UNIVERSITY OF KWAZULU-NATAL

INVESTIGATING THE INFRASTRUCTURE ASSET MANAGEMENT PRACTICES IN THE TRADING CLUSTER OF ETHEKWINI MUNICIPALITY

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ABSTRACT

The South African government strives to achieve economic growth through infrastructure development. The government is under severe pressure to increase capacity due to the ever-increasing demand for basic services by the public. The need to provide for rapid urbanisation has arisen, whilst the challenges of replacing ageing infrastructure and providing quality and reliable service to the community still remain. All these demands need to be met, regardless of the limited budget, thus, municipalities are faced with severe budget constraints. The eThekwini municipal budget is influenced by the strategic objectives identified in the Integrated Development Plans (IDPs). In the same way, the Service Delivery and Budget Implementation Plans (SDBIP) ensure that the municipality implements programmes and projects that are based on the IDP targets and their associated budget. This study thus aims at assessing the service delivery performance of the Trading Cluster Service Units. The study investigated the infrastructure asset management practices in the Trading Cluster of the eThekwini Municipality, by determining if the Trading Cluster budget is aligned with the sustainability of public infrastructure assets. The quantitative approach to research was selected for this study, because the researcher aimed to understand if the budget is aligned with the sustainability of public infrastructure. A questionnaire was used to collect data from participants in the trading cluster. The main finding of the study was that the budget allocation is somewhat misaligned with the sustainability of the public infrastructure and this points to the need for future models of resource allocation. Based on this finding, it was recommended that the budgets need to be geared towards the delivery of effective services to the community, while an "Ecological Budget "system should be implemented.

Key words*: infrastructure asset management; sustainability; budget; eThekwini Municipality; Service Delivery and budget implementation plan (SDBIP); Integrated Development Plan (IDP)*

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COGTA – Corporate Governance & Traditional Affairs

DPLG – Department of Provincial and Local Government

DSW – Durban Solid Waste

DWAF – Department of Water Affairs and Forestry

HSRC – Human Science Research Council

IAMP – Infrastructure Asset Management Plan

IDP – Integrated Development Plan

IMIESA – Institute of Municipal Engineering of South Africa

KMO – Kaiser –Meyer

MFMA – Municipal Finance Management Act

MIIF – Municipal Infrastructure Investment Framework

MSA – Municipal Systems Act

MTEF – Medium Term Expenditure Framework

MTSF – Medium Term Strategic Framework

RSA - Republic of South Africa

SCM- Supply Chain Management

SDBIP – Service Delivery Budget Implementation Plan

STATS SA – Statistics South Africa

CHAPTER 1

OVERVIEW OF THE STUDY

1.1 Introduction

EThekwini Municipality implemented the Infrastructure Asset Management Plan (IAMP) in 2009. This was implemented in order to conform to an accrual accounting system, as well as to support sustainable, social and physical infrastructure plans. One of the goals of the IAMP is to meet the required level of service, at the most cost-effective manner. Local literature revealed that municipalities adopt a holistic approach comprising an enterprise-wide approach to asset management, while at the same time their role is to prepare asset management plans which quantify asset life cycles as a response to service needs. In this way, a supporting implementation plan addresses funding, as well as organisational capacity issues like asset management plans (Boshoff, Childs & Roberts, 2009).

Municipalities are required to provide increasing basic services within the constraints of budget allocation. The budget allocation has to be aligned with the sustainability of public infrastructure assets. The current body of literature on the relationship between the best practice and municipal infrastructure shows that a change in the approach in which municipalities plan, design, construct, manage, maintain and rehabilitate basic infrastructure would improve service delivery excellence (Josie, Khumalo & Ajom, 2006).

Empirical studies investigated the different elements of infrastructure assets management practices and focused on the financial sustainability of infrastructure assets (Bins & Nel, 1999; Njon, 2011). Without the alignment of budget, the current infrastructure management practices may not be as effective as possible. Therefore, this study attempts to make an assessment of the infrastructure asset management activities in the Trading Cluster of eThekwini Municipality.

The research's focus is the Trading Cluster Services, which consists of three [3] service units which include the Cleansing and Solid Waste (CSW), Electricity, as well as Water and Sanitation.

The Trading Cluster Services were split into different service units for better organizational performance. The CSW ensures the cleanliness of the municipality, while the Electricity department provides electricity, public lighting, together with other energy services to consumers and the local community. The Water and Sanitation unit's core function is to provide efficient, effective and sustainable delivery of quality water and sanitation services. From the above description, it is evident that these units are surely essential service units, which the public cannot do without (EThekwini Municipality, 2009).

1.2 Background to the study

EThekwini Municipality's 2030's vision is to be Africa's most livable city, where all citizens live in harmony. This vision would be achieved by growing the economy and managing the formulation of policies, which would facilitate the provision of services required by its people. The efficient infrastructure supports economic growth, while at the same time improving the quality of life of the general public (Baldwin & Dixon, 2008). According to Boshoff et al. (2009), investment in infrastructure contributes to fast-tracked growth; while maintaining the existing infrastructure is equally important for service delivery sustainability.

Currently, the eThekwini Municipality is faced with rapid urbanization, meaning that the demand for basic services is increasing. The water and sanitation backlog for 2015/16 was reported to be at 23.67% that of electricity at 26.24%, while the backlog for solid waste stood at was 0% (EThekwini, 2016). Frischtak (2013) stated in his study conducted in Brazil, that infrastructural spending is a strong driver of output, while in turn, it is likely to place further demands on the infrastructure stock, thereby necessitating further investment demands. Thus, the challenge regarding insufficient funding is likely to be an ongoing one.

In December 2014, the KwaZulu-Natal Province was declared as a disaster due to adverse drought conditions (Mokonyane, 2015). Since then, the residents of eThekwini Municipality have been feeling the impact of drought and as a result of this, water

restrictions have been imposed on domestic, industrial and commercial consumers. The demand for water exceeds the supply. The Hazelmere dam and a few other reservoirs which are using step pumping systems, no longer have enough capacity to meet the current demand (EThekwini, 2015). The impact of climate change creates specific risks that have a direct impact on the life span of infrastructure (Giordano, Hall, Gilder & Parramon, 2011). Thus, integrating the green infrastructure into the strategic planning for new infrastructure project has become critical (Todes, Sim & Sutherland, 2009).

In the State of the Nation address (2012), President Zuma announced enormous infrastructure development plans nationwide, over the medium term, the process of which requires the need to first of all deal with the poor maintenance issues in order to rehabilitate the local government infrastructure (Zuma, 2012). In terms of the proposed infrastructure development, the Port of Durban is earmarked for expansion and would bring new revenue streams for the municipality. The cost of expansion is estimated at R60 billion and would provide additional capacity until 2025. The Port of Durban is the busiest in Africa and this huge investment would attract foreign investors. Investors would however, not invest in a city where services are not sustainable. In view of this, infrastructure projects, upgrades, maintenance and the budget allocation should be aligned with all future development projects. In view of the new development, it is imperative for eThekwini Municipality to provide all services in a sustainable manner (Burinskiene & Rudzkiene, 2009; Grundey, 2008). The analysis of the implementation of sustainable development policies indicated that infrastructure development is an essential element of strategic planning for the sustainable socio- economic development of the country.

Given the above description, the study aims to highlight the practices employed by the eThekwini Municipality Trading Cluster Services unit, as well as how these practices affect infrastructure asset management. The reason for doing so is to find ways of allocating the limited resources for the sake of public infrastructure sustainability.

1.3 Focus of the study

The focus of this study is to investigate the infrastructure asset management practices used by the Trading Cluster Services of eThekwini Municipality. The researcher surveyed Trading Cluster Services employees to get their opinions regarding the subject matter. These employees were chosen because they manage the infrastructural projects and they monitor the respective projects' budgets. The study, however, excluded other stakeholders such as the eThekwini residents, who are the users of the infrastructure provided by the municipality. However, it is the researcher's belief that the residents could have provided a sound and meaningful information in terms of their opinions regarding the sustainability of public infrastructure assets. The nature of the study meant that the researcher had limited time to conclude it hence, the focus was only on Trading Cluster Services employees.

1.4 Problem statement

The Trading Cluster Services Units are all classified as an essential service units and are all tariff-based. Although policies are in place, the implementation of the budget allocation is subjective; there is no scientific model used to allocate the budget. Walker's classic theory indicated that the economic and scientific approaches are the most appropriate tools to be used for budget and allocation (Walker, 1930: 30).

Key (1987) argues in his classic theory, the public budgeting theory and his famous question: how should one decide to allocate X dollar to activity A instead of activity B? Therefore, this research aims to determine if the Trading Cluster Services budget allocation is aligned with the service delivery performance. Municipal budgets form the basis for the performance evaluation and performance need to be measured against the set goals, objectives and targets.

One cannot examine any of the units independently, in terms of budget allocation, because they are all inter-dependent. Aschauer's (1989) study suggests public infrastructure as the foundation for the quality of life: water supply systems and waste management together help in reducing the levels of diseases, while at the same time

improving the health and aesthetics of the environment. Given the interdependency of these units, the implication is that all these service units need to be fully effective. To this end, Folscher (2006) highlights the importance of the budget by indicating that it should be reflective of the priorities, while at the same time being effectively linked with the policies, thereby increasing effectiveness and credibility. With that in mind, the study has the following objectives.

1.5 Objectives

The objectives of this research include the following:

- To establish the criteria used in the allocation of infrastructural projects funding
- To determine whether the budget is aligned with service delivery performance
- To identify the possible strategies for the application of integrated and sustainable asset management practices
- To identify issues impacting upon the infrastructural asset management projects

1.6 Research Questions

- What is the criteria used to allocate funding for infrastructural project?
- Is the budget aligned with the service delivery performance?
- What strategies are used for the application of integrated and sustainable asset management?
- What issues are impacting upon the infrastructural asset management projects?

1.7 Significance of the study

The overall aim of this study is to bring to the fore, the importance of infrastructure asset management. In that view, the study thus endeavors to enhance the current infrastructure management practices within the eThekwini Trading Cluster Services units. Given the

above objectives, the study would provide a practical application for the local government structure of South Africa, by enhancing the current policies and future practices with regards to infrastructure asset management practices. The outcome of the research is aimed to benefit the management, in terms of understanding the issues impacting on the infrastructure asset management practices; thereby developing policies that are aligned with the sustainability of public infrastructure. In turn, these policies would assist the municipality to provide sustainable basic services to all eThekwini residents. The investors would be keen to invest in a city where the delivery of basic services is uninterrupted, therefore, they would also benefit from the study. In this study, the eThekwini residents would gain some knowledge in terms of understanding how infrastructure projects are prioritized. Furthermore, eThekwini Municipality is one of the leading municipalities in terms of service delivery, hence, the study would also benefit other municipalities which would want to perform optimally. Essentially, the study would map a path for a new approach to budgeting, one that is integrated, sustainable, transparent, multidisciplinary and multilayered in the context of South Africa.

