Cape Peninsula University of Technology

A HEALTHCARE TECHNOLOGY MANAGEMENT TOOL FOR PUBLIC-PRIVATE PARTNERSHIP PROJECTS

BY

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DECLARATION

I, Anele Mlungu, declare that the contents of this dissertation/thesis represent my own unaided work, and that the dissertation/thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

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ABSTRACT

Public-Private Partnerships (PPPs) have been found as an alternative service delivery model to traditional procurement. The South Africa government has invested in conducting PPP feasibility studies for identified healthcare facilities in the country. Inconsistencies between the populace's needs, the healthcare built infrastructure and healthcare technologies is found as a challenge for healthcare services delivery. Similar to PPP concessions healthcare infrastructures are built to last for many years whilst healthcare needs and technologies evolve much quicker. This quick evolution therefore exacerbates the complexity of healthcare infrastructure delivery PPPs.

On its mission to developing a framework that can be used to allocate risks in healthcare technology PPPs, this study examines project complexities and inherent risks associated with public-private partnerships. Literature on healthcare technology management processes and its intrinsic phases has also been studied. To further triangulate data obtained through literature reviews, more data on the subject matter has been collected through interviews. Personnel from South African institutions that have been procured through PPPs has been sampled for the interviews.

The study has found PPPs as projects with substantive detail and dynamic complexities. The feasibility study does simplify the detail complexities to a certain degree; however, there are dynamic complexities for future uncertainties. PPP projects are further found to be too difficult to manage when using traditional project management tools. The theoretical study revealed a needs analysis, acquisition planning, acquisition, and asset management as the main processes that are involved in healthcare technology management. The developed framework therefore recommends how healthcare technology management risks must be assigned between the partners.

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As they say the list is endless, I find myself as the perfect epitome of the adage "it takes a village to raise a child".

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CHAPTER 1. INTRODUCTION AND BACKGROUND OF THE STUDY

1.1. INTRODUCTION

A project can be defined as any planned venture that is undertaken to produce an exclusive product, service, or any defined output within a specified time and resource constraints (Steyn; Micheal; du Plessis; Kruger; Kushke, Sparrius; van Eck; Visser, 2012: 3). A project is generally a once-off activity with a distinct set of anticipated end results (Devan, 2005: 17). In their life, most projects experience similar stages of definition, planning, execution and delivery (Kara, 2012: 8). This process is called a project lifecycle (Duncan, 1996: 12). As it is intended to address crucial factors of project scope, time, cost, quality and risks (Bricknell, 2012: 112), project planning forms a significant part of the project lifecycle. Project planning is more critical in today's projects, as they are far more complex owing to the advent of new highly technical products that higher levels of integration of different disciplines. These may involve larger capital investments, which are compounded by the inclusion of many more stakeholders and widely dispersed project participants (Matheu, 2005: 9). Because of these complexities, the risk of failure is equally higher; therefore, it demands stringent operational requirements and product specifications to reduce uncertainties. To deal well with these uncertainties, unforeseen occurrences, and to attain project success; risk analysis and subsequent management continue to be key in project management (Banaitiene and Banaitis, 2012: 430). A project risk is defined as an uncertain occurrence or set of conditions that, should it or they occur, would influence the accomplishment of one or more project objectives (McGregor, 2012: 226).

Public-private partnerships (PPPs) permit private institutions to build, own and operate public projects like hospitals and schools for the public sector (Nissar, 2007: 1). These are obviously dependent on the agreement with government in respect of what would be the working and ownership relationship considering government obligation to citizens. In this type of infrastructure procurement, project complexity increases substantially compared to traditional procurement, because of risk allocation, duration and financing systems that establish the partnership (Carbonara, 2009: 1).

For PPPs to be successful, it is critical for the partners to manage risks at the earliest possible project stage, and to subsequently allocate them to the partner that is most capable of controlling them (Zou, Wang and Fang, 2005: 123). It is partly for this reason that the South African government should conduct feasibility studies for their envisaged PPP projects. The government conducts these feasibility studies to assess whether the PPP option appropriately transfers risks to the private partner (National Treasury, 2008). The feasibility study will, therefore, inform on whether or not government should take the risk of forming the partnership.

The ideal situation for this would be a win – win situation for both parties (stakeholders) within the partnership.

The South African government developed a PPP legislative and regulatory framework in support of its commitment to deliver quality infrastructure projects and related services (National Treasury, 2009:7). The government has a constitutional mandate to provide its citizens with numerous services, which the government would not be able to adequately fulfil on its own. Therefore, the PPP framework is used to deliver government projects through partnerships with the private sector, which often has resources that the government may not have.

PPP projects in health services delivery aim to improve provision of quality healthcare infrastructure and facilities (Ahmend and Nisar, 2010: 910). In response to the altering demands of the healthcare system, the healthcare delivery system is rapidly changing. Contributory factors to healthcare requirements are, among others, shifting patterns of disease, a shortage of professional clinicians, rising public expectations, and advancement offered by new diagnostic and curative technologies (Mckee, Edwards and Atun, 2006: 893). Technological changes in all areas compounded by the expectations and dreaded uncertainties of automation and the Fourth Industrial Revolution may continue to impact medical technologies at rapid paces (Kwankam; Polluta; Heimann; El-Nageh; Belhocine, 2001: 5).

In view of these, and other factors, PPPs inevitably become the most immediate and particularly valuable stakeholders that will assist the government to leverage technical expertise, spurring technology transfer and transference of required management expertise (Nikolic and Maikisch, 2006: 19). From a project management perspective, these will assist to reduce project execution failure rates, and enable the success of the project to meet its intended objectives. This should be done considering that the current project execution failure rate for government projects stands at between 47% - 71% (Ashkenas and Manville, 2018: 272). Proper allocation of these will lead to the effective and efficient management of risks that pertain to healthcare technology planning, acquisition, utilisation and disposal in a PPP project. The responsibilities that will be identified, assessed and assigned include all nine phases of the healthcare technology lifecycle, namely planning and assessment, budget allocation, technology assessment and selection, procurement and logistics, installation and commissioning, training and skills development, operation and safety, maintenance and repair, and decommissioning and disposal (Lenel, Andreas; Temple-Bird, Caroline; Kawohl, Willi; Kaur, Manjit, 2000: 10).

1.2. BACKGROUND OF THE RESEARCH PROBLEM

Identification, acquisition and utilisation of healthcare technologies and systems require huge financial investment, as well as technical expertise. Appropriate decisions are necessary to carefully ascertain correspondence of health systems and technology supplies (Health Partners International, 2013). Hence, this research seeks to develop a conceptual framework that will be used by the public sector to best allocate PPP responsibilities. Project management is basically about managing a project from commencement to its conclusion, and must be discussed in terms of various phases of the project life cycle (Matheu, 2005: 1). The importance of complexity to the project management scope is widely acknowledged (Baccarini, 1996: 201) and, therefore, appreciated as a critical element in the decisions of partnership models. Large and complex projects need substantial management structures to ensure that resources converge in an organised manner to accomplish the tasks at hand (Galway, 2004: 8).

Traditionally, significance of effective project management must correspond with the project size and complexity (Wideman, 1990: 5). The shortage of specialised technical skills affects the ability of government negatively to operate large and complex projects without external assistance. Complex projects occupy a space within traditional project management and extreme project management because they: utilise novel technologies; consist of independent, interacting elements that require integration; involve two or more stakeholders; and entail a dynamic human resource environment (Meier, 2013: 22). Public Private Partnership projects can be categorized as complex projects; this is because they tend to be large, complex and expensive (Cui *et al*., 2010: 1).

Procurement regulations and management of public goods and services is complex owing to competing interests of those involved, namely government agencies, private sector providers, taxpayers, consumers, special groups, and so forth (Carbonara, 2009: 1). The National Health Act (Act 61 of 2003) lists, amongst others, the following as the Ministry of Health's responsibilities:

"Endeavour to protect, promote and maintain the health of the population; and To promote the inclusion of health services in the socio economic development plan of the Republic."

Poor working environments, skills gaps and the use of inappropriate policy tools hamper the execution of these responsibilities (DOH, 2011). However, Public Private Partnership projects combine government resources with those of private agents with the purpose of delivering society's needs (Skecher, 2005: 347). As defined by South African law, a Public-Private Partnership is an agreement between a government department and a private entity, whereby the private entity accepts financial, operational and technical risks in the designing, financing, building and operation of a project (National Treasury, 2008). In a typical hospital development

PPP project, healthcare technologies are part of the project. The National Health Act (Act No. 61 of 2003) defines health technology as machinery or equipment that is used in the provision of health services to the user, but does not include medicine, as defined in section 1 of the Medicines and Related Substances Control Act, 1965 (Act No. 101 of 1965). In this research the term healthcare technology refers to all medical equipment used directly for a patient's diagnosis, therapy and rehabilitation.

1.2.1. Public Private Partnership (PPP)

The South African healthcare system's challenges have left the government with no choice but to investigate alternative service delivery options from the private sector (Haarhof, 2008: 74). This might be because the public sector's resources must be expanded to 80% of the population, whilst the private sector's resources are for the remaining 20% (Hilliard-Thomas, 2009: 12). This 20-80 percentage rule seems to occur in all establishments, both inside and outside of the public sector, which is the norm for government's services requirements.

A Public Private Partnership is a concession between a public body that is mandated to provide a service, and a private consortium of companies, inclusive of financial institutions, granting it permission to finance, build and operate a facility for a specified term (Burke, 2011: 341). Nyagwachi (2008: 16) describes a PPP as a partnership between the public and private sectors, with a purpose to provide major public infrastructure or services. PPP transactions in South Africa cover a broad spectrum of services, including healthcare transport, eco-tourism, correctional services, social development and office accommodation (Manuel, 2007: 56). Private partners' payment for their services can be either via unitary payments (public partner directly paying the private partner), private partner collecting revenue from the users, or a hybrid of the two (National Treasury, 2008). The National Treasury recommends PPP procurement to follow the succeeding, significant stages: inception; feasibility study; procurement; and delivery.

It is not simple to use PPPs, The government must address numerous complex subjects to use this procurement method (Akintola, Matthias and Hardcastle, 2003: 73). PPP projects are complex (Devan, 2005: 54). PPP contracts differ significantly from standard procurement contracts, as these partnerships are not based on the conventional product supplier/buyer relationship, but operate on risk allocation between the partners of an ongoing relationship (Nyagwachi, 2008: 56). These complexities affect both partners, as the private partner comprises different stakeholders that form the consortium and lenders (Ngamlana, 2009: 29). Compared to other infrastructure delivery projects, the complexity of health care services' delivery through PPPs has been further exacerbated by the dynamic nature of the healthcare service itself (Mckee, Edwards and Atun, 2006: 893). Healthcare projects are more

complicated for PPPs; because of the healthcare's inherent complexity, it becomes challenging for PPP agreements to cover vital future contingencies (Burger and Hawkesworth, 2011: 23).

1.2.2. Healthcare technology

Normally used interchangeably with the broader term "health technology", healthcare technology can be defined as devices, drugs, medical and surgical procedures, as well as the knowledge associated with these used in the prevention, diagnosis and treatment of diseases, and for rehabilitation, and organisational and supportive systems within which care is provided (Lenel *et al*., 2000: 2).

Kachienga (2004: 279) describes healthcare technology management as a systematic method that is utilised to ensure that safe, efficacious, affordable and appropriate equipment is available to satisfy the healthcare system's needs. Proper healthcare technology planning and utilisation are key contributors to provide equitable and sustainable healthcare. Various skills would be required to achieve the above, including: technical; financial management; inventory control; and human resources management skills (Lenel *et al*., 2000: 3). The required level for these skills can vary, based on demand, job level and description, and institution type. Healthcare Technology Management involves co-ordination and organisation of the following healthcare technology life cycle aspects: planning; acquisition; operation and maintenance; and disposal.

Drugs and other pharmaceutical services are normally covered by a different act (Medicines and Related Substances Control Act 101 of 1965). Therefore, in this research study, healthcare technology includes only physical medical equipment and related software used for disease prevention, treatment and rehabilitation. The lifecycle of healthcare technology covers a *cradle to the grave* process, beginning with planning and assessment, resource allocation, technology selection, procurement training, operations, maintenance and repairs, and decommissioning and disposal (Health Partners International, 2013).

Devices are assets that require proper management, and most of the research leading to the availability of this technology comes from private industry. This is even more obvious in the case of medical devices, as they generally need considerable investment, have direct impact on human lives, in most cases have high operational costs, while some have fairly short lifespans (World Health Organisation, 2006: 2). Healthcare Technology Management can be defined as an appropriate and effective management of healthcare technology, which contributes to improving the health sector's efficiency (Lenel *et al*., 2000: 1). In developed countries the importance of technology management, especially equipment maintenance, is well acknowledged as an important unit of hospital management (Ogembo_Kachienga and Ogara, 2004: 280).

Dickey (1995: 3) defines a clinical engineer as a professional that applies an engineering and managerial skills set to advance patient care. Clinical and biomedical engineering will, over time, revolve into a single profession, namely healthcare technology management (Healthcare Technology Management Magazine, 2011: 4). Dickey (1995: 3) concurs and states that clinical engineering has advanced to include all facets of technology management. In addition, clinical engineers also perform financial management services to centralise and proactively manage technology, maintenance and repair budgets (Dickey, 1995: 3).

1.2.3. Risk

The word “risk” originates from two sources. The Italian word “*risicare*” means “to dare”, and the French word “*risqué*”, meaning “a danger in which there is an element of chance” (Visser, 2012: 355). A risk, as defined by Stoneburner *et al*. (2002: 1), is the net undesirable effect of the exercise of susceptibility, with consideration of its occurrence’s probability and impact. McGregor (2012: 227) defines a risk as an uncertain event or circumstance that would affect achievement of one or more objectives, should it occur. Risk is a degree of probability for an incident to occur (Burt, 2001: 3) against subsequent severity of its adverse effects (Visser, 2012: 355).

Risk management is a method of recognizing a risk, assessing it, and taking steps to reduce it to a tolerable level (Stoneburner, Goguen and Feringa, 2002: 1). Risk management is the process of identifying, analysing and addressing noteworthy risks on a continuous basis (British Columbia Partnership, 2006: 2). A Project Risk Management plan is the process of managing project risks by identifying, quantifying, responding to, and controlling them (Burke, 2011: 369). Risks can transpire at different phases in the overall process of formalizing a PPP agreement (Bracey and Moldovan, 2006: 6). PPP projects, by their nature, are generally large and complex, hence it is impossible to identify every risk related to the project (Devan, 2005: 45). The principle governing risk assignment in PPPs is that risk must be assigned to the party that is most suitable to manage it at the lowest cost, whilst being mindful of public interest (Nyagwachi, 2008: 45).

1.3. STATEMENT OF RESEARCH PROBLEM

Public private partnership concessions have a term of between five and 30 years, typically (National Treasury, 2008). This differs from the traditional procurement project in a way that the project term includes the operational stage of the procured good or service. Also, environments in which PPP projects operate consist of numerous stakeholders that have an input or impact on the project’s performance. A comprehensive feasibility study is required to mitigate this risk. Objectives of the feasibility study include the following: to conduct a

stakeholder analysis; outline the client's needs; project a constraints appraisal; assess other options and alternatives; and conduct a structured cost-benefit analysis (Burke, 2009: 55).

Although private companies accept the risks of PPP projects, they have to convey these risks to the customer in one way or another probably in the form of higher tariffs (Burke, 2011: 345). Delivery of healthcare is changing partly because of shifting patterns of disease and rising public expectations. Also, technological changes in all areas, including medical technologies, have also proceeded, and will continue to proceed at a rapid pace (Kwankam *et al*., 2001: 5). The above is also coupled with the fact that PPPs involve complex procurement methods, are new in South Africa, and up to now, have attracted limited exploration to refine understanding of their operations (Nyagwachi, 2008: iii). In healthcare PPPs the complexity of the PPP concession itself, coupled with technological change and the shifting burden of disease, make it difficult for both partners to cover future contingencies. Currently, healthcare PPP concessions that have reached financial closure, have terms of between 10 and 21 years (National Treasury, 2009), but the rapid pace of technological changes makes it certain that technologies will become obsolete much faster than the concession period (Devan, 2005: 32). This research, therefore, seeks to develop a conceptual framework that will best allocate responsibilities to manage risks pertaining to managing healthcare technologies in a PPP setting.

1.4. RESEARCH OBJECTIVES

A research objective is essentially the expectations that the researcher has of the research that is conducted. This is derived from the problem statement, which should be addressed. This study divided the objective into two categories, namely a primary objective and secondary objectives. The secondary objectives are derived from the primary objective, and are essentially meant to address the primary objective comprehensively.

1.4.1. Primary objective

- To identify parameters for development of a model to effectively manage healthcare PPPs.

1.4.2. Secondary objectives

- To identify risks commonly encountered in healthcare technology relating to Public-Private-Partnerships.
- To determine the impact of risks in the project processes, which are executed as Public-Private-Partnerships.

- To determine a reduced risk systematic responsibilities allocation formula to minimize the impact of Public-Private-Partnership risks.
- To identify a mutual technology and management transfer and sharing model for Public-Private-Partnerships in healthcare.
- To identify and develop structures that will sustain products of the Public-Private-Partnerships when the project is completed.

