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Financing of infrastructure maintenance in South Africa

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Wits Business School

Sculpting global leaders

Financing of infrastructure maintenance in South Africa.

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A Research Report submitted to Wits Business School in partial fulfilment of the requirements for the degree of Master of Management in Finance & Investment

March, 2017

DECLARATION

I, Matsiu Clementinah Ntjatsane, hereby declare:

- That the content of this research wok is my own, unless otherwise where indicated and acknowledged.

- All sources and documents used have been referenced; and

- That this dissertation has not been previously submitted for assessment in full or in partial fulfilment of the requirements for an equivalent or higher qualification at any other recognised education institution.

The opinions expressed and conclusions arrived at, are those of the researcher and not necessarily those of the Wits Business School

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Matsiu Clementinah Ntjatsane.

March 2017

ABSTRACT

Infrastructure quality is as important as its quantity, although evidence point to lost growth opportunities due to insufficient investment in maintenance of new and existing infrastructure. Notably, bulk of infrastructure in South Africa is old and collapsing faster than planned and is presently failing to meet increased demand for services. The apartheid government invested heavily in infrastructure development that served only minority of the white population and ignored scarcity of resources that led to high poverty rates in the country. While on the verge of reversing inheritances of the apartheid government, the 1994 democratic government reached out to millions of previously disadvantaged majority population with infrastructure that further improved quality of their lives. However, there was no long-term planning for maintenance; old and new infrastructure received inadequate maintenance and much of it is in a state of disrepair.

This research paper aims to explore the condition of the nation's major economic infrastructure with the intention of discovering the infrastructure gap prevalent to South Africa. It also explores effective financing strategies through which adequate levels of maintenance can be achieved to significantly minimise or close the infrastructure gap. And most importantly discovering capacity constraints for financing infrastructure maintenance and identifying additional sources for securing maintenance funding.

Findings of this research indicated that the large infrastructure gap has been a result of maintenance neglect in many areas and inadequacy of maintenance budgets except for infrastructure operated and owned by state owned entities. This study also revealed that South Africa is incapacitated in many aspects which include skills shortage, limited access to financial markets and restrictive regulations governing private sector participation.

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CHAPTER ONE: INTRODUCTION

1.1 Background

Infrastructure development has become a necessary goal in development agenda of many governments around the world, especially the Sub-Saharan Africa countries whose infrastructure lags behind the rest of the world (Banerjee et al., (2008). Benefits of infrastructure cannot be overlooked as studies show that it contributes to economic growth by reducing costs of production, raising quality of life by providing consumption goods (transport and communication services) and by contributing to macro-economic stability (Kessides, 1993). More specifically, Mbaku (2013) argues that infrastructure eases labour mobility, enhances trade and commerce, stimulates national integration and reduces cultural conflict.

As an essential part for investment and livelihood, adequate infrastructure promotes economic growth, reduces poverty and improves delivery of health and other services (World Bank, 2014; Wantchekon, 2014). According to Briceno and Foster, (2010) Africa's per capita growth increased by as much as 1 percentage point due to improvements in infrastructure especially in information and communication technology since the mid-1990's. Nonetheless, many countries in Africa have infrastructure limitations, particularly in the power sector which Briceno and Foster, (2009) argue that they hold back per capita growth by as much as 1 percentage point.

Although infrastructure influences growth, many countries' contribution to growth by each type of infrastructure are different because of each country's economic conditions. African Capacity Building Foundation, (2016) indicates that developed and developing countries need to invest in new infrastructure as well as maintenance of existing infrastructure stocks to support their economic growth prospects. Calderon and Serven, (2004) highlighted that an investment of 7% of GDP is required on new infrastructure and 5.5% on maintenance

in Low Income Countries (LICs) while Lower middle countries (LMCs) and Upper Middle Countries (UMCs) need to invest 4.9% and 3.3%, and 1.3% and 10% respectively to achieve their GDP targets. In addition, The World Economic Forum and others[1] point out that developed and developing countries need US$5 trillion per year to 2030 to meet infrastructure demands that will ensure required levels of growth and poverty reduction.

In South Africa, Perkins, Fedderke and Luiz (2005) have also found that infrastructure has a strong impact on economic growth. However much of South Africa's bulk infrastructure is reaching the end of its useful life and will require upgrade or replacement. The rapidly growing demand for basic services against aging infrastructure due to many years of sub-standard maintenance has led to its inability to meet industry and consumer demands (Bearak and Dugger, 2008).

Existing infrastructure assets require adequate financing and proper management to increase its productivity and longevity to seize growth opportunities and economic growth. Perkins et al., (2005) argue that in order to support economic growth, maintenance and expansion of infrastructure projects should be chosen based on cost-benefit analyses. Lack of adequate infrastructure planning and adequate maintenance means significant portions of national infrastructure stocks will need replacing at the same time, what Thurlby, (2013) refers to as "asset time bomb". Additionally, Pearson, (2013) denotes that private sector involvement in infrastructure investment is needed in order for Africa to attain required levels of infrastructure investment.

The South African government and policy makers have in this regard adopted policies and strategies to improve infrastructure maintenance and upgrade its quality and reliability. Among these measures are the National Infrastructure Plan, the Government Immovable

[1] See: McKinsey Global Institute, McKinsey Infrastructure Practice (2013) http://www.mckinsey.com/insights/engineering_construction/infratsructure_productivity

Asset Management Act, and the National Water Services Infrastructure Maintenance Strategy. The NDP evolved in 2012 and aims to transform economic activity, create jobs and promote service delivery to South Africans and African counties integration by 2030. As part of the NDP, 18 Strategic Integrated Projects (SIPs) were formulated to develop the least resourced districts to address all maintenance backlogs.

In order to minimise the infrastructure gap, governments need to properly manage existing infrastructure rather than invest in new projects while existing assets are deteriorating. The World Bank's Seminal World Development Report, (1994) concluded that inadequate maintenance is an almost universal and (costly) failing with many roads lasting only half their design life. The South African government has put aside R129, 477.90 million for infrastructure investment: R1, 051.90 million for maintenance of existing stocks and R128, 425.90 million for capital infrastructure needs in 2016/17 (National Treasury, 2016).

1.11 **Importance of well-maintained infrastructure**

Infrastructure is defined by the Organisation for Economic Cooperation and Development (OECD 2006), as infrastructure for transport, energy, information and communication technology, as well as for drinking water, sanitation and irrigation. This definition will be used throughout this study. Accumulation of well-maintained infrastructure is shown to have a positive relationship with economic performance and development of any country. Studies by the World Bank, (2014) show that an increase in infrastructure investment strongly affects economic growth if the quantity of infrastructure is low and more emphasis is put on improving its quality. This speaks to having a right mix of well-managed infrastructure to address their economic growth and development challenges.

Additionally, in order for investment in infrastructure to have a positive impact on the country's economic development, quality must be enforced throughout every stage in the life cycle of projects (AfDB, 2013). Being aware of this relationship, the government of South Africa has placed infrastructure development high on the country's expenditure programme. However, infrastructure needs are obviously too high to be financed by the public sector alone, as such more creative mechanisms need to be recognized.

Through effective planning and allocation of funds, countries can achieve desired economic growth levels, achieve substantial poverty reduction and attain their Millennium Development Goals (MDGs). On the assessment of the link between infrastructure and poverty alleviation, the World Bank carried out a study in rural areas where majority of poor inhabitants reside. The findings show that if poverty is to be overcome, investment in economic and social infrastructure must receive focused attention of governments and policy makers.