The Trading Cluster Services permanent employees who manage the infrastructure projects and budgets would benefit the most from the outcome of this research. The eThekwini Municipality Chief Financial Officer is mandated to allocate budgets to various Service Units within each cluster, will also benefit from this study.

1.8 Definition of key concepts

This research defines concepts that assist the reader in understanding the base definitions upon which this research was founded. The following concepts are explained.

1.8.1 Infrastructure asset management

Infrastructure asset management can be defined as "the process of decision-making, planning and control over the acquisition, use, safeguarding and disposal of assets to maximize their service delivery potential and benefits, and to minimize their related risks and cost over their entire life" (Bhoshoff et al., 2007v).

1.8.2 Budget

Khalo and Fourie (2006:134) defined the budget as "the monetary and financial plan of the individual or institution, which outlines the details on how objectives and goals will be achieved".

1.8.3 Integrated Development Plan (IDP)

This is the planning process through which the municipality establishes the development plan for the short, medium and long term. AFReC (2001:4) recognises the IDP as the strategic, consultative and objective-focused approach to the decision-making processes regarding municipal development.

1.8.4 Sustainability

The Brundtland Commission defines sustainability as the "development that meet the needs of the present, without compromising the ability of future generation to meet their own needs" (World Communication on Environment and Development, 1987:43).

1.8.5 Service Delivery

This is the actual production or provision of goods and services to the community (Van der Waldt, 2004:95)

1.9 Dissertation outline

Chapter 1 provided a brief overview of infrastructure asset management practices. It further sets out the challenges that have been identified by framing the problem statement and aim of the research. The objectives were formulated as the foundation to pursue further chapters of the research. **Chapter 2** deals with the review of literature from the perspective of various authors, on subject relevant to the research. **Chapter 3** provides the methodology and the rationale for the research, the population, sampling analysis, methods of data collection, ethical considerations and concludes with the research limitations. **Chapter 4** presents the data findings and observations of the research. **Chapter 5** provides an interpretation of the data collected. **Chapter 6** draws conclusions and recommendations that may be considered by future research.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This literature review chapter unpacks the issues impacting on infrastructure asset management practices, while at the same time examining the strategies that are in place for the sustainability of public infrastructure assets, both locally and internationally. In that view, the following issues are discussed in the chapter: what constitutes service delivery output in the context of Trading Cluster Services, the provision of water and sanitation, as well as electricity and solid waste management. It is also indicated in the chapter that the capacity to provide essential services unequivocally relies on the existence and maintenance of infrastructure.

2.2 Defining infrastructure asset management

Infrastructure asset management can be defined as "the process of decision-making, planning and control over the acquisition, use, safeguarding and disposal of assets to maximise their service delivery potential and benefits, and to minimize their related risks and cost over their entire life" (Boshoff et al., 2009: 234). The International Infrastructure Management Manual (IIMM) defines asset management as "the combination of management, financial, economic and engineering and other practices applied over the full life cycle of physical assets to provide the required level of service for present and future customers in the most cost-effective way" (New Zealand Asset Management Support, 2011). Detter and Fölster (2015) defined infrastructure asset management as the interconnected, multidisciplinary set of strategies in sustaining public infrastructure assets such as water treatment facilities, sewer lines, roads, utility grids, bridges and railways. Various definitions of infrastructure asset management have emerged since the nineties. However, the common factor from the different definitions is how physical and human assets should be managed to expand the life cycle of the asset.

2.3 Infrastructure asset management in South Africa

Infrastructure asset management is a specialised area that calls for expert knowledge, as well as sound information management systems (Boshoff et al., 2009). This is to ensure enough capacity for the provision of the required services, at the right standards and at the most efficient cost. According to Gold et al., (2001) knowledge management requires organizational capabilities. Gold et al further argued that the effectiveness of infrastructure management process lies in its knowledge management.

In South Africa, municipalities are faced with chronic skills shortages in terms of service delivery (IMEISA, 2015). eThekwini Municipality is also faced with a skills shortage (eThekwini, 2016).The infrastructure management processes are complex and sophisticated, meaning that they need engineering expertise and knowledge in all municipal departments, hence, the reason why the sector is considered a scarce skills one (Schraven, Hartmann & Dewulf, 2015). South Africa is not the only country that is faced with skills shortage. Brazil has an annual deficit of over 200 000 thousand engineers, whilst countries like Spain, Japan, China and Portugal have an excess supply of engineers (Confea, 2011).

In addition to the skills shortage gap, municipalities are required to conform to the Municipal Finance Management Act (MFMA), Municipal Systems Act and other legislative pieces which stipulate the need for the long-term maintenance of the infrastructure assets (Booyzen & Fourie, 2010). However, many municipalities have not conformed to the legislation. Researchers noted that complying with the legislation is something that takes years to be implemented, the reason why infrastructure assets deteriorate faster than expected, while those that are in good condition remain overloaded (Boshoff, 2009).

In South Africa, municipalities are forced to improve efficiency and to manage their infrastructure inventory. Furthermore, the increasing demand level, ageing and deteriorating infrastructure, inadequate funding and the need to comply with harsh environmental regulations, are still major challenges (Nishimura, Konishi & Murrakami,

2015). Thus, there is an urgent need to invest in ageing infrastructure. The global infrastructure deficit is estimated at $1 trillion (IMIESA, 2015).

According to De Visser (2005), certain components of the infrastructure in South Africa are neglected and remedial treatment is applied because of inadequate funding. Similarly, a study by the World Bank indicated that businesses experienced major financial losses - about 30% of their profitability, due to the poor public infrastructure (Zeb, Froese & Vanier,2010). A large body of literature, including government reports and government strategic documents, have shown that the South African local government municipalities really need restructuring in order to improve municipal basic infrastructure and budgeting (DPLG, 2004)

2.4 Infrastructure management systems

Asset management methodology specifically uses software tools to organize and implement management infrastructure asset strategies. Thus, the fundamental goal is to preserve and extend the service life of long-term infrastructure assets, which are vital underlying components in maintaining the quality of life in society and efficiency in the economy (Grafton & Hussey, 2011). The tools and methodologies for infrastructure life-cycle management should incorporate all aspects to achieve towards a total solution, be they economic, environmental or technical. In the case of infrastructure assets, Jones (1991) argues that both assets and return may involve components that are not immediately measurable in terms of monetary values.

Local municipalities are investing in the implementation software tools to address the increasing sophistication of the infrastructure management processes. The need for efficient infrastructure management strategies led to the need to adopt a holistic approach to the asset management system (Zeb, Froese & Vanier, 2010). The infrastructure management system functions in such a way that it interacts with, while at the same time interpreting the output coming from the different systems (The Municipal Infrastructure Investment Framework, 2010).

2.5 Service delivery backlogs in South Africa

Detter and Fölster (2015) stated that the role of municipalities in Southern Africa entails the provision of basic services like water, electricity, solid waste treatment, roads and public amenities like cultural, educational, health, agricultural and recreational facilities. The consumers of these services include the social institutions, the business sector and the government as well (McDonald, 2015). However, the delivery of these services by municipalities has always been very poor, mainly due to lack of funding and the poorly skilled technical staff.

The developmental role of municipalities implies that they are responsible for the administration, planning and budgeting process which should prioritise the basic needs of the communities (Haycock, 2005). Service delivery is the actual production or provision of goods and services to the community (Van der Waldt, 2004:95). A backlog in terms of delivery of infrastructure and maintenance indicates that those dealing with services are not successfully dealing with the demand of a particular service (Sindane & Nambalirwa, 2012:697). According to Nzewi (2013), poor service delivery or a delay in service reflects the serious challenges of efficiency in the state processes.

Batho Pele Principles is a Sotho term meaning "people first". Batho Pele principles is aimed at holding public officials accountable for public service delivery and it is used as a tool to treat citizens as customers (Gildenhuys, 2000). It is based on the eight principles which public servants must adhere to in order to provide proper service delivery. Crous (2004) conducted a statistical review of service delivery through the implementation of *Batho Pele* principles. Crous highlighted that the principles are adopted by the White Paper. One of the criterion of the South African Public Services is judged by the effectiveness in delivering services that meet the basic needs of all South Africans.

A survey of 21 municipalities across four provinces, conducted before the 2011 Local Government Elections found that "only one in 10 citizens is satisfied with the quality of services provided by local council" (Van Hoof, 2011). The survey conducted by the Human Science Research Council found that 45% of those surveyed were dissatisfied

with municipal performance (HSRC, 2011). As a result, many communities are using social protests to express their dissatisfaction with regards to municipal performance. The social protests have become prevalent since 2004 (Booysen 2007). Thus, in 2009, the Cooperative Governance Minister, Sicelo Shiceka called for a turnaround strategy to eliminate such protests by 2014 (COGTA, 2009:35). However, social protests are still prevalent in South Africa. Service delivery challenges can be eliminated by the provision of faster and more effective infrastructure services.

A study conducted by Cooperative Governance and Traditional Affairs (COGTA) in 2009 highlighted two main obstacles to accelerating basic services. One is the lack of critical infrastructure in rural areas, while the other is the proliferation of informal settlements in urban areas. According to the COGTA report, "both these obstacles are beyond the capabilities of powers and functions of municipalities to confront by themselves". The study done by Marias and Kroukamp (2005) found that in order for managers to successfully provide for needs to the public, a particular level of skills, capability and capacity is necessary to achieve the desired results. Managers are therefore required to promote and implement innovative service delivery plans within a specific strategic timeframe.

The issues affecting the delays in service delivery are mostly linked to two main problems, namely corruption and delays caused by the restrictive compliance (red tape). Theorists have proven that delays that result from restrictive compliance do hamper the efficiency of provision of services (Nzewi, 2013:18).

2.5.1 Water and sanitation services
The Constitution of South Africa (Act 108 of 1996) states that all people living in South Africa have the right to clean and safe drinking water, as well as dignified sanitation services.

The White Paper on Water Supply and Sanitation Policy, (DWAF, 1994) defines the minimum acceptable basic level of sanitation as:

- Appropriate health and hygiene awareness and behaviour;
- A system for disposing human excreta, waste water and refuse, which is affordable to the users, safe, hygienic and easily acceptable and which does not have an unacceptable impact on the environment; and
- A toilet facility for each household.