1.5. RESEARCH QUESTION

The objectives of the research were derived from the problem statement, as they seek to address the problem statement, hence the researcher found a study gap. For the study to be beneficial, specific questions, which relate to the objectives, must be asked. The research questions guide the choice of literature to be reviewed and help to determine answers in the study gap. The research questions are eventually a guide to construct the research tool or methodology. The research questions are closely related to the objectives, as they seek to help to achieve the research objectives. The research questions are divided into two types, namely the main question and the sub-questions.

1.5.1. Main question

- What information is required to develop a working structure that effectively manages Public-Private-Partnerships in healthcare projects?

1.5.2. Sub-questions

- What risks are commonly encountered in healthcare technology operations in Public-Private-Partnerships?
- What is the impact of unmanaged risks in the execution of healthcare in Public-Private-Partnerships?
- What systematic scientific structures may be used for risks and responsibilities in Public-Private-Partnerships' healthcare?
- How can technology and management expertise be effectively shared and transferred to stakeholders in Public-Private-Partnerships' healthcare?
- What operational structures should be modelled to sustainably maintain the benefits of Public-Private-Partnerships' healthcare projects?

1.6. RESEARCH METHODOLOGY

Research methodology comprises methods that are used in a research study to gather related information and data. The subject under study involves dealing with managers, supervisors and others who are involved in policy making in the partnering stakeholders. This requires a

good understanding of the functioning of relations between the two sectors, considering that governments occasionally pass legislation that may regulate the nature of desired relationships. To be able to collect adequate data, the researcher opted to use both quantitative and qualitative research methodologies. Quantitative methods are expected to assist with “descriptive” statistics, which may be easy to quantify. Conversely, many problems or successes of these partnerships concern attitudes and perceptions. This qualitative research hence allows for open discussions with stakeholders.

1.6.1. Target population

The targeted population for this study include those who are involved in policy making and its implementation strategies at all levels of the partnering entity.

1.6.2. Sample and sampling method

The sample population comprised participants from amongst respective stakeholders that are part of partnerships in the healthcare sector. The researcher sought permission from the respective stakeholders for the research, while respondents were randomly selected from those eligible to participate in the research.

1.6.3. Sample size

The researcher gathered informal information, which indicated that healthcare sector personnel involved in PPPs amount to 1191. The researcher considered the cost of obtaining information, and deciding on a number that will allow for generalization. A total of 300 respondents was considered to be adequate for the purposes of generalization, constituting ¼ of the sampling frame.

1.7. DATA COLLECTION INSTRUMENT

The researcher compiled a questionnaire to collect data in a “trial run” with 20 respondents to test the instrument for both validity and reliability. With the assistance of a statistician, the instrument was reconstructed before it was used for the research. The instrument was divided into 3 sections, namely Section A – Biography, Section B – Likert scale, and Section C – open ended questions, which allowed for interaction (qualitative) with the respondents.

1.8. DATA COLLECTION METHOD

Questionnaires (the research instrument) were distributed among the respondents that were randomly selected, while most of the survey was conducted on a one-on-one basis. This allowed for an opportunity to explain certain aspects that the respondents required, allowed for open discussion of the issue, and helped with the response rate.

1.9. DATA ANALYSIS

The data that the researcher collected from 310 questionnaires was edited, coded and captured. Of the 310, 10 were considered inadmissible for the research. This was captured onto an excel spreadsheet (that is what was readily available), which was considered ideal for the research study, allowing for the use of illustrations in the form of graphs, tables, charts, histograms and frequency polygons to determine relationships between the variables. The open-ended section provided information that, to a large extent, was not included in the questionnaire, but considered valuable for the research.

1.10. DELINEATION OR DEMARCATION OF THE RESEARCH

This research was delineated to South African healthcare institutions that have been developed through Public-Private Partnerships. The conceptual framework was constructed within the context of South Africa's demographic limitations.

1.11. SIGNIFICANCE OF THE RESEARCH

Governments are venturing into PPPs to radically improve infrastructure networks in their countries, and to augment service delivery to their communities (Farlam, 2005: 1). Public-Private Partnerships are being accepted by the public sector as tools for service delivery, especially when private partners can provide the public sector with resources that it lacks. Various healthcare delivery projects in South Africa have been identified as possible PPPs. This research, therefore, acts as a guiding tool for the public partner to negotiate the best allocation of healthcare technology management risks in a healthcare development PPP setting.

1.12. ETHICS STATEMENT

The researcher ensured that all ethics issues were addressed in this research study. All the respondents were informed that they had to consent to participate in the research voluntarily, and were assured that their privacy would be respected and protected throughout. The survey was conducted in a responsible manner, and respondents were informed that information collected in this research would not be misused, and that they were allowed to withdraw from the survey at any time if they so wished.

1.13. CHAPTER OUTLINE

This research study comprises of the chapters outlined below.

Chapter One: Introduction and background of the study. This chapter introduced the topic under study, and provided a brief background of the research. It articulated the research

objectives and questions, and presented the environment in which the research would be conducted.

Chapter two: Literature review. In this chapter the researcher presents a detailed review of relevant literature pertaining to the subject of study. The literature review covered the following topics: project management; feasibility study; public private partnerships; healthcare technology management; and risk management.

Chapter three: Sources of conflict in Public-Private Partnership projects. A further literature review was conducted on potential sources of conflicts in Public-Private Partnerships, outlined in this chapter.

Chapter four: Conceptual framework development. Based on the reviewed literature, the researcher developed a conceptual framework that advises on the best allocation of responsibilities for the management of healthcare technology risks in a PPP setting.

Chapter five: Research design and methodology. This chapter outlines procedures that were used to test the conceptual framework. The chapter also included the research study's data collection methods.

Chapter six: Research findings and analysis. This chapter presents a discussion and analysis of the research findings.

Chapter seven: Revision and conclusion. This chapter evaluates the conceptual framework, based on the study's research findings. The chapter concludes the study.

1.14. SUMMARY

This study was chosen more as a pioneer study, since the researcher was involved in the initial stages when the government first began engaging with these arrangements. Of particular interest was that the previous apartheid regime had informal arrangements with some organisations about specific issues, hence there was no well-developed framework that could be used. However, many developing and developed countries have long been involved in providing their citizen with essential services. This afforded the South African government an opportunity to select and study those structures that were considered ideal for the South African government, considering its context. It should be noted that a lot was learnt, and too often there was more material to choose from than what the government could afford. As one of the pilot studies, there are bound to be many varieties and variations. The focus, however, has been largely on pioneer projects in the country, with minimal reference to other models.

CHAPTER 2. LITERATURE REVIEW

2.1. INTRODUCTION

A literature review is defined as a synthesis of secondary literature that relates to the dissertation's research problem (O'Neil, 2010: 1). Reviewing previous pertinent literature is crucial in academic studies, as it forms foundation knowledge advancement (Jokozela, 2012: 5). The funnel method is used to present this chapter (Hofstee, 2006: 96), which starts with a broad-based focus on literature that deals with public private partnerships, project feasibility study, complex projects, and risk management. There is little research material that covers PPPs, particularly for South Africa (Jokozela, 2012: 5). This might be because the PPP procurement method is currently a novel in the South African market, while few PPP projects have reached completion phase.

2.2. PUBLIC PRIVATE PARTNERSHIPS

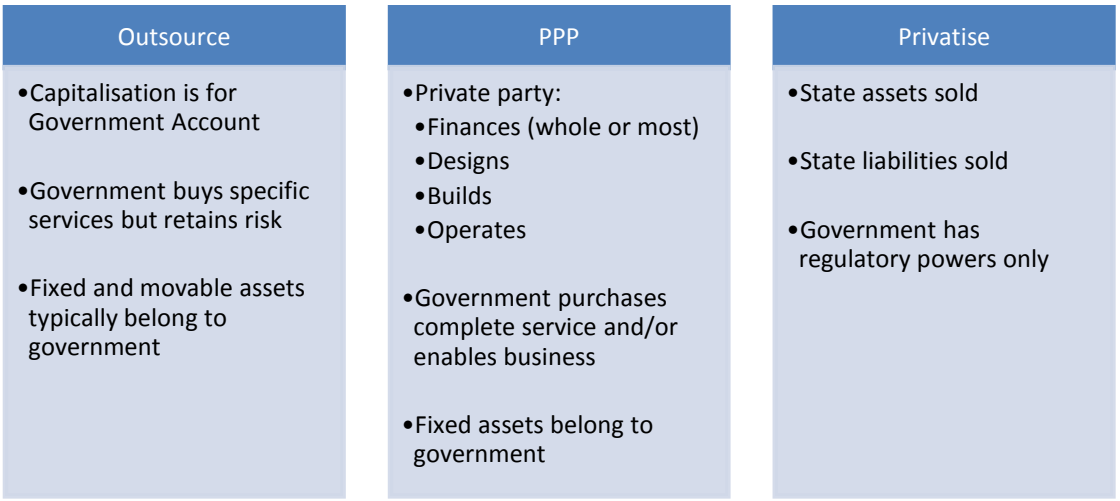
2.2.1. Definition and background of Public-Private Partnerships

The evolution of PPP contracts can be found in concession contracts. These concessions have existed for centuries in sectors like water management (Nyangwachi, 2008: 20). For example, as early as 1438, French aristocrat, Luis de Bernam was approved a river concession to transport goods on the Rhine River (Pandian, Kumar and Nagarajan, 2014: 18). Another significant French water concession was made in 1782, when the Perrier brothers were granted exclusive water distribution rights in Paris for a period of fifteen years (Hanke and Walters, 2011: 34). In the current format, Private Finance Initiatives (PFIs) were formally introduced in the United Kingdom in the early nineties as a means to protect infrastructural investments at a time of tight fiscal constraints (Parker, 2012: 4). Since then significant improvements were made to the policy and legislative framework of public private partnerships in different countries (Zverev, 2012: 1). The emergence of public private partnerships has provided means to develop infrastructure without directly impacting the government's budgetary constraints (Jefferies, Gajendran and Brewer, 2013: 809).

The significant contrast between PPP and conventional procurement is that in a PPP separate arrangements are packaged as one contract, and the private entity is not only appointed to build, but also to provide a stream of infrastructural services over an agreed term (Grimsey and Lewis, 2007: 252). The private contractor must, therefore, provide services and maintain the asset to the same standard for the project lifespan, which is usually between 25 and 30 years (Harris, 2007: 9). Hence, the PPP concept is often confused with proper privatisation. This is because of the shared commonalities between the PPP and privatisation, as the PPP also involves introduction of private sector management of what is traditionally the

government's sole mandate (Burger, 2005). Privatisation can be defined as the transfer of government undertakings into the private sector by partial or full acquisition, or by acquisition of state assets (Ddumba-Ssentamu and Mugume, 2001: 1). Privatisation refers to a private entity, previously and formally owned by the public sector (Jokozela, 2012: 4). PPPs, therefore, occupy a middle ground that is between traditional procurement and privatization (Espigares and Torres, 2009: 5). As Figure 2.1 below shows, in an outsourcing contract the government buys a specific service, retaining all related risks. In privatisation all assets and liabilities are sold to the private sector, and the government only has regulatory powers.

Figure 2.1: Difference between outsourcing, PPP and privatisation



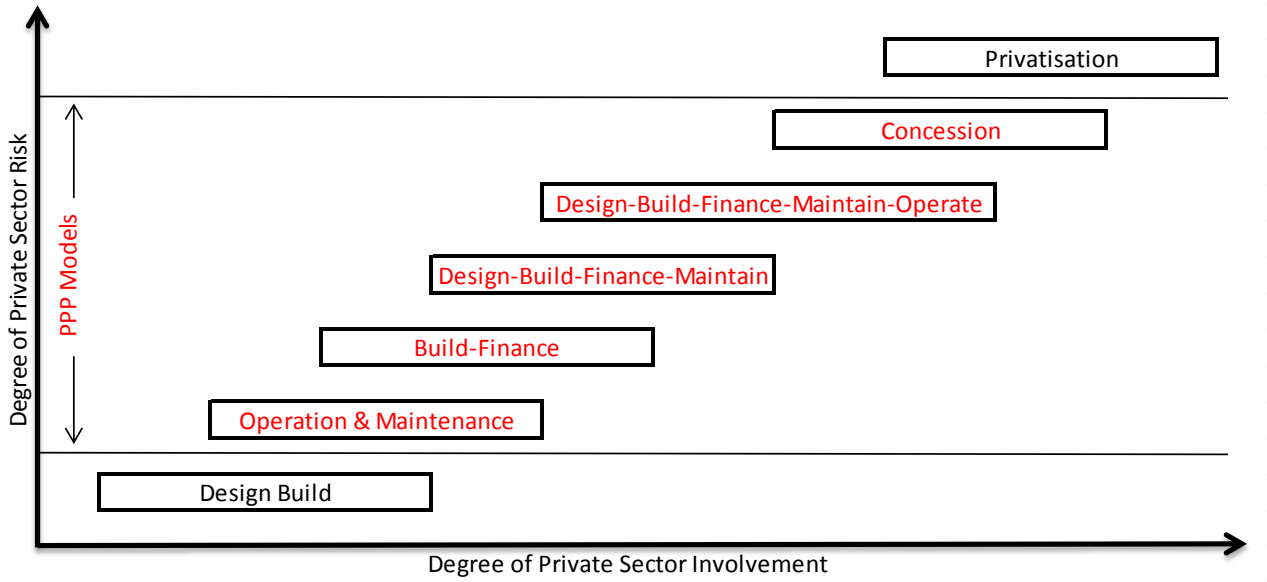
Source: (Adapted from: National Treasury PPP unit)

According to Karim (2011: 8), a PPP is an agreement between the government or a government entity and the private sector for the latter to assume a said service from the former for a fixed period. The aim of a PPP concession is to transfer risks and responsibilities to the private sector to allow public sector to regain efficiency and cost savings (Nikjoo *et al*., 2012: 252). According to Haarhof (2008:2), PPPs have different names across the globe, as they are called Project Finance Initiatives in the United Kingdom, and Privately Financed Projects in Australia. Jefferies *et al.* (2013, 809) describe PPPs as longstanding agreements between public and private sector organizations, used for the provision of infrastructure. PPPs are well-established traditions that provide infrastructure and services to parties that lack the required resources (Forsyth, 2005: 430). Sobhuza (2010:41) concurs and states that PPPs have emerged as a vital model that governments utilise to close infrastructure gaps, as they provide numerous advantages to address infrastructure shortages or to improve the efficiency of government services.

2.2.2. Models of Public Private Partnerships

PPP contracts are developed in a manner that shows the degree of control, participation and responsibility between the two partners. Such arrangements are used in Build Transfer Operate (BTO), Build Operate Transfer (BOT), Build Own Operate Transfer (BOOT), Build Own Operate (BOO) and Design Build Finance Operate (DBFO) agreements (Ntshangase, 2002: 30). There is a selection of models and approaches, which PPPs use (Mitchell, 2008: 8). The key difference between these models is the nature and extent of risk transferred from government to the private sector (Ngcuka, 2010: 108). **Error! Reference source not ound.**Figure 2.2 below shows the Canadian risk transfer model of public infrastructure ranges from a design-build model to complete privatisation (The Canadian Council for Public-Private Partnerships, 1998).

Figure 2.2: Canadian model of PPPs



(Adapted from: Source: http://www.pppcouncil.ca)

The above diagram illustrates models that have been designed in other countries to suit the type of agreements reached between partners there. It is important to note that, as illustrated above, the arrangement should be negotiated between the parties, and may not follow the same pattern in the same country. The mutual relationships and the risks at stake, depending on who needs the other most, may allow for variations.

2.2.2.1. Build Transfer and Operate

The above is a contract, whereby a government facility is built by the private sector as a turnkey project, and is subsequently transferred to the host government before commencement of a separate concession for operations (Maluleka, 2008: 68).

2.2.2.2. Build Operate Transfer

This is a contract, whereby the private sector assumes principal responsibility to finance, design, build and operate a PPP project for a concession term, and thereafter transfer ownership to the government (Binza, 2009: 44).

2.2.2.3. Build Own Operate and Transfer

In this contract a private entity finances, builds, owns and operates a facility for a predetermined term, and at the end of the term the facility is returned to government (Sobhuza, 2010: 44).

2.2.2.4. Build Own Operate

Similar to privatisation in build own operate agreements, the private sector finances, designs, builds, operates and perpetually owns the facility (Binza, 2009: 34).

2.2.2.5. Design Build Finance Operate Transfer

In this model the private sector partner manages all aspects of the project under a contract that defines only the performance objectives, and excludes designs of the project or service.

2.2.2.6. Organisation of PPPs

A public private partnership consists of a public sector agency; and a consortium of private sector institutions comprising of contractors, private investors, maintenance companies, consulting firms and non-governmental organisations (Gupta and Biswas, 2010: 46). This private sector consortium must register an entity, known as a special purpose vehicle (SPV), to raise funds from the investors to deliver the project (Tan, 2012: 3).

