around times. The contract documentation submission period by the Contractor depends on the Contractor's competence and capacity (an indication of contractor's selection process which need to be tightened). GDID needs to set and enforce standard turn-around times for submission of mandatory or requisite documents. In their research, Vicknash, 2016 supported Franks, 1998 findings that the traditional system has shown that lines of communication between the parties tend to be tenuous and interest of all may suffer as a consequence.

Although the emphasis of this research lies in the pre-contract period, it cannot be ignored that the construction period took twenty-four months leading to the project completing in forty-five months. Franks 1991, state that the separation of the design and construction processes tend to foster a 'them and us' attitude between the design and contractors which reduces the team spirit that experience has shown to be vital for the satisfactory conclusion of a building project. The selected contractor must be competent and have the necessary skills, technical staff, experience and adequate resource (financial, equipment and materials). The delays in construction stage can also arise from the community when they demand basic skills training and portions of work as required by the Expanded Public Works Programme. This can be resolved by early community involvement and stakeholder management. While the project manager's time is limited and should be used as efficiently as possible, the stakeholders should be classified according to their interest, influence, and involvement in the project, taking into consideration the fact that the affect or influence of a stakeholder may not occur or become evident until later stages in the project or phase (PMBOK, 2013).

4.5.2 Project B (Thirty-five months)

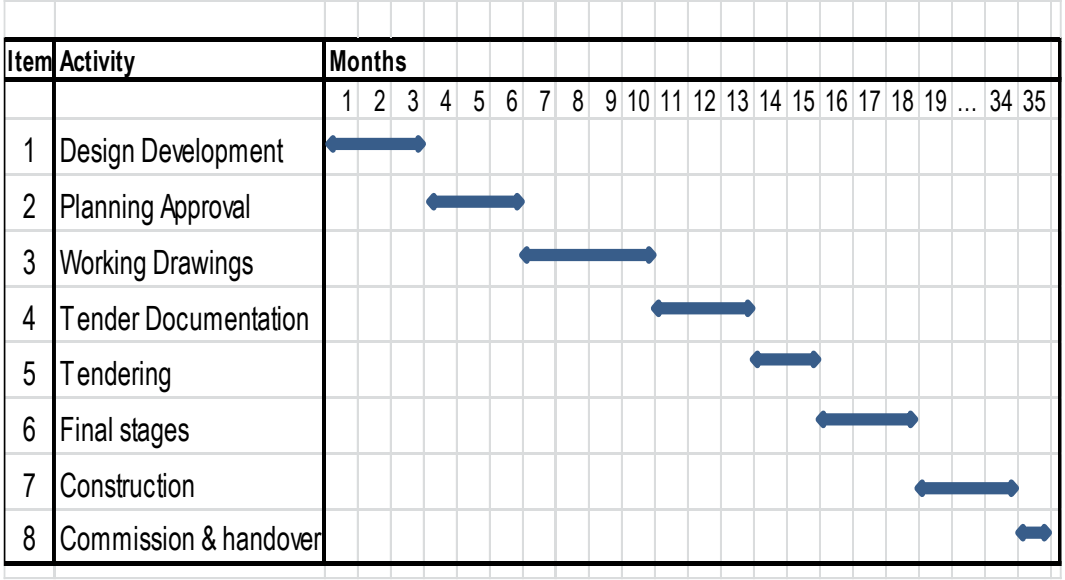

Figure 4. 2: The Process of Project B

The Summary of Project B (Traditional Procurement Method)

1. Design Development = 3

2. Planning Approval = 3

3. Working Drawings = 4

4. Tender documentation = 3

5. Tendering = 2

6. Final Stages = 3

7. Construction = 16

8. Commission and handover =1

Total Duration of Project B = 35

The construction timetable for Project B indicates that the project commenced with Design Development. Consultants were appointed in February 2009. The Design Development Stage was completed at the end of March 2009. The Design Development Stage by the consultants took two months. Thereafter, the drawings were sent to the Client for approval. Approval from Client was received after one

month. The total duration for Design Development Stage was three months. The drawings were then sent to municipality for approvals. Approval and granting of permission to commence Stage Three was received in June 2009. The total period for Planning Approval Stage was three months. The consultants then prepared working drawings. The working drawings activity was done by the consultants in three months. Permission was sought and granted by the client within one month. The total period for working drawings was four months.

The following stage was Tender Documentation. The Tender Documentation activity and approval from the Client took a period of three months. This led to commencement of the Tendering activity. The Tendering activity included advertising, collection of procurement documents, site briefing and closing of tender. The Tendering Stage took two months. When tenders were closed, the Final Stage activity commenced. This included adjudicating and recommending the contractor to be appointed to the Client. The appointment of the recommended contractor was received from the Client after a month. GDID then requested submission of requisite documents, such as, performance and insurance bonds, from the Contractor. When these documents were received the site was handed over to the Contractor to commence construction in June 2010. The Final Stage activity took three months.

The successful Contractor proceeded with the execution of the project. The construction period was until November 2011. The construction activity was for a duration of sixteen months. The project was commissioned and handed over to the Client in December 2011. The commission and handover period was one month.

It was noticed that the activities from Design Development to Completion, Commission and Handover Stage took a duration of thirty-five months. The method utilised was long-winded. The process was very sequential.

The total project time was thirty-five months. The pre-contract stage took a duration of eighteen months. The Client required that the whole project be completed in eighteen months. As discovered in Project A, the above results show that the preconstruction stage took more than the time required to complete the whole project.

The design development stage of Project B is the same with that of Project A. The same reasons stated in Project A affected the efficiency of execution of Project B. Again the department may need to be more rigorous in their selection of the consultants. GDID needs to relook at its bureaucratic hierarchical nature of the department and delegate approvals to lower level officials with the necessary competencies.

The Planning Approval stage took five months. The Planning Approval stage, just like any other activity in the Traditional Procurement Method, lies on the critical path, and as such, there is need to explore methods of reducing the duration. Early involvement of Stakeholders remains to be of paramount importance to the successful completion of the project.

The Tender Documentation Stage took three months. This activity was affected by the competence of the appointed consultants and approvals as described in Design Developments Stage. The same methods recommended in reducing the time can be implemented on reducing the Tender Documentation Stage.

The Tendering Stage took two months. This is much longer than Public Finance Management Act (PFMA) prescribed period of twenty eight days (unless a motivation is submitted and approved for a shorter period). The period taken for this activity is reasonable though the GDID can increase efficiency on its approval process by delegating approvals to the lowest competent level of government officials.

The Final Stage Activity took three months. As learnt in Project A, the Final Stage activity involves evaluating, reporting and recommending the successful bidder. The successful bidder was then requested to submit performance bonds, insurances, programme of works and any other required information. The professional team verified the documents. The contract document was signed and construction work was ready to commence. The period is affected by the time taken to do the evaluation, obtaining approvals of the recommended contractor by GDID and the Client, and by submission of the contractual documentation by the Contractor.

The findings reveal that the evaluation period can again be reduced by the appointment of competent Consultants. The approvals stage can be accelerated

by delegating approvals to the lowest competent government office and/or by setting standard turn-around times, and enhanced by the appointment of an experienced, skilled and capacitated Contractor.

The construction period took sixteen months, leading to the project completing in thirty-five months. The bureaucratic nature of GDID makes the decision-making process lengthy, thereby impacting on the time efficiency of the Traditional Procurement Method. In Chapter Two, it was discussed that for a traditional system to be effective its activities must be carried out sequentially one after another (Rashid et al.,2006). The results show that the Traditional Procurement Method resulted in low levels of Client satisfaction, owing mostly to poor cost and time predictability (Challender et al., 2014).

4.5.3 Project C (Thirteen months)

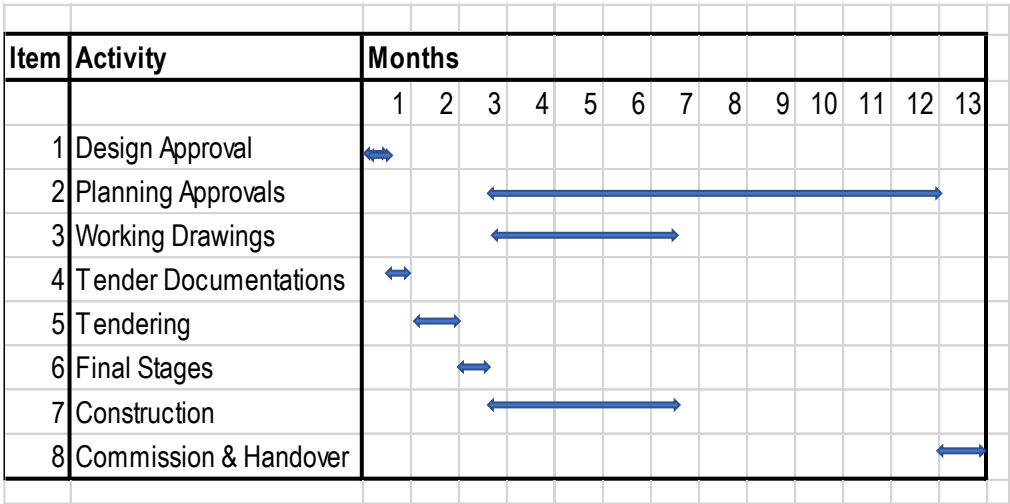

Figure 4. 3: The Process of Project C

Summary of Project C (Integrated Procurement Method)

1. Design Development = 0,5
2. Planning Approval = 9,25
3. Working Drawings = 4
4. Tender documentation = 0,5
5. Tendering = 1
6. Final Stages = 0,75
7. Construction = 4

8. Commission and handover =1

Total Duration of Project B = 13

The construction process for project C shows that the project commenced with Design Development in August 2012. This process was done by both the GDID and the Client (GDE). The co-operative and collaborative working arrangement between GDID and its Consultants, on one hand, and the Client (GDE), on the other, meant that there was no need for designs to shuttle documents between GDID and GDE while refining the designs. It was not necessary for GDID to complete the designs before they could submit them to GDE for comments and further fine-tuning. Consequently, time taken to complete the design development was shortened. The Design Development Stage took fourteen days.

As the Client (GDE) was actively involved in the design development, they gave consent for tender documentation to commence using prototype drawing without finalisation of approvals and working drawings. Tender documents were prepared and floated, and the Contractor and Consultant Team were appointed before working drawings and municipality planning approvals were finalised. The Contractors submitted their bids on the basis of detailed designs and partially completed working drawings. The processes of tender documentation, tendering and final stage took two and some quarter months. These are there critical activities during the preconstruction stage. Removal of the Planning Approval Stage and the Working Drawing Stage from the critical path during the preconstruction stage shortened the pre-construction phase and allowed the construction to start earlier. However, the Approval Stage remained on the critical path for the hand-over of the project.

The project access certificate was issued in November 2012. This allowed the Contractor to start construction on the strength of Section 7 (6) of the Municipality approval. This allows for construction to commence with partial approval but without complete working drawings (only drawings necessary for that portion of construction are approved). The appointment of the Contractor before the finalisation of the working drawings allowed the Contractor to have inputs in the designs which also suited his working experience and method. This had the effect of shortening the construction period. The Working Drawings Stage took four months but this no longer had material impact on the actual construction duration,

as the drawings were now being produced as dictated by the actual stage of construction. However, this has a drawback that the consultants always have to be alert of the next construction phase so that they are always one step ahead in preparation of the next phase drawings. This activity ran parallel to the Construction Stage and Planning Approval Stage. The construction stage was achieved at the end of March 2013. The Construction Stage took four months.