Prior to the first democratic local government elections in 1994, only 50% of households had access to sanitation (Van Vuuren, 2008). The statistics has since improved to 60.6% (Stat SA, 2016). The global study found that over 1.9 billion people have gained *access* to improved sanitation services between 1990 and 2012 (World Health Organization and United Nations Children's Fund, 2013). In South Africa, huge funding is required for the construction of suitable water infrastructure. According to Ruiters (2011; 2013), the under-investment in the water sector was estimated at more than R600 billion in 2011; and an estimated R66.3 billion needed for water resources infrastructure to meet the increasing water demands over the following 20 years. These estimated costs seem excessive. However, in 2010, the World Bank indicated that Africa was lagging behind other developing countries globally in terms of infrastructure (World Bank, 2010). Jackson and Hlala (1999:9) state that efficiency and effectiveness of service delivery are not based on a huge amount of resources, rather on the best utilization of the available resources and in particular, human resources. In his findings, Collins (2000) concluded that the increase in funding for service delivery could be unrealistic and attention should be given to the way service delivery is organized, executed and the barriers of improving service delivery.

2.5.2 Electricity

Maloka (2002) tabled a mid- term report to the national government, which showed that 3.5 million electricity grid connections have been made since 1994. The demand has increased post the 1994 local government elections. According to Boshoff et al. (2009), the ever-increasing demands for the municipal services have accelerated infrastructure development and maintenance. The study conducted by Vecchiatto (2012) found that an

estimated budget of R35 billion was required for the maintenance and refurbishment of old distribution networks. The Stats SA Community Survey Report (2016) indicated that 91.1 % households have electricity connections.

2.5.3 Solid waste

According to Moghadam and Mokhataran (2009), rapid urbanization, increasing population levels and the booming economy, have greatly accelerated the municipal solid waste generation rate in the developing countries. Thus, there are inefficient waste collection services which are attributable to insufficient funding (Moghadam et.al., 2009). Henry et al. (2006) stated that poor road conditions and inadequate vehicles for waste collection services contribute to improper waste collection services. The study conducted in India highlighted that municipalities have failed to manage solid waste due to financial restrictions, while huge expenditure is needed to provide waste collection services (Sharholy, Vaishya & Gupta 2007). The absence of financial support, limited resources, the unwillingness of users to pay for the services, as well as the lack of proper use of economic instruments, have hampered the delivery of proper waste management service (Sujauddin et al., 2008). According to Stats SA Community Survey Report (2016), 68.6 % of households are receiving weekly refuse removal service. In the case of eThekwini Municipality, 100% of the households is receiving a weekly refuse removal service.

2.6 Service backlogs- Trading Cluster Services

Table 2.1: the state of eThekwini Municipality infrastructure delivery to eradicate existing backlogs in 2015/16 financial year.

Basic Service	Existing Backlog (consumer units) as at 31 December 2015	Delivery ranges per annum	Time frame to address based on current funding levels*
Water	59192	2000-2500	24-29 years
Sanitation	158837	8000-10000	16-20 years
Electricity	258449	8000-13000	20-32 years
Refuse Removal	0	1500-2000	0years[2]
Roads	1079, 36kms	10-15kms	71-107 years

Source: eThekwini Municipality, IDP, 2016/17

According to Table 2.1, it would take a minimum of 24 years to eradicate the water, 16 years to eradicate sanitation and 20 years to eradicate electricity services backlogs. This backlog could be exacerbated if the municipality fails to deliver services (Boshoff, 2015) and if the population growth increases.

2.6.1 Urbanization as a contributing factor to infrastructure crisis

The growth of urbanization provides an additional strain on the provision of water, electricity and waste services in South Africa. The research on urbanization shows that 61% of the Southern African population is living in urban areas (UNHabitat, 2010). The demographic growth rate in Africa is slowing, with rural-urban migration being on the increase, thereby forcing larger cities to equip themselves to accommodate new arrivals (Sanyal, 2011*).*

According to UNHabitat (2010), about 62 % of Sub-Saharan urban dwellers live in non-serviced slums, which is indicative of increasing urbanization, as well as poverty and social insecurity. This is one way of showing that the global infrastructure crisis has presented itself, and how this crisis has affected an increasingly resource-constrained

world. However, there are different views indicating that most of the urban cities lack the infrastructure required for people to live a quality of life equivalent to their counter-parts in the developed city. This prompted many scholars to focus on issues of sustainability of the basic services (Hodson & Marvin, 2009; Krausmann et.al. 2008; Smith et.al, 2000). Research on urban infrastructure transformation focused on suggesting ways of reducing the consumption of resources, while improving efficiency through infrastructure redesign (Hodson & Marvin, 2010; Weisz & Steinberger, 2010). This study focused on 'grey infrastructure' networks of energy and the supply of material systems.

The essence of urban biophysical networks, also known as 'green assets' or 'green infrastructure' has not receive enough attention in literature. This "green infrastructure" provides ecosystem services necessary for improving the resilience of sustainability of communities. In eThekwini Municipality, rapid urban growth has a major impact on the city's environmental assets and the ecosystem service they provide. The study conducted by the World Bank found that the eThekwini global biodiversity hotspot is degrading due to rapid urbanization and climate change (World Bank report, 2016).

2.7 The state of the budget

In South Africa, budget allocation and expenditure patterns in the municipalities directly affect service delivery (Mkhize & Ajam, 2006). Theorists suggested different definitions of the budget. Khalo and Fourie (2006:134) defined the budget as "the monetary and financial plan of the individual or institution, which outlines the details on how objectives and goals will be achieved". Van der Waldt (2004:101) states that budgets need to be shaped by plans and link these plans of the organization concerned. These plans need to be realistic and be linked into a multi-year budget system. Several studies noted the essence of effective financial planning in municipalities, which is basically to deliver basic services required by the municipality residents and to keep these services within a restricted budget. (Ross, Westerfield & Jaffe, 1996: 686; Hellriegel, Jackson, Slocum, Staude, Klopper, Louw& Oosthuizen, 2006: 8). Thus, long term financial sustainability remains a priority for municipalities. The financial plan may be categorised into medium

term and short-term plans, thereby giving room for flexibility in the planning process (Kavanagh, 2007: 7; Lucey, 2002: 265).

According to Mkhize and Ajam (2006), effective financial management is achieved through budgeting and budgeting ensures that funds are available to implement the municipality's policies and delivery of service. However, Graves and Dollery (2009) noted that the budget is ineffective and unsustainable, mainly because the budget funding is directly influenced by the output of the financial plan (National Treasury, 2008; Managa, 2012). For municipalities to achieve their objectives, they are compelled to adopt a rolling 3-year budget (Medium-term Revenue and Expenditure Framework). However, the success of the implementation of the medium-term budget depends on the expenditure limit set over the medium-term to produce the desired results (Schick, 2010:12). Abedian, Strachan and Ajam (1965) stated one of the contributing factors to the failure of planned programme and budget system initiatives to deliver results was due to failure to integrate planning and budgeting. EThekwini municipality capital expenditure in 2013/14 was 80%, in 2014/15 it was 87% and in 2015/16, it was 88 % (eThekwini Municipality, 2016/17 IDP).

In terms of the South African Constitution, municipalities are required to structure and manage their budgets in ways that prioritize the basic needs of the communities that they serve (Haycock, 2005). Thus, the performance of the South African public service is crucial to eradicate the service backlogs (Erasmus, 2008). Thus, according to Valeta and Walton (2008), the effectiveness and efficiency to deliver the required services by municipalities largely depends on their ability to plan and allocate their resources in sustainable ways.

With regards to infrastructure management, the budget provision for infrastructure development, maintenance and refurbishment needs to be prioritized globally. The World Bank (2010) indicated that infrastructure in Africa lags behind other developing countries globally. This trend has still not changed. Thus, infrastructure spending is expected to grow by 10% each year and is currently estimated at $60 billion per annum. This

expenditure would be tripled by 2025, thereby putting more pressure on the currently strained financial resources (IMIESA, 2015).

Currently, very few municipalities in South Africa provide an adequate budget for infrastructure maintenance. They often concentrate on the construction and commissioning of new infrastructure, while ignoring the maintenance of the existing infrastructure (DPLG, 2004). Statistical research in this study showed that eThekwini Municipality repairs and maintenance expenditure was reported at 9.3 % for the 2014/15 financial year, which is well above the acceptable levels of the National Treasury benchmark (National Treasury, 2016).

The financing of basic infrastructure has gained global attention in literature, with reference to international fiscal arrangements. The study has shown, in the South African context, that funding of the basic service infrastructure must be aligned with the strategic framework. This approach would force municipalities to plan and align their budgets with the national strategy for basic services (Polokwane Local Municipality, 2010).

In terms of strategic planning, eThekwini Municipality introduced the integrated development Planning (IDP) policy in 2008, with the purpose of providing a means of coordinating services in a financially responsible way (Van Donk et al., 2008: 323). Thus, the eThekwini IDP is a five-year plan outlining the projects that need to be implemented (eThekwini Municipality, 2015/16). Venter (2007) argues that the success of the IDP is determined by the alignment of resources like financial and human, as well as the systems surrounding the municipality to enhance service delivery. The IDP has become an important tool around which the local government operates (Malefane, 2004:108). eThekwini Municipality's IDP process includes integrated planning and monitoring processes, which is managed via the strategic development process as detailed in Figure 2.1.
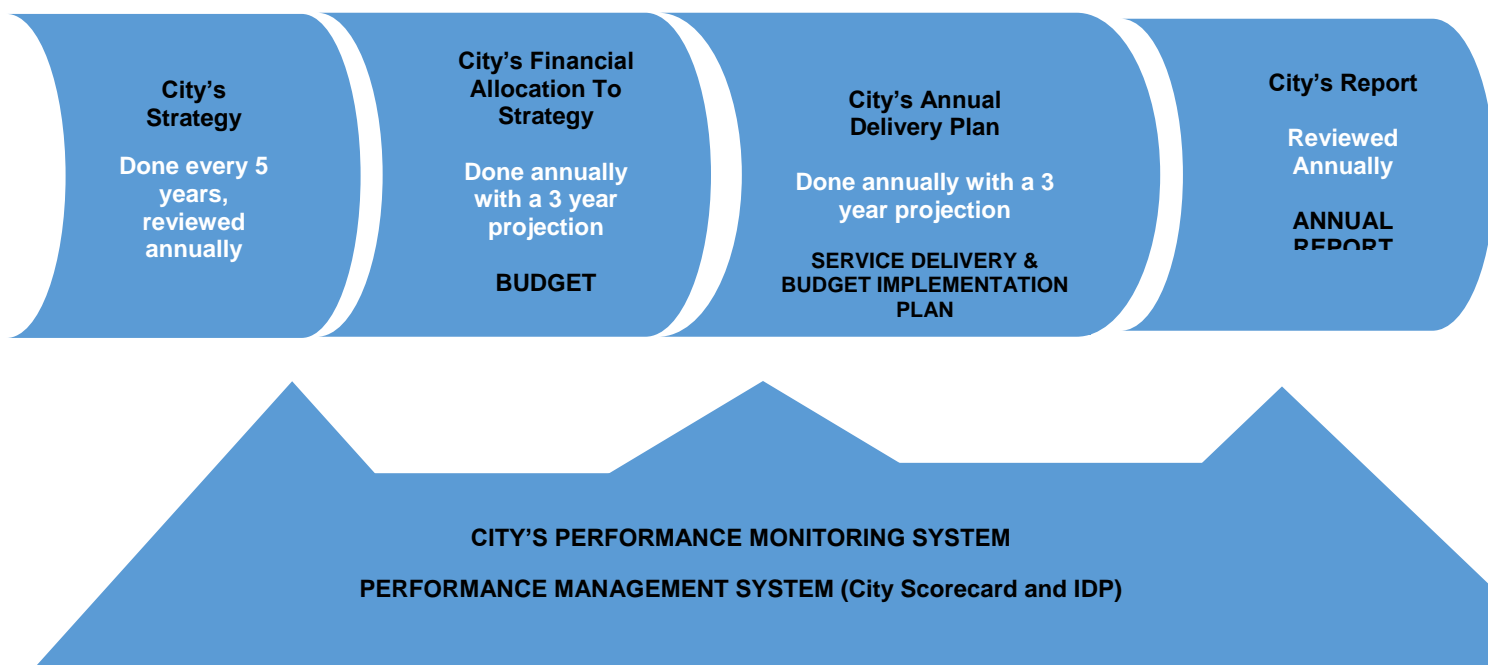
FIGURE 2.1 Integrated Planning and Monitoring Processes