2.2.3. South African Government's Public-Private Partnership Perspective

2.2.3.1. Emergence of Public-Private Partnerships in South Africa

The first PPP in South Africa was set in motion in 1995 with the emergence of the Maputo Development Corridor (Söderbaum, 2011: 3). This corridor was a critical project to provide sustainable economic benefits to the two countries involved. A thirty-year concession was reached between the South African and Mozambican governments in partnership with Trans Africa Concessions to build, operate and maintain a 570km two to four lane toll road between Gauteng and Maputo (USAID, 2007: 3). This partnership was entered into in an effort to restore the road link between the two countries economically. This once highly active link between the two countries deteriorated owing to no maintenance during South Africa's economic sanctions period (because of apartheid), and the civil war in Mozambique (FRELIMO government and the rebel group RENAMO). These two factors resulted in the destruction of some of the road sections, and the lack of maintenance over those years (Camane, 2013: 81). The PPP option

was found to be the best, as both countries faced fiscal restrictions, and hence could not finance the project without assistance from the private sector (Farlam, 2005: 9).

In November 2002, Inkosi Albert Luthuli Central Hospital in Durban, KwaZulu-Natal Province, was officially opened as the first healthcare PPP in South Africa (USAID, 2005: 17). According to Haarhof (2008: 77), Inkosi Albert Luthuli Central Hospital is perceived as a pioneer project, as it was the first PPP project to be commissioned under the Public Finance Management Act's (PFMA) regulations that were published in 1999. This 850- bed hospital adopted a model that divides healthcare services into zones of clinical care core functions that are managed according to public health strategies, whilst non-core services are managed by the private partner (Moodley, 2011: 28). A 15 year Design-Finance-Build-Operate and Transfer (DFBOT) contract, worth R4.5 Billion, was awarded to the Impilo Consortium (Pty) Ltd. This enabled the effective transfer of technology and expertise from the private sector to the public sector, and provided much-needed management support for the public's benefit.

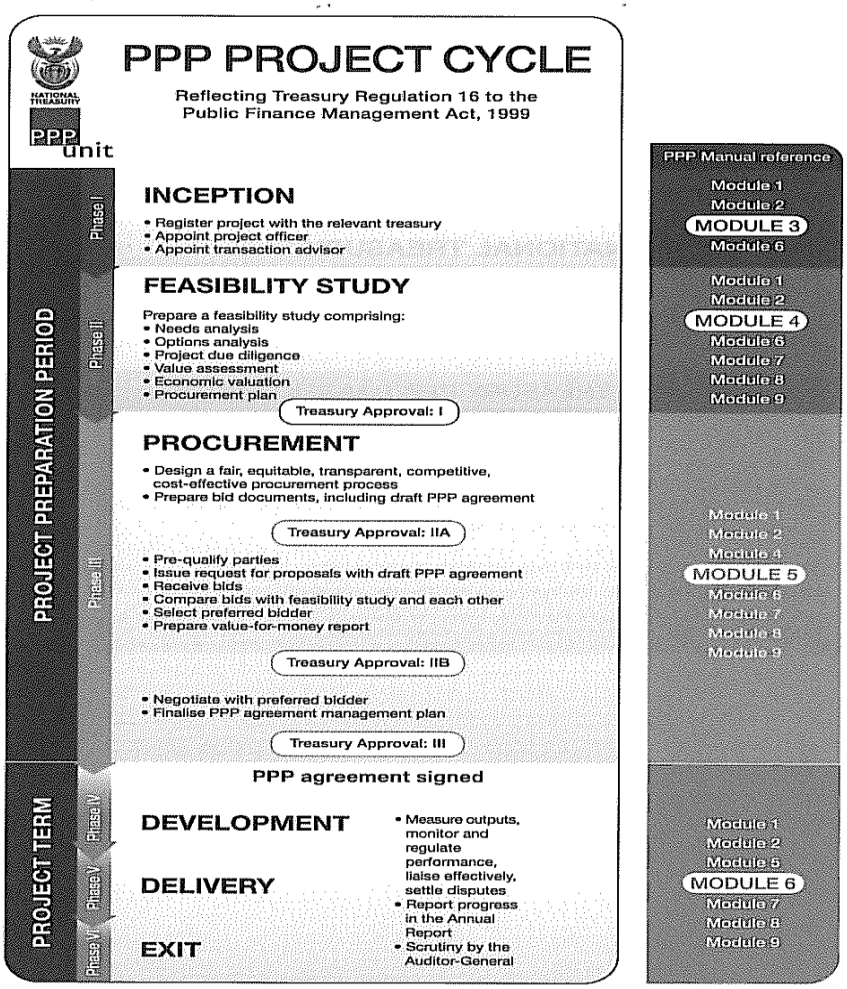
2.2.3.2. Legislative framework that governs PPPs in South Africa

South African law defines a PPP as a contract between a public sector institution or municipality and a private party, in which the private party assumes substantial financial, technical and operational risk in the design, financing, building and operation of a project (National Treasury, n.d.). This is a form of social responsibility on the part of the private company, but is tied to a special and specific project in conjunction with the government.

Public-Private Partnerships are long-standing concessions (mostly between five and thirty years) that are developed to provide well-maintained, cost-effective public infrastructure or services through leveraging private sector expertise, financial resources, and transferring or sharing the risk with the private sector partner.

The private partner's repayment for services can be made by way of unitary payments (public partner directly paying the private partner), by the private partner collecting revenue from the users, or by a hybrid of the two (National Treasury, n.d.). As shown in Figure 2.3 below, the National Treasury recommends that PPP procurement should navigate the inception, feasibility, procurement, delivery, and exit phases. The initial three stages present the pre-contract or preparation period, while the last three stages present the project term (Burger, 2006: 91).

Figure 2.3 PPP Project Phases



(Source: National Treasury PPP Manual)

These different stages feed into each other and comprise the complete process required for partner establishment. The initial stage involves inception of the project; its registration with the Department of Treasury, appointment of the project officer to operate / lead the project, and the appointment of a transaction advisor. Once this stage is established, the programme turns to a feasibility study, and if this is satisfactory, the project cycle proceeds.

2.2.3.3. Feasibility study

The term feasibility study comprises objective and subjective analyses, inclusive of economic and financial projection, legal standing of the proposed project, its environmental impact, and all other project lifecycle aspects (Eriksson, 2005: 28). A feasibility study is an imperative part of the project lifecycle, and conducts an analysis on one or more business cases to determine if the proposal(s) is possible within the terms of reference, and the constraints outlined in the project charter (Burke, 2011: 363). The feasibility study process has the greatest influence on a project's success, because years after its completion, it continues to support or constrain the

project team's response to unforeseen customer needs and expectations (Moshe Safdie & Associates, n.d.: 53).

Massive expenditures on infrastructure projects make feasibility studies compulsory as means to weigh the benefits that these projects offer the economy (Hyari and Kandil, 2009: 66). A detailed cost-benefit-analysis (CBA) report must be conducted, and serves as a base of the project plan (Fourie, 2006: 929). In a South African PPP model, the feasibility study is performed as the second phase of the project lifecycle, subsequent to the inception phase (Hilliard-Thomas, 2009: VI). A feasibility study clarifies the functions of the private party in the concession, and includes analysis of the needs that will be addressed, and the government's options (Burger, 2005: 11). Based on the feasibility study, a decision is made whether to move the project forward to the next phase of the project lifecycle, which is procurement (Ngamlana, 2009: 9).

2.2.3.4. Healthcare infrastructure delivery through PPPs

In terms of personnel, resources and funding the South African public health sector is severely under-resourced compared to private healthcare (Jokozela, 2012: iv). The private healthcare has 80% of the resources that service 20% of the country's population, whereas the 80% population is serviced by 20% of healthcare's resources. This serious imbalance creates serious service delivery problems, resulting in continuous service delivery strikes in the country. Public-private partnerships are now becoming a viable approach to maximise the use of national resources to complement public sector inability to meet those critical expectations. Co-opting the private sector, therefore, increases the pool of resources (for the government), and improves the quality of healthcare delivered to the population (Brey, 2010: 1). Clearly, the government does not seem to have adequate resources (financial and human) to meet the demands of the citizens for equitable healthcare. Jefferies *et al.* (2013: 809) concur with the view that PPPs are increasingly becoming the preferred option for governments to resort to in a bid to deliver social infrastructure, particularly healthcare. Due to confrontations that the South African healthcare environment faces, the government has been forced to invite the private sector to engage in alternate service delivery possibilities (Haarhof, 2008, 74). This might be because the public sector's resources have to be expanded to 80% of the population, whilst the private sector's resources focus on the remaining 20% (Hilliard-Thomas, 2009, 12).

PPPs in the healthcare sector can take a range of forms with differing levels of responsibility and risks shared between partners (Nikoli and Maikisch, 2006: 2). The nature and structure of the partnership depends on what should be done together, and what each part can offer (or is willing to dispense) to implement the project. Different private sector companies focus on different aspects of healthcare, depending on the market's requirements. The range may

involve or be as varied as pharmaceuticals, medical equipment, personnel training, specialist clinicians, and other aspects of health care business. The private sector does everything that the government does, generally, but provides other specialised services not commonly found within public health structures (Espigares and Torres, 2013: 11). It is in these exclusive areas, or areas in which the government may be involved, but may not have adequate capacity, that partnerships are generally formed to complement government resources for the benefit of all citizens. Jokozela (2012: 33) concurs and identifies six types of healthcare PPPs based on their purpose. These are illustrated in Table 2.1 below.

Table 2.1: Models of PPPs in hospital provision

MODEL	DESCRIPTION
Franchising	The public sector contracts a private company to manage the existing hospital – this is intended to obtain private sector skills to provide quality services to citizens.
DBFO (Design, Build, Finance, Operate)	The private company designs, builds, finances and operates the hospital as per its contract with government. – This will complement government resources – generally provided in areas where there is no existing government infrastructure.
BOO (Build, Own, Operate)	The public authority purchases services for a fixed period after which ownership reverts to the provider. It is a form of transference of services or responsibility to the private sector, which will assist government to meet its obligations.
BOOT (Build, Own, Operate, Transfer)	The public authority purchases services for a fixed period after which ownership is transferred to the public sector. Transference from the private to the public sector occurs after establishing the required infrastructure for the service/s.
BOLB (Buy, Own, Lease back)	The private contractor builds the facility, and then leases it back to the public sector. The public sector owns the facility, but leases it to the government to use – often there is skills transfer and training provided to the public sector.

Alzira model	The private contractor builds and operates the hospital on the basis of a contract to provide medical care for a defined population. This allows for citizens' access (generally the poor that cannot afford private sector fees) to private facilities at concessional rates, or agreed-upon service provision.

Source: Adapted from Jokozela (2012:34)

These different forms of partnerships are contextualised in respect of the community's needs, and based on resources that the partners have for the projects. In as much as these may translate into social responsibilities by the private sector, there may have to be a give-and-take agreement to ensure that both parties win. A tax incentive may be a win-win situation for the partnership. In addition, some of the PPP arrangements that may not involve infrastructure, but are important, include product development, improving access to health care products, and education.

- **Product development:** the process of developing products involves extensive research and development studies, which may need financial resources, expert equipment, expert researchers (biochemists, physicists, chemists, and so on) and trials.
- **Improved access to products:** the private sector may have products that citizens need, but these may be expensive. The government and the concerned company may need to reach an agreement involving either the cost of production, or some concession to enable the products to be accessible to the public.
- **Education:** training of clinicians may involve government and the private sector complementing each other by means of bursaries and scholarships, discounted education at private institutions, or subsidised education for clinicians training at private institutions to complement government human resources.

Over and above these, the government may have other needs at provincial levels; hence, the National Treasury empowered the department to become involved with PPPs. This depends on the department's objectives and the needs expressed by communities (necessitated by the ever-changing medical terrain) with new diseases like AIDS, Ebola, Asian flu, and others. The research and development of these, largely determined by their potency and impact on the citizens, may encourage the department to enter into PPPs to help curb the effects of these diseases. The government has a constitutional mandate to meet these requirements, and the politicians would also strive to reach these standards for them to be re-elected into office.

Failure to satisfy these needs, apart from the political fallout, may result in higher costs for the government that has sick citizens, high death rates, and work absenteeism (which affects both private and public sectors), reducing productivity, whilst becoming an unbearable cost for the economy. It is, therefore, in the interest of both government and the private sector to prevent these catastrophic risks.

2.3. COMPLEX PROJECTS

The nature of the PPP is also determined by the complexity of the project, as alluded to earlier in the literature review. A project is any undertaking that has been designed with the understanding that it has a start and end date. It is expected to have clearly designed deliverables measured or structured around the objectives for which the endeavour is planned (Steyn, Micheal, du Plessis, Kruger, Kushke, Sparrius and van Eck; Visser, 2012: 3). The duration of the project is a matter decided on by the partners against the stated deliverables, which are the summation of a series of tasks (Clements and Gido, 2009: 4). A project is, therefore, a one-time activity, which is defined by what should be achieved, and it has a life cycle comprising four stages, regardless of the size of the project in question (Devan, 2005: 17). The project execution lifecycle normally passes through four phases consecutively, namely definition, planning, execution, and delivery (Gray and Erik, 2008: 6).

It may be necessary to differentiate here between project execution success and project success, which is critical for PPPs.

It is imperative that both the implementation and objectives should be successful if the PPP should benefit the citizens, for whom it was intended. When an organisation identifies an opportunity, it authorizes a feasibility study to decide if it should undertake the project (PMBOK, 2000: 12). It is clear, therefore, that the undertaking (project) needs a thorough feasibility study to allow for a reduction in the risk of failure, of both the execution and the benefit to the community for whom it is intended. It goes without saying, therefore, that the more complex the project is, the more information is needed about the project. The feasibility will be equally long and exhaustive; defining the project will be demanding; the planning should be meticulous; execution will need expertise in both hard and soft skills; and the project charter will require proper attention, should the resources be properly utilised.

2.3.1. Project complexity

Complexity is defined as consisting of many different but related components or parts in the form of tasks, which are intricately combined upon completion of the execution process (Baccarini, 1996: 201). Complexity in a system is a direct function of the different components, which need to fit together to produce the intended (complete) project. The system comprises

numerous work breakdown structures (WBSs), which are operated and executed separately, but are interrelated with the other components to make up one complete system (Whitty and Maylor, 2008: 306). Though the system comprises these different structures, seemingly unknown units to each other, Sussman (2000:5) posits that in the complex system the degree and nature of the relationships of the units are not well known. This emanates from the different WBSs and the divergent specialisations required to assemble those units, which will be combined. Senge (2004:56) categorises complexity into two forms, namely detailed complexities and dynamic complexities.

- **Detailed complexities:** complex projects tend to have many variables, which need to be considered, as they may be interrelated and correlated with some of them following each other (sequentially), whereas others may be carried out simultaneously. Those relationships need to be identified, defined, evaluated for risk, and managed to avoid project failure.
- **Dynamic complexities:** some complex projects have dependable variables, which are affected by occurrences of certain phenomenon, thus causing (or not causing) unpredictable alterations to the existing phenomenon. Such complexities are likely to increase failure risk, and thus require thorough investigation by means of a feasibility study. Some of the complexities may be time dependent and may need speedy action before anything happens or delays to allow certain things to happen to avoid problems.

Project complexity can be defined as containing many diverse interconnected portions that can be operationalized in terms of distinction and interdependency (Baccarini, 1996:202). They are further characterised by a degree of disorder, volatility, evolving decision-making, non-linear processes, iterative planning and design, ambiguity, indiscretion, and unpredictability (Shane, Strong and Gransberg, 2012: 2). Many of these complex projects are obstructed or fail because they do not manifestly define technical and organizational boundaries (Meier, 2013: 27). Large, complex and long projects suffer from requirements volatility (Lane and Woodman, 2006: 2). In order to ensure proper organisation of resources, inclusive of labour and materials, substantial management structures are required for large and complex projects (Galway, 2004: 8). Wideman (1990: 5) concurs that effective management of the project, therefore, becomes proportionally significant to its size and complexity.

A project charter, terms of reference, or project mission is a tightly articulated document, delineating what should be done within the limitations of the project (Burke, 2007: 117). The project charter is developed from the project scope (Gray and Larson, 2008: 92), which outlines what is expected of the project, and defines the deliverables. If the project charter is articulated clearly and properly, the project will be planned and executed effectively and efficiently. Project

scope management can be further sub-divided into its finer components, which include project initiation, scope planning, scope definition, scope verification, and scope change control (Khan, 2006: 12). The scope is then subdivided into manageable work packages called work breakdown structures that can be estimated, planned and assigned to a responsible person (Burke, 2007: 129). Work breakdown structures are common ways to depict a nested system of hierarchies, formally breaking down the activities in a project into manageable chunks (Remington and Pollack, 2006: 4). These components are generally managed by specialists within the discipline even though technical qualifications are not a given assurance of the operation's success. This process can, therefore, assist to reduce the detailed complexity of the project, make the tasks easier to comprehend and, therefore, easier to manage.

Unmanageability of projects can also stem from uncertainty; uncertainty is the gap between the information required to build a technical system, and the information available in the project organisation to do so (Leijten, 2009: 2). Project uncertainty renders the project more complex to manage, because the suitable means, methods, and capabilities to be deployed in the project are not always well known at the start of the project work (Lebcir and Choudrie, 2011: 478). Uncertainty is a fundamental characteristic for all complex projects; a high level of uncertainty is an indication of dynamically complex projects (Whitty and Maylor, 2008: 309). For managers to survive complex projects successfully, they must embrace a pluralistic method of management. Managers of complex projects are further encouraged to adopt diverse management tools and ways of thinking, and develop their personal pattern and methods in line with each project's requirements (Remington and Pollack, 2006: 2). Effective management of a project goes beyond expectation of the technical skills (hard skills), as demonstrated by the high failure rate of project executions that technically skilled people manage. The need for soft skills is critical to execute the project correctly, effectively and efficiently.