The Planning Approval Stage took nine months and even delayed the handover of the completed project. The Planning Approval Stage in this procurement method lay on the critical path and was the determining activity as to when the project could be handed over. This period involved obtaining approvals from the Municipality. There is an opportunity to reduce this duration by having constant follow up by the Consultants. Early involvement of all stakeholders in the project, particularly the Municipality, can facilitate approvals. Involving stakeholders and obtaining their buy-in can assist in having them prioritising the project. The project was completed, commissioned and handed over to the Client in August 2013.

It is notable that the construction phase of the project took four months. This was mainly due to the fact that the contractor was not getting provisional approvals from the Municipality. This, in turn, affected the whole approval process and eventually delayed the handover of the project. The Municipality demanded that some works be opened and exposed for them to be able to inspect before issuing approvals. This activity could have been shortened by ensuring that the provisional approvals were issued as and when required before proceeding to the next phase.

The Commission and Handover Stage took one month. The stage involved inclusion of political representatives and ceremonial activities to hand over the project to the End User Client. The activity can be shortened by ensuring that GDID involves the stakeholders for preparation of the ceremonies.

The project was executed under the Integrated Procurement System. The project overall duration was thirteen months. The school was completed in less than eighteen months. GDID was able to meet the Client’s requirement.

4.5.4 Project D (Sixteen months)

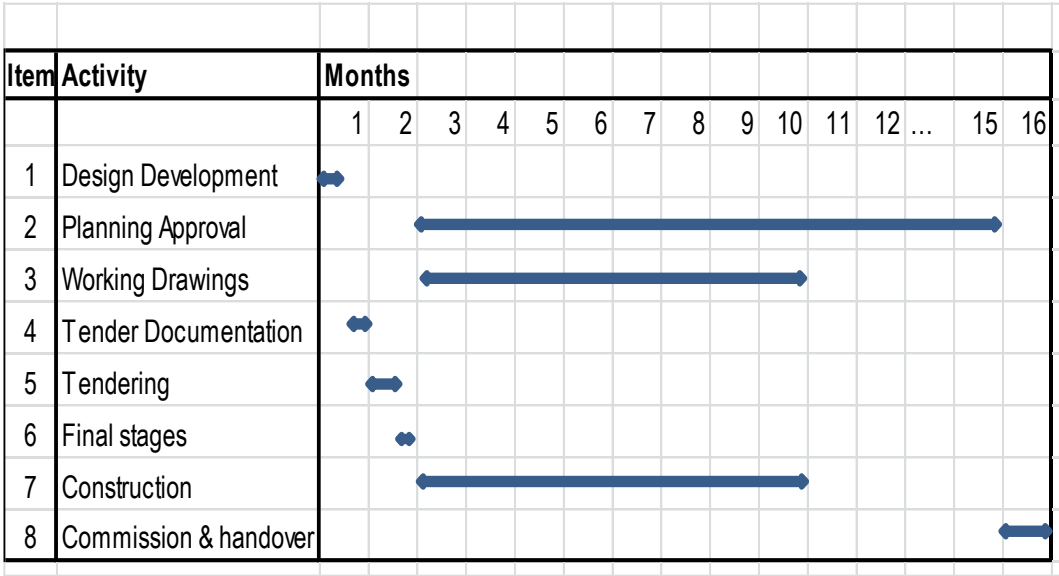

Figure 4. 4: The Process of Project D

Summary of Project D (Integrated Procurement Method)

1. Design Development = 0,5

2. Planning Approval = 13

3. Working Drawings = 8

4. Tender documentation = 0,75

5. Tendering = 1

6. Final Stages = 0,25

7. Construction = 8

8. Commission and handover =1

Total Duration of Project D = 16

The programme for project D depicts that the project commenced with Design Development in the month of September 2012. The Design Development stage took fourteen days. At the same time prototype Bills of Quantities and procurement documents were prepared for the purpose of Tendering Stage. This process took twenty-one days. The tender was advertised for twenty-one days. Final Stage

included adjudicating, appointment of the contractor, submission of requisites documents such as performance and insurance bonds. This process took seven days. The project Site Access Certificate was issued in October 2012. The Construction Stage took eight months. This phase ran parallel to the preparation of the Working Drawings. The project completion was achieved at the end of June 2013. The Planning Approval took thirteen months. The project was completed, commissioned and handed over to the client in December 2013. The Commission and Handover Stage took one month. The project was executed under the Integrated Procurement System. The overall project duration was sixteen months.

The co-operative and collaborative working arrangement between GDID and its Consultants, on one hand, and the Client (GDE), on the other, meant that there was no need for designs to shuttle documents between GDID and GDE while refining the designs. It was not necessary for GDID to complete the designs before they could submit them to GDE for comments and further fine-tuning. The Integrated system provides the necessary multi-disciplinary approach because it forms a designer-contractor team at an early stage in the process, and thus, it vests authority and some responsibility to both the design and construction with one organisation, (Boudjabeur, 1997). Consequently time taken to complete the design development was shortened. The Design Development Stage took fourteen days.

As the Client (GDE) was actively involved in the design development, they gave consent for tender documentation to commence using prototype drawing without finalisation of approvals and working drawings. Tender documents were prepared and floated, and the Contractor and Consultant Team were appointed before working drawings and municipality planning approvals were finalised. The Contractors submitted their bids on the basis of detailed designs and partially completed working drawings. The processes of tender documentation, tendering and final stage took two and a quarter months. These are there critical activities during the preconstruction stage.

Removal of the Planning Approval Stage and the working drawing stages from the critical path during the preconstruction stage shortens the pre-construction phase and allows the construction to start earlier. However, the Approval Stage remains on the critical path for the hand-over of the project.

The project access certificate was issued in November 2012. This allowed the Contractor to start construction on the strength of Section 7 (6) of the Municipality approval. This allows for construction to commence with partial approval but without complete working drawings (only drawings necessary for that portion of construction are approved). The appointment of the Contractor before the finalisation of the working drawings allowed the Contractor to have inputs in the designs which also suited his working experience and method. This had the effect of shortening the construction period.

The Working Drawings Stage took five months but this no longer had material impact on the actual construction duration. This activity ran parallel to the Construction Stage and Planning Approval Stage. The Construction Stage took eight months.

The Planning Approval Stage took thirteen months and even delayed the handover of the completed project. The Planning Approval Stage in this procurement method lay on the critical path and was the determining activity as to when the project could be handed over. This period involved obtaining approvals from the Municipality. There is an opportunity to reduce this duration by having constant follow up by the consultants. Early involvement of all stakeholders in the project, particularly the Municipality, can also facilitate approvals. Involving stakeholders and obtaining their buy-in can assist in having them prioritising the project.

The Commission and Handover Stage took one month. The stage involved inclusion of political representatives and ceremonial activities to hand over the project to the End User Client. The activity can be shortened by ensuring that GDID involves the stakeholders for preparation of the ceremonies.

The project was executed under the Integrated Procurement System. The project overall duration was sixteen months. The school was completed in less than eighteen months. The time plan again reveals that the design development stage, the tender documentation stage, the tendering stage and the final stage are sequential and form the critical path, together with planning approval and commissioning and handover stages.

4.5.5 Project E (Fourteen months)

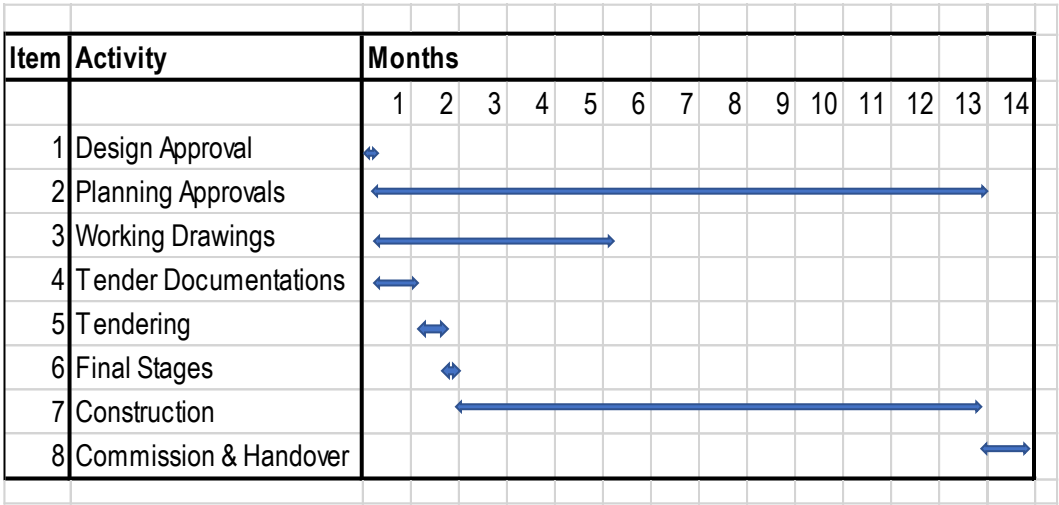

Figure 4. 5: The Process of Project E

Summary of Project E (Management Oriented Procurement Method)

1. Design Development = 0,25

2. Planning Approval = 12,75

3. Working Drawings = 5

4. Tender documentation = 1

5. Tendering = 0,5

6. Final Stages = 0,25

7. Construction = 11

8. Commission and handover =1

Total Duration of Project E = 14

The construction process for project E illustrates that the project commenced with Design Development in November 2011. This process was done by both GDID and the Management Consultants. The Design Development stage took seven days. The appointment was done for only one organisation which has all professions who then carried all the developments. Having a single organisation carrying out all the design development meant one point of control and accountability unlike where multiple consultants from different organisations were

utilised. This had an effect of reducing the Design Development Stage duration to seven days.

Immediately after the Design Development activity, the Planning Approval, Working Drawings and Tender Documentation activities commenced and ran in parallel. The Tendering Stage activity immediately followed the Tender Documentation activity which was then followed by the Final Stage. The Construction Stage commenced soon after the Final Stage.

The Planning Approval took twelve months. The Planning Approval was running parallel to the Working drawings and Construction activities. This had the effect of prolonging the duration. The approvals were given in stages depending on the working drawings completed and submitted, and the pace of the contractor. The Planning Approval Stage took almost thirteen months to be implemented and approved. Consultants sought permission from the Municipality under Section 7(6). This section allows a developer to start construction before the full planning approval has been granted by the Municipality.

Working drawings took five months and the period could have been shortened by close monitoring of the Management Consultants by GDID. The Working drawings activity is indicative of the competence of the Consultant. This period can be shortened by appointing adequately skilled and experienced consultants with sufficient capacity. In this project the items on the critical path are the Design Stage, the Planning Approvals and the Commissioning and Handover. These are the items that need to be monitored closely to complete the project in timely.

The Tendering Stage activity was short at fourteen days because the Management Consultant motivated and obtained approval to advertise for fourteen days, which is less than the PFMA prescribed period twenty-eight days, thereby saving time on this activity. The Final Stage took a short duration of seven days because the Managing Consultant did not require approval from GDID and the Client. He only needed to advise the department of the appointed Contractor.

The Construction Stage took eleven months. The project completion was achieved at the end of November 2012. This is attributed to the competency of the contractor and also to close monitoring by the consultants and GDID. The Management Consultant did not follow the normal route of stakeholder consultation, which

resulted in disruptions by the local communities. The period could have again been reduced by full stakeholder management consultation. The construction period could have been shortened by appointment of skilled and experienced Consultant and Contractor. Close monitoring by GDID could also have expedited completion of the construction stage and planning approvals.

The project was completed, commissioned and handed over to the client in December 2012. The Commissioning and Handover period took one month. Again this was attributed to the involvement of political members and ceremonial preparations to hand over the project to the end user Client. The project overall duration was fourteen months.

The findings show that this GDID implementing agent choose of procurement system was able to meet the Client's requirement. The school was delivered within the set timeframe of eighteen months.