By upping their urban infrastructure investment, developing countries stand a chance of keeping pace with increased demand for basic services such as water, power, and electricity caused by high rural-urban migration where more than 5 million people in developing countries move from rural to urban areas every month where schools, jobs and other opportunities are easy to find.

Consequently, inadequate maintenance bears economic costs to business performance. Limi, (2008) shows that operating costs of businesses significantly increase with frequent electricity outages, and interruptions in water supply. He also found that if electricity outages and water interruptions were eliminated, the economic gain would be 0.5-6% and 0.5-2% for shorter and infrequent electricity outages and shorter hours of water interruptions respectively. While improving quality of telecommunications services is

insignificant to economic growth because generally telecommunications infrastructure is in adequate supply.

As a result of interruptions in infrastructure services, firms incur extra costs by investing in power generators, water disposal equipment, and so on which reduces their investment in other capital needed for their production activities. World Bank, (1994b) shows that $12 million in power generating capacity could be saved if $1 million expenditure is invested to improve power lines. Estache, (2004) further shows that infrastructure in good condition plays a key role in reducing poverty and improving access to infrastructure services. Following their study in 121 countries on the evaluation of the impact of infrastructure development and income distribution Calderon and Serven, (2004) found that improving quality of infrastructure reduces poverty levels and that has significant implication on maintenance.

However, the infrastructure gap of many countries is too large and highlights the magnitude of funding required to repair and rehabilitate infrastructure that is aging and has not been maintained. Adequate management of infrastructure that involves effective maintenance and optimal use of existing infrastructure saves on the planned investment in new infrastructure and creates funds for maintenance. The African Capacity Building Foundation, (2016) indicates that spending needs for operations and maintenance are $41billion for power, $18 billion for transport, and $11 billion for water infrastructure in the Sub-Saharan Africa region between 2005 and 2015. When maintenance is not adequate infrastructure deteriorates faster leading to expensive rehabilitation and replacement costs. Therefore, in order to achieve effective maintenance there must be a strong link between maintenance planning and financing.

1.12 Infrastructure and growth benefits to the economy

The relationship between infrastructure and economic growth has been studied thoroughly and empirical findings show a long-run positive impact of infrastructure investment on output Munnell, (1990), Moreno, (2003) and Perkins, (2005). McKinsey Global Institute, (2013) estimates that developed and developing countries require around US$4 trillion per year to 2030 to meet infrastructure demands to ensure needed levels of economic growth and poverty alleviation. However, the deficit of US$1.4 trillion is the scale of funding required to close what is called infrastructure gap. According to the World Economic Forum, (2014) the gap can be closed via innovative demand management measures, providing new infrastructure, and optimizing the use of existing assets.

Additionally, optimal use of existing infrastructure will minimize the amount of new investment required and the contribution of infrastructure to social development and growth will be maximized. However, the World Bank's seminal World Development Report, (1994) concluded that the contribution of infrastructure to economic development and poverty alleviation is only possible when infrastructure provides services that respond effectively and efficiently to demand.

While there is a long-run forcing relationship between infrastructure investment and growth, studies have not adequately confirmed the linkage to be unidirectional. Instead, the direction of association between infrastructure and growth has been shown to run in both directions; investment in infrastructure promotes GDP, from roads to GDP, and from GDP to other types of infrastructure. In his study Perkins et al., (2005) concluded that despite that linkage, a major challenge remains with maintenance and expansion where required investment is not enough to support economic growth hence growth opportunities could be missed through inadequate service delivery.

Although infrastructure is broadly seen as a remedy for higher growth opportunities, enough is not done for its maintenance. As much as findings show that infrastructure management via effective maintenance strategies is an important ingredient for economic development, there is too little money assigned for it while new projects are being funded. However, there are more innovative maintenance financing strategies including; private sector, user fees, specific government borrowings, and support from development partners as well as proper budgetary allocations (United Nations, 1993).

Maintenance of existing infrastructure has often been neglected in developing countries while highly visible new infrastructure investment took precedence. Low effectiveness of old infrastructure assets impose a cost of foregone output. In his study, Rioja (2003) reveals that the long-run penalty of ineffective infrastructure is 40% on per capita GDP, while raising effectiveness has significant positive effects on per capita income, private investment, consumption, as well as welfare.

While maintenance is important, several countries have not sufficiently supported it including countries whose economic growth has been enabled by past investment in infrastructure which is now reaching the end of their economic lives. Much of the USA infrastructure was built in the 1950's when it was investing around 2-2.5% of their GDP in new infrastructure, and 1-1.25% in operations and maintenance[2]. It was noted in the early 1980's that the USA national infrastructure was not keeping pace with demand because of inadequate funding for maintenance, replacement and new infrastructure (Munnell, 1992).

[2] The USA is ranked tenth in the world on GDP per capita basis by both the World Bank and IMF; http://en.wikipedia.org/wiki/List_of_countries_by_GDP(PPP)_per_capita

1.13 **Motivation of the Study**

Infrastructure is an important aspect of life as it provides services utilized by households such as drinking water, sanitation and electricity. Ineffective maintenance lowers quality of infrastructure and negatively affects GDP. Dysfunctional facilities such as sanitation or unreliable water supplies pose threats not only to health but also to economic activity-and trigger service delivery protests. Inadequate and unreliable infrastructure services are common in majority of communities in South Africa, where only 66% of the population has access to electricity, 87% to improved water sources, and 67% to improved sanitation, benchmarked against 87% access to electricity, 93% to improved water services and 86% to improved sanitation in the upper middle countries (Bogetic and Fedderke, 2006). This has resulted in rise of violent service delivery protests since 2012 when thousands of Sterkspruit in Eastern Cape residents took their battle for running water to the streets.

Moreover, the South African power utility that was once ranked world's best could not keep pace with surging power demand recently. Power outages lasting up to 12 hours became normal to South Africa since 2007. KPMG, (2014) also highlights that underinvestment in the power sector has led to decreased efficiency, frequent power outages and high maintenance costs. Lack of maintenance and investment has reduced the state-owned power provider Eskom Holdings Ltd daily supply threatening economic growth as mines and factories lose output and foreign investors lose confidence and move their projects elsewhere (Alexandra, 2015).

While there is urgent need to address energy supply issues, lack of capacity in a number of other infrastructure sectors such as insufficient roads, water & sanitation, rail and port have also proven damaging to the economy. South Africa's total road network consist of approximately 154 000 km of paved roads and 454 000 km of gravel roads with most roads' condition ranked poor to very poor in KwaZulu-Natal, Mpumalanga, and North West as

the worst performing provinces (DBSA, 2012). The deterioration of this road network has been due to among other factors lack of routine maintenance, whereby 75% of gravel roads have been neglected (DBSA, 2012). The World Bank's Seminal World Development Report, (1994) further asserts that delivery of infrastructure is beneficial for economic growth only when it provides services that respond to demand. It is therefore vital for the government to provide adequate maintenance to ease the effect this has on the economy.

Current information indicates that the country has approximately 750 000 km of road network of which 158 124 km is paved and 21 946 km is operated by SANRAL (National Treasury, 2016). According to SANRAL, the rest of these routes are divided up between provinces, metros and municipalities depending on which part of the country the road passes through. Table 1.13 below gives an estimate of the total road network in South Africa.