Source: eThekwini Municipality (2016)

The municipality's budget is influenced by the strategic objectives identified in the IDP. The Service Delivery Budget Implementation Plan (SDBIP) ensures that the Municipality implements programmes and projects that are based on the IDP targets and their associated budget. The review of various IDP's in 2010, such as the one from Aganang and Polokwane Municipalities, shows that municipalities prioritise their basic infrastructure needs based on projects capture in the planning and budget systems of their last financial year. However, according to Polokwane Local Municipality (2010), ward councilors who have political influence are prioritised in terms of service delivery (Polokwane Local Municipality, 2010). There is a large body of literature globally and locally, which primarily focuses on the transformation of municipal planning and budgeting. The results of these studies have made a significant contribution to the best practice in the improvement of basic service provision. The section that follows describes the legislative issues surrounding the IDP and the budget.

2.7.1 Legislative provisions demonstrating a linkage between the IDP and budget

A number of legislative policy initiatives have been implemented by the South African government since 1994. These legislations are aimed at strengthening the linkage between planning and financial management (DPLG, 2001: 35). The present form of the developmental nature of local government in South Africa is premised on linkages between development, service delivery and local citizen participation (Govender, Khan & Moodley, 2007).

The South African Constitution Act (108 of 1996) highlights the legislative framework for the planning, as well as the implementation of the budget within the local government (Kumar & Moodley, in Reddy, Sing & Moodley, and 2003:66). Essentially, the Municipal Systems Act (32 of 2000) provides some guidance on the provision of services by municipalities, the MSA specifically indicates how the IDP should be used to prioritise service delivery, it provides the framework for the IDP methodology, while at the same time linking the IDP to structured programmes and project financial management. The Municipal Finance Management Act (56 of 2003) stipulates the financial management framework for local government, with the purpose of ensuring that municipalities' financial management is sound and sustainable. The linkage between municipal budget and the IDP is clearly defined in the Act. Thus, the IDP informs the budget which is implemented over the three-year cycle. The IDP may be reviewed, given the budgetary resources and spending commitments of the municipality.

The Medium-Term Expenditure Framework (MTEF) was established in 1997 as an important aspect of the budgetary reforms in public financial management. Visser (2005:21) noted that the framework highlights a solid basis for integrating planning and budgeting, while at the same time ensuring that the budget is reflective of the government's socio-economic priorities. He further noted that strategic planning and budgeting in the public sector is impossible to achieve when the strategic plan and budget are developed separately (Visser, 2005:20).

The Medium Term Strategic Framework (MTSF) is a medium term strategic priority which is aimed at informing, planning, budgeting and the implementation of strategies. The overall purpose of the MTSF framework entails the alignment of government planning cycles and procedures, as well as ensuring that policy and planning influence the budgetary process. The integration of strategic planning and budgeting is outlined in the National Treasury guidelines (2001). The integration is informed by monitoring and evaluation of performance and service delivery programmes, of course in line with clearly defined objectives, priorities, key performance indicators, targets and measures.

The Municipal Finance Management Act (MFMA) and Municipal Systems Act (MSA) provide a framework for the sound and sustainable management of municipal financial affairs. This research deals with the budget alignment within the Trading Cluster Service Units and the sustainability of infrastructure assets. The Integrated Development Plan (IDP) is the tool used by municipalities to link their goals to a financial plan (budget). Section 26 (h) of the Municipal Systems Act stipulates that the financial plan is the most important element of the IDP, which should include a three-year budget provision. The essence of the budget implies the need for sound financial planning, for efficient and effective service delivery (Abedian, Strachan & Ajam, 1998:5).

The Service Delivery and Budget Implementation Plan (SDBIP) ensures that the municipality implements programmes and projects that are based on an IDP and their associated budgets. The SDBIP has two layers (that is a two-phase plan), the top layer has consolidated service delivery targets and in-year deadlines. The second layer consists of detailed information prepared by business unit managers for their section, which is further broken down into sections and other operational areas (RSA, 2003). The SDBIP plan has the following indicators:
- Input indicators (expenditure patterns);
- Output indicators (e.g. number of new water connections);
- Outcome indicators (e.g. number of people with access to water (Vatala, 2005).

EThekwini Municipality uses its Integrated Development Plan, which is a detailed strategy divided into an eight-point plan. The implementation of the eight-point plan is through the Service Delivery Budget Implementation Plan (SDBIP) (eThekwini Municipality annual report, 2014/15).

2.8 Best infrastructure management practices

Several studies focusing on municipal infrastructure best practices confirm a significant need to develop an innovative approach to improve service delivery excellence. The empirical studies looked at the different elements of best practices (Bins & Nel, 1999) and Njon (2011) focused on the financial sustainability of infrastructure asset management globally. Ogu (2000:2) focused on the stakeholder partnership approach and Aijaz (2010) discusses capacity building and good infrastructure maintenance for sustenance of basic service delivery. According to Ogu (2000), the stakeholder partnership approach is the most effective one to improve the method in which municipalities plan and implement their budget. In addition, it is necessary to maintain their basic infrastructure services in partnership with all relevant stakeholders. Furthermore, the attributes of this stakeholder partnership approach include improvement in the development of basic service policy.

The asset management plan can achieve long-term economic success and overcome a number of challenges, if strategic alignment is achieved. This strategic alignment would ensure that the stakeholder's values and objectives achieve a balance maintenance budget (Schneider et al., 2006). An infrastructure asset management plan technically analyses the life cycle of an asset and predicts when maintenance needs to be done to the assets, before it deteriorates to such an extent that it no longer meets the community needs (Infrastructure asset management report, 2008). The body of literature on the relationship between best practices and municipal infrastructure shows that a change in the approach in which municipalities plan, design, construct, manage, maintain and rehabilitate basic infrastructure services will improve service delivery excellence (Josie, Khumalo & Ajen, 2006; Department of Provincial and Local Government, 2006).

2.9 The three pillars of sustainability of infrastructure asset management

The term "sustainability" was made popular in 1987 by the Brundtland Commission. The Commission defined sustainability as "development that meet the needs of the present, without compromising the ability of future generation to meet their own needs" (World Communication on Environment and Development, 1987:43). The concept of triple bottom line of sustainability in infrastructure emerged in the 1990's. Elkington (1998) described the three pillars of sustainability: environment, economics and society. These three pillars assist project managers and engineers in designing and constructing infrastructure that is sustainable. These three pillars are explained in terms of how they link to sustainability of infrastructure asset management. It is difficult to discuss the three pillars independently, as they are interconnected.

The environmental pillar of sustainability deals with protecting the environment. Different aspects of the consideration of environmental factors would lead to the construction of green buildings (Issa et al., 2010). The green infrastructure approach should be formalised and be included in the planning phase before any construction could commence (Wolf, 2004). Thus, municipalities should consider the essence of green assets as aspects of their infrastructural development plan. Since the municipal plans are linked to the budgets, green infrastructure projects should be included into their budgets. According to Kambites and Owen (2006), green infrastructure is a "connected network of multifunctional, predominantly unbuilt, space that supports both ecological and social activities and processes". The ecosystem approach can be used to sustain societal development and a combined socio-ecological approach can enhance urban resilience (Alberti et. al., 2003; Du Plessis, 2008).

The urban reliance approach can elevate the purpose of urban green spaces in the production of local ecosystem services like air purification, food provision, rain water drainage, social benefits and sewage treatment (Barthel et al., 2010; Ernston et al., 2010b). However, many scholars argued that the green space planning in most urban areas has been negatively affected by institutional failures to appreciate the mutual benefits supplied by ecosystem services to both social and ecological systems (James et

al., 2009; Janson & Polasky, 2010; Sandsrom et al., 2006). There is very limited literature dealing with the social sustainability of infrastructure. However, most recently, construction engineering research has begun to address social sustainability (Buser & Koch, 2014).

In terms of economic sustainability, including the ecological system as an infrastructure services provider may reduce the dependence on the often irreversible and costly investment in technical connection (Herder et al., 2011). The research on economic sustainability has focused on the price impacts of green design (Feige et al., 2013). Other researchers have considered the life cycle costing of the infrastructure projects (Kirkham, 2005). Municipalities should therefore redesign their budgets, municipal asset management processes, as well as accounting, so as to better embrace green infrastructure. According to McDonald (2015) if municipalities conform to the requirement of the Municipal Systems Act, the sustainability of the infrastructure would be achieved by the implementation of the development plans.

2.10 Gaps have been identified

The gap in literature in terms of examining the budget impact for green infrastructure project has been identified and the least researched area in this field is how municipalities embarking on sustainable project initiatives are rewarded with incentives in terms of the National Treasury budget allocation. The practice in the commercial sector involves incremental incentives for all sustainable/ green projects implemented and this has seen an increase in their bottom line profits (Toyota South Africa Motors, 2013).