4.5.6 Project F (Fourteen months)

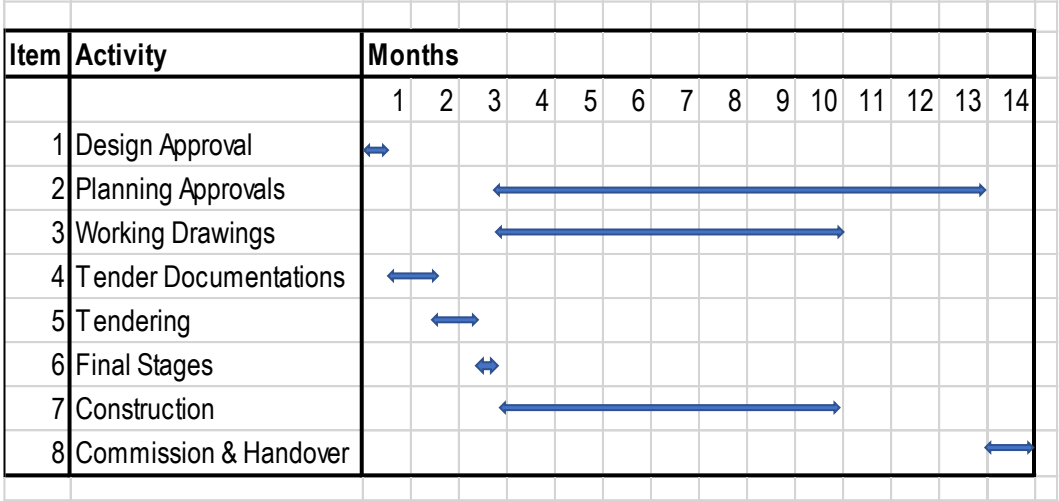

Figure 4. 6: The Process of Project F

The Summary of Project F (Integrated Procurement Method)

1. Design Development = 0,5
2. Planning Approval = 10
3. Working Drawings = 7
4. Tender documentation = 1
5. Tendering = 1

6. Final Stages	= 0,75
7. Construction	= 7
8. Commission and handover	=1
Total Duration of Project F	= 14

The construction process for project F illustrates that the project commenced with Design Development in December 2012. The Design Development stage took fourteen days. This process was done by GDID and the Client. At the same time, terms of reference, template of the Bill of Quantities and procurement documents were prepared for the purpose of tendering. This process took one month. The tender was floated for one month. The Final Stage included adjudicating, submission of pre-requisite documents such as performance and insurance bonds and appointment of the Contractor. The Final Stage activity took twenty-one days to be executed. The project Access Certificate was issued in April 2013. The Working Drawings were prepared within seven months. This process ran parallel to the Construction Stage. The Construction Stage took seven months. The project completion was achieved in mid-January 2014. The Planning Approval stage took ten months. The project was completed, commissioned and handed over to the Client in January 2014. The Commission and Handover Stage was done in one month. The overall project duration was fourteen months.

The findings show that the project was executed under the Integrated Procurement System. The contractor was responsible for developing the design drawings into working drawings and seeking planning approvals from the Municipality. The works on site commenced concurrently to the Planning Approvals and Working Drawings Stages. The Contractor was able to complete the works early, but the school was not ready for occupation. The Client had to wait for planning approvals to occupy the school. GDID met the Client’s requirements by completing the project in fourteen months, which is less than the target eighteen months.

4.5.7 Project G (Eighteen months)

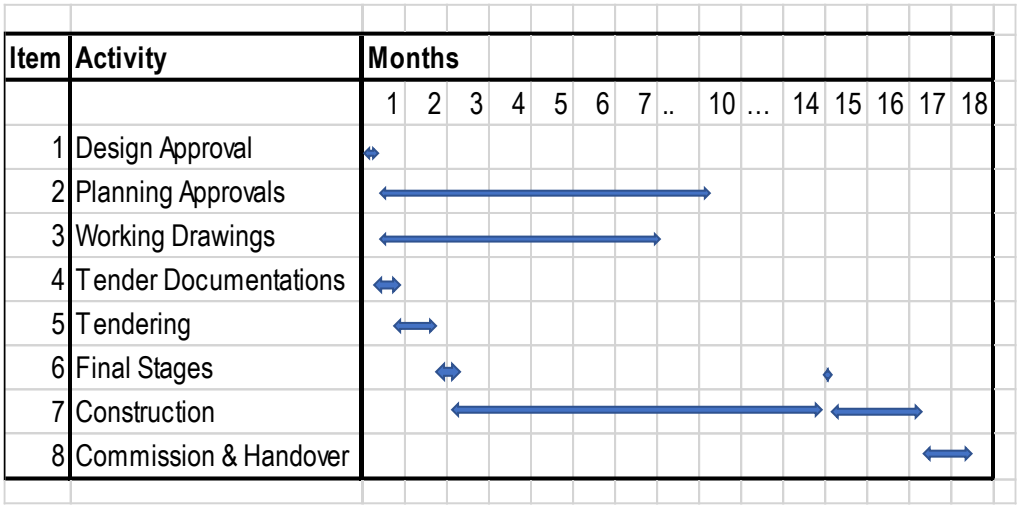

Figure 4. 7: The Process of Project G

Summary of Project G (Management Procurement Method)

1. Design Development = 0,25
2. Planning Approval = 10
3. Working Drawings = 7
4. Tender documentation = 0,5
5. Tendering = 1
6. Final Stages = 0,50
7. Construction = 16
8. Commission and handover =1

Total Duration of Project G = 18

The construction process for project G illustrates that the project commenced with design development in early December 2011. This process was initiated by GDID. It was then handed over to the Management Consultant. The Design Development period took seven days. The Management Consultant prepared the tender documents. This stage took fourteen days. The tender was advertised for twenty-one days. The Final Stage included adjudicating, submission of pre-requisites documents such as performance and insurance bonds and appointment of the Contractor took fourteen days. The project Access Certificate was issued at the end of January 2012.

The Working Drawings were prepared over seven months. This process ran parallel to the Planning Approvals and Construction activities. The Construction Stage took fourteen months. The Contractor went into liquidation and the project was terminated. The reason for termination was attributed to the incomplete and inconsistence of the drawings and instructions being issued to the Contractor. Franks, 1991 advised that the disadvantage of the Management Oriented Procurement System is that the architect may have less time to develop the design because he is under greater pressure from client, contractor and sub-contractors. The design may suffer as a result. The second Contractor was appointed within seven days and completed the works within two months.

The findings revealed that even with the termination and thereafter appointment of the other contractor, GDID met the Client's requirement of completing the project within eighteen months. With the use of the Management Oriented Procurement system, GDID and the Consultants are able to make prompt decisions which can be implemented without delays. It makes possible a prompt response by the client to unforeseen site problems and by the contractors to changes required by the client (Franks,1991).

4.5.8 Project H (Thirteen months)

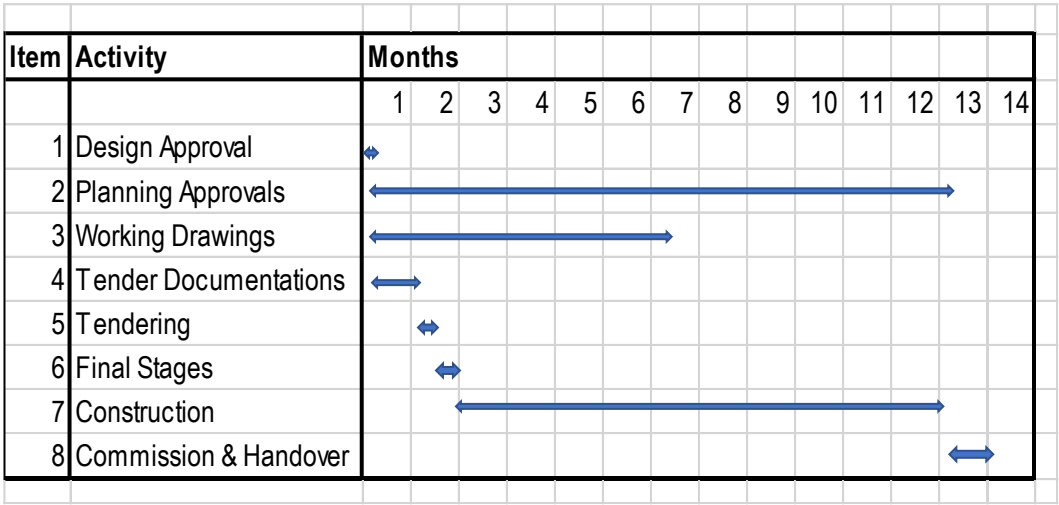

Figure 4. 8: The Process of Project H

Summary of Project H (Management Oriented Procurement Method)

1. Design Development = 0,25

2. Planning Approval = 12

3. Working Drawings	= 6
4. Tender documentation	= 1
5. Tendering	= 0,25
6. Final Stages	= 0,50
7. Construction	= 10
8. Commission and handover	=1
Total Duration of Project H	= 13

The construction process for project H illustrates that the project commenced with design development in early November 2011. This process was done initially by GDID and then forwarded to the Management Consultant. The Design Development stage took seven days. Tendering documentation was prepared for the purpose of tendering. This process took one month. The tender was floated for seven days. Thereafter the Final Stage took fourteen days. The project Access Certificate was issued in February 2012. The Working Drawings were prepared within six months. The Managing Consultant ensured that drawings were available for tendering purpose only. This process ran parallel to BOQ preparation, tendering, and Final Stages and into the early days of the Construction Stage. The construction phase took ten months. The project completion was achieved by the end of November 2012. The planning approval took twelve months. The project was completed, commissioned and handed over to the client in January 2013. This stage took one month.

The project execution plan was similar to that of project E. GDID engaged the Consultant to participate in the project at an early stage. During the execution of works it was noted that the Contractor had inputs into the design development which agreed with his construction experience and methods. The Contractor was appointed much earlier than would be possible with the Traditional System. The Contractor was able to become a member of the design team and contributed their construction knowledge and management expertise. The ‘them and us’ attitudes were reduced and lines of communication were improved (Franks, 1991). The project was implemented under the Management Oriented Procurement System.

The GDID's choice of procurement system enabled it to meet the Client's requirement. The commissioning hand over was done in a month.

The findings of the time plan show that once the design development stage activity was approved, the planning approval, working drawings and tender documentation immediately commenced, thereby saving time in the pre-contract stage. The Design Development, Planning Approvals and Commissioning and Handover were recorded as the items that were sequential and on the critical path for the successful completion of this project.