Table 1.13: SA road network-2016

Authority	Paved(km)	Gravel(km)	Total(km)
SANRAL	21,946	0	21,946
Province-9	46,805	226,273	273,078
Metros-8	51,682	14,461	66,143
Municipalities	37,691	219,223	256,914
TOTAL	158,124	459,957	618,081
Unproclaimed		131,919	131,919
TOTAL	158,124	591,876	750,000

Source: SANRAL

Transport sector is a key contributor to South Africa's global competitiveness and has since received substantial enhancement from the 2010 FIFA World Cup projects. The road

infrastructure is in general good to excellent condition and the road network is 10th largest in the world (National Treasury, 2016). Despite these credentials, South Africa's road infrastructure has not expanded in line with international trade and is estimated to be older than its original design life due to inadequate resources allocated for maintenance and repairs (CSIR, 2013).

In 2012, the government developed its first National Infrastructure Plan, which puts infrastructure development central to eradicating poverty and to achieving high economic growth levels. Following from this plan the government has invested heavily in infrastructure development. In 2014, the government allocated capital expenditure amounting to R847 billion to infrastructure development, in particular for transport and electricity sectors, while in 2015 R813.1 billion was budgeted for infrastructure: R339 billion for transport and R166 billion for energy infrastructure over three years (National Treasury, 2015). Most specifically, R129, 477. 90 million for investment in infrastructure in 2016/17; R1, 051. 90 million for maintenance and R128, 425. 90 for capital infrastructure investment (National Treasury, 2016).

National Treasury, (2015) thus exemplifies that in 2013/14 R6.3 billion was underspent and returned to National Treasury due to among others the local government equitable share funds being withheld to provide for the municipal infrastructure condition allocation, delays in implementing health infrastructure projects as well as delays in the roll out of the school infrastructure backlog. In this regard, infrastructure maintenance is not only a result of lack funds but rather funds mismanagement play a big role.

Maintenance and repairs often receive less priority whereby in 2012/13 it was only 2.1% of the total infrastructure investment budget and is expected to reach 5.2% by the end of 2017/18 (National Treasury, 2014). If maintenance continues to be indefinitely

disregarded, the cost for rehabilitation and refurbishment is expected to reach 11.3% of the infrastructure investment budget by the end of 2017/18 which makes closing the infrastructure gap even more difficult (National Treasury, 2015).

Unreliable electricity supply is also impeding the transition to higher productivity levels. While many countries have managed to sustain infrastructure investment levels financed by a mix of domestic and external sources, outcomes have not always improved accordingly, suggesting limited investment efficiency. Regulatory and capacity constraints in project development and implementation are also important obstacles to boosting quality of infrastructure investment outcomes.

Major infrastructure is collapsing and reaching the end of its useful life making maintenance very significant. New infrastructure is constructed, unfortunately at the expense of maintenance of existing infrastructure hence sustainability of most services is indeterminate. SAICE, (2011) highlights that most infrastructure sectors have held up since 2006 primarily because of high rate of construction. Insufficient maintenance in water, road, and electricity infrastructure has resulted in further deterioration of the almost 30 years' old infrastructure assets (DBSA, 2012).

Finance and investment for infrastructure development has remained a challenge and is crucial for South Africa's economic growth. National Treasury, (2006) indicates that a one percentage point increase in infrastructure investment will increase long-term GDP by 1.3% and employment by 0.7%, consequently inadequate investment in infrastructure generates bottlenecks and slows down development (DBSA, 2012). The NDP further argues that current investment is inadequate and maintenance programmes are also scarce.

Infrastructure development is central to South Africa's NDP, therefore high levels of infrastructure investment are required for promoting economic growth and supporting

service delivery. Government allocated R847 billion in 2014 and R813.1 billion in 2015 over the next three years to infrastructure investment, in particular the transport and energy sectors (National Treasury, 2015).

Fedderke and Garlick, (2008) indicates that good infrastructure generally raises productivity of other inputs in the production process but maintenance of existing infrastructure is mostly assigned less priority. In the 2015 MTEF budget, 55% of resources were allocated to new infrastructure investment while the balance was allocated to repairing, rehabilitating and upgrading existing infrastructure (National Treasury, 2015). The magnitude of funding is sizeable with annual maintenance needs amounting to R7.8 billion for water infrastructure, R10.8 billion for provincial road network, R15.4 billion for national roads and R35 billion for electricity infrastructure (National Treasury, 2016).

The 2016 national budget shows that government has increased infrastructure maintenance spending significantly to address maintenance backlogs. This shows that the 2016 budget addresses both the MTSF and NDP by prioritising spending to enhance quality and capacity of infrastructure services. National Treasury, (2016) shows that government has therefore allocated R32.5 billion for maintenance of provincial roads, R49.3 billion for maintenance of national roads, R15 billion for water and sanitation infrastructure maintenance and R54 billion for energy infrastructure maintenance over the MTEF period.

However, investment in infrastructure is always not sufficient, as governments' own fiscal revenues cannot address all their infrastructure needs hence private sector participation is required. Involving private sector may offer valuable long-term business opportunities and a chance to deliver high quality and efficient infrastructure services by delivering finance and technical assistance (World Bank, 2010). Koppenjan and Eserink, (2009) further argue

that Public Private Partnerships (PPPs) have particularly emerged as an effective means for delivering infrastructure services of high quality.

Private sector involvement in managing and providing infrastructure services is important to injecting capital that the public sector does not have, and asset management capabilities thereby increasing productivity and cost efficiency in both operations and maintenance (Banerjee et al., 2006). Current research shows that a total of 15-20% of developing countries' infrastructure finance is provided in PPP models World Economic Forum, (2014) and further that PPPs that cover the whole life of the asset provide more reliable maintenance financing than government financing. Also that PPPs provides specialized expertise, effective contract management, and strong governance structures.

Despite these findings, there is a slow pace for their implementation in South Africa although it has enjoyed many years of private capital access and skills in providing road infrastructure through SANRAL, which is internationally recognized as centre of expertise in road PPPs (Castalia Strategic Advisors, 2007). Other successful PPPs in S.A are the Maputo Development Corridor, which links the South African mines with industries at the port of Maputo (Mozambique) World Economic Forum, (2013) and the completion of the Gautrain, which connects Johannesburg, Pretoria and the OR Tambo International Airport.

Further to these observations, there is too little money assigned for maintenance while new projects are funded and existing infrastructure is deteriorating due to many years of maintenance neglect (Thurlby, 2013). Lack of maintenance can then not be wholly attributed to an over-all lack of funds but more a problem of utilization of budgets (capex and opex) and making funds readily available for maintenance requirements.

1.14 Research questions

The aim of this research is to provide a study that focuses on the state of repairs on South Africa's major infrastructure sectors which will lead to identifying appropriate and effective financing strategies for maintenance requirements. The World Economic Forum, (2014) shows that having the right policies in place to prioritize maintenance leads to obtaining the optimum balance between capex and opex budgets. Instilling maintenance culture to policy makers and citizens will also ensure that previous infrastructure investments are protected and adequate measures are put in place to protect current and future investments.

The research intends to answer the following questions:

- What is the current condition of infrastructure?
- How much money is actually required for maintenance?