2.11 Summary

This chapter discussed literature on infrastructure asset management. It has been revealed in the discussion that infrastructure assets management strategies can allow municipal entities to provide sustainable basic services. The global and local literature has indicated that urbanization directly impacts on the delivery of municipal services. This is said to provide more strain on the municipality's budget. Thus, the linkage between Integrated Development Plans (IDP) and the budget remains crucial. This linkage is said

to bind the process for planning with budgeting, which would ensure that projects implemented are detailed in the strategic planning. Further, this can be achieved through an integration of strategic planning and budgeting. The integration is informed by monitoring and evaluation performance in relation to clearly defined objectives, priorities, key performance indicators, measures and targets. This integration would not be achieved without an accurate, reliable asset management system. Research on the best infrastructure management practices confirm a significant need to develop an innovative approach to improve service delivery excellence. In discussing the relevant literature on infrastructure assets management practices, several gaps have been identified. The next chapter clarifies the objectives of the study that was conducted. In view of that, the methodology underpinning the study is described in the next chapter.

CHAPTER 3
METHODOLOGY

3.1 Introduction

This chapter discusses the methodology underpinning the research problem. The research design, research tools, sampling strategies and the location of the study are discussed in this chapter. The ethical issues have been observed, the limitations of the study and the data analyses strategies are also highlighted in this chapter.

3.2 Research design

The research design entails the action plan for the study. It is the roadmap that directs how the study maneuvers from one stage to the other, in terms of selecting the population, the sampling, the data collection, up to the end (Creswell, 2013). The purpose of this study is to gain a better understanding of the perceived issues impacting upon infrastructure asset management practices and concepts. The available local and global research has shown that there are various methods used to accomplish this (Strauss & Corbin, 1998). The aim was to establish all four objectives identified in Chapter 1 and these objectives are descriptive in nature. A descriptive study can be undertaken if a researcher wants to understand the characteristics of an organization that follows some common practices (Verma, 2003). In this study, the descriptive study was selected to describe the characteristics of the organization that have achieved effective infrastructure assets management practices.

According to Sekaran & Bougie (2010), descriptive studies offer the following benefits:

- They allow for an understanding of the characteristics of the group
- They enable systematic thinking on aspects in a certain situation
- They offer ideas for further probing and research
- They help in making simple decisions

A descriptive study is done when the investigated characteristics in a certain scenario are existing. Thus, research is aimed at describing the characteristics of profile factors.

Hall (2003) identifies three main types of descriptive study methods which include the observational method, the case study, as well as the survey method. In the study, the survey method was applied, because the nature of the research necessitated obtaining data from various stakeholders. In view of that, the quantitative approach to research is described below, as it was deemed the most appropriate for this kind of a study.

3.2.1 The Quantitative method

There are three types of research methods: the qualitative method, the quantitative method and the mixed research method. It is thus important to select and use an appropriate approach for the research study. The quantitative approach was selected for this study, because the researcher aimed to understand if the budget is aligned with the sustainability of public infrastructure. The quantitative method focuses on the statistical methods thus, explaining what is observed. Therefore, it generates data in the form of numbers and statistics produced from a large sample (Creswell, 2009: 23).

Jones (2012) acknowledges that there are disadvantages to this type of study, for example, a quantitative research method leads to limited outcome in terms of the research proposal. However, the advantages of the quantitative study are undeniable, since this approach reduces complex situations to clear statistics which can be then be utilized to explain certain trends. In addition, quantitative studies are more cost and time effective than qualitative studies in general (Nielsen, 2004). Webb and Auriacombe (2006) applied statistical reality by seeking and explaining measures in quantitative research and used the qualitative research methods that looked at in-depth descriptions and explorative method on an assumed reality.

3.3 Location of the study

This study was directed at three of eThekwini service units: Water and Sanitation; Electricity and Cleansing and Solid Waste Unit. The Head Offices of all three Service Units are located in Durban and the surrounding areas. The Water and Sanitation head office is at 3 Prior Road, Durban; The Electricity Unit is at 1 Jelf Taylor Crescent and the Durban and Cleansing and Solid Waste is at 17 Electron Road, Springfield.

3.4 Target population

Barun & Graff (1992:240) defined a target population as the total set from which the individual of the study are chosen.The target population was carefully drawn from the eThekwini Municipality. The municipality comprises of the 255 employees from the 10 clusters, namely; Community and Emergency Services, Corporate and Human Resources, Finance, Governance and International Relations, Economic Development and Planning, Human Settlements, Engineering and Transportation, Strategic Management, Trading Services (Electricity / Water and Sanitation / Cleansing and Solid Waste (DSW), Chief Operations and Chief Audit. Within each cluster there are several units (eThekwini's Administrative Clusters, 2015).

Bryman (2012) highlights the importance of determining the right individuals as representatives for the whole population and he further states that it is often impractical to survey the entire population. Prior to embarking on the fieldwork, the researcher envisaged including diverse groups of people as participants, as long as they are knowledgeable about the subject matter and they relate to it in one way or the other. In that regard, the target population for the study comprised of the eThekwini Municipality employees working in the Trading Services cluster. The Trading Services cluster comprises of 51 employees within the three service units namely: Cleansing and Solid Waste, Electricity and Water and Sanitation. Thus, purposeful-sampling technique was employed to select the cluster.

It has been observed that the sample of participants for every study should not just be knowledgeable about the subject matter, but should be able to engage in meaningful

conversations regarding the subject under discussion (Morse, 1994; Seidman, 1991; Kvale, 1996). Accordingly, the target population were experts in the field of infrastructure assets and management, as well as policy and decision making. In other words, the participants for the study were senior and middle management, as well as the engineers and project managers who manage projects and monitor budgets. The participants were knowledgeable about the practices being implemented in the Trading Cluster Services units.

3.5 Census Approach

To meet the objectives of the study a census approach was adopted. All the 51 employees from the Trading Services cluster were chosen to participant in the study. Data collected through a census approach provided an intensive knowledge about the research problem and a high degree of accuracy (Shannon & Bradshaw, 2002).

3.6 Data collection

The data collection process is critical, since it ensures that the data collected are defined and accurate; thus, resulting in decisions based on arguments emerging from the findings are valid. Primary data were collected through the use of the questionnaire, while secondary data were collected from relevant literature which included material on infrastructure management, especially electronic journals. The literature for secondary data provided an in-depth theoretical foundation, concepts, as well as approaches on which to support the study and broaden the researcher's understanding of the subject under study.

3.6.1 The survey instrument: the questionnaire

A survey study entails participants answering questions administered through a survey or a questionnaire, which makes it easy to analyse the responses (Sekaran & Bougie, 2010). Nielsen (2004) noted the benefits of the survey as being economic and practical, while it also takes less time to collect data as huge amounts of data can be collected within a short space of time. In the same way, Ong'anya and Ododa (2009) noted that the questionnaire is an effective and efficient data collection tool, especially in terms of

establishing the specific objectives and measuring the known variables. In the case of this study, the questionnaire was designed to reduce respondent bias and measured errors by defined categories for responses.

A questionnaire is a research tool which contains series of questions to gather information from the respondents. A questionnaire could be structured or unstructured and the structured questionnaire is used for the quantitative research method (Timpany, 2011). A reference is made to appendix xvii, the first section of the questionnaire consisted of questions that sought the demographics of the respondents, while the remaining section had questions which sought information about the infrastructure asset management practices employed by eThekwini Municipality.

3.6.2 Pilot testing

Before distributing the questionnaire to the participants, the researcher pilot tested it to ensure that there were no ambiguities within the questioning, as well as to ensure that the questions were appropriate and understandable (Grimm, 2010). The reason for pre-testing the questionnaire is to correct any inconsistencies, thus reducing bias. The questionnaire was pilot tested on 16 people from the Trading Cluster Services, but these people were not part of the actual population for the study. Based on the feedback from the people who participated in the pilot study, the researcher corrected a few issues regarding the questioning.

3.7 Ethical considerations

Prior to the collection of data, ethical clearance was granted by the University of KwaZulu-Natal's research committee. In the same way, permission was sought and a gate keeper's letter was provided by the management of the eThekwini Municipality. The purpose of the study was then explained to all the participants, who agreed to participate by way of signing the consent forms. It was articulated that the participation was voluntary, while anonymity and confidentiality would be maintained. Furthermore, participants were informed that they were free to withdraw from the study at any particular stage, and the action would not result in any negative consequences. In this regard, participants signed

consent letters. Participants were also informed that the data collected in this study were solely for academic purposes, while the information gathered would be kept safe and confidential, since some of the data were sensitive.

3.8 Data analysis

Data analysis is the process of synthesising the collected data into understandable elements. It is thus the logical and systematic application of different methods to evaluate the collected data. It is important to determine how one variable relates to the other when analysing variables of descriptive statistics. It is also essential to establish the nature, direction and essence of the bivariate relationships of the variables used in any study (Sekaran & Bougie, 2010). This study employed the Kaiser-Meyer (KMO) statistic of sampling adequacy to establish whether the data were suitable for multivariate procedure.

3.9 Validity and reliability

Validity is about the effectiveness of the research instrument, technique, or process to measure a certain concept. Reliability has to do with the consistency of the instrument in terms of exploiting the variable (White, 2002). Low validity is evident if the questionnaire does not explore questions in depth. However, the anonymous nature of questionnaire administration process provides a more truthful and realistic response, thereby increasing validity (Sekaran & Bougie, 2010). In this particular study, the strategies used to answer the research questions indicated a sound degree of reliability, in-depth questions were asked in trying to unpack issues impacting on infrastructure asset management practices. Furthermore, participants were allowed to remain anonymous, this gave the researcher some comfort that respondents were honest with their responses.

3.10 Limitations of the study

The first limitation to this study was the time restriction in terms of distribution and the collection of questionnaires as a quantitative methodology was employed. The time period to finish the study was limited as the nature of the dissertation in not a full thesis. There was also a limitations in terms of budget, for transportation as the researcher had to travel to distribute and collect questionnaires from the respondents.

3.11 Summary

This chapter presented insights into the reasons which informed decisions on the selected quantitative methodology. Accordingly, reasons for choosing the applied methodology were clearly discussed in the chapter. For instance, the Trading Cluster Services Units were purposively chosen because these service units provide the basic essential services to all the households within eThekwini municipal area and the provision of these services is heavily reliant on the adequate provision of infrastructure.

The reason for choosing employees from grades TK14 to TK18 was because the researcher was aware that these participants were in a better position to provide the sought answers, since they were engaged in some kind of project management and budget monitoring. The next chapter presents and analyses the data collected as described in this chapter.