4.5.9 Project I (Forty months)

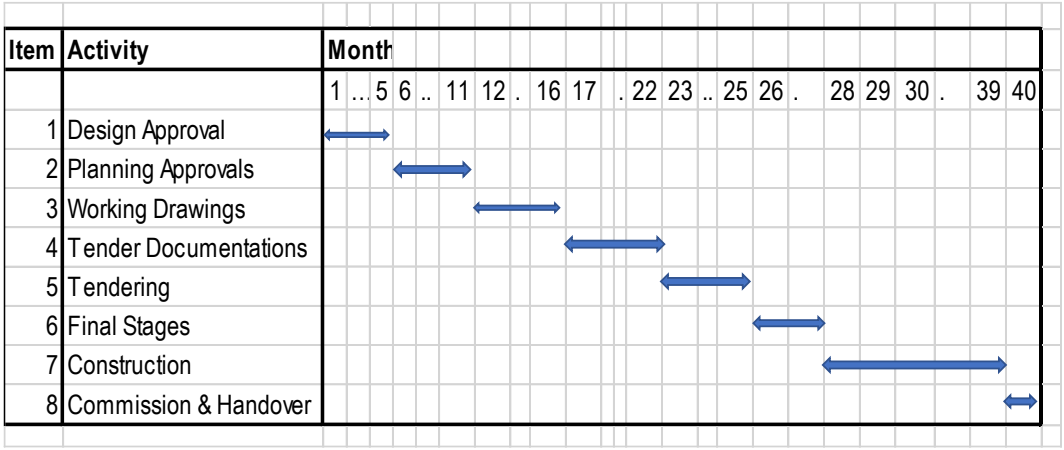

Figure 4. 9: The Process of Project I

Summary of Project I (Traditional Procurement Method)

1. Design Development = 5

2. Planning Approval = 6

3. Working Drawings = 5

4. Tender documentation = 6

5. Tendering = 3

6. Final Stages = 3

7. Construction = 11

8. Commission and handover =1

Total Duration of Project I = 40

The construction timetable for Project I indicates that the project commenced with Design Development. Consultants were appointed in September 2011. The Design Development Stage was completed at the end of February 2011. The Design Development Stage by the Consultants took four months. Thereafter the drawings were sent to the Client for approval. Approval from Client was received after one month. The total duration for Design Development Stage was five months. The drawings were then sent to municipality for approvals. Approval and granting of permission to commence Stage Three was received in February 2011. The total period for Planning Approval Stage was six months. The consultants then prepared working drawings. The Working Drawings activity was done by the Consultants in three months. Permission was sought and granted by the Client within two months. The total period for working drawings was five months.

The stage that followed was Tender Documentation. The service commenced in August 2012 and was completed in January 2013. The Tender Documentation activity and approval from the Client took a period of six months. This led to commencement of the Tendering activity. The Tendering activity included advertising, collection of procurement documents, site visits and closing of tender. The Tendering Stage took three months. When tenders were closed the Final Stage activity commenced. This included adjudicating and recommending a Contractor to the Client. The appointment of the recommended Contractor was received from the Client after a month. GDID then requested submission of requisites documents such as performance and insurance bonds from the Contractor. After the documents were received, the site was handed over for construction to the Contractor in October 2013. The Final Stage activity took three months.

The successful Contractor proceeded with the execution of the project. The construction period was until September 2014. The construction activity was for the duration of eleven months. The project was commissioned and handed over to the Client in December 2014. The commission and handover period was one months.

What is important to note from the above results is that the preconstruction stage took more than the time required to complete the whole project. The

preconstruction stage took twenty-eight months, whereas the completed project was required to be handed over to the User Client in eighteen months.

The design development stage was affected by the competence of the design team. This indicates that the department may need to be more rigorous in their selection of the design team and that the Department needs to supervise the work of Consultants, especially with regards to compliance with time frames. Since the designs also had to be approved by the Department, the Department needed to reduce its turnaround time for approvals of the designs. Franks, 1991 stated that the need for the design to be fully developed before tenders are prepared leads to an 'end-on' design/ build arrangement. Frequently, such an arrangement requires a longer overall project time than is necessary if both design and construction are able to proceed concurrently. Design Development was further affected by the bureaucratic hierarchical nature of the department. Obtaining approvals depended on the availability of the office bearers and their work rates. The solution to this problem could be to delegate the functions to the lowest technical competent government official and setting stringent standard response times to each office bearer.

The Planning Approval stage took six months. The Planning Approval stage, just like any other activity in the Traditional Procurement Method, lies on the critical path, and as such, there is need to explore methods of reducing the duration. This period involves obtaining approvals from the Client and the Municipality. Early involvement of all stakeholders in the project, particularly the Municipality, can facilitate approvals. Involving stakeholders and obtaining their buy-in can assist in having them prioritising the project. There is also an opportunity to reduce this duration by having constant follow up by GDID.

The Tender Documentation Stage took four months. This activity was affected by the competence of the appointed Consultants and approvals as described in Design Developments Stage. The same methods recommended in reducing the time can be implemented on reducing the Tender Documentation Stage.

The Tendering Stage took six months. This is much longer than Public Finance Management Act (PFMA) prescribed period of twenty-eight days (unless a motivation is submitted and approved for a shorter period). The lengthy period taken for this activity is indicative of the communication problems between the

technical section and the supply chain management section of GDID. As recommended in the Design Development Stage, this can be resolved by early involvement of all stakeholders and also by delegating approvals to the lowest competent level government official.

The Final Stage Activity took three months. The Final Stage activity involved evaluating, reporting and recommending the successful bidder. The successful bidder was then asked to submit performance bonds, insurances, programme of works and any other required information. The professional team verified the documents. The contract document was signed and construction work was ready to commence. The period was affected by the time taken to do the evaluation, obtaining approvals of the recommended Contractor from GDID and the Client and by submission of the contractual documentation by the Contractor.

The finding show that the evaluation period can be reduced by the appointment of competent Consultants. The approvals stage can be accelerated by delegating approvals to the lowest competent government office and or by setting standard turn-around times. The contract documentation submission period by the Contractor depends on the Contractor's competence and capacity (an indication of contractor's selection process which need to be tightened). GDID needs to set and enforce standard turn-around times for submission of mandatory or requisite documents.

The construction period took twenty-eight months leading to the project completing in forty months. The delays in construction stage arose from the community when they demanded basic skills training and portions of work as required by the Expanded Public Works Programme. This could have been resolved by early community involvement and Stakeholder Management.

4.5.10 Project J (Seventeen months)

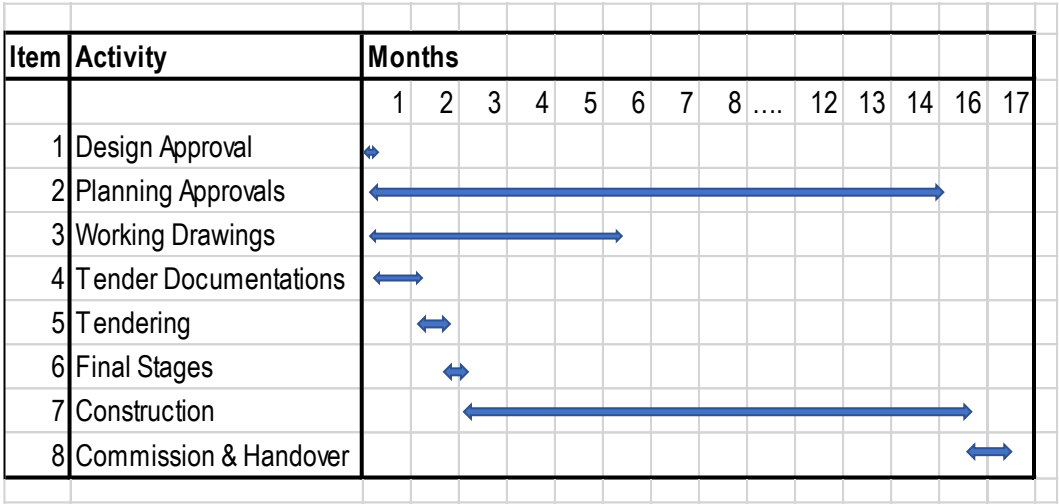

Figure 4. 10: The Process of Project J

The Summary of Project J (Management Oriented Procurement System)

1. Design Development = 0,25

2. Planning Approval = 16

3. Working Drawings = 5

4. Tender documentation = 1

5. Tendering = 0,5

6. Final Stages = 0,25

7. Construction = 14

8. Commission and handover =1

Total Duration of Project J = 17

The construction process for project J illustrates that the project commenced with Design Development in November 2011. This process was done by both GDID and the Management Consultant. The Design Development stage took seven days. The Working Drawings stage took five months. The Tender Documentation process took one month. The tender was advertised for fourteen days. The Management Consultant applied for a waiver of the normal twenty eight days

requirement set by the PFMA. The Final Stage included adjudicating and appointing the Contractor, followed by submission of requisite documents, such as, performance and insurance bonds by the Contractor. The Final Stage took seven days.

The project Access Certificate was issued in January 2012. The Construction Stage took fourteen months. The project completion was achieved at the end of March 2013. The Planning Approval Stage took sixteen months to be implemented and approved. Consultants sought permission from the Municipality under Section 7(6). This section allows a developer to start construction before overall planning approval has been granted by the Municipality. The project was completed, commissioned and handed over to the Client in April 2013. The Commissioning and Handover period took one month. The project overall duration was almost seventeen months.

The project execution plan is similar to Projects E, G and H. During the project execution it was noted that the Management Consultants was involved in the project from inception, through design and tendering to construction period. The activities overlapped resulting in time savings.

The findings show that GDID met the Clients requirements. The school was completed in eighteen months. The Planning Approval activity started once the Design Development Stage was approved and ran concurrently to all other activities, thereby saving time. The total project completion period is reduced by parallel working (Franks, 1991).

4.6 DISCUSSION OF OVERALL FINDINGS

This is a recapitulative discussion of the study findings for the research. The findings below depict the time implications and adverse impact of procurement systems as discussed.

4.7 OVERALL PROJECT TIME

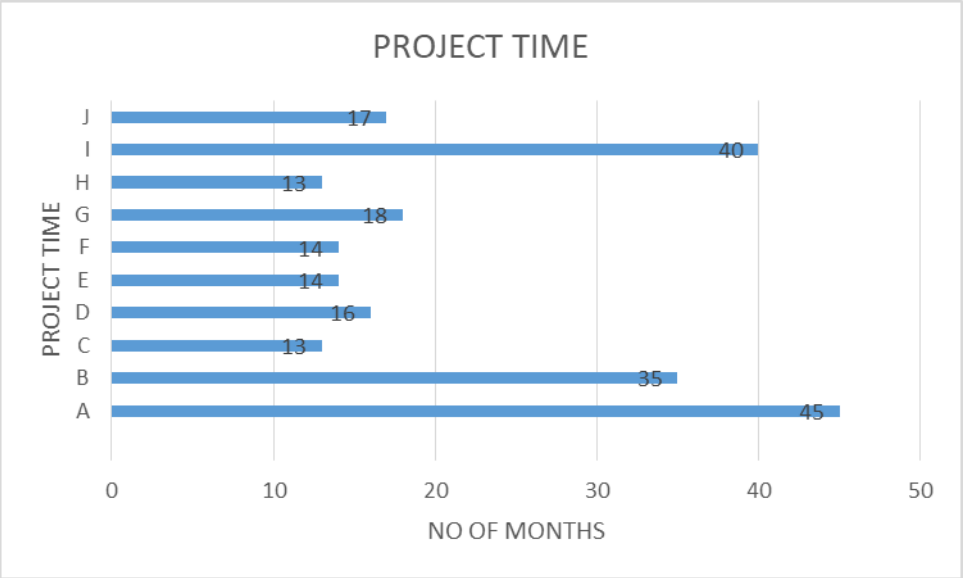

Figure 4. 11: Projects overall time

Summary of Project Durations

Project A (Traditional Procurement System)	= 45
Project B (Traditional Procurement System)	= 35
Project C (Integrated Procurement System)	= 13
Project D (Integrated Procurement System)	=16
Project E (Management Oriented Procurement System)	=14
Project F (Integrated Procurement System)	=14
Project G (Management Oriented Procurement System)	=18
Project H (Management Oriented Procurement System)	=13
Project I (Traditional Procurement System)	=40
Project J (Management Oriented Procurement System)	=17

The project survey results reflect that projects C (Integration Procurement System) and H (Management Oriented Procurement System) had the overall project shortest times. The time from inception to completion was thirteen months. The

pre-construction stage for Project C was 2,75 months this allowed the construction to start early while planning approvals and working drawings progressed and consequently lead to the early completion of the project. The activities on the critical path were the Design Development, Planning Approvals, Tender Documentation, Tendering, Final Stage and Commissioning and Handover. In project H, approvals where sought immediately after Design Development Stage and all the other activities, except Commissioning and Handover, ran in parallel. The pre-construction stage took two months. The only activities in the critical path were Design Development, Planning Approvals and Commissioning and Handover. It was possible to complete Project H in thirteen months.