1.15 Research objectives

In respect of this research, the specific objectives are to:

- Document the current state of repairs of existing stocks in various infrastructure sectors of South Africa;
- Identify maintenance gaps in different infrastructure sectors if any;
- Identify specific capacity challenges to financing infrastructure maintenance;
- Suggest some financing strategies for closing the maintenance gaps.

CHAPTER TWO: LITERATURE REVIEW

2.1 THE CURRENT STATE OF REPAIRS OF EXISTING INFRASTRUCTURE IN SOUTH AFRICA

Often times, maintenance receives little attention in the development agenda of many countries which leaves vast amounts of assets further deteriorating and in need for reconstruction and rehabilitation. Recent research underpins that disinvestment in infrastructure is worse in the SSA where its infrastructure lags far behind its peers in other developing countries in every infrastructure metric (Yepes et al., 2008). Data on the state of infrastructure in South Africa is available in a number of documents including the World Bank reports. For this research, most data is collected from the SAICE infrastructure report cards and the DBSA reports, and will be ordered and organised in a manner that will provide a clear estimate of the state of infrastructure repairs in major sectors in South Africa.

The infrastructure report cards reflect at a point in time the condition of the nations' infrastructure that produces services consumed by households and enables economic activity. The first ever report card in South Africa was released in 2006 by the South African Institute of Civil Engineers (SAICE) in partnership with the Council for Scientific and Industrial Research (CSIR). According to the report the overall score for all the nation's infrastructure was graded D+. In that report skills shortage and lack of maintenance were key factors across all sectors. However, the 2011 report card received a C+ grade, showing an overall improvement in the condition of infrastructure because of heavy investment especially in preparation for the 2010 FIFA soccer World Cup. On the contrary, quality and reliability of most infrastructure that serves the majority of residents remained poor and is getting worse because of many years of sub-standard maintenance or lack thereof.

When the South African democratic government came into power in 1994, it placed infrastructure policy among its greatest concerns by providing access to basic services to previously disadvantaged communities. According to SAICE, (2006) 15 million people previously not served by formal supply were provided with water, sanitation and road infrastructure, which further improved quality of their lives. However, majority of this infrastructure has gone from poor to very poor due to maintenance neglect. Again, while addressing the inherited under-investment of the pre-1994 government, the National Infrastructure Plan was formulated with aspirations to grow the economy by more than 5% per year through additional infrastructure investment over the coming years (OECD, 2015). Table 2.1 below is an estimate of S.A's condition of infrastructure as reported by SAICE (2011).

Table 2.1: **Condition of major infrastructure assets in South Africa**

	QUALITY/ GRADES			
STOCKS	B	C	D	E
Water & sanitation		Water quality is a problem in major urban areas. Wastewater spillage is too high in major urban areas.	Maintenance neglect of water infrastructure portfolio leading to further deterioration, and increase in protests for service delivery	Inadequate operation and maintenance of sanitation works is too high for all areas.
Roads	The national road network is in general good condition.	Less than 10% of metropolitan roads are in poor to very poor condition	Paved provincial roads have deteriorated due to lack of maintenance, inadequate funding and outdated systems.	Maintenance of 75% of all gravel roads have been neglected.
Electricity	Reasonable maintenance for high voltage long distance transmission	There is reasonable maintenance for 95% of Eskom's generating capacity.	Inadequate operation and maintenance for local distribution network, in many areas infrastructure is aging or overloaded.	
Overall		Priority had been given to development of new infrastructure at the expense of existing infrastructure maintenance, however infrastructure condition deteriorated and remained poor in most municipal areas.		

Source: SAICE infrastructure report card 2011

Note: Meaning of grades

B= Fit for the future; **C**= Satisfactory for now; **D**= At risk; **E**= Unfit for purpose

The 2011 report card highlights that demand for maintenance is huge and expected to broaden further the longer it is ignored. The infrastructure gap reflects that significant portions of

national infrastructure stocks will need replacing all at the same time. Urgent attention is therefore required to alleviate and recover from the negative impacts of lack of maintenance. The following section presents a unified estimate of the state of repairs in various infrastructure sectors in South Africa.

2.11 Power

The power sector is the most deficient in SSA in terms of accessibility where only 66% of the total population has access to electricity relative to 87% access in the upper middle-income countries (Bogetic and Fedderke, 2006). The generation capacity of the South African state owned utility Eskom, which accounts for 85% total net maximum faced supply challenges since 2007 mainly because of aging power stations that were approaching end of their economic life and received little maintenance in the past. In many cases, the municipal distribution network is worse where infrastructure is ageing and often overloaded. The lack of capacity to meet current demand and absence of significant investment creates bottlenecks for economic development and growth.

As noted by the National Treasury, (2015) the economic cost of this is too high and estimated that a 1 % point decrease in GDP will result due to further deterioration in electricity supply. The average age of Eskom assets ranges from 25-30 years and this high age makes maintenance even more important and very difficult. Although Eskom embarked on policies that increased investment, the distribution sector remained under funded in a number of municipalities hence caused the rolling blackouts that hit the country in 2007/08. The unplanned blackouts were a result of inadequate staffing and maintenance neglect on the distribution network whose quality is deteriorating and becoming useless. Moreover, the generation infrastructure is in general

good health and compares very well with international standards even though it is usually overloaded and makes maintenance difficult.

2.12 Water and sanitation

As the most water scarce country in the world, South Africa's main source of water supply comes from rivers and dams sustained only by rainfalls. Recently the water levels in most rivers and dams are at the lowest levels despite current rainfall. In keeping up with the aspirations of the NDP, South Africa has managed to provide access to 89.4% of households with clean-piped water and the nation saw a steady progress towards the bucket toilet system eradication in both formal and informal settlements (Stats SA, 2016). According to the survey, the general quality of water was rated well by almost 62% of the households; however, 4.4% of communities drink water from rivers, streams, wells and springs. Additionally, 54% and 65.8% of dwellers in Limpopo and Mpumalanga have access to improved sanitation respectively. However, much of the bulk water infrastructure has reached end of its economic and useful life and poses threats of unreliable water supplies, which not only concern health but also economic activity.

Ageing (average 39 years) bulk of water infrastructure portfolio is deteriorating fast as a result of maintenance neglect by the Department of Water Affairs infrastructure and the level of water supply has fallen below 98% as recommended by the National Water Resource Strategy (SAICE, 2011). In an effort to force service improvement, there have been protests in both urban and rural areas in which case Sterkspruit residents in the Eastern Cape took their battle for running water to the streets.

Moreover, more than 67% compared with the initial 49% in 1994 of people have access to improved sanitation services but are more prone to high service failure rates because of compromised technical design standards that lead to high maintenance problems.

2.13 Transport

I *Roads infrastructure*

South Africa's road network consists of 747 000 km of which 75% is unpaved. The national roads under management of SANRAL are in good to excellent condition with a slight percentage of roads in poor to very poor condition but still within international benchmark of 1069 (World Bank, 2014). Much of this road network has reached the end of its design life and highly deteriorating. Most provincial roads have significantly deteriorated overtime due to skills shortage, inadequate funding, outdated systems and lack of routine and periodic maintenance. Additionally, for most provincial, metropolitan and municipal gravel roads the condition remains poor to very poor with maintenance of 75% of this network having been neglected. Notably all provincial and district paved roads as well as local and municipal gravel road network have been rated D (at risk) and E (unfit for purpose).