CHAPTER 4

PRESENTATION OF RESULTS

4.1 Introduction

In this chapter, the quantitative data are presented and analysed. The analysis is performed on the data and each question is presented in a form of graphs or tables with a brief explanation. This information presents deeper insights into the infrastructure asset management practices used by eThekwini Municipality.

4.2 Section A: Demographics of the respondents

The response rate from this study was 81%, the researcher received 40 questionnaires out of the 51 that were distributed to the participants. Table 4.1 shows the demographic variables in order to determine their influence on infrastructure asset management practices. The items include gender, age, racial group, task grade, years of service and trading cluster. The response format consisted of a range of options for each item and respondents were asked to select the box which best represented their own personal characteristic. A summary of the demographic characteristics of the respondents (Table 4.1) indicated that 80% of the respondents were males and 20% were females. There was thus a strong gender bias in the responses. The majority of the respondents (40%) were Indians. Only 10% of the respondents was Coloured. After summarizing the age categories of the respondents, the largest percentage identified themselves as in the group of 50 years and above, which is consistent with the grade and level of responsibility of the employees.

Table 4.1: Demographic profiles of the respondents

Demographic variable	Sub-category	Total	
		n	%
Gender	Male	32	80.0
	Female	8	20.0
Age (years)	26-29	1	2.5
	34-37	5	12.5
	38-41	7	17.5
	42-45	8	20.0
	46-49	6	15.0
	50$^+$	13	32.5
Race	African	13	32.5
	White	7	17.5
	Indian	16	40.0
	Coloured	4	10.0
Task grade	TK 14-15	12	30.0
	TK 15-16	7	17.5
	TK 16-17	14	35.0
	TK 17-18	7	17.5
Period of service (years)	1-6	6	15.0
	7-12	10	25.0
	13-18	8	20.0
	19-24	11	27.5
	25$^+$	5	12.5
Trading Cluster Services	Water and Sanitation	12	30.0
	Electricity	12	30.0
	Cleansing and solid waste	16	40.0

$N = 40$

$n = $ number of respondents per sub $-$ category

Figure 4.1 shows the distribution of respondents per trading cluster. The respondents from each cluster were almost the same, thus 30 % came from water and sanitation, 30% from electricity and 40% from the cleaning and solid waste cluster. The eThekwini Municipality uses the task grade system to determine an employee's remuneration. Task grades 14 to 15 are Asset Managers, Project Managers, as well as Operations Managers. They were represented by 30% of the respondents. Grade 15 to 16 were Technical Managers, Engineers and Senior Technologists, 17.5% of the respondents fell into this category. Grades 16 to 17 were Senior Managers and Projects Executives. This group was represented by 35% of the respondents. Task grade from 17 to 18 were mostly Senior Managers. These comprised 17.5 % of the respondents.

- Water and Sanitation
- Electricity
- Cleaning and Solid Waste
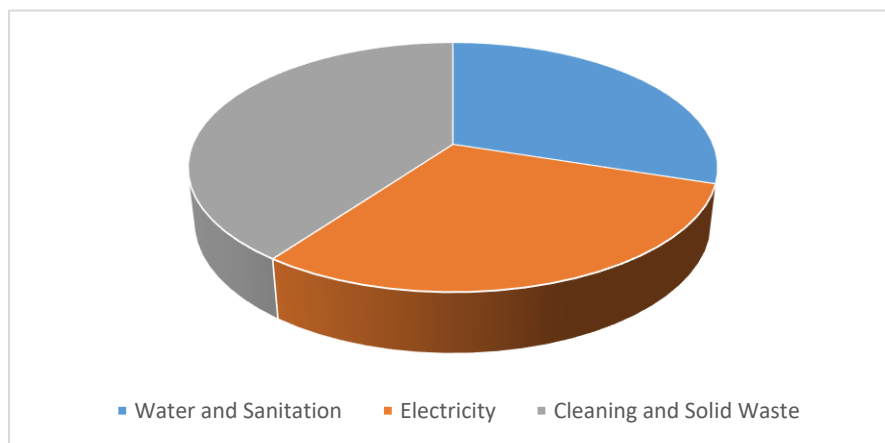
Figure 4.1: Distribution of respondents per trading cluster

4.3 Inferential statistics

The reporting framework was based on the research objectives. They were obtained using primarily descriptive statistics. However, inferential statistical techniques were also helpful for interpreting data.

4.3.1 Section B- infrastructure asset management practices in the trading cluster

Section B1 consisted of 12 items that collected responses with regards to infrastructure asset management practices in the trading cluster of eThekwini Municipality. A five-point Likert scale was used to measure asset management practices. The scale ranged from

1= strongly agree to 5= strongly disagree. Section B2 consisted of 4 open-ended questions.

In the questionnaire, the first question required the respondents to list the criteria followed in funding infrastructural projects. The second question asked whether the budget allocation was aligned with service delivery. The third question required the respondents to list the strategies used in applying integrated and sustainable asset management practices. The fourth question needed the respondents to highlight issues impacting upon the infrastructural asset management projects. The aims of these questions were to enable the respondents to express their opinions and to assist the researcher in interpreting the answers to the structured questions in Section B1. Table 4.2 shows the responses of the respondents as a percentage per each category.

Table 4.2: Managers' responses on infrastructure asset management practices

Questionnaire item	Respondent's responses (%)				
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. A need to improve budget allocation.	45.0	45.0	7.5	0	2.5
2. A need to improve budget allocation for sustainability of public infrastructure.	32.5	57.5	5.0	0	5.0
3. Is there a budget constraint within the Trading Services Cluster?	45.0	40.0	12.5	0	2.5

4. A need to improve budget allocation for the sustainability of the public infrastructure	35.0	47.5	12.5	5.0	0
5.The infrastructure asset management decision take into account cost and benefit of the life cycle assets	20.0	62.5	7.5	7.5	2.5
6. The infrastructure asset management are clearly defined.	10.0	22.5	50.0	12.5	5.0
7. The infrastructure asset management practices are aligned to meet changing need of customers.	5.0	15.0	45.0	30.0	5.0
8. There is an alignment between infrastructure objectives, situation and interventions sustain service	7.5	27.5	37.5	22.5	5.0

delivery performance.					
9. The strategic asset planning processes are in place.	10.0	22.5	42.5	15.0	10.0
10. The current infrastructure asset management practices is effective	5.0	27.5	30.0	27.5	10.0
11. The criteria followed in funding infrastructure projects is transparent and well known.	7.5	22.5	42.5	17.5	10.0
12. There are strategies that can be used in applying integrated and sustainable asset management practices.	20.0	42.5	30.0	7.5	0
Average	20.2	36.0	26.9	12.1	4.8

Table 4.3 : The questions from the survey pertaining to each objective

	QUESTIONS						
The criteria used to allocate funding	5	6	7	8	9	11	13
The budget and service delivery alignment	1	2	3	4	14		
Strategies of integrated and sustainable asset management	10	12	15				
Issues impacting upon infrastructure asset	16						

4.4 Descriptive statistics of research objectives

Descriptive statistics of the research objectives are used to state the basic features of data in a study (Trochin, 2006). They provide simplified summaries that are easy to understand about sample and measures. Together with simple graphic analysis, they can form the basis for virtually every quantitative analysis of data. Typically, descriptive statistics are used to examine or explore one variable at a time, the frequency of each score in the data set, deriving percentages and visualising and describing the shape of the distribution. Statistics provide a way of describing collected data in a way that can be assimilated by readers. This allows the research outcomes to be used for evidence-based practice, thereby narrows the theory-practice gap. Descriptive statistics are perfectly suited for collating and summarising quantitative data (Marshall & Jonker, 2010).

4.5 Objective 1: to establish what criteria are followed to fund infrastructure projects
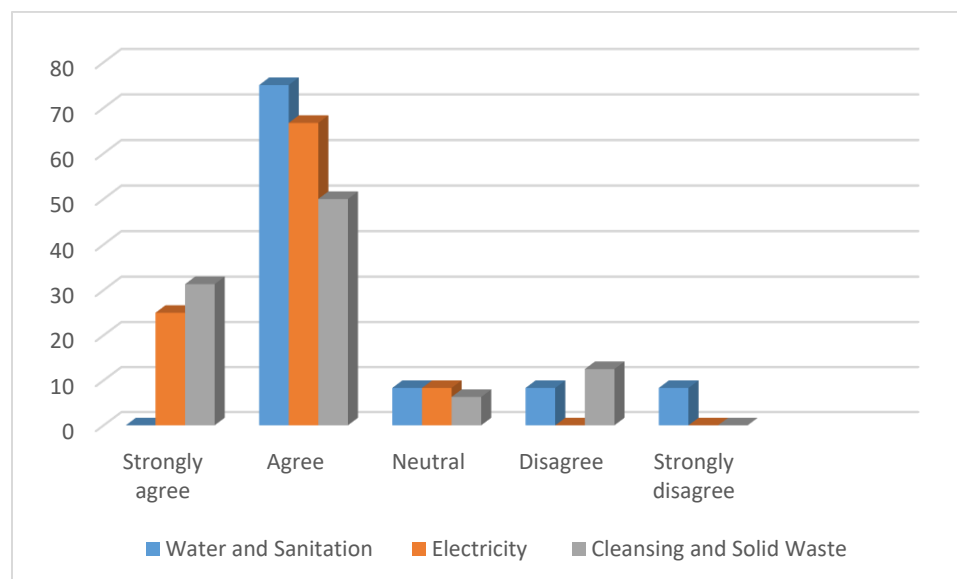
Figure 4.2: Infrastructure asset management decisions take into account the cost and benefit of the asset life cycle (Q.5)