Projects E (Management Oriented Procurement System) and F (Integration Procurement System) are third in position. The project duration was fourteen months. The activities on the critical path for project E (Management Oriented Procurement System) and Project F (Integration Procurement System) are as described in the preceding paragraphs for the procurement systems. The pre-construction period for Project E took 2 months while it took three months for Project F.

The durations for Project D (Integration Procurement System) was sixteen months and is ranked fifth. The pre-construction period was two months. Project J (Management Oriented Procurement System) is position six with a total duration of seventeen months. The pre-construction period was 2,25 months. Project G (Management Oriented Procurement System) is seventh, with project duration of eighteen months. The pre-construction period was again 2,25 months.

It is noted that all projects under Integration Procurement System and Management Oriented Procurement System were achieved at eighteen months, or below, as required by the Client. This was mainly achieved by reducing the number of activities on the critical path and allowing activities to start early and run in parallel.

Project B (Traditional Procurement System) was eighth in position, with a project duration of thirty-five months. The pre-construction period was twenty months. All activities from Design Development to Commissioning and Handover ran sequentially and were on the critical path. No activity was allowed to commence before the preceding one ended. Project I (Traditional Procurement System)

completing in forty months was in position nine, while Project A (Traditional Procurement System) took the longest period of forty-five months and is ranked tenth. The pre-construction period for Project I was twenty-seven months and Project A was twenty months. The pre-construction stages for all projects under Traditional Procurement Systems exceed the overall projection delivery time required of eighteen months. This is predominately attributed to the requirement that all events run sequentially and are on critical path. Consequently, all projects under Traditional Procurement System took much more time to complete than the required eighteen months.

For the purposes of this research survey, ranking based on average duration of the pre-construction period and the total project period of each procurement system is utilised. However, emphasis is placed on the pre-construction period as previous stated.

Project Type	Project Name	Pre-construction Period	Total Project Period
Integration procurement System	C	2,75	13
	D	2	16
	F	3	14
Management Procurement System	E	2	14
	G	2,25	18
	H	2	13
	J	2,25	17
Traditional Procurement System	A	20	45
	B	20	35
	I	27	40

Figure 4.12: Procurement System Ranking

1. Traditional Procurement System

Projects A, B and I were executed under the Traditional Procurement System. The overall project period on projects executed under the Traditional Procurement System were:

Total Project Period

Project A	45 months
Project B	35 months
Project I	40 months

Question

What is the average (mean) of the overall project duration for the Traditional Procurement System?

Mean ($\bar{x}$) = $\frac{\text{Sum of values}}{\text{Number of observations}}$

$$\bar{x} = \sum_n x / n$$

$$= \frac{45 + 35 + 40}{3}$$

$$= 40$$

Therefore, on average the total project duration for the Traditional Procurement System projects is forty months.

Pre-Construction Period

Project A	20 months
Project B	20 months
Project I	27 months

Question

What is the average (mean) of the pre-construction project duration for the Traditional Procurement System?

Mean ($\bar{x}$) = $\frac{\text{Sum of values}}{\text{Number of observations}}$

$$\bar{x} = \sum_n x / n$$

$$= \frac{20 + 20 + 27}{3}$$

$$= 22{,}33 \text{ months}$$

Therefore, on average the pre-construction duration for the Traditional Procurement System projects is 22,33 months.

2. Integrated Procurement System

Projects C, D and F were executed under the Integrated Procurement System. The overall project durations on projects executed under the Integrated Procurement System were:

Total Project Period

Project C	13 months
Project D	16 months
Project F	14 months

Question

What is the average (mean) of the overall project duration for the Integrated Procurement System?

$$\text{Mean } (\bar{x}) = \frac{\text{Sum of values}}{\text{Number of observations}}$$

$$\bar{x} = \sum_n x/\mathbf{n}$$

$$= \frac{13 + 16 + 14}{3}$$

$$= 14.33$$

Therefore, on average the total project duration for the Integrated Procurement System projects is fourteen months.

Pre-Construction Period

Project C	2,75 months
Project D	2 months

Project F	3 months

Question

What is the average (mean) of the pre-construction project duration for the Integrated Procurement System?

Mean $(\bar{x})$ = $\frac{\text{Sum of values}}{\text{Number of observations}}$

$$\bar{x} = \sum_n x/n$$

$$= \frac{2{,}75 + 2 + 3}{3}$$

$$= 2{,}58$$

Therefore, on average the pre-construction duration for the Integrated Procurement System projects is 2,58 months

3. Management Oriented Procurement Method

Projects E, G and H were executed under the Management Oriented Procurement System. The overall project durations on projects executed under the Management Oriented Procurement System were:

Total Project Period

Project E	14 months
Project G	18 months
Project H	13 months
Project J	17 months

Question

What is the average (mean) of the overall project duration for the Management Oriented Procurement System?

Mean $(\bar{x})$ = $\frac{\text{Sum of values}}{\text{Number of observations}}$

$$\bar{x} = \sum_n x/n$$

$$= \frac{14 + 18 + 13 + 17}{4}$$

$$= 15.5$$

Therefore, on average the duration for the Management Oriented Procurement System projects is 15,5 months.

Pre-construction period

Project E	2 months
Project G	2,25 months
Project H	2 months
Project J	2,25 months

Question

What is the average (mean) of the pre-construction project duration for the Management Oriented Procurement System?

$$\text{Mean } (\bar{x}) = \frac{\text{Sum of values}}{\text{Number of observations}}$$

$$\bar{x} = \sum_n x/\mathbf{n}$$

$$= \frac{2 + 2{,}25 + 2 + 2{,}25}{4}$$

$$= 2{,}13$$

Therefore, on average the pre-construction for the Management Oriented Procurement System projects is 2,13 months.

The ranking of the projects of the different types of procurement methods is as depicted below.

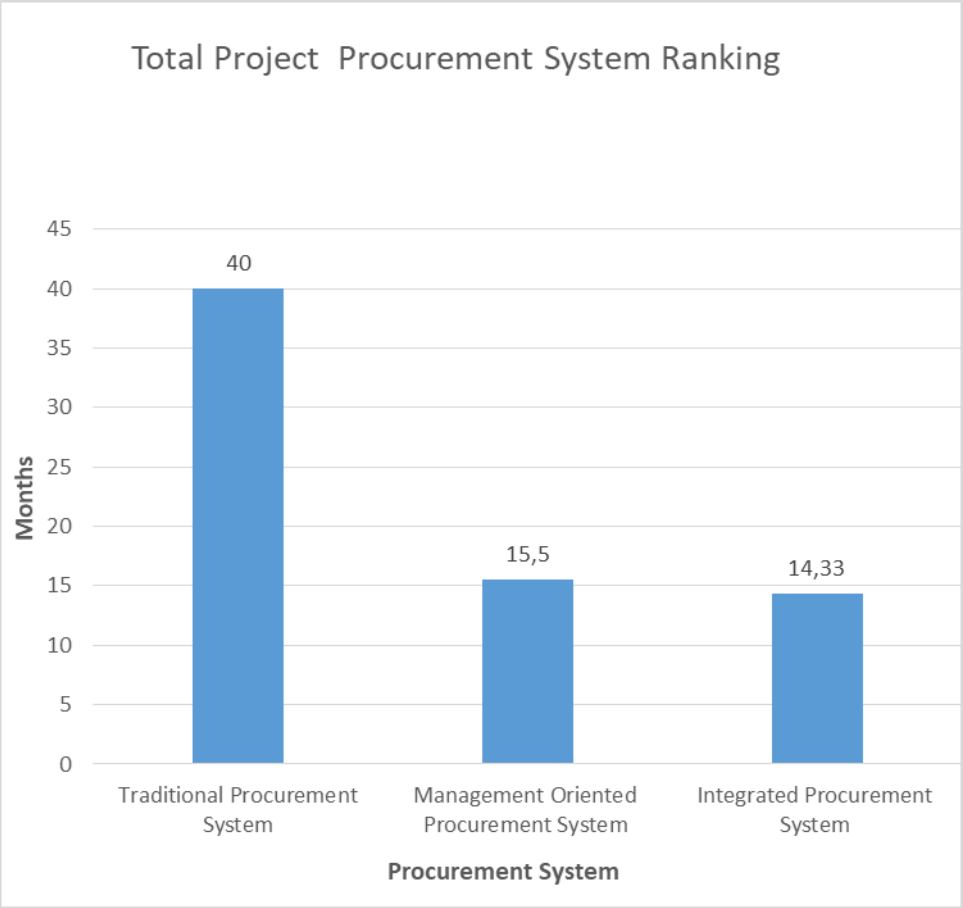

Figure 4.13: Total Project Procurement System Ranking

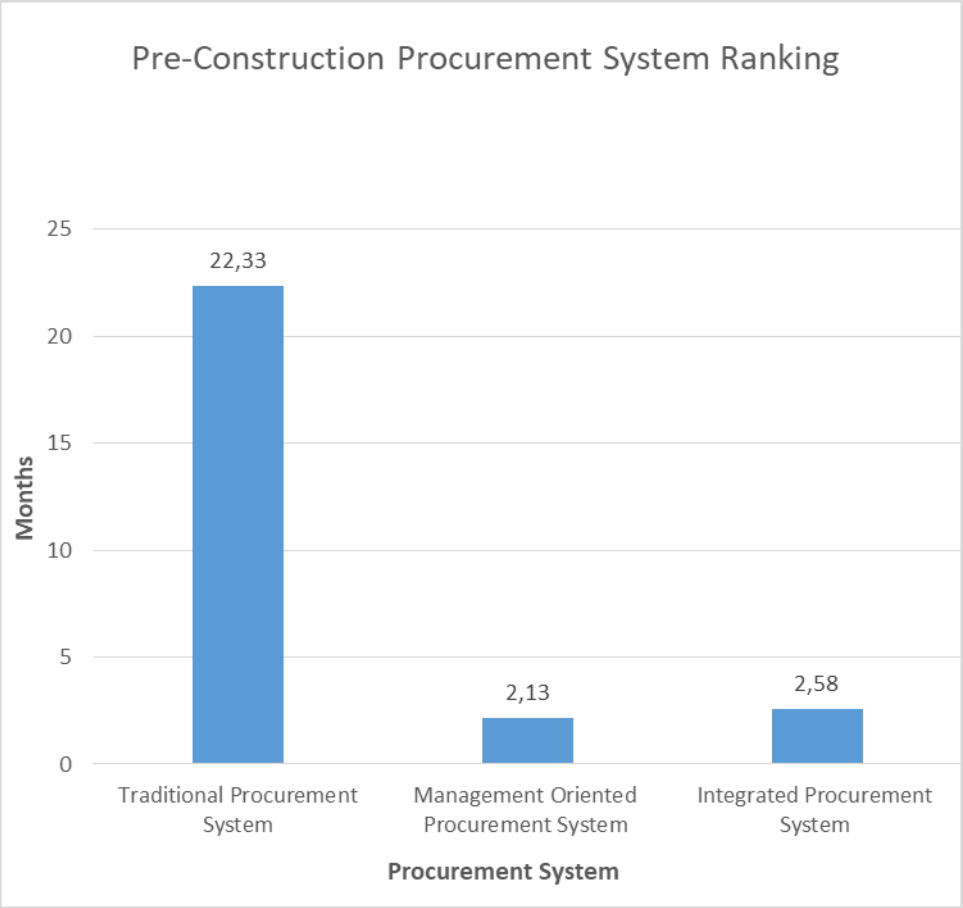

Figure 4.14: Pre-Construction Procurement System Ranking

4.8 COMPARISON OF PROCUREMENT METHODS

According to the survey results, the Traditional Procurement System was ranked third in terms of pre-construction duration and the total project duration. The Management Oriented Procurement System was ranked second on total project duration but first on the pre-construction duration. The overall project duration for the Management Oriented Procurement system was inordinately affected by the cancellation of the first Contractor's contract and the appointment of a second contractor to complete the construction. This implies that the Management Oriented Procurement system could easily become the first in both pre-construction and total project duration. The Integration Procurement System is ranked first on total project duration and second on the pre-construction duration. Since this research focuses on the pre-construction stage, assuming the construction stage is linear and ideally should take the same time for any procurement method, given a competent, experienced and skilled contractor and

barring unforeseen circumstances, natural disasters and community disruptions, the procurements system are ranked as follows:

1. Management Oriented Procurement System
2. Integration Procurement System
3. Traditional Procurement System

The surveys above show that the use of Integrated and Management Oriented Procurement Systems enable construction work to commence earlier than is possible with the end-to-end traditional system.