II *Ports infrastructure*

South Africa boasts well-developed and largest airport network in the continent. Of all major infrastructure sectors, airports are mostly in good condition maintained and operated by Airports Company South Africa (ACSA) owned by the Department of Transport (DoT), which manages three of the major airports in South Africa (Johannesburg, Cape Town, and Durban). These airports allow almost 90% of passenger movement annually, and growth over the past years on these ports averaged 10% annually. ACSA has appropriate and qualified staff, which

carries regular maintenance and replacement to preserve its infrastructure in the most efficient manner.

In terms of funding capacity, ACSA has a strong financial state, which allows it to sustain high levels of maintenance. R17 billion has been allocated for capital investment for five years starting from 2012-2016 and will further be used to maintain ACSA's world-class standards and aviation.

III Rail transport infrastructure

South Africa's major cities are connected by the publicly owned rail network, which is the most highly developed in Africa according to (Bullock, 2009). However, the almost 30-35 years old rolling stock is responsible for many operational problems which will need urgent upgrading to retain passenger safety. The declining state of the rolling stock and maintenance neglect has also led to decrease in the market share to roads annually. Theft, vandalism and inadequate electricity supply are also major challenges to lurking performance of the rail transport and safety has become a major concern for passengers. There has been a slight improvement however on the network because of recent capital investment programmes for heavy haul freight lines and general freight lines.

2.14 MAINTENANCE FUNDING REQUIREMENTS PER SECTOR

According to Briceno-Garmedia, (2009) Sub-Saharan Africa needs for infrastructure are very sizeable with a need for approximately US$ 93 billion annually over the next ten years, 30% estimated for maintenance of existing stocks. Most specifically, Mitulah et al., (2016) purports that in order to attain sustainable economic growth, Africa needs to look up to successful countries like China that invest 14% of GDP in infrastructure. The poor condition of SSA

infrastructure is reducing economic growth by as much as two percentage points per year and productivity by as much as 40 percent (AfDB, 2011a). Foster and Briceno, (2010) estimate that MICs need to spend about 2.9% of their GDP on O&M while LICs need 1.8-2.0%. Furthermore, studies by the World Bank highlight that 50% of funding requirements must be provided by private sources in order to close SSA infrastructure deficit. There are specific requirements to every maintenance need and generally more options for carrying out maintenance. Labour intensive methods are generally more expensive while high technology methods are not as costly and are more appropriate in some maintenance cases.

In assessing financing requirements, it must be considered that as assets age they require more funds for repairs and maintenance to minimize breakdowns. Mostly, there is too little money assigned for maintenance resulting to further damage to infrastructure and high costs for rehabilitation or reconstruction, which comes to the aim of this section of the study to evaluate the magnitude of funding requirements for infrastructure maintenance in major sectors.

In respect of providing maintenance budgeting guidelines, the government of South Africa adopted a National Infrastructure Maintenance Strategy (NIMS), which provides strategies for more effective infrastructure asset management. Regarding the magnitude of damage in most infrastructure sectors, NIMS's strategy is to give priority to infrastructure which if it fails will have a larger impact on service delivery such as electricity generation which is regarded as the backbone of the nation as it provides power supply to the entire nation. To continue to support economic growth, it is critical to adequately manage, maintain and replace existing and new assets to appropriate levels of service delivery.

2.15 Power

The power sector is the most deficient in the Sub-Saharan region with an estimated $41 billion required annually for ten years from 2005, where $14 billion is the sector's operations and maintenance deficit (Eberhard et al., 2011). The current Eskom's funding gap is R225 billion over the next 5 years starting from 2016 and private sources will be required as Eskom's financial capacity is below the needs of the sector (OECD, 2015). Cohen and Burkhardt, (2015) shows that the department of energy together with Eskom will spend R18 billion between 2015/16 and 2017/18 to provide on-grid electricity access to 810 000 households and non-grid electricity to 65000 households as well as build 12 substations and upgrade 18 others. Theft on Eskom's transmission lines has resulted in a backlog of R4.4 billion and R27.4 billion in the distribution lines expected to increase by approximately R1.6 billion annually (Cohen and Burkhardt, 2015).

2.16 Water and Sanitation

Long delays in identifying and monitoring maintenance and distribution of the bulk water will result in severe capacity shortage within the DWA. Bearing in mind these challenges, the department is battling with capacity and funding issues. Currently all water authorities are required to spend 7% of their total budgets on maintenance and management of their infrastructure to improve their capacity effectively and efficiently (National Treasury, 2015). The Department of water affairs is committed to deliver quality drinking water to South Africans, although acid marine drainage impose high costs to clean the water. Progress has been slow in this sector as the annual funding requirements for maintenance are estimated at R1.4 billion and the department is also running short of skilled personnel to implement and supervise maintenance (OECD, 2015).

Sanitation services have increased since 1994 to cover 67% of households with access in 2006 opposed to only 49% access in 1994 (SAICE, 2011). Although this has been an improvement, frequent failures are predominant and most sanitation facilities are not in compliance with design and technical standards. The Department of Water and Sanitation (DWS) seeks to eliminate sanitation backlog that amounts to R50 billion in Free State, Eastern Cape, Limpopo, KwaZulu-Natal and the Northern Cape as provinces with highest sanitation backlogs (StatsSA, 2016). Again, the Minister for Cooperative Governance and Traditional Affairs (GOGTA) urged municipalities to spend at least 10% of their budgets in maintenance activities. Briefly, R7 billion annually is required to wipe away the sanitation backlog.

2.17 Transport infrastructure

South Africa has a well-developed and modern transport system consisting of air, and rail networks, which are considered the largest in the continent, and the road network that is in general good condition. An efficient transport network contributes to the country's global markets competitiveness and is a driver for economic and social development. However, this sector is facing a number of challenges that could influence the country's growth and competitiveness. Current research has estimated that of the total world's infrastructure backlog of $57 trillion, $3.2 trillion a year over the next two decades is needed to eliminate maintenance backlogs (World Bank, 2014). The estimated maintenance backlog is R1.5 trillion in South Africa and the transport sector is a very much part of it (National Treasury, 2015).

i Roads infrastructure

South Africa has about 750 000km total road network, regarded the longest in the continent. While the total national road network is keeping pace with demand, provincial and municipal roads are in a state of disrepair owing to lack of maintenance and skills shortage (SAICE,

2011). Current research shows that SANRAL has acquired some provincial roads due to provinces' inability to provide adequate maintenance and has tripled its investment in road infrastructure. South Africa's road network is highly congested arising from high car ownership and increasing freight volumes leading to deterioration in road quality that dampens economic growth. According to Statistics South Africa, the road maintenance backlog was estimated at R78 billion in 2010 amounting to 3% of GDP. Table 2.17 shows a breakdown of road maintenance costs for 2010.

Table 2.17 Road infrastructure backlog-2010.

Authority	Paved road backlog ZAR million	Gravel road backlog ZAR million	Total road backlog ZAR million
National roads (SANRAL)	9,249	0	9,248
Provinces	36,093	5,486	41,579
Metropolitan areas	12,713	719	13,433
Municipalities	6,283	8,143	14,427
Total	64,339	14,348	78,688
Budget per km	420,000/km	32,000/km	130,000/km

Source: SANRAL

SANRAL further depicts that despite recent heavy investment in road infrastructure, South Africa's road sector has an infrastructure backlog of almost R200 billion and a maintenance backlog of R3.2 billion. In 2014/15 SANRAL expended about R1.9 billion to maintain 1899 km of its toll roads.