It can be deduced that complex projects might contain either detailed or dynamic complexities, or both. In the South African context, the legislative framework and the project scope can be described as detailed complexities, whilst technology changes, the burden of disease, the length of concessions, and the socio economic environment can be described as dynamic complexities in healthcare PPPs. Haarhof (2009: 9) recommends a more refined and contextualised approach to procurement of PPPs. This is necessary to minimise the risk that may result in failed project execution management, and the reasons why the project is designed in the first place.

2.4. RISK IN PPPS

The word “risk” has two origins. The French word “risqué” means “a danger in which there is an element of chance”, and the Italian word “risicare” means “to dare”. Visser (2012: 355) defines a risk as an effort to work out or try to measure the probability and possible severity of the impact of an event. Stoneburner *et al.* (2002: 1) define risk as the net negative impact that may result from an exercise of vulnerability of a system, based on the probability of the event taking place, and the extent to which it may have a negative effect. The occurrence is estimated and projected, while careful consideration is taken and none of the fears are assured, except that they are anticipated in the event of certain things taking place. Risks are about uncertainties that create anxiety (McGregor, 2012: 227), based on the anticipation that the uncertain events or sets of circumstances, if they occur, will affect the planned programme. This determines the success or failure of any undertaking, especially where preventive measures could have been resorted to, should these have been foreseen and planned for (Lee, Lee and Lee, 2010: 53). The ability to identify or foresee likely risks, too often based on experience, enables project practitioners to calculate the cost, risk-quantification (Burt, 2001: 3). This could be measured in different forms, including, among others, the time, magnitude, operational limitations, likely changes, new technologies, resource shortages or partner conflicts (Benta, Podean and Mircean, 2011: 142). All these make the management of risk critically important when PPPs are formed, as each party (especially the private sector) focuses more on efficiencies than on anything else. If risks are appropriately identified and planned, then it will be easier to pre-empt related problems and issues such as cost overruns, whilst allowing for maximisation of resources usage, benefitting the partnership, as set out in the founding objectives (Joosub, 2006: 10).

Recent extreme weather events, acts of terrorism, and the global financial crisis have amplified the importance of risks and their management (Hopkin, 2012: 2). Hence, risk, whilst predictable, has many other aspects beyond the government and private sector’s knowledge, and these are referred to in insurance as “Acts of God”.

2.4.1. Risk management

To plan for the effective management of the risk, practitioners should understand the nature of the risk, the likely impact, the alternatives (if any), and how this can be avoided, where possible. Only at this point (Collier, 2009: 6) can the practitioners plan with higher degrees of certainty to avert or reduce the risk’s impact. Because risk management concerns risk identification, and then planning to manage or prevent it, Devan (2005:4) posits that the issues around the perceived risk must be calculated meticulously, and all necessary precautions put in place.

Hopkin (2012: 4) opines that risk is not a one-time-event, but that it occurs at different levels or stages in the project, including when the PPP agreement is formulated. Hence, special care should be taken of the way that the agreement is structured with a clear understanding of what each stakeholder's interest is in the project that is undertaken (Bracey and Moldovan, 2006: 6). The partnership should be in agreement from the onset as to what constitutes a risk, and how the risk should be managed in future. Failure to solve this at this level may manifest itself as another risk (conflict) in future processes. Risk management in PPP contracts requires proper risk anticipation, planning and addressing during the planning stages, while sincerity and openness should be practiced, and everything agreed upon should be documented for future reference (Sedisa, 2008: 106). PPPs involve collaboration, and this should be seen throughout all stages of the relationship between the partners.

2.4.1.1. Risk identification

A detailed risk description is critical for the risk to be identified, and so that its ownership or responsibility is clearly understood (Hopkin, 2012: 16). This process can be initiated with a broader view demonstrated by the question: how can the resources or earning capacity of the enterprise be threatened (Dickson, 1995: 75)? Before conducting a risk identification process, it is important to define the limits, objectives and scope of the activity under examination (Boubala, 2010: 36). PPP participants observe the risks in different phases of the project, namely conception, inception, design, construction, commissioning, operations and termination (Burt, 2001: 24). In South Africa, PPPs' risk assessment and transfer take place; however, owing to a lack of proficiency, these risks are not conceptualised appropriately (Nel, 2013: 365). In the course of time these may become areas of concern and eventually conflict, depending on what the private company receives from the partnership.

2.4.1.2. Risk assessment

Subsequent to risk identification, its impact on operations should be measured (Dickson, 1995: 76). This should enable the parties to have a better understanding of uncontrolled levels at which the risk may be highest, and plan to prevent, confront or minimise the risk and, by implication, the impact of all identified risks (Hopkin, 2012: 17). The objective of risk assessment is to divide risks into priorities that contribute to the development of a risk management strategy (Boubala, 2010: 15). Mathematical risk calculations are used as foundation for risk management theories (Bourne, 2005: 46). The basic principle of effective and efficient management is that parties should be able to measure and quantify the risks, because failure to measure the risk may mean that it may be difficult to manage it.

2.4.1.3. Risk allocation

Risk allocation is one of the critical aspects for effective risk management, specifically in the PPPs (Karim, 2011: 13), where the purpose is to share these responsibilities and risks. Effective risk allocation is regarded as a crucial aspect to accomplish PPP procurement projects, primarily because it helps the government to bridge gaps in its inefficiencies (Li *et al*., 2005: 461). In PPP projects, each identified risk is assigned to the party best suited to carry out or perform the duties and responsibilities, as required by the PPP arrangement (Burger, 2006: 2). Any PPP endeavour must display a value for money (VFM) for expenditure by the public sector (Espigares and Torres, 2009: 13). Optimal transfer of risk to the private sector will, therefore, create the best value for money for the government (Zittlau, 2003: 15), and this will mean more money available to the government for other service delivery projects. In South Africa the Treasury Department uses the demonstration of affordability and value for money as determining factors for PPP approval (Minnie, 2011: 109).

In PPPs, risk allocation refers to a primary measure of assignment between the project‘s direct participants, namely between the public and private sector (Karim, 2011: 8). When structured properly, PPPs have a capability to deliver value for money (Nyagwachi, 2008: 45).

CHAPTER 3. SOURCES OF CONFLICT IN PUBLIC PRIVATE PARTNERSHIPS

3.1. INTRODUCTION

The word conflict is derived from the Latin word “configure”, meaning striking together, simultaneously trying to occupy the same place. It is expected that conflict may occur in a bodily space when two or more opposing forces intend to occupy the same space at the same time (Salleh and Adulpakdee, 2012: 1). In a contemporary environment conflict refers to two or more forces / parties, which are incompatible and oppose each other for control of the other. Too often it is associated with antagonism towards each other (Fisher, 2000: 1), which may cause discomfort to each other. The conflict is generally based on beliefs and attitudes towards a particular view, values about certain things, or disagreements as a result of individual interests amongst the warring parties. Conflicts amongst business partners (PPPs) will result in possible delays, if not operational disruptions, which is a risk. Van Tonder *et al.* (2008: 373) mention that major change and continued turbulence in social, political, technological, and economic environments, as sources of uncertain and complex environments, may lead to conflict. Practitioners may also perceive uncertainties, disagreements and resource constraints as sources of conflict (Talmaciu and Maracine, 2010: 1). Practitioners in the same organisation may well engage in dysfunctional conflict, which can be a serious risk for operations.

A public-private partnerships is a system of agreement between government and private entities in which services of public benefit are undertaken by a private partner (Montagu and Harding, 2012: 15). The PPPs enter into this contract with the intention to assist the government in its endeavours to uplift or provide services to citizens. Williams (2010: 3) says that PPPs should be considered as an arrangement of roles and responsibilities in which the government enters into an operational contract with one or more private sector entities to provide a particular service. The joint pursuit is intended to be complementary to the different entities, possibly by way of a symbiotic relationship. The presence of common objectives and the overarching nature of the resource sharing brings about the required synergy to work together to achieve the common objectives.

In PPP programmes, the government generally requests private entities to bring their resources to execute public projects. Depending on the nature of the project, where the profits accrue, they may be shared between the different parties, much like the responsibilities, roles and risks are shared (Rahman, Memon and Zulkiffli, 2014: 238).Whilst public-private partnerships have been in existence for centuries, their numbers have significantly increased only in the past few decades (Ruuska and Teigland, 2009: 324). Seemingly, worldwide population growth has placed pressure on governments to provide much-needed services. This, compounded by technological advances, generally emanating from the private sector,

means that government operational systems are under heavy constraints to keep abreast. The most convenient way for government to do this is by way of PPPs, in which case technology and expertise may be transferred.

The need for public-private partnerships arose against the backdrop of inadequacies on the part of the public sector to provide public good on their own, in an efficient and effective manner, owing to a lack of resources and management skills (Nishtar, 2004:23). While PPPs can provide a mechanism to exploit comparative advantages of public and private sectors in mutually supportive ways, several issues are salient and deserve careful consideration when contemplating a PPP (Jamali, 2004: 419). From a public partner's perspective, it would be prudent to investigate in advance all these salient issues before embarking on a partnership. This is further supported by the fact that PPPs are complicated contracts that often differ significantly from project to project, and from country to country, based on the government's legislative framework (Istrate and Puentes, 2011: 2).

Hence, it would be wise to first determine a partnership from a general perspective. Brinkerhoff (2002: 21) defines a partnership as a dynamic relationship among diverse actors, based on mutually agreed-upon objectives. These objectives should be pursued through a shared understanding of the most rational division of resources, based on advantages provided by and sought by each party within the agreement. Partnerships in public health are committed to the creation of social value, especially for disadvantaged populations (Reich, 2000: 618). A variety of factors may influence the success of a PPP project. Darvish, Zou and Zhang (2006: 4) postulate that the following factors should be considered during the formation of PPPs.

- Transparency of the process: the contracting partners should be transparent with each other – too many salient features tend to be left unattended. These always find a way of emerging at awkward times, causing distrust, which may spoil the working relationship. There will be no substitute for honesty when parties come together to meet the same objectives.
- Competitiveness of the bids: considering the objectives for the partnership, it is best that the parties seek the best benefits for themselves, and state them upfront to avoid future changes and suspicions. If a prospective partner is not comfortable, it is best that they do not enter into a bid (partnership) that they doubt. The government should select partnerships with private companies that provide them with the best fit-for-purpose partnership.
- Developer's return commensurate with risks: if the risk is higher than the return on the investment in the project, the likelihood is that the partner with the raw deal may not

cooperate fully, and commit to the project. This only serves to emphasise the importance of the feasibility study at the beginning of the parties' relationship.

- Credit enhancements: a partnership should allow for the growth and development of both private and public enterprises in this symbiotic relationship. If there is a future for both entities post project delivery, there should be a realisation that the operations should benefit and grow both parties in their respective ways.
- Effective procurement: procurement is a critical element in all such operations, as it impacts directly on the cost of putting the project together. From the Statement of Requirements (SOR) identification stage, proper planning on procurement methods, risk calculation and allocation of the role and responsibilities should be established to avoid evitable cost overruns.
- Appropriate risk management: as alluded to above, risk should be managed at every stage in the process of coming together and eventually executing the project. Proper feasibility studies, project charter construction, clearly defined project scope, well understood and agreed upon roles and responsibilities, as well as the risk allocation, must be done before the project begins. Possible conflict areas should also be identified and discussed in advance to pre-empt any surprises when misunderstandings, hitherto unexpected, suddenly surface.
- Government guarantees: whatever guarantees the government may provide to the other parties should be legal, and clearly understood. Private sector practitioners should understand that governments can only work within legislative frameworks; in this case under the custodianship of the National Treasury. The agreements entered into should speak to these expectations, as promulgated by parliament, and an understanding of these may become the guarantee that the private sector partners require.
- Stable policy regime: the government's stability and the ability of the executive to maintain consistency in policy making and implementation is important for the private sector partners. Some forms of governance made create instability, leading to changes in legislation too frequently, and thereby altering the terms and conditions under which certain contracts are entered into. A stable political climate may be a strong indication of the likelihood of stable legislative frameworks.
- Favourable economic conditions: the country's economic conditions will affect both government and private sector partners, since income tends to be low when the economy is not doing well. The government collects revenue in the form of taxes from private companies and citizens, and the companies themselves get their business from the citizens and/or the government. A slump in economic activities, therefore, affects

both parties in the partnership – the economic environment must be ideal if money is needed to finance the project.

- Reliable consortium with strong technical strength: in most instances the government may have the money (perhaps not all the money that is required), but not the technical expertise. The industry generally has the expertise, hence the public sector will partner to help with transference of that technical know-how from the private sector. It is important, therefore, for the government to seek private sector partners that have the requisite technical skills for the project, and required services for the community.
- Collaboration: partnership is about collaboration and, as stated earlier, the collaboration should be complementary and symbiotic if it is to last for long and deliver on the objectives effectively. The easiest way for a PPP to fail is when there is a predatory relationship between the partners, where one partner feeds on the welfare of the other, often to their demise. Collaboration works towards maintaining a win-win situation for both partners.
- Reputation, trust and motivation: it is also important that the partnership should consider the reputation of the entities that they partner – be they government or private sector. If an entity cannot be trusted, it is extremely difficult to commit one's resources when there are glaring doubts about the other partner's faithfulness. The presence of a record of trustworthiness may serve as a motivating factor for the betterment of the collaboration and partnership.

Ho and Tsui (2009: 2) observe that PPP governance is a thought-provoking task, because these involve unique associations between public and private parties, along with complex financing issues. Jamali (2004: 419) concurs, and further recommends that in a PPP setting, the respective partner roles must be neither antagonistic nor identical, but rather complimentary. Ontological uncertainties like burden of disease exacerbate the dynamic complexities of healthcare PPPs.

3.2. PERFORMANCE SPECIFICATIONS, RESOURCE IMPLICATIONS AND QUALITY OF SERVICES

One of the risks that can be identified in healthcare PPPs is a possible lack of integration between the clinical models of care, and the infrastructure and equipment that should support the clinical models, making it hard to align incentives between the parties involved to achieve high performance (Visconti, 2014: 4). Mainly owing to technology, better information, regulations and reimbursement systems, there has been an increase in the rate of medical device changes (Montagu and Harding, 2012: 17). Performance measurement is easier in infrastructure PPPs like power, water, and road access, but it is cumbrous in healthcare

services because of the difficulty to structure the observation of the patient's condition, co-morbidities and patient characteristics (Montagu and Harding, 2012: 16). This happens whilst the failure of most PPP projects is credited to vague performance measures or contract requirements, or a later shift in the requirements (Hanson and Skjutar, 2010: 30).

Cautious reflection and accurate description of the partnership's objectives, transparent mapping of all costs, distinct margins, quantifiable output performances and transparency, as well as an appropriately designed legal framework, are some of the aspects that should be negotiated as early as project initiation (Jamali, 2004: 421).

3.3. PROJECT LEADERSHIP

Leadership involves the process or activities and behaviours, which influence other people, individuals or groups towards achieving common goals (Nauman and Khan, 2011: 2). The process involves the development of a clear path and direction that should be followed by people with expectations in agreement with the individual influencing them (Verma and Wideman, 1994: 2). There are as many definitions for leadership as there are people trying to define the concept of leadership itself, but the fact that leadership involves people, is important (Turner and Muller, 2005:31). Because leadership involves people leading and others following, it may also be important to state that leadership involves forming relationships of trust between the respective parties, as they strive to achieve common objectives (Xiong, 2008: 14). Leaders, as individuals would generally have cognitive, as well as cachectic functions.

- **Cognitive functions** – are those aspects of the leader's personality that enable them to guide, direct, and take others (people) with them towards a goal or vision.
- **Cachectic functions** – are those aspects of an individual that refer to emotions and dedication or commitment towards undertakings, which may draw other people with them.

Effective project leaders are capable of articulating an inspiring project vision, and build an appropriate project spirit or spark aligned with project strategy, which creates energy, excitement and commitment among the project team to perform efficiently to ensure project success (Ahmed, Azmi and Masood, 2013: 48). The effectiveness of a leader goes beyond technical expertise, and includes the ability to convince people to complete their tasks. In almost all projects there are technically orientated people who would know what should be done, while the leader serves the purpose of making them do the tasks with little pressure. Even though both leader and manager may sit at the helm of an organisation, the two are not the same thing, as there is a difference between leader and manager. Jowah (2013:97-108) posits that effective leadership is a direct result of effective followership, and that leaders have

followers, while managers have subordinates. This means that managers tend to use legitimate power (authority) to get things done, whereas leaders use expert or referral power to get things done. Power can be defined as the ability to influence, in which case leaders use influence (relationships) to get things done.