It was noted, however, that the appointment of competent consultants can facilitate all the activities irrespective of the procurement system. Consultants should be experienced enough to able to produce detailed designs and working drawings, facilitate approvals, generate tender documentation, evaluate and finalise appointment of contractors, monitor construction and facilitate commissioning and handover in the minimum possible time.

Consultants should be able to involve all stakeholders, including the municipality and communities to facilitate approvals and to avert disruptions during construction. They should also be able to appoint competent contractors who have enough technical experience, skills, and capacity (finance, materiel, equipment and human resources). Consultants should also be able to monitor construction and control activities to ensure that they meet the required time frames. Consultants should be able to coordinate, well in advance, the commissioning and handover of the project.

It was also noted that motivation for the waiver of the advertisement period can reduce the pre-construction period and the overall project duration. It appeared this was easier to carry out under the Management Oriented Procurement System and the Integrated Procurement System.

The pre-construction duration and the total project duration for Management Oriented and Integrated Procurement System were shortened mainly by:

- Allowing activities to start early and run parallel

- Reducing the number of sequential activities on the critical path
- Co-operative and collaborative working among GDID, Consultants, GDE and Contractor
- Waiving of the PFMA prescribed duration
- Obtaining section 7(6) from the municipality to allow commencement for construction on site prior to full approvals
- Obviating the need to obtain approvals for appointment of Contractors (It was only necessary to advise).
- Management Oriented Procurement System had an edge over the Integrated Procurement System in that only one company of consultants was appointed thereby providing one point of accountability unlike the Integrated Procurement Systems were the various consultants were appointed from different companies

However, the drawbacks of the systems were observed as:

- Lack of follow up of approvals from the municipality by the Consultants
- Lack of planning from the consultants so as to produce the working drawings immediately before they were required for the construction stage. This also resulted in extended periods for the working drawings and construction stages
- Appointment of incompetent Consultants, who among other things, fail to monitor the Contractor

The length of times for the preconstruction period and the total project period in the Traditional Procurement method were mostly affected by:

- The sequential nature of the activities, which demanded that a preceding activity be completed before the next activity commenced, thereby placing all activities on the critical path.
- The bureaucratic and hierarchical nature of GDID and GDE, and the need for approvals to be signed off by the officials. The absence of officials and

their turnaround times to sign off documents affected duration of the pre-construction stage.

An improvement in the system can be realised by delegation of authority to sign off approvals to the lowest competent government official and/or by setting standard turnaround times of documents.

4.9 SUMMARY

The chapter analysed the findings from the research instrument. The findings were linked to the literature review. It was found that the Management Procurement System is the most favourable for GDID schools delivery project programme because it meets the clients' needs and incorporate the client's new schools time requirement of eighteen months. The research focused on the pre-construction stage and assumed the construction stage was linear and ideally should take the same time for any procurement method, given a competent, experienced and skilled contractor and barring unforeseen circumstances, natural disasters and community disruptions. It cannot be over emphasised that the selection of competent consultants and contractors is absolutely essential for completion of projects on time. The findings also revealed that GDID practices compare with the international practices in public procurement for infrastructure although there is room for improvement. Time has an impact on project perfomance.

CHAPTER 5: RECOMMENDATIONS AND CONCLUSION

5.1 INTRODUCTION

This chapter discusses the drawn findings, limitations, recommendations and conclusions. The findings are derived from the exploratory study, research study and analysis of the time of projects linking them to the objective of the research study. Limitations and recommendations section highlights the practical implication of the study and suggests areas of further research studies.

The project set out to research the following, as stated in Chapter 1:

5.1.1 Aim

From among the GDID-adopted new school construction procurement systems, the research aims to identify and recommend one which enables GDID to deliver the whole project, from initiation to close-out, but focussing on the preconstruction stage, at a faster pace than ever before, while holding costs, quality and other variables constant at an acceptable and desired level.

5.1.2 Research Objectives

- To identify the procurement systems utilised by GDID
- Review the identified GDID procurement systems, individually, and rate their performance with regards to time
- Identify a procurement system which is most compatible with the GDID bureaucratic environment and which will be able to deliver the whole project, from initiation to close out, in 18 months or less, which is half the current project duration of 36 months.
- Recommend modifications that can be made to the preferred procurement system, or its implementation, to make it more time-efficient in the GDID operating environment.

5.1.3 Secondary Research Questions

- What are the GDID practices in procurement for new school infrastructure projects?

- How does each of the procurement system perform in the time-domain and how do they compare to each other?
- Given that GDID is a government department, where bureaucracy is essential to the management and organisational structure, can one of the GDID-adopted processes be identified and recommended to GDID to facilitate delivery of new schools infrastructure within 18 months, or less, as required by its Client GDE, with special attention being paid to the preconstruction stage?

Are there any modifications that can be made to the recommended procurement system, or its implementation, to make it more time-efficient in the GDID operating environment?

5.2 FINDINGS

It was the contention of this paper that the requirement to deliver new school projects in 18 months was achievable by selecting a particular procurement method, especially so, by focussing on the pre-construction stages. It is reasonable to assume that the actual construction duration can be accurately predicted, given the same prototype designs, budget allocation, and competencies and capabilities (skill, experience, finances, etc.) of the appointed Contractor. This, of course, bars natural disasters and strike action and lock-outs by communities, workers and suppliers.

In Chapter 4 the different procurement systems were reviewed individually, and their performance rated with regards to time. The Traditional Procurement system was third. It had an average pre-construction duration of 22,33 months . The Integrated Procurement System was rated second, with an average pre-construction period of 2,58 months while the Management Oriented Procurement System was ranked first with an average pre-construction period of 2,13 months.

The Management Oriented Procurement System and the Integrated Procurement Systems enable construction work to commence earlier than is possible with the end-to-end traditional system (Vicknash, 2016). The Management Oriented Procurement System was found to be most compatible with the GDID bureaucratic environment and will be able to deliver the whole project, from initiation to close out, in eighteen months or less, which is half the current project duration of thirty-

six months. The Management Oriented Procurement System had an edge over the Integrated Procurement System and Traditional Procurement System in that only one company of consultants was appointed, thereby providing one point of accountability, unlike the Integrated Procurement System and the Traditional Procurement System, where various Consultants, representing different professions, were appointed from different companies (Rashid, 2006).

Another advantage of Management Oriented Procurement System over Integrated Procurement System and Traditional Procurement System was that it only had three activities on the critical path (Design Development, Planning Approval, and Commissioning and Handing over) compared to Integrated Procurement System with six activities (Design Development, Planning Approval, Tender Documentation, Tendering, Final Stage and Commissioning and Handing over) and the Traditional Procurement System, with all eight activities of Design Development, Planning Approval, Working drawing, Tender Documentation, Tendering, Final Stage, Construction, and Commissioning and Handing over.

Management Oriented Procurement System and Integrated Procurement system also enjoy the benefit of being able to apply for Section 7(6) from municipalities, which allows for construction to commence without full approvals. This allows projects to start early and finish early. However, this has a short coming of consultants failing to produce working drawings and submitting them for approvals before the next stage commences resulting in delays of overall approvals.

Yet another advantage of Management Oriented Procurement System and Integrated Procurement system is that they can apply for the waiver of the PFMA prescribed twenty-eight day advertisement period and advertise in a shorter period.

Further still, in Management Oriented Procurement Systems, the management consultant does not need to obtain approvals for the appointment of the contractor. They need only advise the department of the appointed contractor.

It was noted that modifications needed to be done to the manner in which the Management Oriented Procurement System was being implemented by GDID to make it more time-efficient in the GDID operating environment. The appointment of competent consultants can facilitate all the activities irrespective of the procurement system. Consultants should be experienced enough to able to

produce detailed designs and working drawings, facilitate approvals, generate tender documentation, evaluate and finalise appointment of contractors, monitor construction and facilitate commissioning and handover in the minimum possible time.

Consultants should be able to involve all stakeholders, including the municipality and communities to facilitate approvals and to avert disruptions during construction. They should also be able to appoint competent contractors who have enough technical experience, skills, and capacity (finance, materiel, equipment and human resources). Consultants should also be able to monitor construction and control activities to ensure that they meet the required time frames. Consultants should be able to coordinate, well in advance, the commissioning and handover of the project.

Moshini (1995), notes that the negative impact of coordination on project performance in building industry in general may partially be attributed to a particular deficiency of any temporary multi-organisation namely that it lacks an effective mechanism for project feedback and this relationship impact on the certainty of timely completion of new school projects holding quality, cost and all other variables constant.

5.3 LIMITATIONS

One of the challenges faced with this research was to validate data from the archives. GDID does not have a library and project information is stored haphazardly. GDID has a Registry Section. The Registry Section is responsible for filing and keeping all the project data. However, the filing system is not up to standard. Files cannot be timely retrieved.

A population of ten projects was targeted. This was a list of all schools projects executed.

The cost of following different new schools construction, on their different project locations, was prohibitive. Given the wide range of projects undertaken by GDID, the scope of the study was limited to construction of new school projects only, with same drawings, budget and scope of work. The study focused on time taken for delivery of the whole project from design stage to close out stage because it represented a complete project procurement life cycle.

The survey results were derived eventually from ten schools projects. While the findings may not be broadly generalised, they are indicative of the impact of procurement systems on the performance of construction projects, given that most of the key findings confirmed the findings of the literature review.

5.4 RECOMMENDATION

It is recommended that GDID, in order to achieve project delivery in a reduced period, adopts the Management Oriented Procurement System, with the following modifications to their current implementation of the system:

- GDID should establish relationships with stakeholders, particularly municipalities, at an early stage
- It must ensure that the drawings are progressively submitted and approved by municipalities.
- The bureaucratic levels and hierarchy must be reduced by delegating authority to the lowest competent level of personnel.
- GDID must introduce turnaround standard times for their officials to sign-off approvals.
- It must make use of the Tender advertisement waiver as far as possible.
- GDID should monitor and enforce agreed time frames for the various activities of the project, and not just the overall project completion time.
- GDID must appoint competent Consultants and ensure that competent Contractors are appointed for the projects.

It is also recommended that further studies be carried out on:

- More projects, so that the results can readily be generalised

Other aspects of project management, such as quality and cost, and explore their impact on delivery of projects.