In order to achieve sustainable economic growth and meet demands on existing infrastructure, there is an urgent need to improve South Africa's road network. The visual condition of the road infrastructure indicates a steady increase in the percentage of provincial road network that is worn-out and needs maintenance. Currently, South Africa has an estimated 750 000km road network, 618 081km of them are proclaimed roads (National Treasury, 2015). Assessment of the condition of these roads is hampered by outdated management systems' database which lacks information on about 18% of the roads (National Treasury, 2014). In this regard Srnivasan and Parlikad (2013) states that condition monitoring techniques to capture the condition of assets must be implemented in order to have a useful database.

Despite lack of comprehensive data, studies indicate that about 80% of the road network is older than its original 20 year design life and its maintenance is 18 times higher than the cost for routine and planned maintenance. National Treasury, (2014) also indicates that about 30% of the provincial roads which data is available is in poor or very poor condition due to maintenance neglect and should not be allowed to deteriorate further.

Furthermore, decline in the quality of South Africa's roads indicates an urgent need for adopting a maintenance culture to ensure a regular supply of resources to eliminate maintenance backlogs. In the 2014 budget, R25 billion was allocated to SANRAL, the provinces and municipalities for road maintenance, however it was insufficient to address the estimated road infrastructure backlog of R340 billion where R149 billion is needed just for maintenance (National Treasury, 2015).

ii Rail infrastructure

The total rail network is almost 21 000 km, and compares favourably in size to that of Poland, Italy, Ukraine and Mexico. However, the carrying capacity of Transnet and PRASA is below current demand because of shortage of rolling stock. The state owned enterprise (PRASA), responsible for rail commuter transport has currently embarked on a programme that will increase its investment in infrastructure to replace the existing rolling stock and upgrade quality of stations to reverse past disinvestment.

Investment planning was done on five-year programmes with the first programme starting in 2011-2015 and involves improving punctuality by 25%, locomotive efficiency by 30% and reducing turnaround times by 20% (DBSA, 2012). The total Transnet's investment needs for the rail sector are R56 billion on a five-year planning horizon, about 35% of which will be spend on expanding rail capacity and 65% on upgrading and maintaining existing rail stock (Transnet, 2010). PRASA's total capital costs amount to R200 billion over a 30-year planning period also starting from 2011, whereby R3 billion to R4 billion per year will be spend on upgrading and maintaining its rolling stock to improve its operating life and service quality (DBSA, 2012).

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This platform outlines the manner in which a problem is solved during research. The first two objectives have already been addressed in the literature review chapter by studying publicly available documents and policy analysis reports to provide a unified report on the condition and size of maintenance required for each sector. The following chapter intends to answer research questions relating to the third objective, which aims at identifying capacity constraints of the current financing strategies to address maintenance deficiencies in South Africa. This type of research is descriptive in nature and warrants a qualitative approach. Creswell, (2009) argues that a qualitative study intends to understand vividly the views on a topic of interest from participants who hold certain degrees of expertise in a particular field. Data collection for this kind of research takes different forms and is available in a number of sources; publicly available documents and through interviews.

Not much research has been conducted on identifying challenges faced by the current financing strategies to address maintenance needs especially in South Africa, hence lack of available information on this topic presents a need to obtain first-hand (primary data) from experts in both public and private sectors. In order to study the views of participants, comprehensive interviews are conducted.

3.11Methodology

Interviews enable a researcher to gain rich and insightful views in a specific topic of interest from knowledgeable parties or sources. In this case the respondent is regarded an expert in a particular field and the interviewer expects to learn as much as possible about the topic. Interview questions should be asked and structured in a manner that does not lead response of the interviewee.

3.12 Respondents selection

In order to gain more insights into infrastructure maintenance financing matters in South Africa, choice of respondents is based on availability and willingness of participants in the public and private sector to express their views freely in answering research questions. Semi-

structured interviews are developed to gain rich and deep understanding of matters pertaining to financing infrastructure maintenance by interviewing appropriate persons who are well informed on the current financing strategies. For the purpose of this research, random sampling is inappropriate, as an in-depth understanding of the topic is required.

3.13 Data Collection

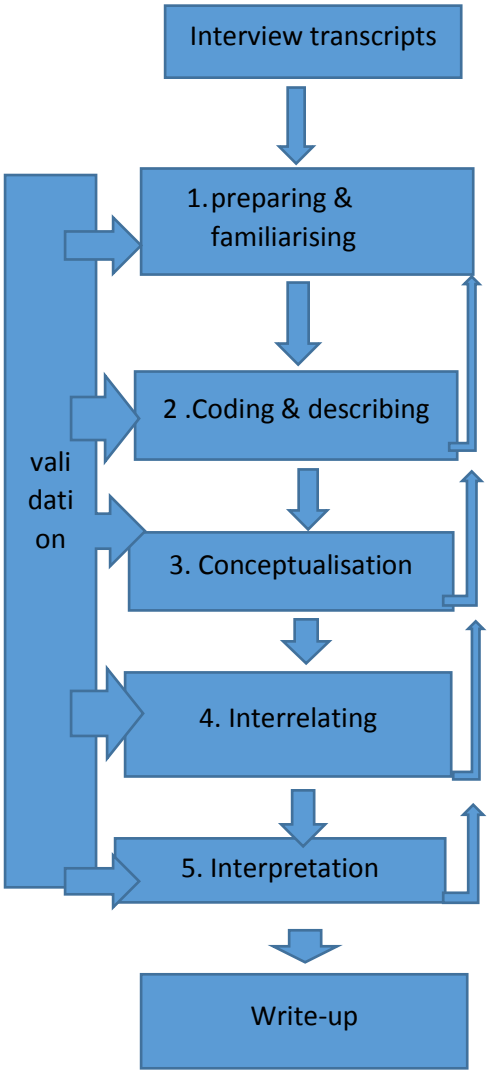
There are several ways of conducting interviews and they include; face-face, telephone and email. The choice of each is influenced by technology used, time and space to generate responses. Face-face interviews are not possible for some participants because respondents could not schedule interviews due to busy nature of their jobs. However, personalized e-mails were sent to selected participants to request for their participation a survey questionnaire that briefly outlined the purpose of this research and a detailed list of guiding questions (provided in appendix at the end of the report) to ensure that relevant questions on the topic are addressed.

3.14 Data Analysis

Analysis section is an important part of research whereby the researcher seeks to interpret data gathered throughout the study. According to Taylor-Powell and Renner, (2003) interpretation of data is a continuous process which lies between data collection, data analysis and interpretation. This process is not constant hence moving back and forth between the steps is likely.

The narrative analysis process followed for this research is adapted from (Taylor-Powell and Renner, (2003); Piercy, 2004; Creswell, 2009) and involves five steps that are briefly described by fig: 3.14 below.

Fig: 3.14



Source: (Taylor-Powell & Renner, 2003; Piercy, 2004; Creswell, 2009)

1. Preparing and familiarising

This step involves investing time and effort in order to understand data. In interviews, notes are taken and any impressions are written down as one goes through data.

2. Coding and describing

The second step to analysing narrative data involves reviewing the purpose of evaluation and the ultimate objectives of the research. Again, the researcher identifies key questions that will lead to achieving study objectives. This will assist the researcher by giving direction on how to begin identifying consistencies and differences in the respondents' answers.