3.3.1. Project management and project leadership

Like in many other industries, the terms management and leadership are frequently used interchangeably in project management, albeit that they are different. Management is the performance of a series of activities that are meant to allow for the maintenance of a stable environment, where individuals in an organisation (formal or informal) work together towards effectively and efficiently to achieve their goals (Weihrich, 1993:1). This implies that the function of the manager has more to do with keeping order in the system, and making sure that nothing goes wrong according to the organisation's policies and regulations. Cieslinska (2007: 4) says that a manager is an individual whose function is to maintain order whilst working towards the fulfilment of organisational goals through the proper use (efficiency) of available resources. Managers spend time planning for the resources, and controlling whatever may go wrong or may likely go wrong. Management concerns monitoring the efficient use of resources, allocation of resources and making decisions that will allow the status quo to be maintained, whilst finding ways to motivate subordinates to perform (Gonos and Gallo, 2013: 160). If managers fail to get people to comply, they can use the organisation's policies and regulations to compel them to do so. Thus, managers are figureheads that control units, and maintain contacts between lower and higher stakeholders within the system. Their time is spent negotiating, controlling, disseminating information, correcting wrongs, and maintaining workflows by directing subordinates in terms of what they should do and how they should do it (Hales, 1986: 95).

Project management is an initiative management method that not only focuses on prototype creation, but also on individual expertise that may be required from across departmental boundaries (Gillard, 2009: 724). In this way project managers are accountable for the integration of assigned resources to complete the project according to plan (Gray & Larson: 2008: 316). Over and above efficient administrative skills and technical know-how, effective and successful project managers must further practice an appropriate leadership style (Burke: 2009: 330). Leadership is a dynamic mode of persuasion that organisations use to obtain their objectives (Gonos and Gallo, 2013:160). Sharma and Jain (2013: 310) concur, and define leadership as a method whereby an individual influences others to achieve an objective, whilst guiding the organisation to become more cohesive and coherent. A leader selects, equips, trains, and influences followers with different competencies and skills by directing them

towards the organisation's vision and mission (Hales, 1986:95). Leaders use their own personal attributes to attract followers, and this attraction becomes their power base for cooperation. Followers comply willingly and are motivated and enthusiastic about their response to the influence, and strive to achieve the organisation's mission and objectives (Wilson and Patterson, 2006:7).

3.3.2. Project leadership in PPPs

The World Economic Forum (2013: 23) notes that the one major risk to the welfare of a PPP in its infancy is the lack of attentive and consistent guidance. Because of the nature of the collaboration, there is a need for direct involvement from senior politicians and government sponsors. It is important for political leadership to support the PPPs' initiatives, and they should educate the public about active and prospective PPP initiatives (Sedisa, 2008:116). Senior management or stakeholder support has a tendency to galvanise and mobilise enthusiasm amongst the followers. A leadership that portrays moral values and honesty is a deterrent to possible unwanted malpractices at lower levels. Therefore, visible leadership may pre-empt the emergence of ills such as corruption, nepotism, inefficiency, poor coordination, lack of accountability, and abuse of power and public resources, which are known to be the main causes of PPP failures (Mu, 2008:13). These thrive well where there is no clearly displayed honesty and integrity for the followers to emulate. Many practitioners quickly identify opportunities for self-enrichment, and this is a serious risk that must be managed from the onset by pre-empting any possible occurrences. Mitchell (2007: 13) also lists insufficient institutional capacity to manage and maximise potential of the partnership arrangement as a source of failure. Thus, the risks that should be managed are many and are found at every stage; good leadership will, therefore, be able to identify these, and the possibility of these happening during the initial stages of project planning.

Jamali (2004: 421) mentions that long-term planning horizon, complex projects, institutionalised competition rules, change in position of partners, and cultural differences between the partners are underlying factors that cause conflict in PPPs. From the government's perspective, a successful PPP is one that provides services that the government needs, offers value for money measured against public service provision, and complies with set standards for good governance. Mamun *et al*. (2013:421) list the following as crucial in this regard: transparent and competitive procurement; fiscal prudency; and compliance with legal and regulatory regimes that apply to the industry in which the PPP exists. Furthermore, workable partnerships require a well-defined governance structure to be established to allow for the distribution of responsibilities to all the players (Nishtar, 2004: 7).

3.4. PROJECT UNCERTAINTIES AND RISK ALLOCATION

3.4.1. Project uncertainties

PPPs are long-term contracts, involve large upfront specific investments, and a level of uncertainty that is bigger than most ordinary contracts (Athias, 2007: 8). Boussabaine (2014: 34) states that PPPs have both epistemic and ontological uncertainties that can be sourced from uncertainty of information and descriptions, uncertainty about abstraction and interpretation, uncertainty associated with complexity, and uncertainty associated with a lack of knowledge and trust. These uncertainties may cause ambiguous risk sharing between the partners, which may lead to operational disputes (Acerete, Stafford and Stapleton, 2013: 24).

In other projects consequences of epistemic uncertainties were evidenced in the London Underground Tunnel PPP, where a complete lack of information on the condition of the tunnels made both the public and private sectors unable to estimate the cost of future maintenance and upgrades, exposing them to risk of cost overruns (Hallikeri, 2012:8).

As most hospital PPPs receive their income from government through unitary fees, the risk of hospital PPP success is often owing to uncertainty about long term compliance with payment commitments than market demand predictions (Montagu and Harding, 2012:16). This means that the government retains the risk of change in demographics and the burden of disease. A case experience of overlooking population uncertainties was the Brampton Civic Hospital project in Canada. A lack of sufficient flexibility in addressing population growth, changes in capital cost estimates, failure to transfer risk, and building alterations to incorporate new technologies caused the project to experience major delays (Barrows *et al*., 2012: 12).

3.4.2. Project risks

There are various risks associated with PPPs. These risks differ with the PPP project development trajectory from the planning phase through to design, construction and operations (Li, Akintoye and Hardcastle, 2001: 897). The best way to manage PPP risks is through clear and well considered division of roles between the partners (Nikolic and Maikisch, 2006: 6). With each risk borne by the partner that is best able to manage it, a PPP can be an instrument that government uses in its quest for efficiency owing to it being built on the assumption of the proper sharing of risks (Alfen *et al*., 2009: 23). Risk transfer occupies the heart of designing a successful PPP, while failure to strike a well-balanced risk transfer may result in increased costs and failure to achieve project objectives by one or both partners.

3.5. PROJECT COSTS

3.5.1. Transaction and lead costs

Higher efficiency caused by effective resource utilisation is predominantly emphasised in PPPs. This is subjectively done at the understatement of transaction costs that are generally embedded in PPP projects (Ho and Tsui, 2009: 2). Transaction costs are the ex-ante costs of drafting, negotiating and safeguarding an agreement, especially, the ex-post costs of maladaptation and adjustment that arise when contract execution is misaligned as a result of gaps, errors, omissions and unanticipated disturbances (Herpen, 2002: 8).

In the PPP context, transaction costs entail the costs of setting-up and maintaining a partnership; more explicitly, they incorporate legal, financial, and technical advisory costs that both the public and private sectors acquire in the procurement and operational phases of the project (Dudkin and Valila, 2005: 3). Financial and economic rewards of PPPs are inexact and subject to deliberation; furthermore, some of the PPP projects do not yield any value for money at all (Hanson and Skjutar, 2010: 5).

3.5.2. Value for money

A realisation of value for money is the main objective of acquiring public projects through public-private partnerships (Jakutyte, 2012:14). This implies that government can enter into a PPP concession, provided that the private sector can realize equivalent or better levels of service with lesser costs than traditional public sector delivery (Posner, Ryu and Tkachenko, 2009: 3).

Value for money valuation, although broadly utilised worldwide, its use is still questionable owing to shortcomings, as shown in its literature, as it deliberates mostly on the financial aspects with less focus on bids evaluation methods (Takim, Ismai and Nawawi, 2011:1). This, therefore, causes vagueness in the value for money analysis process, and, as a result, other forces rather than value for money end up dictating the choice between a PPP and traditional procurement (Burger and Hawkesworth, 2011: 2). This would imply that other critical elements that advise around the choice of a procurement option may be overlooked because VfM is the main determinant.

3.5.3. Cost of healthcare PPPs

PPPs in healthcare differ from ordinary infrastructure projects mainly because private income generation is usually small; consequently, they need on-going payments from the government (Barlow, Roehrich and Wright, 2013:150).

3.6. INTERNATIONAL CASE STUDY OF PPP CONFLICT (THE CROSS CITY TUNNEL IN SYDNEY, AUSTRALIA)

The Cross City Tunnel (CCT) in Sydney, Australia, has been a fairly remarkable failure as a Public Private Partnership concession (Phibbs, 2008: 364). It was built under the centre of Sydney, subsequent to a bidding process to find a private partner to fund, build and operate it (Haughton and Mcmanus, 2012: 90). The aim of the Cross City Tunnel was to lessen traffic congestion in Central Sydney, and to thereby improve eco-friendliness in the central business district (Chan *et al*., 2008:70).

The technical specifications of the project described it as involving the financing, construction, operation and maintenance of two 2.1 km road underpasses, as well as financing, designing, and constructing linked improvements to surface roads, including new bus and bicycle lanes, intersection improvements, traffic calming measures, wider footpaths and other improvements of pedestrian facilities to take advantage of the opportunities as a result of reduced traffic congestion (Road and Traffic Authority NSW, 2005b). The idea of an underground tunnel was first mooted in 1991, while subsequent project feasibility studies were conducted in 1998, and the tunnel was opened in 2005 (Phibbs, 2008: 446). The tunnel cost just under 900 Million Australian dollars to build, of which around $300 Million came from shareholders, and $570 Million from secured bank loans (Haughton and Mcmanus, 2012: 90). Initially, the project seemed economically viable as a 20 minutes saving on traveling time was projected, and an initial uptake of 35 000 vehicles per day increasing to 90 000 by the end of the first year of operation (Wellman and Spiller, 2012). A consortium of Chinese, German and Australian companies was appointed (Zou, Wang and Fang, 2008: 123). The consortium would bring an equity and recover its costs of design, construction and maintenance via the collected tolls (Chan *et al*., 2008: 70).

The first New South Wales parliamentary report on the tunnel was tabled in February 2006. The report clarified that the project's *go ahead* decision was made when the government's policy emphasis was on reducing debt. Value for money for tunnel users was not effectively studied. The report stated that an inadequate public interest evaluation was conducted before a conclusion was made to take the project to the private sector. It further revealed that the project was taken at a "no cost to government"; however, it led to substantial costs to the community by means of higher than expected tolls and added inconvenience.

3.7. CONCLUSION

Many government entities believe that PPP procurement can provide a wide variety of net benefits for society, including enhanced government capacity, innovation in delivering public services, reduction in the costs and time of project implementation, and transfer of major risks

to the private sector in order to secure value for money for taxpayers (Hardcastle *et al.,* 2003:6). However, the length of the contract makes it impossible to anticipate all the risks and contingencies, as some variables change with the passage of time. Various risks are entrenched in the PPP process, starting from political and economic risks at a strategic level of the PPP project down to operational and contractual risks at its operational level. Managing PPPs is complex and challenging, as every PPP embodies a complex set of relationships between diverse public and private actors (Wadee *et al*., 2004: 17). The uncertainties vary from economic/financial, demand and capacity availability. Because of the dynamic nature of healthcare and technology, these uncertainties are compounded in healthcare delivery PPPs. The defining factor in hospital development PPPs is the link between the partners, which cannot be fully planned in advance, and contract management is much greater in hospital PPPs during their lifetime (Montagu and Harding, 2012:17).

In order to define and properly allocate these risks, a clear framework must be developed to manage these risks properly. The public partner must further conduct an internal assessment to determine the risks that it can retain, and only release those that can be best managed by the private partner.

CHAPTER 4. HEALTHCARE TECHNOLOGY MANAGEMENT, OVERVIEW AND A CONCEPTUAL FRAMEWORK

4.1 OVERVIEW OF HEALTHCARE TECHNOLOGY MANAGEMENT

4.1.1 Introduction

The primary drivers of change in the healthcare state in any country are essentially technological, social and political aspects of the market economic (Cram, 2004: 36). The levels at which technological advancement continues to grow, has constantly restructured the medical field, and inevitably healthcare services delivery too (Bronzino, 2004: 3). Technological innovations and advancements have impacted positively on health care delivery, with increased and improved diagnosis and mitigation of illnesses in disease prevention. The understanding of disease, causal factors, life cycle of the pathogens, intervention methods and treating and healing of such, have assisted to promote health amongst the populace (Chan, 2003: 3). Largely, the use of technology has blended together the field of engineering with medicine, which has helped to reduce costs associated with the treatment, healing or management of many illnesses, including chronic diseases. Today's emphasis on healthcare cost control enforces engineers to contribute to comprehending costs connected with the utilisation of modern medical technologies (Bronzino, 2004: 6). Quantities of medical devices may vary between 1 000 for a smaller hospital, and over 10 000 for large hospitals (Baretich, 2004: 122), all of which are meant to complement each other and promote the wellbeing of patients, now emboldened in a maze of many new diseases and ailments hitherto unknown.

Therefore, it makes financial sense to guarantee that healthcare technologies are: selected properly; used to utmost capacity; and last longer (Lenel *et al*., 2000: 1). Because of these complexities and the many other aspects that the government may not be able to grasp and deal with, the public health system can only partner with private industries, where these specialities abide. On-going research by the private sector, purely for profit purposes, finds room in government hospitals, and in the medical field, in general. The symbiotic relationship between the two sectors benefits the common stakeholder that they share, namely the citizen, whose good health becomes a benefit to both sectors. This collaboration resulted in the formation of a new field of study, which is Health Technology Management.

Health Technology Management can best be described as a well-structured process of managing health technology assets that involve a partnership of well qualified medical clinicians and clinical engineers (Judd, 2004: 99). This partnering has the objective of meeting the highest quality of care at the best cost, thus cutting down costs that may be needed

elsewhere, and improving the life of citizens. This will also further impact on the life expectancy of the population, as well as maintain a productive citizenry. Healthy employees are likely to be productive employees, less time off being sick, happy and motivated, and above all, strong and invigorated. Dickey (1995: 3) concurs and states that clinical engineering has advanced to incorporate all facets of technology management, including obligation for or contribution towards activities such as:

i. Assessing technology needs; as technology innovation increases, it is immediately realised that there are possibilities for further advancement to better the existing technology that is currently used;
ii. Planning capital equipment replacement; the technological advances have enabled the use of more durable and efficient equipment cutting down on time needed previously for other applications;
iii. Evaluating new product offerings; when new products are introduced into the market, advances in technology have assisted to measure and evaluate the efficacies of such new products in a shorter time;
iv. Evaluating equipment prior to purchase; any new equipment to be purchased has become easier to assess by using technology and establishing how it would meet the country's needs;
v. Writing equipment requests; the presence of clinical engineers means that the equipment that was requested by a medical facility can be professionally evaluated, and the benefits assessed before procurement;
vi. Proposals and analysing vendor responses; vendor submissions for business with the private sector need professional evaluation – partnerships with such professional clinical engineers will be able to evaluate the proposals with ease;
vii. Managing all medical equipment; hospital equipment should be managed by specialists – engineering clinicians are outside of the medical expertise of medical practitioners;
viii. Repair and maintenance; equipment should be maintained regularly, and when it breaks down it should be repaired or replaced depending on the conditions. This is critical for both in-house and outsourced equipment;
ix. Negotiating and managing vendor service contracts; a well-qualified specialist in medical technology would be the most ideal to negotiate for prices and contracts, as this is outside of the medical clinician's expertise;
x. Training users; the engineering clinician will assist to train medical personnel that will be entrusted with the use of this equipment. This further indicates the importance of partnerships in transferring skills and improving the healthcare service quality;

xi. Ensuring environmental safety; the technology is designed with the understanding that the hospital or any of the points where patients are treated, should be safe and secure for both patients and clinicians;

xii. Investigating device related incidents; too often things may go wrong – the presence of an expert engineering clinician enables investigation into the incidents. This may also assist to identify causes and preventative measures for future occurrences;

xiii. Designing and customizing patient care equipment; medical technologists design equipment that is relevant to the needs of patients for whom the technology was designed;

xiv. Coordinating and documenting clinical trials; the hospitals conduct clinical trials, which require technologists who are generally not available in the public sector. Instead, the partnership will provide such expertise;

xv. Installing equipment; any equipment that is required or should be purchased by the public health sector from the private sector, should be installed. It is the experts who will install and commission such equipment before it can be used to care for and/or assist patients; and

xvi. Managing equipment regulatory compliance; all equipment is measured against certain standards that may be determined by the Standards Bureau or some international organisation. Clinical engineers will ensure that the equipment complies with the required standards.

As alluded to by Dickey (1995: 3), healthcare technology management is a cycle. These different stages inevitably require different skill-sets and, therefore, different people, most of whom may not be in the public sector, hence the significance of PPPs.

4.2 FRAMEWORK DEVELOPMENT

Module 4 of the National Treasury Manual states that the objective of the feasibility study phase of the PPP project life cycle is to assess whether traditional public procurement or a PPP is in the best interest of the organisation for service delivery. It further intensifies authenticity and thoroughness, which are required by the feasibility study to demonstrate that the project is affordable, is able to transfer appropriate technical, operational and financial risk to the private party, and gives value for money.

It follows the inception phase as the second of three phases during the project preparation period, and comprises of the following, as shown in the table below.