5.5 CONCLUSION

This project set out to the research procurement methods implemented by GDID, identify the most suitable, and recommend the most appropriate, with

modifications, if any, to be implemented by GDID, to achieve project completion in minimum time. Relevant literature was reviewed in Chapter 2. Chapter 3 gave an account of the available research methods. A research method was selected and justified, together with its research instruments. Results were presented and discussed in Chapter 4. It was discovered that the Management Oriented Procurement System was the most suitable system to achieve the minimum time requirement. Recommendations were made on how the implementation of the Management Oriented Procurement System can be improved and on areas of further study.

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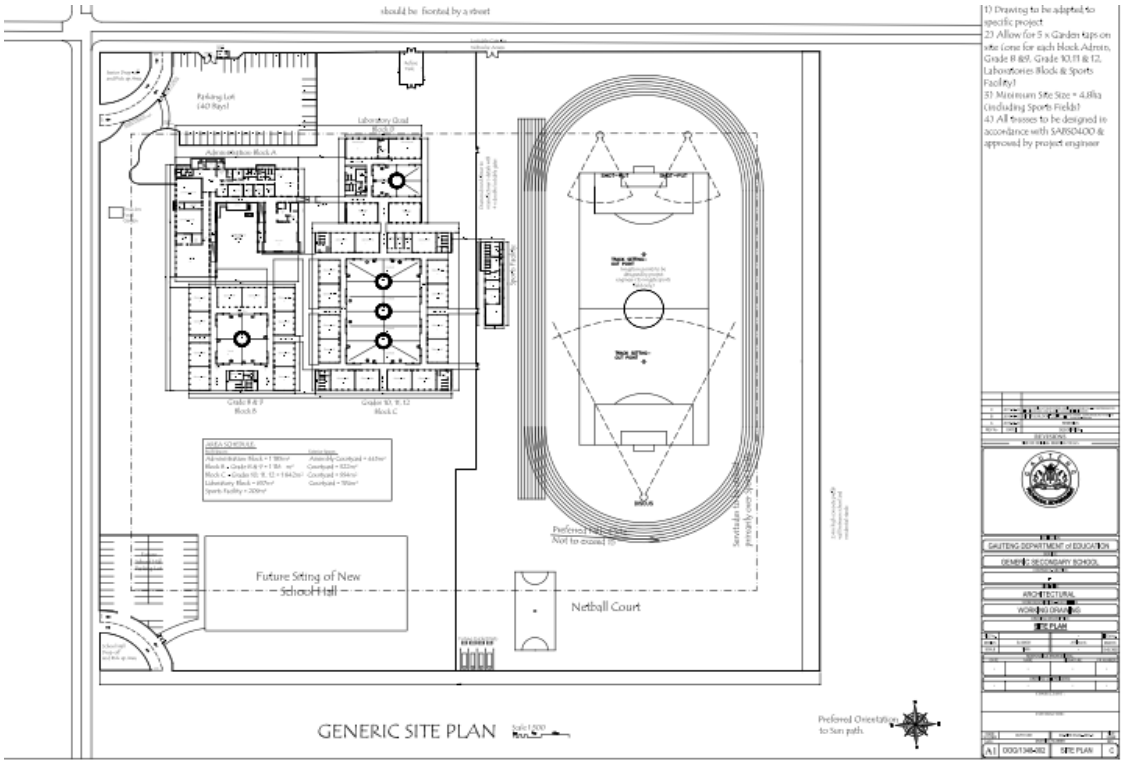
APPENDICES

Appendix A



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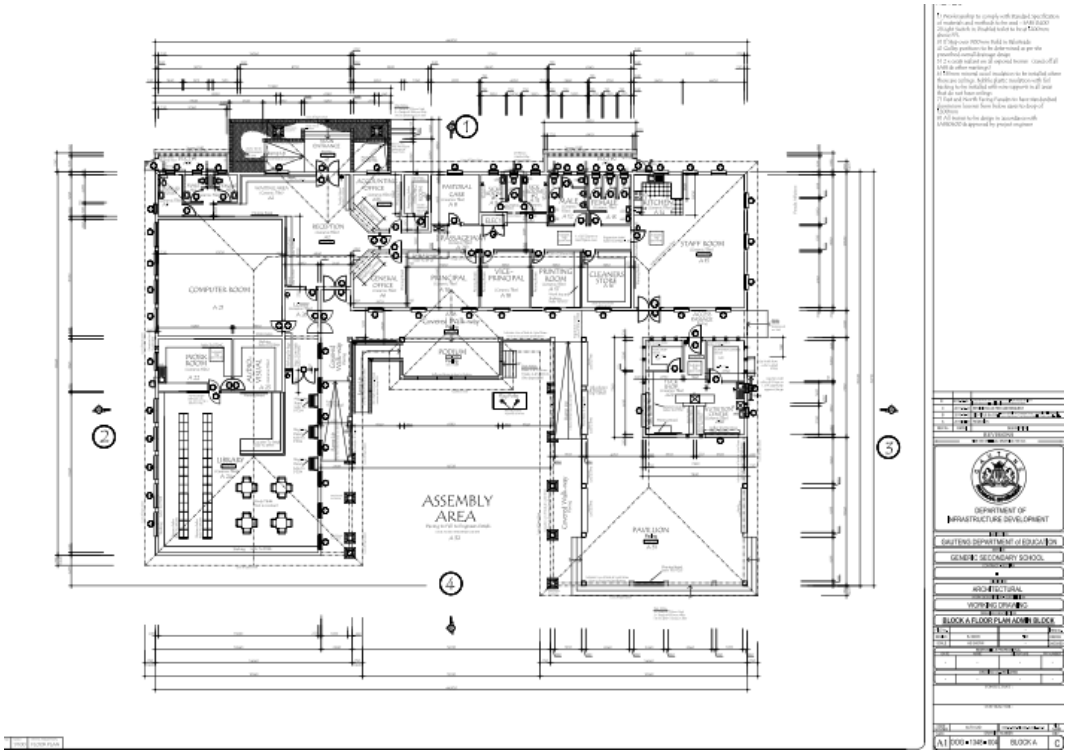

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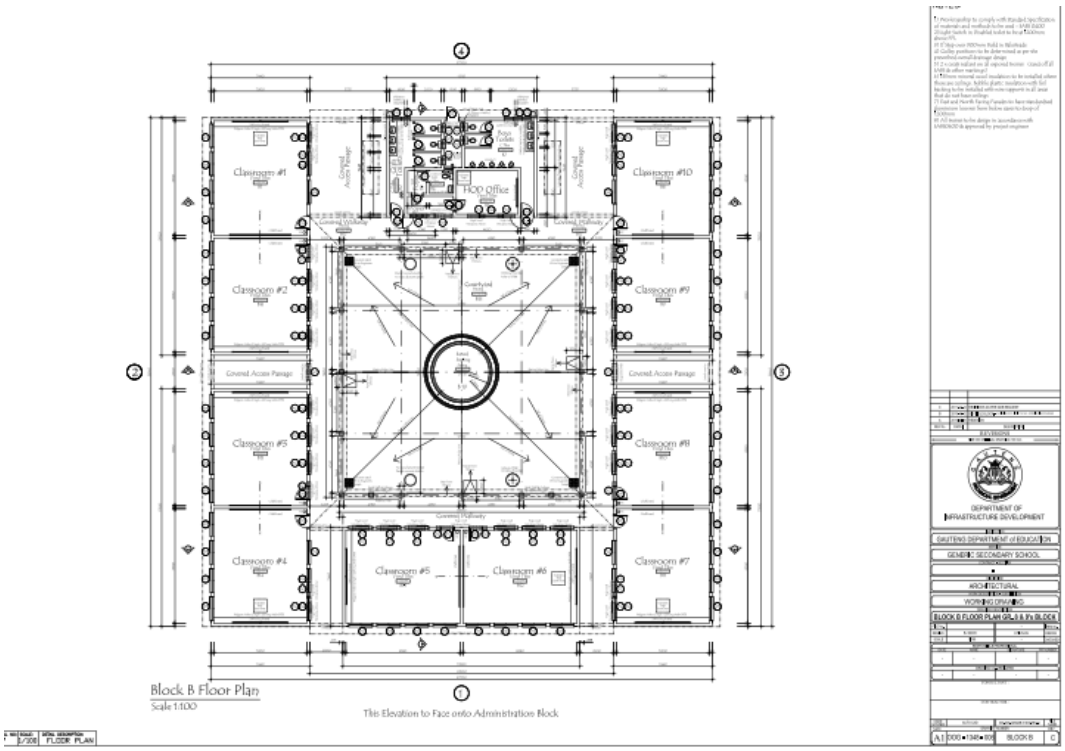

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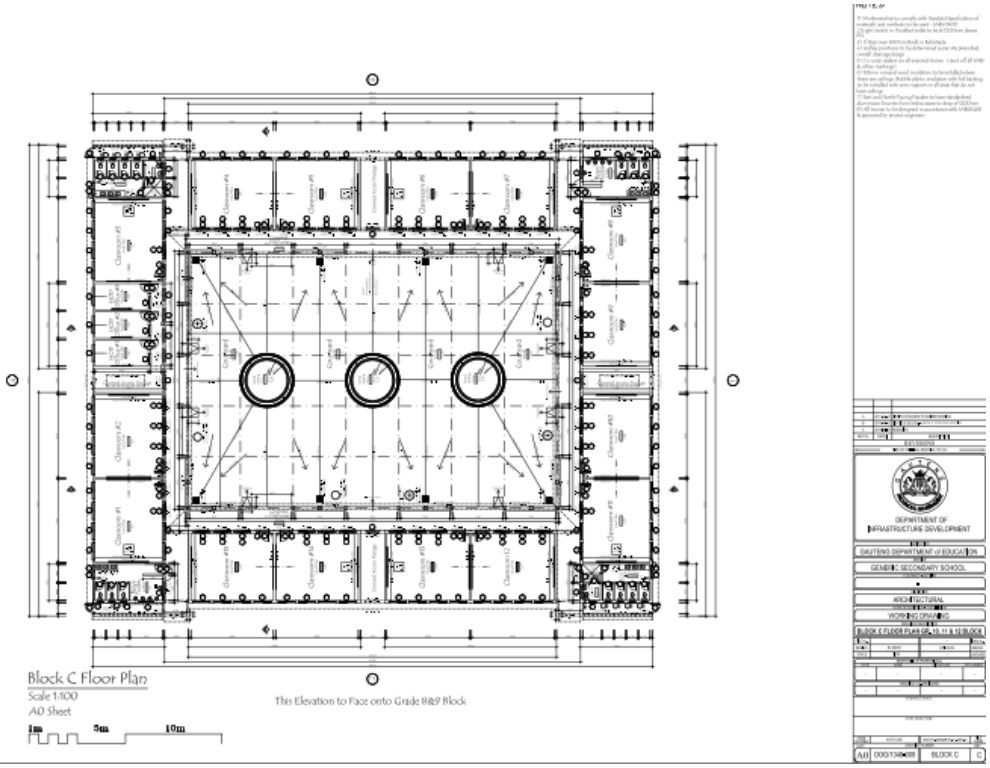