3. Conceptualization

In the third step of the analysis, the researcher brings meaning to the words and forms ideas, identify themes or patterns and organize them into coherent categories that summarize and bring meaning to the text

4. Interrelating

The fourth step of data analysis involves identifying patterns and connections within and between categories. A theme is a meaning that is common across various instances within the interview data. These themes are used to identify dependability of responses.

5. Interpretation

The final stage in which themes and connections are used to explain research findings. It involves attaching meaning and significance to the analysis.

CHAPTER FOUR: DATA ANALYSIS AND RESULTS DISCUSSION

INFRASTRUCTURE MAINTENANCE FINANCING CAPACITY IN SOUTH AFRICA

4.1 Introduction

This section of research presents outcomes of primary data gathered through a survey questionnaire relating to capacity challenges facing financing infrastructure maintenance in South Africa. A questionnaire detailing the nature of questions posed for this study is provided in the appendix at the end of this research.

Personalized e-mails were sent to infrastructure professionals and developers from both public and private sectors. Of this population, only 19 showed interest and agreed to take part in the survey. Until the compilation of this report, correspondence was received from fifteen participants, and the other four promised to provide their responses. The fifteen respondents represented (nine in the private sector and six in the public sector). Analysis is designed to form an understanding of capacity challenges in financing infrastructure maintenance and cuts across the following subjects; infrastructure maintenance professionals' capabilities (attitude, skills and knowledge) and access to financial services & use of available funds.

4.11 Access to financial services & use of available funds

Table 4.11 presents unified dominant responses on the ability to use available funds and capacity to access new funds from financial services for infrastructure maintenance needs. The relative questions are designed to attain a vivid understanding of how maintenance shares in the government budgets and how efficiently government utilises markets to provide adequate levels of funding. Table 4.11 tabulates dominant responses to the key questions on these matters.

Table 4.11 Capacity to use and access financial markets

	Dominant responses (yes/no)	Proportion of respondents
1. Does government allow reallocations of funds from less spending line items to those that have critical demands?	NO	8/15
2. Are there situations where there are unspent funds in particular line items and such funds are repossessed and reallocated to the next fiscal year?	YES	15/15
3. Does government have capacity to support capital spending?	YES	11/15
4. Do state departments recycle old assets including those items no longer fit for purpose?	NO	9/15
5. Is there a well-developed capital market that can allow government to raise debt securities to finance infrastructure?	YES	15/15
6. Is government spending adequate for infrastructure maintenance?	NO	13/15
7. Is there enough capacity to raise funds from external sources? (institutional framework)	YES	11/15
8. Can private sector contribute to funding infrastructure requirements especially maintenance?	YES	14/15

According to respondents, funds disbursement from treasury normally take a long time to reach ministries and cause delays for planned activities to be carried out. They also noted that this delay result in unspent funds which treasury repossesses at the end of the fiscal year. Respondents ascribed this to lack of planning and execution of duties by officials who are directly involved with infrastructure management. They also noted that, politicians' interest in new construction have maintenance of existing assets deferred and deteriorating leading to high costs for rehabilitation and reconstruction.

Additionally, they stated that South Africa has a well-developed capital market trading bonds and shares at the Johannesburg Stock Exchange (JSE), which has sufficient ICT infrastructure that enables for better understanding of different ways of market operations. They also stated that bond financing presents the most profitable and appropriate financing for infrastructure projects. However, limitation of access to bond financing is apparent at the municipalities because of the large scale of their funding requirements.

They also stipulated that local debt markets have been utilized at length for infrastructure financing in the past, but funds have never been enough to address all infrastructure needs due

to risky nature of infrastructure projects. However, they noted that private sector financing for infrastructure is the major approach that will set South Africa on the right growth path by delivering finance and asset management expertise to the projects. Even so, there is limitation of entry for private investors in infrastructure investment due to lack of proper government policy to ensure structuring financing deals and unresolved legislation governing contracts.

4.12 Capabilities of infrastructure maintenance professionals

Similar to analysis in 4.11, table 4.12 presents unified responses from a developed questionnaire on the capabilities of infrastructure maintenance professionals in providing maintenance at adequate levels to restore the country to expected levels of economic performance.

Table 4.12 Capabilities of infrastructure maintenance professionals

	Dominant responses (yes/no)	Proportion of respondents
1. Is the level of staff in state run utilities adequate to handle infrastructure matters?	NO	12/15
2. Is the internal staff conversant with disciplines such as finance and economics?	NO	15/15
3. Are there appropriate policies and regulations to reduce corruption and poor procurement practices?	YES	10/15
4. Is the internal staff aware of the current age and condition of infrastructure assets?	NO	15/15
5. Are there in-service trainings to develop internal skills on maintenance issues?	YES	9/15

Respondents noted that a number of factors have resulted in significant under-funding for maintenance, which they ascribed to shortage of artisans, inadequate management practices, and ineffective regulatory systems. Maintenance professionals are uncertain of the extent, location and composition of key needs of infrastructure assets hence they provide inadequate maintenance budgets that do not properly address backlogs. This problem is most apparent at rural municipalities. Again, in response to addressing corruption issues government has initiated the Association for South African Quantity Surveyors (ASAQS) that aims to root out corruption in infrastructure projects by ensuring that contracts are delivered effectively on the merits of the contractor and that projects are completed within time and budget.

Government is also addressing incompetence of maintenance professionals especially at rural municipalities through establishment of lifecycle strategies for assets to achieve international best practice requirements for maintenance funding. Respondents also advocated that government deploy cost-effective development plans by balancing best use of existing stocks with replacement or new infrastructure and adopt best infrastructure management methods comparable to those used by private sector in order to secure sufficient funding for maintenance.

Government needs to reduce deferred maintenance by taking positive steps towards developing long-term strategies to ensure existing maintenance backlogs are significantly minimised and associated costs are sufficiently confined. In order to achieve this the extent, nature and condition of infrastructure assets need to be determined and plans on how to carry out maintenance be established. This information will provide a guide to developing adequate maintenance budgets and asset management planning programmes to curb maintenance deficiencies.

Respondents also noted that a major problem with infrastructure development is that too little money is available for maintenance and deterioration of assets rises faster than anticipated. However, skills shortage, lack of knowledge of work as well as theft and vandalism seem to exacerbate the situation suggesting a need to identify additional funding mechanisms that deliver maintenance at adequate levels.

4.13 SOURCES OF ADDITIONAL MAINTENANCE FUNDING

The most profound steps to identifying additional funding mechanisms reside in forming a sound understanding of the magnitude of funding required for each maintenance need and issues pertaining to unavailability of funds when required. These will enable better matching of needs with capabilities of different funding models as well as maintenance standards that should adopted. The high age of a bulk of infrastructure stocks in South Africa imply more repairs and maintenance to minimise high costs of rehabilitation. Identification of per sector needs can assist in identification of suitable funding models.

Again, having the right policies to prioritize maintenance can help to develop a culture that protects existing assets and provide adequate funding to new and existing assets.

Engineers and infrastructure professionals can ensure this by consistently educating politicians and the public about the importance of maintenance. The absence of maintenance policies is a major obstacle in protecting infrastructure investments. The government of South Africa, through its treasury department has established a National Development Plan, which offers a long-term perspective of eliminating poverty and reducing inequality by 2030 through increased investment in infrastructure. However, the importance of infrastructure maintenance is not fully understood by government shown by funding priority being given to new construction. The aim of this section is to identify additional sources for securing additional maintenance funding.