Table 4.1: Project inception phase

- Needs analysis	- An analysis should be conducted of the need for the project, with clearly defined deliverables and how they will help to meet the community's needs and improve their living standards.
- Options analysis	- There could be other alternatives – other projects that could serve the same purpose. These should be identified and feasibility studies conducted to reveal the best research.
- Project due diligence	- Projects should be chosen with particular attention to community expectations, constitutional imperatives and community context.
- Value assessment	- The cost and benefit analysis of these projects for both short and long term should be considered, with special reference to the PPPs that may not want to participate in projects that do not have commercial spin-offs for them.
- Economic valuation	- Businesses are involved in undertakings where there is economic value for them, otherwise there would be no deal to get into adventures that may be detrimental to their own survival. Economic viability is of primary importance to the private sector, as they are in business to make profits.
- Procurement plan	- Procurement is generally a contentious issue, as organisational corrupt activities mostly take place here. From the onset, the organisation's procurement plan should be established, specifically indicating the process, suppliers, quantities required, the lead times, and specificifications of delivery modes. Any deviation should be discussed by the procurement team, and all other involved parties.

- Communication plan	- It is necessary for every project (small or big) to have a clearly defined communication plan, which clearly indicates the communication channels, and what should be communicated, to whom and when.
- Continuously align the strategic objectives	- The objectives of the project are the reasons for which the project was conceptualised in the first place – too often these have altered with time, especially where the projects are complex, and take a long time to fulfil.
- Align budget to actuals	- Budgets are projections for the future, with assumptions that “all things being constant.” It has been proven that there are always differences between budgeted amounts and actuals that are realised at different project stages. Therefore, there is a constant need to continuously align budgeted to actual expenditure.
- Align original scope to current needs	- Scope change is a common element of project management as a result of different causes. Scope Crip, and many other factors contribute to these changes, including the sudden realisation that something important was left out and should be added, or even the availability or absence of certain materials, which all impact on scope change. This has the effect of altering the structure of the triple constraints.
- Identify possibility of deliverables	- The overall processes involved in the project should focus on the “deliverables.” The purpose for which the project is executed, and the basis for the project’s success and execution, will be evaluated.

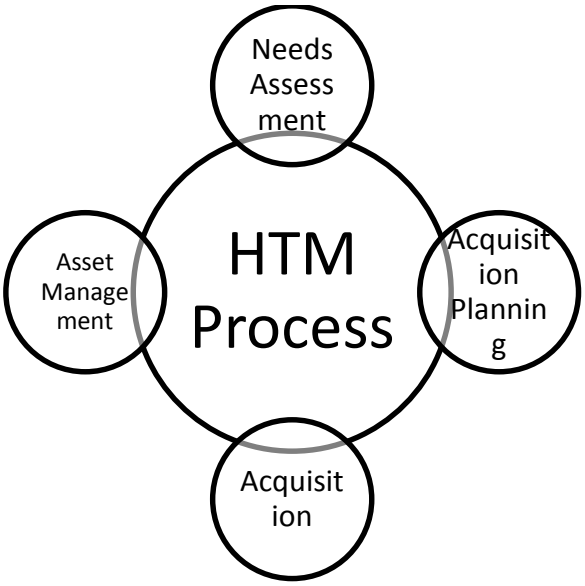
Source: (2019 Own Source)

All these issues should be considered in detail in the feasibility studies, and at this stage all possible risks must be identified. It may be important to make use of experienced people (inside or outside) who may be aware of other generally unexpected risks. The old adage, *to*

be fore warned is to be fore armed, cannot not be any more relevant than at this stage, when partners are venturing into unknown terrain. Needs analysis should be undertaken at all stages of the project. The project plan is merely a projection, which is generally understood to be based on all things being constant. No two projects will be the same; however, one should focus on lessons learnt as means to pre-empt any possible uncertainties. Hence, a needs analysis should be conducted at every turn.

Once needs have been identified and assessed, options to satisfy them have to be determined. This, therefore, leads to the second phase of the feasibility study, which is known as the options analysis or solution options analysis stage. With healthcare infrastructure provision, as shown in Figure 4.1 below, the healthcare technology management process revolves around needs assessment, acquisition planning, acquisition and asset management.

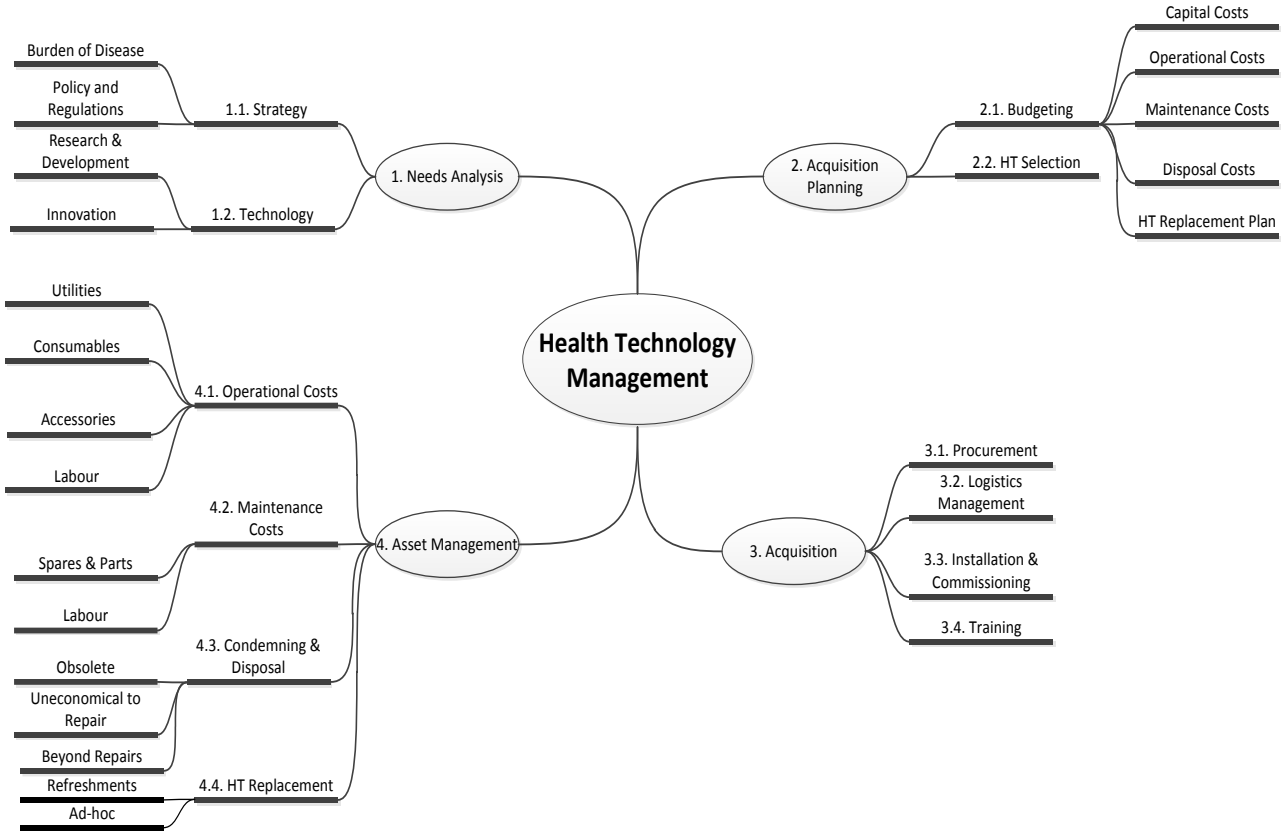
Figure 4.1: Healthcare Technology Management Process



Source: (Own construction)

However, as Figure 4.2 above**Error! Reference source not found.** shows, various other internal and external factors impact these processes. A SWOT analysis of all these factors must be analysed with the following objectives in mind: to improve patient outcomes and satisfaction; to increase access to care; to reduce risks to patients, clinicians and the environment; to balance clinical needs and staff wishes against available resources; to adopt proactive planning to address long term needs and reduce emergency acquisitions; and to reduce the total cost of ownership (Wang, 2009: 16).

Figure 4.2: Healthcare Technology Framework



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- Source: (Own construction)

4.3 HEALTHCARE TECHNOLOGY MANAGEMENT RISKS IN A PPP

It is imperative for both the private and public sector to launch functional risk allocation approaches to realize well-organized contract negotiation methods, and to lessen dispute occurrences during the concession period (Ke, Wang and Chan, 2010: 344). In order to ensure the realisation of PPP advantages, appropriate risk allocation should be employed to motivate the private partner to deliver the project on time, at the least cost, to the quality requested, and expected standards (Jakutyte, 2012: 64). This can be made possible by ensuring an optimal sharing of risks, whereby emphasis is placed on risks being assigned to the party that is best suited to manage them (Karim, 2011: 8). According to the European Investment Bank (2015), the private sector is better positioned to undertake commercial risks, while the public sector is better positioned to assume political and legal risks.

Figure 4.2 above postulates healthcare technology aspects that have to be managed during PPP concessions. Management responsibilities of these healthcare technology aspects have to be assigned to the parties that are most suited to managing them. Effective healthcare technology risk allocation strategies and frameworks must be established and developed to ease contract negotiations and mitigate disputes. It is important to understand all the healthcare technology aspects before the risk allocation process can commence. These aspects have been further analysed using both literature and empirical findings.

4.3.1 Healthcare technology needs analysis

Needs assessment is a complex procedure that incorporates a number of variables that afford decision-makers the required data to prioritize and select appropriate medical devices at national, regional or hospital level (World Health Organisation, 2006: 8). Health care delivery strategy and available intervention technologies are primary components of the needs analysis process.

In PPP projects this process must be initiated during the needs analysis stage of the feasibility study, and be amended continuously based on changes in either the strategy or the technology. A health technology needs analysis tool must be developed by the Transaction Advisor to scrutinise the perceived needs. Using the tool, the Transactional Advisor must then consult the HT users and the institution's HT professionals to obtain the institution's detailed HT needs. The final deliverable of the HT needs analysis process must be a consolidated HT list, clearly stating the HT's space and infrastructural requirements.

The Australian Institute of Health and Welfare defines Burden of Disease (BoD) as a measure that is used to assess and compare the relative impact of different diseases and injuries on populations, by quantifying health losses owing to diseases and injuries that remain after treatment, rehabilitation or prevention efforts within the health system and society, in general. Disease incidence and prevalence are used to measure the burden of diseases. The incidence

represents the rate of occurrence of new cases in a given period in a specified population, while prevalence is the frequency of existing cases in a defined population at a given point (Bonita, Beaglehole and Kjellstrom, 2006: 18). BoD is one of the variables that is used in healthcare delivery strategy planning. Healthcare delivery strategy planning can be defined as the process of addressing a population's health needs within a geographically defined area by assessing the population's health and risk factors and the organisation's capacity to promote and address health care needs (Oleske, 2009: 152). During the needs analysis process, a link between the healthcare delivery strategy and the healthcare technology needs must be shown.

In modern society technology is seen as a motor of change and is welcomed, as it brings progress, but is also feared, as it is perceived to disrupt the existing social order, introducing unintended side-effects (Poel, 1998: 9). Technologies eventually reach their limit and become obsolete, and if demand for the product persists, a new technology replaces the old one (Strong, 2007: 48). Technology change does increase the health expenditure; however, it is amenable to control, unlike demographic changes (Fett, 2000: 18). In a PPP concession, it is logical for both strategy and technology change risks to fall under the realm of the public partner. The public partner must develop a strategic technology plan. The strategic technology plan must be a continuously evolving process that is updated annually, and is directly linked to the clinical strategic plan (David and Judd, 1995: 2508).

4.3.2 Healthcare technology planning and acquisition

HT acquisition planning stems from HT needs. The HT acquisition planning process seeks to (Polluta, 2011):

- Ensure that affordable, appropriate and sustainable technologies are acquired;
- Minimise the lifetime cost of ownership;
- Maximise healthcare technology efficiency (its availability and functionality); and
- Improve health outcomes through qualitative service delivery.

Contradictory to the needs analysis process, this process is done in cognisance of resource constraints.

In a PPP setting the acquisition planning process should be done in a collaborative manner. For this to be fair, proper research must be conducted by both partners and evidence must be produced to support all decisions within the process. Once a decision is reached on the technologies that will be acquired in the financial year, responsibilities for the acquisition processes must be assigned to the partners that are best suited to manage them. The acquisition processes include procurement, logistics management, installation and commissioning, and training.

4.3.3 Asset management

Subsequent to the technology planning and acquisition phase, is the asset management phase of the healthcare technology management process. Once the technology has been commissioned, it is controlled and monitored to ensure that its life-span is cost-effectively optimised. Responsibilities for this control and monitoring process are extended between the clinical user, technical department and the finance department. These responsibilities include: repairs and maintenance; conditional assessment; cleaning and safekeeping; and utilisation. User acceptance, technology obsolescence, reparability and cost of ownership are critical factors that advise on the effective life span of the technologies.

In a PPP, technical and financial asset management responsibilities are assigned to the partner that is best suited to manage them, but utilisation responsibilities are always left to the public partner.

4.3.4 Condemning and disposal

Health technologies are condemned because they are beyond repair (technically irreparable), uneconomical to repair (financially irreparable), redundant (no longer needed), or obsolete (incompatible with current technologies). In a PPP setup it is advisable for the partner that is accountable for maintenance and repair of the health technologies to be given the subsequent duties of its condemnation and disposal.

4.3.5 Health technology replacement

In a PPP setting, healthcare technologies may be replaced, based on two scenarios:

- During conceded refreshment cycles, when the institution's equipment is replaced at agreed upon intervals; or
- On an ad-hoc basis, as the technologies are condemned owing to technical or economic reasons. This happens between the refreshment cycles, when the need arises because of technical or financial reasons.

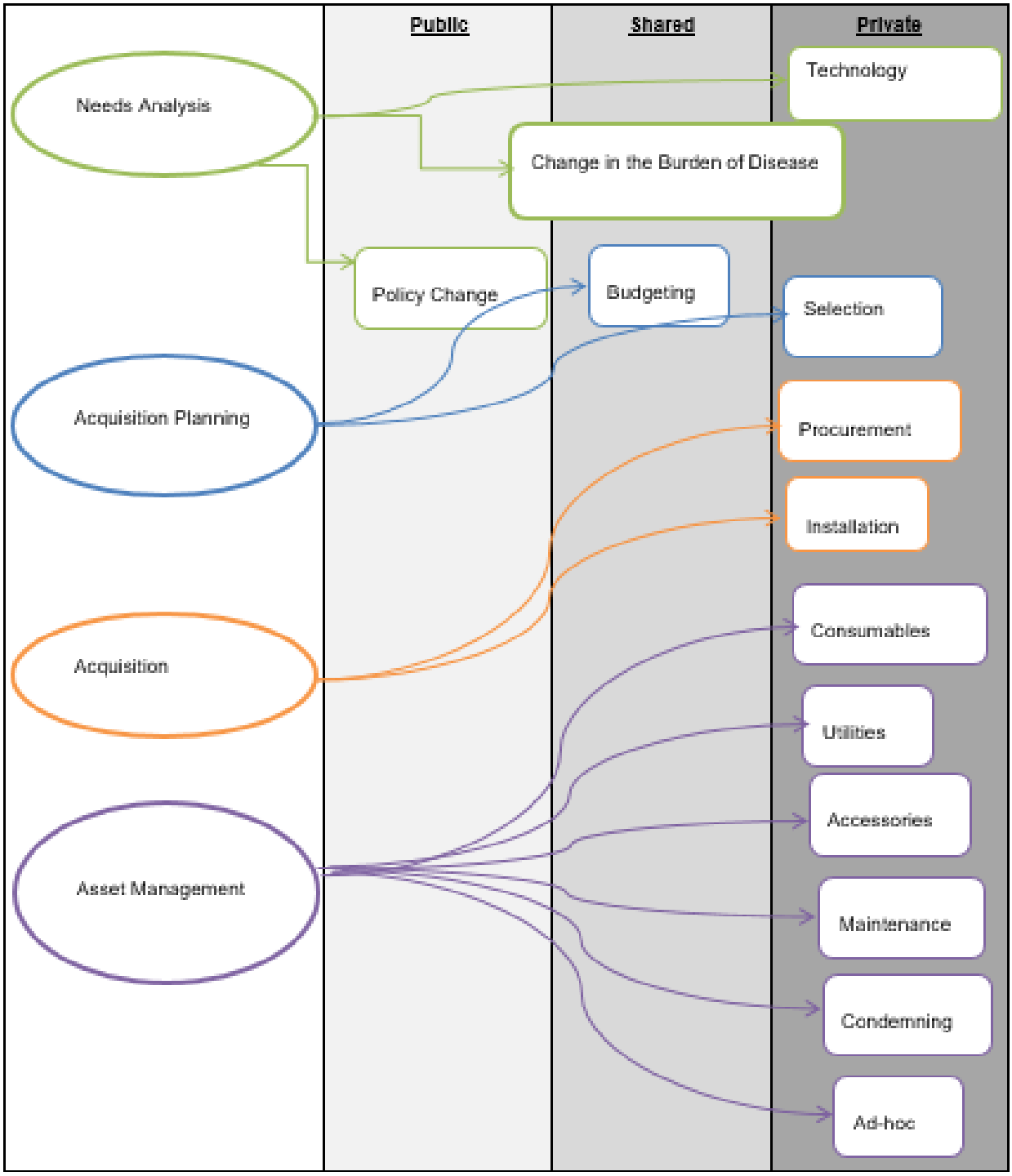
The healthcare technology responsibilities require a collaborative environment amongst the partners. This process must be further linked to the asset management component of the project. The utmost risks of this component must be assigned to the partner that is best suited to manage them.