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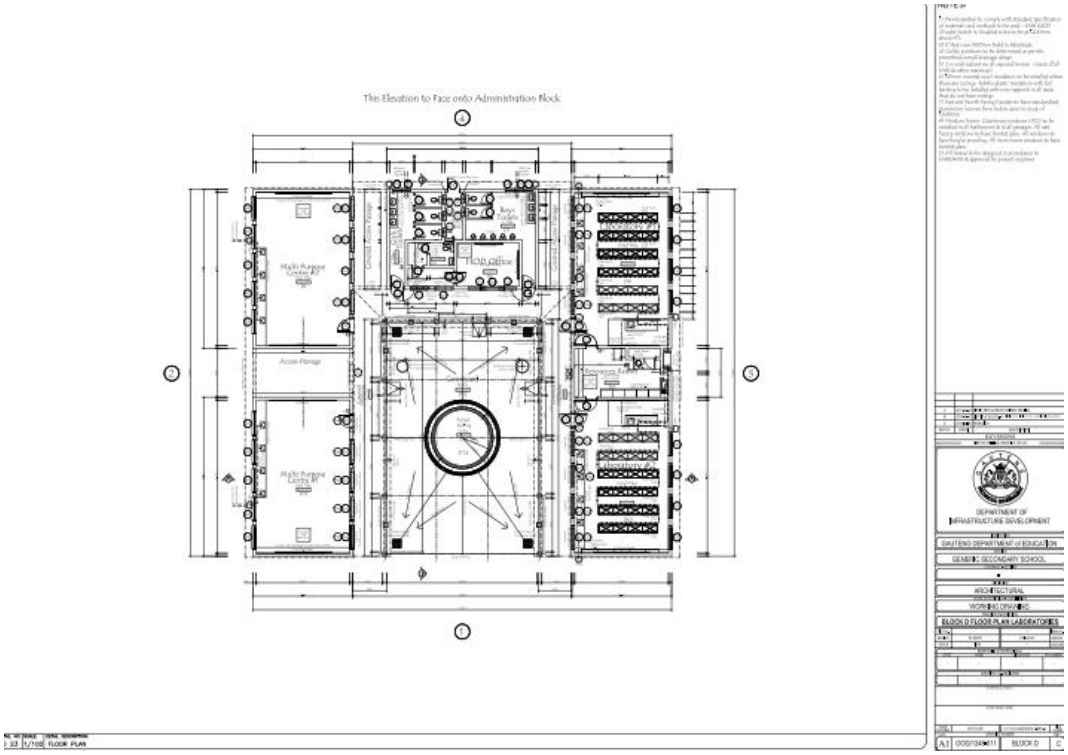
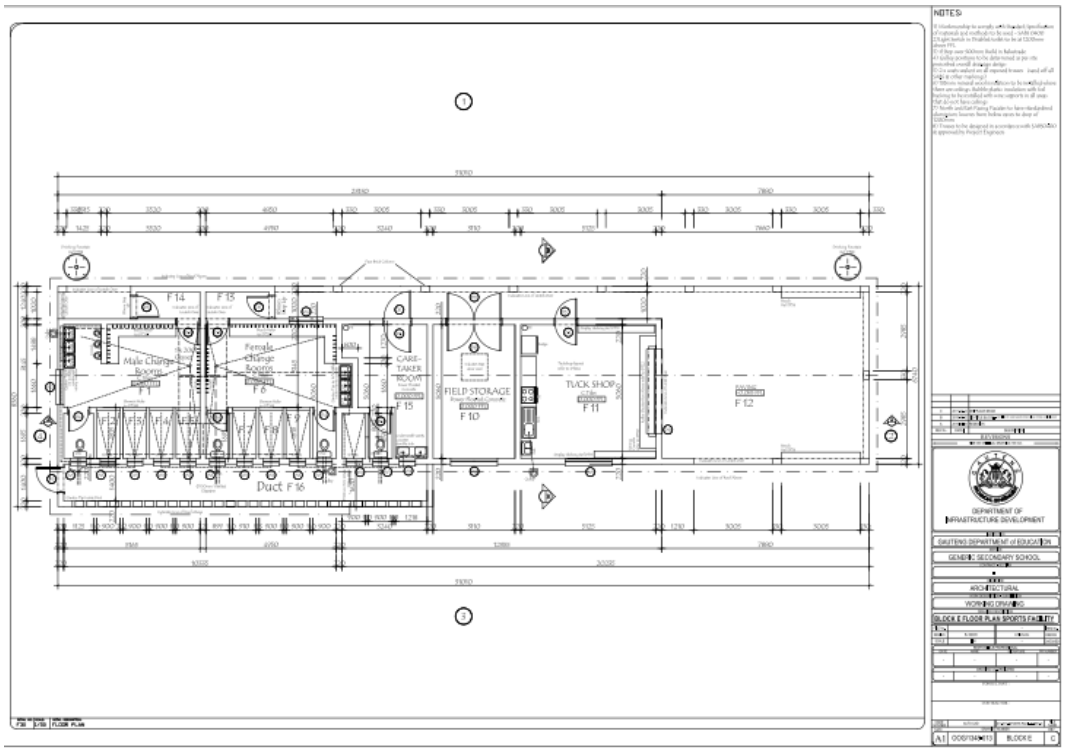


Multi-Purpose and Laboratory Block



Sport Facility Block

Appendix B: Information Document

Letter of Introduction

School of Construction Economics and Management
Faculty of Engineering and the Built Environment
University of the Witwatersrand, Johannesburg
Private Bag 3, WITS, 2050
Tel. 011 475 2310
Cell 082 678 5427
E-mail memoryzvo@yahoo.com

Study title: EVALUATING THE PROCUREMENT SYSTEMS WITHIN THE DEPARTMENT OF INFRASTRUCTURE DEVELOPMENT FOR BETTER SERVICE DELIVERY"

Dear Sir / Madam

I am a postgraduate student in the Faculty of Engineering and Built Environment at Witwatersrand, where I am registered for a Master of Science in Building (Project Management). As part of my programme, I am required to submit a complete research report. My research, which is being conducted under the supervision of Professor D. Root, is on the topic "EVALUATING THE PROCUREMENT SYSTEMS WITHIN THE DEPARTMENT OF INFRASTRUCTURE DEVELOPMENT FOR BETTER SERVICE DELIVERY"

As part of my research I requires information on construction project management techniques used in service delivery within your department. I has approached you to try and obtain some of this information. I would appreciate it if you kindly oblige and assist me in any way possible. By doing so, you will be adding valuable contribution towards the expansion of knowledge in an area which is both timely and very important in the South African construction environment and the economy as a whole.

The informal interviews will be approximately 30 minutes. Please do not be afraid of assisting on the informal interview and availing of project files, this research is purely for academic purposes and no individual will be victimized. You and your company are assured of complete confidentiality. Personal information may be disclosed if required by law.

Once again, thank you for your time and participation in this study.

Yours Sincerely

Memory Zvomuya
Construction Economics and Management
University of Witwatersrand
0788256197

Appendix C: Permission to undertake research in the Department

GAUTENG PROVINCE
INFRASTRUCTURE DEVELOPMENT
REPUBLIC OF SOUTH AFRICA

Enquiries: M. Zvomuya
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TO : **Mr. B. Netshiswinzhe**
HOD

FROM: **Ms. M. Zvomuya**
Internal Project Manager: Education

SUBJECT : REQUEST FOR PERMISSION TO USE THE DEPARTMENT FOR AN ACADEMIC RESEARCH ENTITLED: EVALUATING THE PROCUREMENT SYSTEMS WITHIN THE DEPARTMENT OF INFRASTRUCTURE DEVELOPMENT FOR BETTER SERVICE DELIVERY

PURPOSE

The purpose of this submission is to request for permission to use of the Gauteng Department of Infrastructure Development as an entity and information thereof in the development of an academic research for the degree of Master of Science (Building) in Project Management.

BACKGROUND

I am an employee in the Department under Capital Works (Education) and pursuing my Masters in Project Management (Building) studies with the Faculty of Engineering and Built Environment, University of Witwatersrand. This research will entail the use of the organisational information and administration of informal interview with Expects and Project Managers in the organisation

MOTIVATION

In response to the failures in service delivery the government of South Africa has taken the initiative to transform the public sector into a vibrant and customer focused machinery to improve on service delivery (GDID, 2011). This has seen the

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restructuring of some of the government departments leading to the establishment of the Gauteng Department of Infrastructure Development (GDID) to manage all government buildings and free user Departments to focus on their core business and avoid duplication of technical capacities. The function of the department is to implement and provide new structures and maintain, restore and repair existing structures for the Gauteng Provincial Government (GPG). The GDID functions include the provision, management and maintenance of infrastructure social services such as schools, hospitals, roads, water and sanitation (*ibid*).

The public sector obligation to improve the performance of construction procurement has resulted in several changes to the organisation roles and systems adopted for development schemes. The different procurement systems have the potential to affect the schools service delivery projects given that the methods, processes, procedures and organization vary according to the system. Thus there is a clear need for GDID to identify and utilise the appropriate procurement methods for school service delivery projects This requires an evaluation of the procurement systems to establish which is better suited for GDID to deliver schools faster and more effectively particularly in respect of the certainty of timely completion given the implication of delivering late for a School's ability to provide education to its learners. The detailed proposal for the objective is attached (Annexure A).

FINANCIAL IMPLICATIONS

There are no financial implications to the Department.

POLICY IMPLIMENTATION

The studies are done as a part time. The learner intends to complete her studies in December 2015. The learner pledges to make available the outcome of this research to GDID on conditions to be agreed with the university.

RECOMMENDATION

It is recommended that the HOD approve that:

1. Memory Zvomuya,Persal Number 23171987 undertake the academic research.
2. The Academic research entitled: Evaluating the procurement systems within the department of infrastructure development for better service delivery be implemented.
3. The scope of study is limited to new schools projects and focuses on the time taken for delivery of projects only.
4. The research will adhere to the framework and policies of the School of Construction Economics and Management, University of Witwatersrand.
5. The data obtained will not be used for commercial purposes and can only be made available to third parties with express written consent from GDID.

Annexure

A: Proposal of the research

Designation	Recommended / Not Recommended/ Recommended as amended	Signature	Date
IPM. Education Ms M. Zvomuya	RECOMMENDED	Zvomuya	29/09/2015
Comment:			

Designation	Supported /Not Supported / Supported as amended	Signature	Date
Act Director: : Education Infrastructure Southern Cluster: Mr. R. Sithole	SUPPORTED	RSithole	30/09/2015
Comment:			

RECOMMENDATION

It is recommended that the HOD approve that:

1. Memory Zvomuya, Persal Number 23171987 undertake the academic research.
2. The Academic research entitled: Evaluating the procurement systems within the department of infrastructure development for better service delivery be implemented.
3. The scope of study is limited to new schools projects and focuses on the time taken for delivery of projects only.
4. The research will adhere to the framework and policies of the School of Construction Economics and Management, University of Witwatersrand.
5. The data obtained will not be used for commercial purposes and can only be made available to third parties with express written consent from GDID.

Designation	Supported / Not Supported / Supported as amended	Signature	Date
CD:Education Infrastructure, Maintenance and Technical Services Mr. M. Selepe	supported		01/02/2016
Comment:			

Designation	Supported / Not Supported / Supported as amended	Signature	Date
DDG: Education Infrastructure and Other Provincial Departments Infrastructure Technical Services Mr. A. Zimbwa (on leave).	Supported		01/02/2016
Comment:			

Designation	Approved / Not Approved / Approved as amended	Signature	Date
HOD: Department of Infrastructure Development Mr. B. Netshiswinzhe			17/2/16
Comment:			

Appendix D: Application to the Human Research Ethics Committee Form

Herein attached

Appendix E: Faculty Title Approval

Faculty of Engineering and the Built Environment
Private Bag 3, WITS, 2050
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Tel: +27 (0) 11 717-7603

Reference: Ms Glenda Levitan
E-mail: glenda.levitan@wits.ac.za
10 September 2012
Person No: 421992
PAG

Ms M Zvomuya
P O Box 113
Wilgeheuwel
1736
South Africa

Dear Ms Zvomuya

Master of Science in Building: Approval of Title

We have pleasure in advising that your proposal entitled "*Evaluating the use of procurement systems within the department of infrastructure development on service delivery*" has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mrs Lesley Salter
Faculty Registrar
Faculty of Engineering and the Built Environment