On the question of whether Infrastructure asset management decisions take into account the cost and benefit of the asset life cycle, respondents were asked to indicate on a five point Likert scale, whether they strongly agree (1), agree (2), are neutral (3), disagree (4) and strongly disagree (5) .Figure 4.2 clearly illustrates that (75 %) of the respondents agreed with the statement that infrastructure assets management decisions take into account the cost and benefit of the asset life cycle. The figure also illustrates that respondents from Cleansing and Solid Waste (31.3%) and Electricity Unit (25%) strongly agreed with the statement and less than (15%) of the respondents disagreed, strongly disagreed and were neutral.
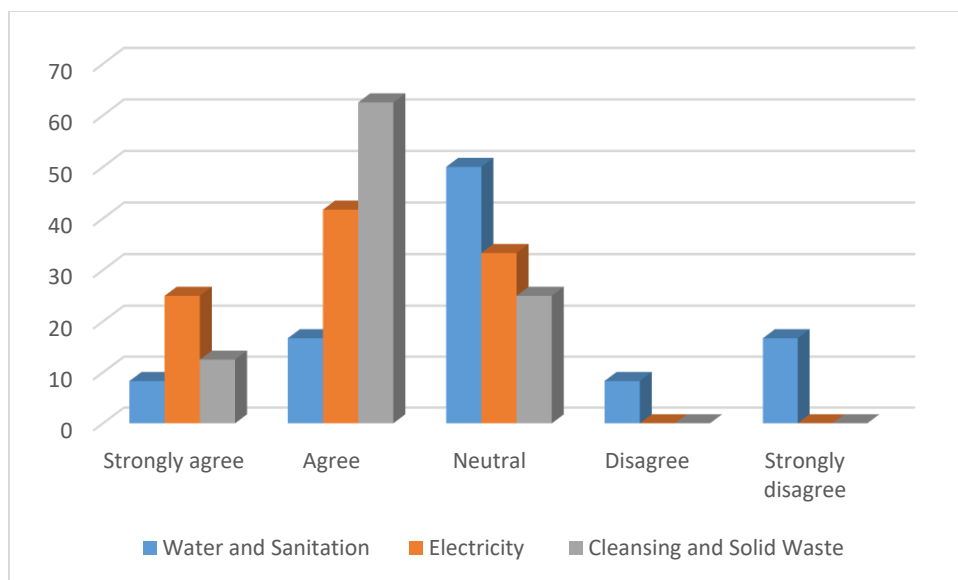
Figure 4.3: Infrastructure asset management processes are clearly defined (Q.6)

As illustrated in Figure 4.3, the majority (62.5%) of the respondents from the Cleansing and Solid Waste Unit agreed that infrastructure asset management processes are clearly defined, 41.7 % of the respondents from Electricity also agreed, while 16.7% of the respondents from Water and Sanitation agreed. Most of the respondents (50%) from Water and Sanitation were neutral with the statement. At least 25% of the respondents strongly agreed, below (20%) disagreed and (8.3%) from Water and Sanitation disagreed with the statement.
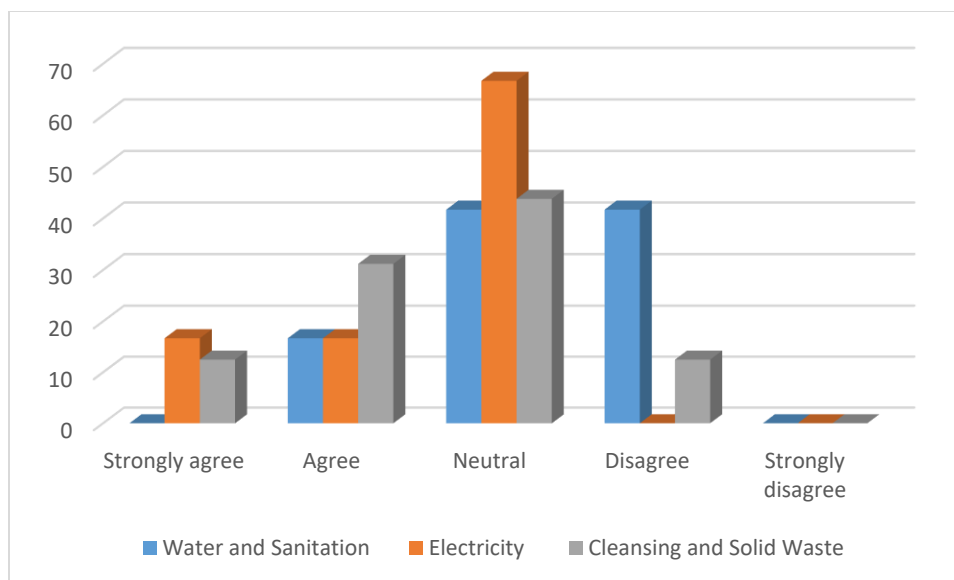
Figure 4.4: Infrastructure asset management practices are aligned to meet the changing needs of customers (Q.7)

Figure 4.4 depicts that the majority of the respondents from all the Trading Cluster Service Units were neutral on whether infrastructure asset management practices were aligned to meet the changing needs of the customers. The above also illustrates that (41.7%) of the respondents from Water and Sanitation disagreed with the statement, (31.2%) from the Cleansing and Solid Waste agreed, (16.7%) from the Electricity Unit strongly agreed and none of the respondents from the three Service Units strongly disagreed.
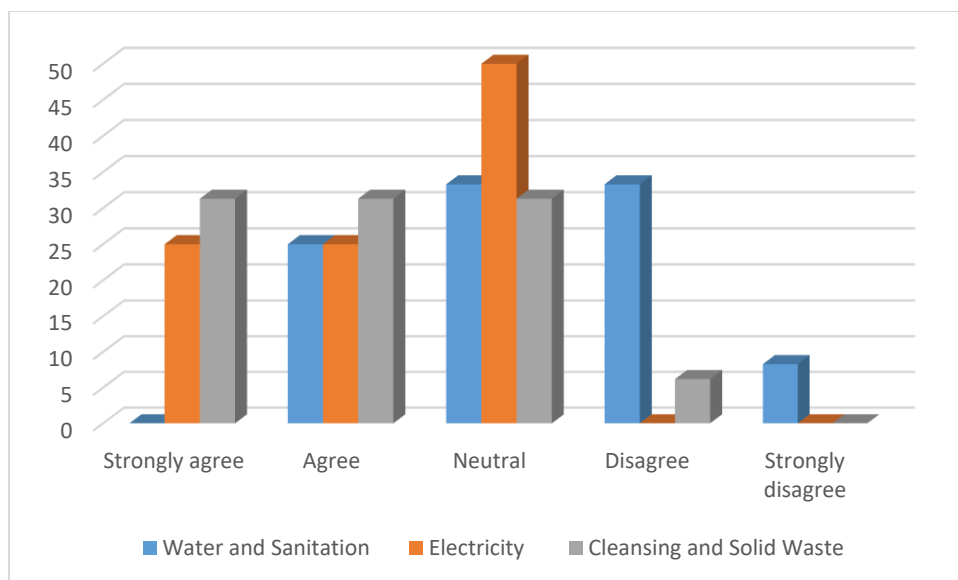
Figure 4.5: There is an alignment between infrastructure objectives, situation and intervention to sustain service delivery performance (Q.8)

As illustrated in Figure 4.5, the majority (50%) of the respondents from the Electricity Unit was neutral that there was an alignment between infrastructure objectives, situation and intervention to sustain service delivery performance. Above thirty percent (33.3%) of the respondents from Water and Sanitation disagreed, (33.3%) of the respondents from Water and Sanitation disagreed and (31.3%) strongly disagreed. A minority of the respondents (8.3%) from Water and Sanitation strongly disagreed.
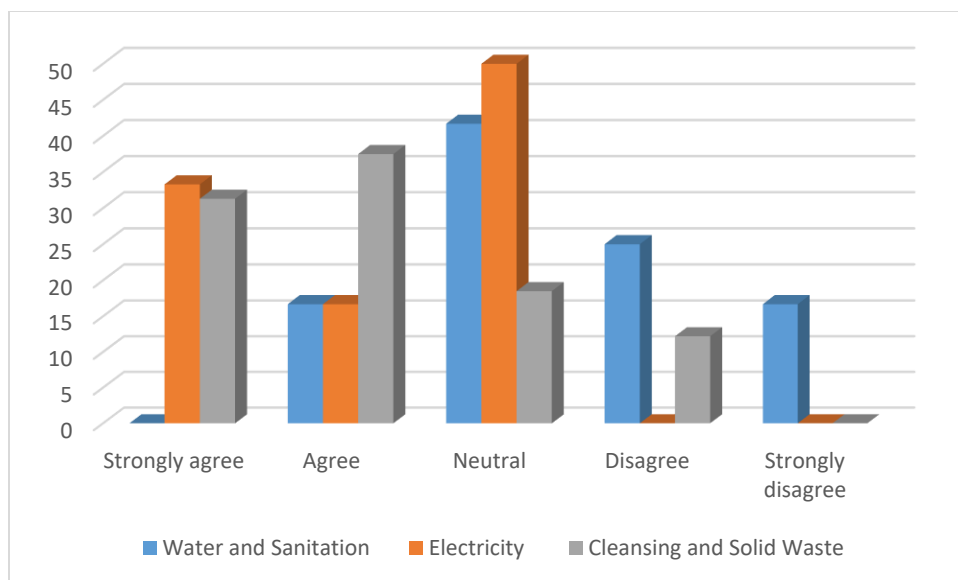
Figure 4.6: The strategic asset planning processes are in place (Q.9)

Figure 4.6 depicts that the majority of the respondents from all the Trading Cluster Service Units were neutral on whether the strategic asset planning processes were in place. The above also illustrates that (37.5%) of the respondents from Cleansing and Solid Waste agreed with the statement, (33.3%) from the Electricity strongly agreed, (25%) from the Water and Sanitation Electricity Unit disagreed and (16.7%) of the respondents from the Water and Sanitation Units strongly disagreed.
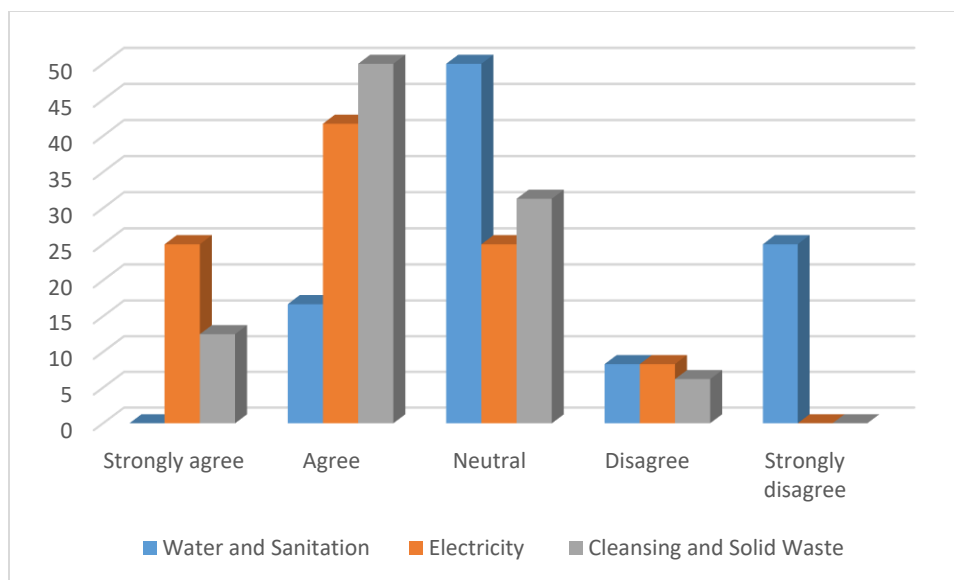
Figure 4.7: The criterion followed in funding infrastructure projects is transparent and well known (Q.11)

Figure 4.7 depicts that (50%) of the respondents from Water and Sanitation was neutral in their opinions on whether the criterion followed in funding infrastructure projects was transparent and well known. Whereas, (50%) of the respondents from Cleansing and Solid Waste agreed with the statement. Twenty-five (25%) of the respondents from the Water and Sanitation strongly disagreed, 25% of the respondents from the Electricity Unit strongly agreed and below 10% of the respondents from all Service Units disagreed with the statement.