4.4 CONCEPTUAL FRAMEWORK DEVELOPMENT

The word “concept” should be defined first, as it is used acceptably in different contexts. Concepts are complex representations, whose structures generally encode a specification of necessary and sufficient conditions for their application (Stich and Warfield, 2008: 191). Zirbel defines a concept as a mental model that can be articulated by a single word, or a set of ideas defined by a few words. Margolis (2007: 569) defines a concept as a mental representation type in terms of the senses that it expresses. A concept can be anything about which something is said and, therefore, could be the description of a task, function, action, strategy, reasoning process, and so on (Smith, 2004: 4). Jabareen (2009: 50) points out a few aspects of the term, concept, namely: every concept has an asymmetrical contour defined by its components; every concept has a history; every concept usually contains “bits” or components originating from other concepts; and all concepts relate back to other concepts.

A conceptual framework may be defined as an end-result of bringing together a number of related concepts to explain or predict a given event, or to give a broader understanding of the phenomenon of interest (Imenda, 2014: 189). Miles and Huberman (1994) define a conceptual framework as a visual or written product, one that explains, either graphically or in narrative form, the main things to be studied, the key factors, concepts, or variables and the presumed relationships amongst them. Jabareen (2009; 51) defines a conceptual framework as a network or “plane,” of interlinked concepts that provide a comprehensive understanding of a phenomenon or phenomena. Theoretical frameworks and conceptual frameworks have a complementary relationship; the latter refers to the theory that a researcher chooses to guide him/her in his/her study, whilst the former refers to the synthesis of both theoretical and empirical findings (Imenda, 2014: 189). The conceptual framework in Figure 4.3 allocates responsibility to manage various healthcare technology aspects and their subsequent risks.

Figure 4.3: HT Risk Management Conceptual Framework



Source: (Own construction)

4.5 SUMMARY

Risk transfer incurs costs, hence it is important to ensure that the risks that are transferred to the private partner are those that are best suited to the partner. However, a combination of the risk allocations assists to ensure continuity, whilst minimising disproportion in the overall

healthcare technology management process of the PPP project. An analysis of the internal skills and expertise, market capability and appetite, as well as cost analysis should be conducted before a decision is made concerning procuring healthcare technologies through a PPP.

CHAPTER 5. RESEARCH DESIGN AND RESEARCH METHODOLGY

5.1 INTRODUCTION

This chapter details the research methodology that was used to obtain the study's results and conclusions. Research commonly refers to a search for knowledge (Kothari, 2004: 1). Gregory (2003: 10) understands research as an activity of systematically trying to find something out, and as an undertaking that is distinctive to the human species. Research refers to an activity that enables us to test some hypothesis or to draw conclusions and contribute to knowledge (Shrader-Fredericks, 1994: 2). It involves obtaining scientific knowledge by means of various objective methods (Welman, Kruger and Mitchell, 2010: 2). In this context, scientific knowledge refers to a generalised body of laws and theories to explain a phenomenon or behaviour of interest, which is acquired by using scientific methods (Bhattacherjee, 2012: 2). Health and Human Services Regulations further define research as a systematic investigation, including research development, testing and evaluation, which are designed to develop or contribute to generalizable knowledge. According to Kumar (2008: 1), research comprises defining and redefining problems, formulating hypothesis or suggested solutions, collecting, organising and evaluating data, making deductions and reaching conclusions, and carefully listing the conclusions to determine whether they fit the formulating hypothesis.

Research findings provide enormous contributions to academic knowledge, organisational practices, and systems improvement (Nyame-Asiamah and Patel, 2009: 1). The purpose of this research was to develop a framework for the feasibility study phase of healthcare delivery in public-private partnership projects. This framework could be used as a guiding tool to determine the optimal way to allocate risks and responsibilities between the PPP project partners. In order to develop and test this framework, a proper research design methodology had to be constructed.

5.2 RESEARCH STRUCTURE

Chapter 1 of this research study provided a brief and holistic introduction of the research paradigm. Chapter 2 reviewed relevant literature about PPPs, with a specific interest in healthcare delivery PPPs and their complexities. The chapter further reviewed literature that deals with general project complexities and risk management, and aligns their indications to PPP projects. Considering Chapter 2's revelations, Chapter 3 presented literature that covers sources of conflict in PPP projects. The chapter further reviewed matters such as project scope, project leadership, project uncertainties and risks, and the overall cost of PPP projects.

In Chapter 4 the researcher used literature that was presented in Chapters 2 and 3, as well as new literature to develop a conceptual framework, which covers the allocation of healthcare

technology management risks in a PPP setting. This conceptual framework divides the healthcare technology management process into systems and smaller subsystems. The researcher sought to determine the best method to allocate the management risks of these subsystems in a PPP setting.

As explained further below, this chapter, Chapter 6, describes the study's research methodology, while Chapter 6 presents data collection and analysis of the data. Based on these findings, Chapter 7 revisits the conceptual framework and proposes recommendations for the allocation of healthcare technology management risks.

5.3 RESEARCH METHODOLOGY

Research methodology can be described as procedures that researchers adopt to describe, explain and predict phenomena (Rajasekar, Philominathan and Chinnathammbi, 2013: 5). It involves the process of systematically listing the processes, tools and techniques that the study uses from primary identification of the research problem to its conclusion (Singh, 2006: 79). Research methodology is a way to systematically solve the research problem (Kothari, 2004: 8). Research methodology is about the attitude and understanding of research, and the strategy that you choose to answer the research question (Greener, 2008: 10). Research methodology has many dimensions, and research methods constitute a part of research methodology (Kumar, 2008: 5). Kumar (2008: 4) further defines research methods as all those methods and techniques that are used to conduct research.

Traditionally, research methodologies are broadly classified into qualitative and quantitative research, thereby creating a huge divide among researchers, especially in social sciences (Nyame-Asiamah and Patel, 2009: 2). Qualitative research methods are often employed to answer the *why* and *how* of human behaviour, opinion, and experience; information that is difficult to obtain through more quantitatively oriented methods of data collection (Guest, Namey and Mitschell, 2012: 1). Qualitative research is concerned with developing explanations of social phenomena, that is to say, it aims to help us understand the social world in which we live, and why things are the way they are (Hancock, Ockleford and Windridge, 2009: 7). Qualitative research methods include action research, case studies, ethnography, grounded research, semiotics, discourse analysis, hermeneutics and narratives, whilst quantitative research methodologies encompass surveys, simulation, mathematical modelling, laboratory experiments, statistical analysis, and econometric and structured equations modelling (Nyame-Asiamah and Patel, 2009: 2). Due to the nature of this study, and the availability of data, the researcher used qualitative research methodology.

5.3.1 Research population and sampling

The research population comprises the total collection of all units of analysis about which the researcher seeks to make specific conclusions (Welman, Kruger and Mitchell, 2005: 52). De Vos (2000:198) refers to a research population as potential subjects who possess attributes that interest the researcher. South African healthcare delivery PPPs that have healthcare technology management risks comprised the identified population for this research. Currently, there are a few active signed PPP projects of this nature, as seen from the list below.

i.	- Inkosi Albert Luthuli Hospital in Durban, KwaZulu-Natal Province
ii.	- Western Cape Rehabilitation Centre and Lentegeur Hospital in Cape Town, Western Cape Province
iii.	- Port Alfred and Settlers Hospitals in Port Alfred and Grahamstown, respectively, Eastern Cape Province.

PPPs are largely in their infancy in the South African context, and it was therefore difficult to identify and access. As all the facilities are public sector institutions, attainment of ethics clearance was delayed by inherent bureaucratic processes. The researcher used the three PPP projects as the research sample. Due to its nature and limitations, this study had a high risk of sampling bias. Sampling bias is any trend or deviation from the truth in data collection, data analysis, interpretation and publication, which can result in false conclusions (Sundic, 2013: 12). Collier and Mahoney (1996: 59) posit that selection bias arises because of different circumstances. It can be derived from the self-selection of individuals into categories of an explanatory variable, which can significantly distort causal inferences if the investigator cannot fully model the self-selection process. In order to mitigate this, the researcher first studied the experiences and expertise of the sampled population (Collier and Mahoney, 1996: 59).

5.3.2 Research design

Burns and Grove (2001:223) define research design as clearly defined structures within which the study is conducted. Bhattacherjee (2012: 2) defines research design as a comprehensive plan for data collection in an empirical research project.

To ascertain the conceptual framework developed in Chapter 3, the researcher sought to conduct a case study involving healthcare delivery PPPs in South Africa. The case study approach is useful to employ when there is a need to obtain an in-depth appreciation of an issue, event or phenomenon of interest in its natural real life context (Crowe *et al*., 2011).

Johansson (2003: 2) suggests that a case study should have a case, which is the object of the study, and the case should be a complex functioning unit, which is investigated in its natural context, and must be contemporary. Yin (2003: 13) describes a case study as an empirical inquiry that investigates phenomenon within its real life context, specifically when the boundaries between the phenomenon and the context are clearly evident. The researcher consulted relevant literature about each of the multiple cases for a background understanding of how the partnership started.

5.3.3 Data collection method

Sogoni (2011: 35) defines data collection as the process by which a researcher gathers empirical data of a historical, documentary or statistical nature through different methods and techniques of observation such as document analysis, content analysis, interviewing and psychometric testing. The researcher consulted documents pertaining to the subject of study from the identified institutions, and analysed these to determine the apportioning of risks among the partners.

In order to triangulate the documentation and the literature, the researcher engaged in further study of the subject matter by conducting interviews. Gillham (2000: 1) defines an interview as a conversation, usually between two people, where one person, namely the interviewer seeks responses for a particular purpose from the other person, the interviewee. Although many surveys are done using self-administered methods, using interviewers to ask questions and record answers is certainly a common part of survey measurement procedures, both face-to-face and by telephone (Fowler, 2009: 127). This interview process was done through a structured open-ended questionnaire. A questionnaire can be described as a medium of conversation between a researcher and a respondent during a survey (Brace, 2008: 5). Reja *et al.* (2003: 161) advise that open-ended and close-ended questions differ in several characteristics, especially concerning the role of respondents when answering questions. Close-ended questions limit the respondent to the set of alternatives that is offered, while open-ended questions allow the respondent to express an opinion without being influenced by the researcher (Reja *et al*., 2003: 161). Yin (2003: 91) mentions that most case study interviews are open-ended in nature, probing respondents about the facts of a matter, as well as their opinions about events.

This research study's questionnaire is based on the conceptual framework that was designed in Chapter 3 of the study. The questionnaire comprised four sections, as shown below.

Section 1- Needs analysis: This section sought to understand the management of risks that may occur owing to strategy, technology or economy changes.

Section 2- Health technology acquisition and planning: This section sought to understand allocation of responsibilities for the selection, procurement, logistics management, installation and commissioning of new healthcare technologies.

Section 3- Operation of healthcare technologies: This section considered the allocation of risks and responsibilities for the utilisation and maintenance of healthcare technologies.

Section 4- Disposal and replacement: This section considered the responsibilities for condemning, disposing and replacing healthcare technologies.

The interviews were loosely structured and their intention was to obtain an understanding from the partners about the reasoning behind the allocation of risks amongst them. Houser (2012: 239) states that an open-ended, loose structured interview allows for more detailed information than in highly structured interviews.

5.4 ETHICAL CONSIDERATIONS

Ethics concerns the morality of human conduct (Mauthner *et al*., 2005: 14). Ethical behaviour is important in research as in any other field of human activity (Welman, Kruger and Mitchell, 2010: 181). Ethical behaviour helps to protect individuals, communities and environments, and offers the potential to increase the sum of good in the world (Israel and Hay, 2006: 2).

Universities and research granting bodies, without considering the research paradigms, may inadvertently generate a campaign that sustains scholarly outrage about methods on the margins (Hoonaard, 2002: 5). Due to this, ethical reviews are becoming mandatory for social science research globally. In South Africa most leading universities require that all social science research that involves human participants should be reviewed by an independent research ethics committee before data collection commences (Terreblanche, Durrheim and Painter, 2007: 61).

Before collecting data for this research study, the researcher contextualised whether the research process or its conclusion may have any ethical reservations. All the cited literature was duly acknowledged, and was recorded both in-text and in the bibliography section of the dissertation. The university's Research Ethics Committee approved the research study's data collection methods, while the interviewees were advised of the voluntary nature of their participation in the study. Furthermore, declarations were made of the findings and any shortcomings thereof.

5.5 SUMMARY

The preceding chapters identified that the phenomenon of Public-Private Partnerships in South Africa is still new; hence, it would be difficult to obtain conclusive quantitative data on this

study's subject matter. It was, therefore, imperative for the researcher to use a triangular research methodology approach, which comprised the literature review, document analysis, and interviews. Promulgations in parliament and other legal government structures like the National Treasury are still developing White Papers and other legal documents that may eventually create the standard. To date, much of the information relied on was primarily from National Treasury, and what has been proposed to parliament for consideration. It is possible that as the government extends its stakeholder base, new or modified versions of the current PPP structure may appear.

CHAPTER 6. DATA COMPILATION, ANALYSIS AND INTERPRETATION OF FINDINGS

6.1 INTRODUCTION

The primary purpose of the research was to identify common risks that arise in healthcare technology in PPPs, which are increasingly used to deliver government projects. The risks are commonly identified during project execution of the agreed upon undertakings, which are entered into to uplift communities' standards. The identification process was intended specifically to reduce failure risk that is common in many projects, which are well intended. Risk reduction would include, among other things, proper allocation of responsibilities, appropriate risk allocation and minimisation of conflict areas. The process was also intended to identify mutual technology and management transfer, as well as a sharing model for Public-Private-Partnerships in healthcare. Finally, the objective was to establish infrastructure or systems to service the community beyond the duration of the PPP.

6.2 BACKGROUND TO THE RESEARCH PROBLEM

It is accepted in Project Management, and indeed in all undertakings, that the larger (more complex) an undertaking, the greater the need for extended expertise to accomplish it. The nature of healthcare projects is vast, as it includes the effort to provide for the country, at large. Governments may not always have all the required resources and may need to complement these with private sector participation. To achieve this, the government has to court and contract willing partners within the private sector, leading to private-public-partnerships (PPPs). These PPPs have their own dynamics, and hence the study, covering how they relate, what problems are encountered, and what precautionary measures are needed to make them work.

The study sought to identify and develop structures that will sustain Public-Private-Partnerships' products when the project is completed.

6.3 RESEARCH QUESTION

The research study's objectives were derived from the problem statement, seeking to address the problem statement, identified as a study gap. For the study to be beneficial, specific questions on or related to the objectives should be asked. The research questions guide the choice of literature to be reviewed, and help to determine the answers for the study gap. Research questions serve as a guide to construct the research tool or methodology, and relate closely to the objectives, as they seek to assist to achieve these. Research questions are

usually divided into two types, namely the main question and the sub-questions, as was the case in this research study, as shown below.

Main question

What information is necessary to develop a working structure that effectively manages Public-Private-Partnerships in Healthcare Projects?

Sub-questions

- What risks are commonly encountered in healthcare technology operations in Public-Private-Partnerships?
- What is the impact of unmanaged risks in the execution of healthcare Public-Private-Partnerships?
- What systematic scientific structures may be used in the allocation of risk and responsibilities in Public-Private-Partnerships in healthcare?
- How can technology and management expertise be effectively shared and transferred amongst stakeholders in Public-Private-Partnerships in healthcare?
- What operational structures should be modelled to sustainably maintain the benefits of Public-Private-Partnerships healthcare projects?

A total of thirty-four questionnaires were successfully completed by management personnel at three healthcare institutions, namely Inkosi Albert Luthuli Central Hospital, Western Cape Rehabilitation Centre and Settlers Hospital. The questionnaire sought to understand the perceptions of senior management in the allocation of healthcare technology risks in a PPP.

6.4 SECTION A: BIBLIOGRAPHY

6.4.1. Respondent's employer

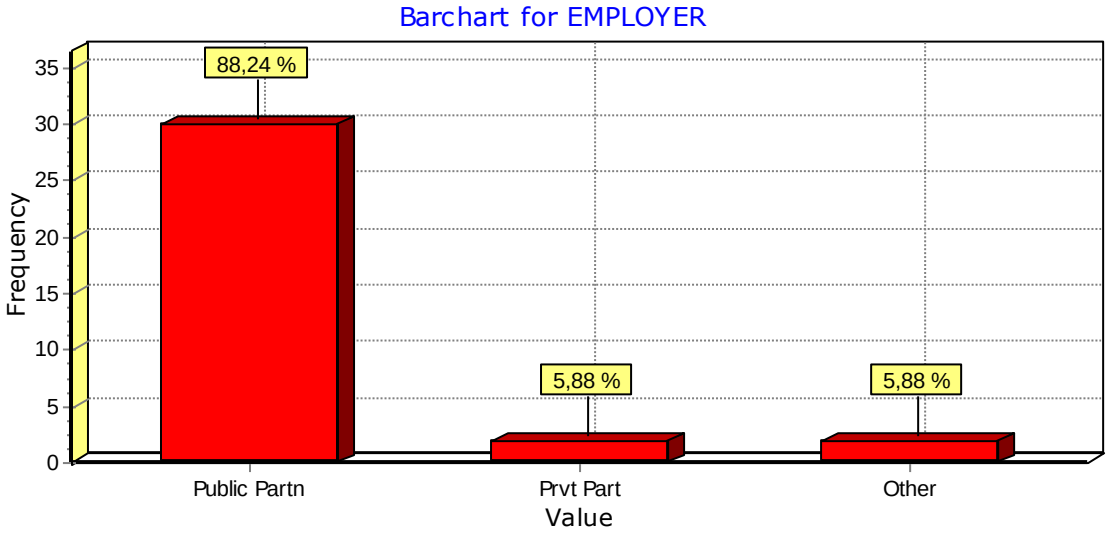


Figure 6.1: Bar chart for Employer

Figure 6.1 indicates that 88.24% of the respondents work for the public partner, while 5.88% work for the private partner. This variable was necessary for the findings to understand the impartiality of the respondents.