Support from development partners:

It is a support programme meant to provide assistance to public spending actions of a partner country to enhance the effectiveness and efficiency of its development. According to the OECD, (2006) external financing resources are transferred to the partner government's national budget to provide extra support in attaining their MDGs. Organising necessary funds to satisfy growing demand for maintenance funding requires ample support from development partners to supplement their inadequate government maintenance budgets. However, efficient reporting mechanisms must be in place to support conditional use of partners' funds. Performance of several funding mechanisms is generally poor due to poor financial management, illegal shifting of donor funds and use of funds for unauthorized expenditures. As such, reforms to enhance good financial reporting that cover all administrative mechanisms and rules should be revised from time to time to support properly compiled infrastructure plans.

User fees:

Charging fees for infrastructure services provided will help secure adequate funds for future maintenance of infrastructure. These fees can be used to recover costs associated with development of infrastructure and can be linked directly to the level of service provided. User charges in the form of toll tariffs on usage of South African national roads have provided additional funds for maintenance. Although design of user fees is usually politically determined, care should be taken to allow easy payment by users in the long-term. Again, in order to achieve long-term business plans these fees can be used to make ample provision for effective maintenance.

The World Economic Forum, (2014) shows that this can be achieved by enhancing service effectiveness, dedicating user fees to maintenance funds and capturing additional business opportunities. It is also imperative that governments adopt infrastructure management mechanisms comparable to those used by private infrastructure providers. The long-term planning process that involves whole-life cost determination will also assist in identifying cost effective investment strategies and allow multi-year maintenance plans to take place.

Private Sector:

Maintenance neglect, corruption, inability to deliver efficient investment spending and misallocations of resources have led to large infrastructure deficits. As a result, private sector participation has evolved as an alternative mechanism for attracting private capital and expertise for infrastructure investments thus increasing productivity and cost-efficiency in long-term operations and maintenance. Private financiers have potential to increase infrastructure funding to allocate resources to developing infrastructure as well as provide adequate maintenance through long-term contracts.

World Bank have discovered that involving private sector to offer financial and expert assistance in infrastructure development may provide adequate finance for maintenance and infrastructure services of high quality. Accordingly, PPP models that cover the whole life of an asset provide reliable maintenance financing World Economic Forum, (2014). Similarly, Castalia Strategic Advisors, (2007) noted that there is low institutional capacity for PPP models although South Africa has enjoyed many years of private participation in infrastructure through its state owned utilities such as Eskom and SANRAL. However, private sector participation is still low in South Africa due to its restrictive institutional and regulatory environment (Bruchez, 2014). In order for governments to attract private capital, it is credible that reforms that involve clear and stable regulations and efficient procurement procedures are developed.

CHAPTER FIVE: SUMMARY OF FINDINGS AND CONCLUSIONS

This chapter reports outcomes of research objectives that were set out in section 1.15 in chapter 1. The investigated objectives are stated as follows:

- Document the current state of repairs of existing stocks in various infrastructure sectors of South Africa;
- Identify maintenance gaps in different infrastructure sectors if any;
- Identify specific capacity challenges to financing infrastructure maintenance;
- Suggest some financing strategies for closing the maintenance gaps.

Much of infrastructure assets in South African is deteriorating and its quality is doubtful which places it in dire need for maintenance. Lack of maintenance in majority of infrastructure has further contributed to unreliable services in water & sanitation, road and electricity that is linked to recent service delivery protests in many parts of the country. Careful consideration on how to allocate scarce resources must be placed by policy makers and give maintenance priority over new infrastructure projects (Gibson and Rioja, 2017). They further denoted that maintenance affects quality of existing infrastructure and thus the flow of services resulting from it. To present, operations and maintenance budgets are inadequate in all areas and maintenance programmes are insufficient except for infrastructure that is owned and managed by State-run Entities such as Eskom and SANRAL. These entities usually have strong financial and asset management regimes that allow high levels of maintenance compared with public sector managed infrastructure.

The investigation also reveals that the magnitude of financing maintenance is huge in the country and is expected to increase further the longer maintenance and repairs is ignored. In general, not much has been done to redress funding gaps; of the major sectors, power maintenance needs are more colossal with R225 billion over 5 years from 2016. Theft to Eskom's transmission line is expected to increase the maintenance backlog by R1.6 billion annually which further exacerbates the problem. Again, shortage of skilled infrastructure professionals to implement and supervise maintenance is a problem across all municipalities.

This study also investigated capacity issues that affect adequate infrastructure maintenance financing. This was achieved by studying capacity of maintenance professionals in relation to their skills, attitude and knowledge of work and the capacity to efficiently use available funds as well as of use of financial markets. The study highlights that lack of knowledge of the extent, location and condition of infrastructure assets have led to under-spending on maintenance. This specifies that shortage of skilled personnel in infrastructure is key in many municipalities and has resulted in underestimating maintenance budgets.

Second, although local debt markets have been utilised at length municipalities have limitations to access these markets due to repayment plans offered and the magnitude of funding that they require. Therefore, involving private sector participation will provide financial and expert assistance in infrastructure projects. Although South Africa has in many years enjoyed private capital and sustainable infrastructure services provided through PPP models, restrictive regulations governing PPP contracts have limited entrance to infrastructure investment. Possibly, there has to be review of these regulations and disburse knowledge and understanding of the prominence and appropriateness of infrastructure maintenance investment by policy makers.

Finally, the study revealed that several maintenance funding mechanisms that provide supplementary maintenance budgets follow ample reporting standards that deliver adequate financial management reporting that prevent illegal use of funds for unauthorised expenditure.

APPENDIX: RESEARCH QUESTIONNAIRE

Table 4.11 Capacity to use and access financial markets

	Dominant responses (yes/no)	Proportion of respondents
1. Does government allow reallocations of funds from less spending line items to those that have critical demands?		
2. Are the situations where there are unspent funds in particular line items and such funds are repossessed and reallocated to the next fiscal year?		
3. Does government have capacity to support capital spending?		
4. Do state departments recycle old assets including those items no longer fit for purpose?		
5. Is there a well-developed capital market that can allow government to raise debt securities to finance infrastructure?		
6. Is government spending adequate for infrastructure maintenance?		
7. If the answer to the above question is NO, what are the causes of underspending?		
8. Does underspending occur in all locations or specific to others only?		
9. If the answer to 9 is NO, please provide suggestions on how sending can be improved.		
10. What measures can be proposed to address underspending?		
11. What are the primary sources for infrastructure available in this country?		
12. What forms do they come in (bonds, loans, grants)?		
13. Can private sector contribute to funding infrastructure requirements especially maintenance?		
14. How long does it take treasury on average to authorize/ release funds for use by line ministries?		

Table 4.12 Capabilities of infrastructure maintenance professionals

	Dominant responses (yes/no)	Proportion of respondents
1. Is the level of staff in state run utilities adequate to handle infrastructure matters?		
2. Is the internal staff conversant with disciplines such as finance and economics?		
3. Are there appropriate policies and regulations to reduce corruption and poor procurement practices?		
4. Is the internal staff aware of the current age and condition of infrastructure assets?		
5. Are there in-service trainings to develop skills of maintenance staff?		

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