6.4.1 Respondent's office base

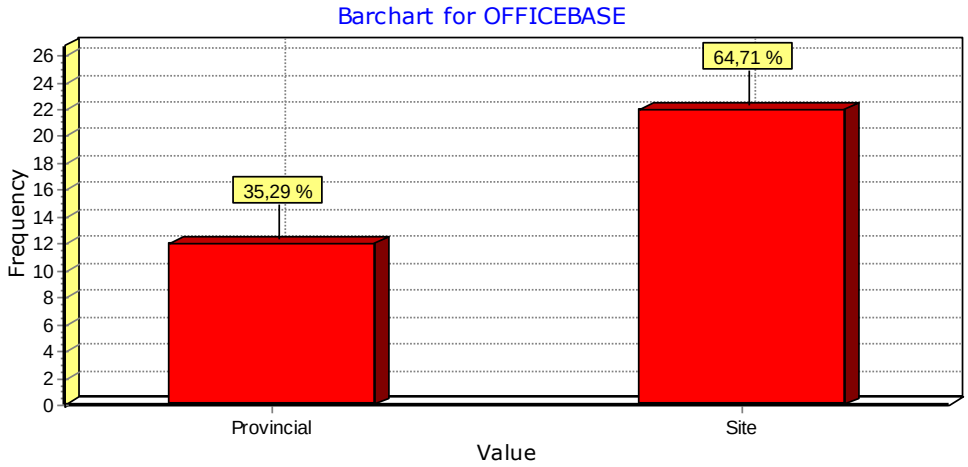


Figure 6.2: Respondent's office base

A total of 64.71% of the respondents are based at the project site, while 35.29% is based at the provincial offices.

6.4.2 Respondent's level of authority

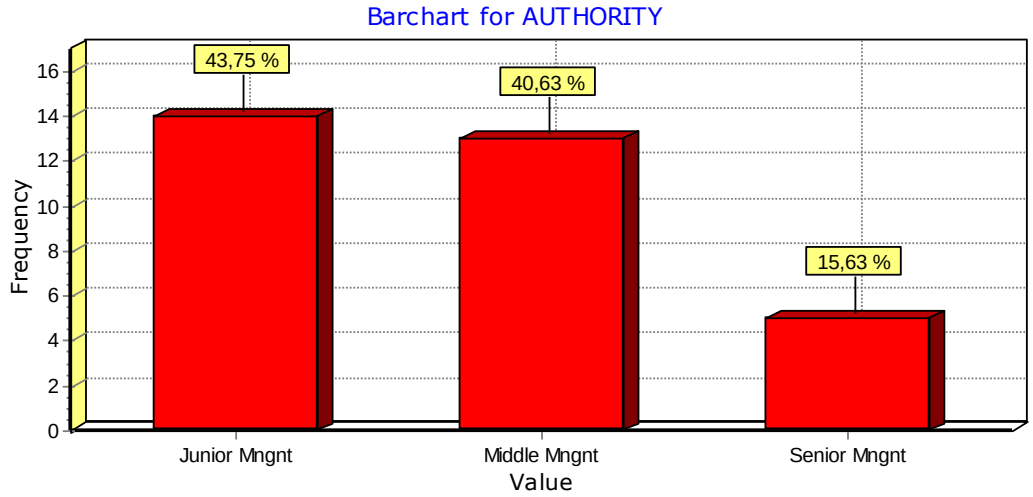


Figure 6.3: Respondent's level of authority

A total of 43.75% of the respondents stated that they are junior managers in their organisations, 40.63% are middle managers and 15.63% are senior managers.

6.4.3 Respondent's experience

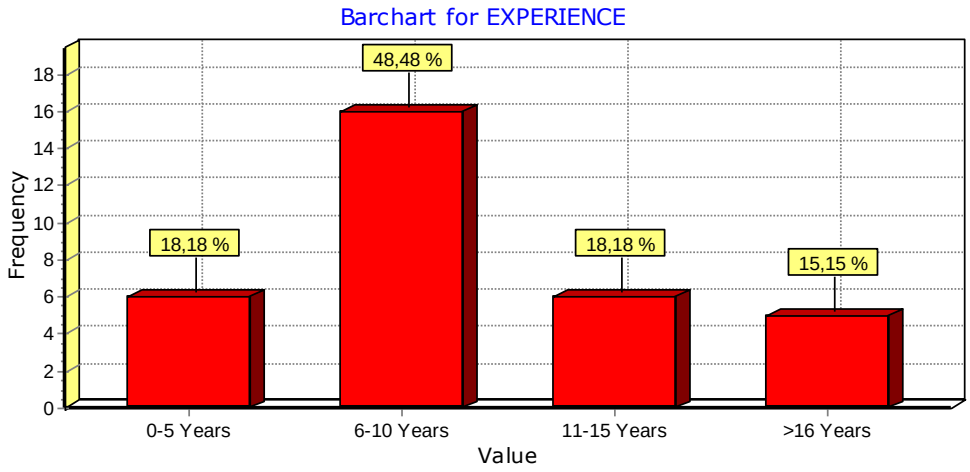


Figure 6.4: Respondent's experience

A total of 18.8% of the respondents have 0 to 5 years' experience, 48.8% has 6 to 10 years of experience, 18.8% has 11 to 15 years of experience, and 15.5% of the respondents has more than 16 years of experience.

6.5 SECTION B: FINDINGS

		Private Partner	Shared	Public Partner
1. Healthcare Technology (HT) Needs Analysis		2.94%	54.9%	42.16%
1.1.	The risk of change in healthcare technology needs owing to changes in the burden of disease.	2.94%	61.76%	35.29%
1.2.	The risk of change in healthcare technology needs owing to changes in healthcare delivery policy.	2.94%	44.12%	52.94%
1.3.	The risk of change in healthcare technology needs owing to the emergence of new technologies.	2.94%	58.82%	38.24%
2. Healthcare Technology Acquisition Planning				
2.1.	Risk of financial loss owing to currency and inflation changes.	38.24%	44.12%	17.65%

-				
3. Healthcare Technology Acquisition		29.64%	45.96%	24.41%
3.1.	Responsibility for the procurement of healthcare technologies.	28.13%	34.38%	37.5%
3.2.	Responsibility for the logistics management of procured healthcare technologies.	17.65%	58.82%	23.53%
3.3.	Responsibility for the installation and commissioning of procured healthcare technologies.	35.29%	50%	14.71%
3.4.	Responsibility for the provision of operations and technical training of procured technologies.	37.5%	40.63%	21.88%
-				
4. Asset Management		28.82%	42.35%	28.82%
4.1.	Responsibility for the procurement of healthcare technology utilities and consumables.	11.76%	58.82%	29.41%
4.2.	Responsibility for the procurement of healthcare technology accessories.	17.65%	52.94%	29.41%
4.3.	Responsibility for the maintenance of healthcare technologies.	44.12%	29.41%	26.47%
4.4.	Responsibility for the condemning and disposal of healthcare technologies.	35.29%	35.29%	29.41%
4.5.	Responsibility for ad-hoc replacement of healthcare technologies between the refreshment cycles.	35.29%	35.29%	29.41%
5. Overall Average		23.83%	46.49%	29.68%

6.6 CONSIDERATIONS IN ALLOCATION OF RISKS IN A PPP CONCESSION

The respondents were asked to list five factors that they perceive to be important regarding allocation of risks between partners in a PPP concession. The intention of this request was to triangulate the respondents' quantitative responses.

CHAPTER 7.CONCLUSION ON RESEARCH FINDINGS AND RECOMMENDATIONS

7.1 INTRODUCTION

The primary objective of this study is to identify parameters for development of a model to effectively manage healthcare PPPs. The study found Public-Private Partnerships projects as contracted concessions between the public and private sectors, where a private entity is delegated to provide public sector activity. A significant feature with PPPs is that the project time does not end with deliverance of the project, but the private sector concessionaire continues with the project's operational activities for a specified period of time. In this setup the public sector partially or wholly transfers management of the identified project's risks to the private partner. This risk transfer activity comes at a cost to the public partner. In order to show value for money in the risk allocation process, a feasibility study must be conducted, as this evaluates risk allocation between the partners to ensure respective allocation to parties that are best suited to manage them.

PPPs have been found to be projects with substantive detail and dynamic complexities. The feasibility study does simplify the detail complexities to a certain degree; however, there are dynamic complexities for future uncertainties. PPP projects are further found to be too difficult to manage when using traditional project management tools.

7.2 RESEARCH FINDINGS

In a quest to achieve the primary objective the study has, therefore been conducted to develop a framework that can assist decision makers concerning the allocation of healthcare technology management responsibilities in PPP projects. The theoretical study revealed:

- needs analysis,
- acquisition planning,
- acquisition, and
- asset management

as the main processes that are involved in healthcare technology management. A feasibility study must therefore be conducted in an effort to determine risks associated with these processes and further recommend their allocation between the partners.

7.2.1 Healthcare technology needs analysis

The World Health Organisation (WHO) (2006: 8) has defines healthcare technology needs analysis as a complex procedure, incorporating numerous variables that provide decision-makers with necessary information to prioritise and select appropriate medical devices. PPP

project timelines normally surpass the healthcare technology lifecycle; therefore, the needs analysis exercise is normally expected initially at the PPP project feasibility study stage, and is subsequently continuously amended based on changes in technology, burden of disease or healthcare delivery strategy.

A total of 54.9% of the respondents recommended that healthcare technology analysis risks should be shared by both partners in the concession; and 61.76% said that the risk of changes in healthcare technologies owing to changes in the burden of disease should be shared by the partners. A sum of 52.94% of the respondents mentioned that healthcare technology risk changes owing to policy changes should be incurred by the public partner, while 52.82% indicated that the risk of healthcare technology changes owing to the emergence of new technologies should be shared by the partners.

7.2.2 Healthcare technology acquisition planning

Acquisition planning involves processes of selecting the most appropriate technologies to meet the needs identified during the needs analysis phase. The risk that was identified regarding this stage was the risk of financial loss owing to currency and inflation fluctuations. The empirical responses were found to be indecisive regarding this question, as 44.12% recommended that the risk should be shared, while 38.24% stated that it should be assigned to the private partner, and 17.65% said that it should be given to the public partner.

7.2.3 Healthcare technology acquisition

Healthcare technology acquisition processes include the procurement of selected healthcare technologies from identified suppliers, logistics management of the procured technologies, installation and commissioning of the procured technologies, and provision of operational and technical training for relevant personnel. A total of 45.96% of the respondents recommended that the risks of this exercise should be shared between the partners, while 29.64% recommended that it should be conducted by the private partner, and 24.41% said that these risks should be assigned to the public partner.

A sum of 37.5% of the respondents recommended that the procurement responsibilities of the healthcare technologies' acquisition cycle should be assigned to the public partner, while 34.38% recommended that the responsibilities should be shared. A further 58.82% of the respondents mentioned that logistics management processes that are subsequent to procurement should be shared between the partners, while 23.53% recommended that these risks should be retained by the public partner. A total of 50% of the respondents stated that the responsibilities associated with commissioning healthcare technologies should be shared between the respondents, while 35.29% indicated that the risk should be assigned to the private partner. A total of 40.63% of the respondents said that operational and technical training

responsibilities should be shared between the partners, while 37.5% stated that the responsibility should be wholly assigned to the private partner.

7.2.4 Asset management

Once technologies have been commissioned, the responsibilities of cost-effectively optimising its lifespan, emerge. These responsibilities are extended between clinical users, technical experts and procurement officers, and include repairs and maintenance, conditional assessment, cleaning and safe keeping, and utilisation. A total of 42.35% of the respondents in this study indicated that the asset management risks should be shared among the partners, and 28.82% also said that the risk should be assigned to both the private and public sector.

Healthcare technology utilities and consumables, accessories, maintenance, and condemning and disposal are also critical components of the asset management cycle. A sum of 58.82% of the respondents further mentioned that the risk of procuring healthcare technology utilities and consumables should be shared by the partners, while 29.41% recommended that the risk should be assigned to the private partner. A total of 52.94% of the respondents indicated that the risks of procuring healthcare technology accessories should be shared amongst the partners, while 29.41% said that the risk should be wholly assigned to the public partner. Further, 44.12% of the participants stated that maintenance risks of healthcare technologies should be wholly assigned to the private partner, while 29.41% said that these risks should be shared. An equal number of respondents, namely 35.29% mentioned that risks associated with condemning and disposing of healthcare technologies should be wholly assigned to the private partner, and should be shared amongst the partners. A dissemination of responses similar to the above was also recorded for the ad-hoc replacement of healthcare technologies between refreshment cycles.

7.2.5 Summary of research findings

Overall, an average of 46.49% of the respondents indicated that healthcare technology risks should be shared between the partners of the PPP concession. An average of 29.68% recommended that the risks should be wholly assigned to the public partner, and an average of 23.83% recommended that the risks should be wholly assigned to the private partner. The following themes were subsequently developed from the empirical research:

1. Value for money;
2. Proper due diligence;
3. Clear risk quantification and risk communication;
4. Project risk affordability; and
5. Continuous performance review.

7.3 HEALTHCARE TECHNOLOGY MODEL

In overall this has displayed the importance of the feasibility study before procuring service through public private partnership. This feasibility study must determine the partner that is best suited to handle each identified risk. A healthcare technology services risk profiling exercise is, therefore, critical for healthcare projects, and should be conducted independent of other services. The table below has been developed from the conceptual framework presented in Chapter 4. The table is recommended to be used by the decision makers subsequent to the feasibility study to ensure that all identified risks are allocated to the partner that is best suited to manage them.

HTM Process	**Private**	**In-house**	**Shared**
1. Needs Analysis			
1.1. Change in burden of disease			
1.2. Policy Change			
1.3. Technology Change			
2. Acquisition Planning			
2.1. Budgeting			
2.2. HT Selection			
3. Acquisition			
3.1. Procurement			
3.2. Logistics Management			
3.3. Installation and Commissioning			

3.4. Training			
4. Asset Management			
4.1. Operational Costs			
4.1.1. Utilities			
4.1.2. Consumables			
4.1.3. Accessories			
4.1.4. Labour			
4.2. Maintenance Costs			
4.2.1. Spare Parts			
4.2.2. Labour			
4.3. Condemning and Disposal			
4.3.1. Obsolete			
4.3.2. Uneconomical to repair			
4.4. HT Replacement			
4.4.1. Refreshments			
4.4.2. Ad-hoc Replacements			

Table 6.1: Healthcare Technology Risks Allocation Model.

The public partner in PPP projects is expected to directly or indirectly pay for the risks that are transferred to the partner. This, therefore, specifies two factors that are critical in the risk allocation process, namely affordability and value for money. In conventional healthcare technology procurement processes, budgetary constraints are associated with the needs analysis and the acquisition planning processes. Hence, a ballpark budget for healthcare technologies can be established irrespective of the party that has to retain management of its risks. This is followed by a value for money analysis that informs, which party has better value for money to retain the risks.

7.4 FUTURE RESEARCH

The study has been conducted to achieve its primary objective i.e. to identify parameters for development of a model to effectively manage healthcare PPPs. These parameters have been identified and further displayed in the conceptual framework in Chapter 4.4. Value for money and affordability have been found as critical factors in allocation of these parameters between the partners.

Researched data on the performance of these parameter in a PPP setup is however limited. As such more detailed studies on the individual performance of these parameters in a PPP setup is recommended for future research. This is necessary as governments are exploring unconventional procurement processes inclusive of public private partnerships.

7.5 CONCLUSION

The research concludes that Public-Private Partnership projects contain more project complexities than normal projects. Identification of expectations from both partners and quantifications is a detail complexity challenge. Feasibility study exercises are used as a solution for this with its challenges though of time and costs. Deficiency of PPP projects that include healthcare technologies are, however, generating a challenge of not having a good knowledge resource upon which to benchmark.

The feasibility study exercise is also recommended to consider the dynamic risks of PPP projects aligned with their long term. Burden of disease, healthcare delivery and technologies deliver a dynamic complexity to the project. The above are expected to change during the course of the project, and should, therefore, also be considered.

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APPENDIX 1: QUESTIONNAIRE

APPENDIX 2: ETHICS CERTIFICATE

APPENDIX 3: PLAGIARISM TEST RESULTS

APPENDIX 4: GRAMMARIAN CERTIFICATE