Respondents were asked an open- ended question which enquired if they knew the criterion followed in funding infrastructural projects. The analysis shows that 87% of the respondents had different ideas on the criterion used to fund the infrastructure projects, as illustrated in Table 4.10. Thirteen percent of the respondents were unsure as to what criterion is used (Q.13).

Table 4.10: Employees' comments on the criteria used to fund infrastructural projects

1	The funding of infrastructural project is based on the availability of the budget	22.5%
2	The funding is based on the service demands	35%
3	The funding is based on the strategic planning which is informed by the consultative process of IDP and the availability of budget.	22.5%
4	The funding is based on political affiliation, wards that are led by the ruling party are prioritized.	7.5%
5	The funding is based on possible other factors	12.5%

Source: **Researcher (2017)**

Table 4.10 provides a summary of the main points as indicated by the respondents. Valuable information emerged from the respondents' contributions and their ideas or themes are supported in the theorisation of data in the next section. This provides support to the conclusions reached and serves as a guide to enhance the existing criteria used to fund infrastructural projects

4.6 Objective 2: to determine if budget allocation is aligned with service delivery performance
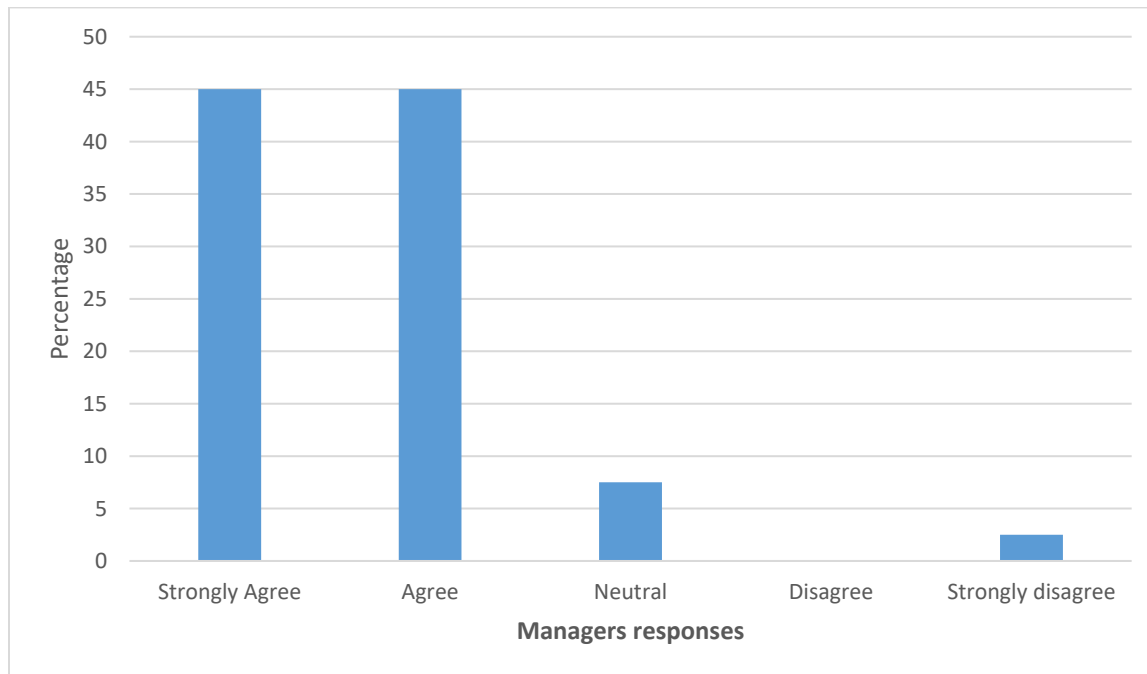
Figure 4.8: The Trading Cluster Services needs to effectively improve the budget allocation in all its Units for sustainability of public infrastructure (Q.1)

Figure 4.8 shows that 45% strongly agreed that Trading Cluster Services needed to effectively improve the budget allocation in all its service units, for the sustainability of public infrastructure; 45% agreed, 7.5 % was neutral and 2.5 % strongly disagreed.
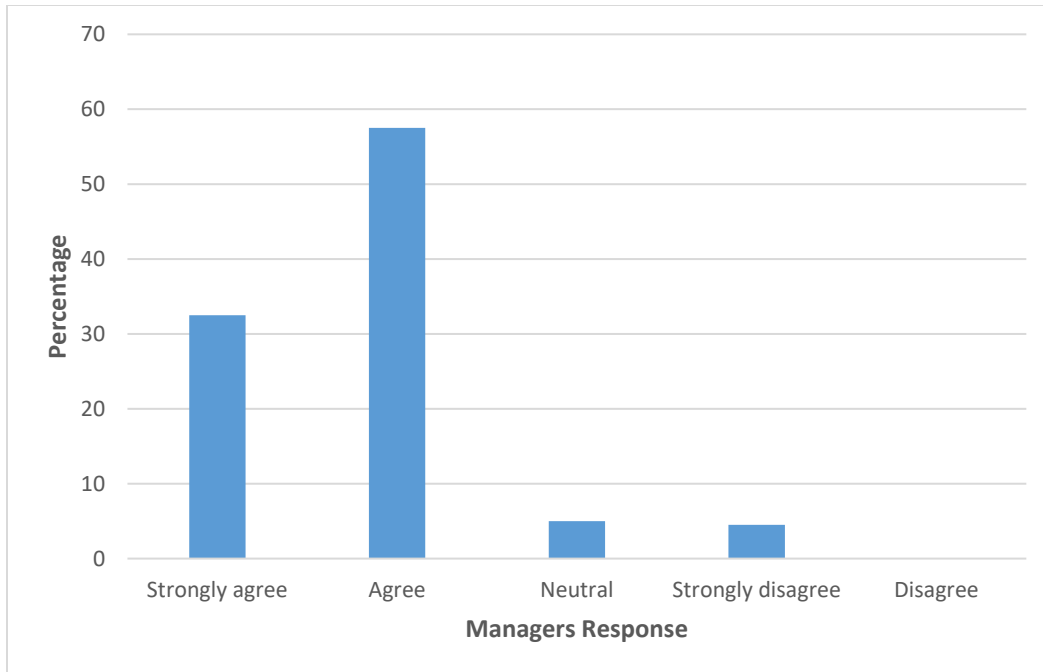
Figure 4.9: There are budget constraints in the Trading Cluster Services within the Municipality (Q.2)

Figure 4.9 shows that 32.5 % of the respondents strongly agreed that there were budget constraints on the Trading Cluster Services; 57.5% agreed, 5% was neutral and 5% strongly disagreed.
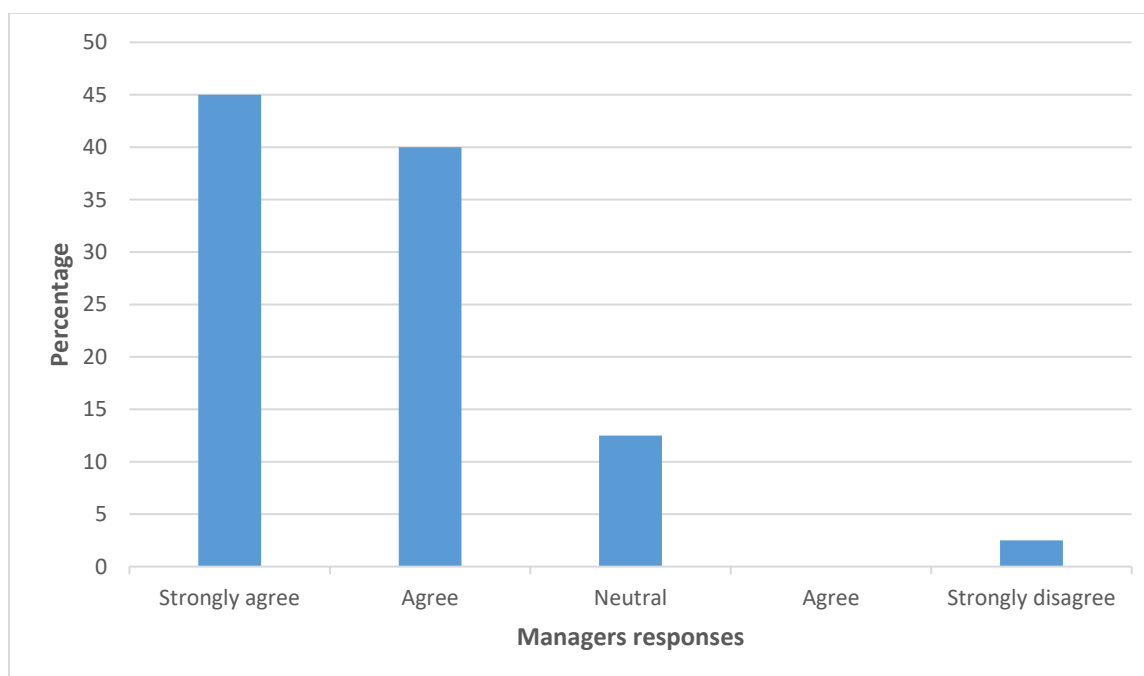
Figure 4.10: Budget constraints in the Trading Cluster Services affects positive functioning of infrastructure assets (Q.3)

Figure 4.10 shows that 45% of the respondents strongly agreed that the budget constraints within the Trading Cluster Services affected the functioning of infrastructure assets, 40% agreed, 12.5% was neutral and 2.5% strongly agreed. There is therefore the need to improve budget allocation in all units for the sustainability of the public infrastructure assets (Q.4)

The respondents were asked an open-ended question, (whether the budget allocation was aligned with service delivery performance). Table 4.11 shows that 37.5 % of the respondents thought that the budget allocation was aligned with the service delivery needs; 57.5% of respondents believed there was no alignment and 5% were not sure.

Table 4.11: Is the budget allocation aligned with service delivery performance

1	Yes	37.5%
2	No	57.5%
3	Uncertain	5.0%

Source: Researcher (2017)

4.7 Objective 3: to identify the strategies used in applying integrated and sustainable asset management practices
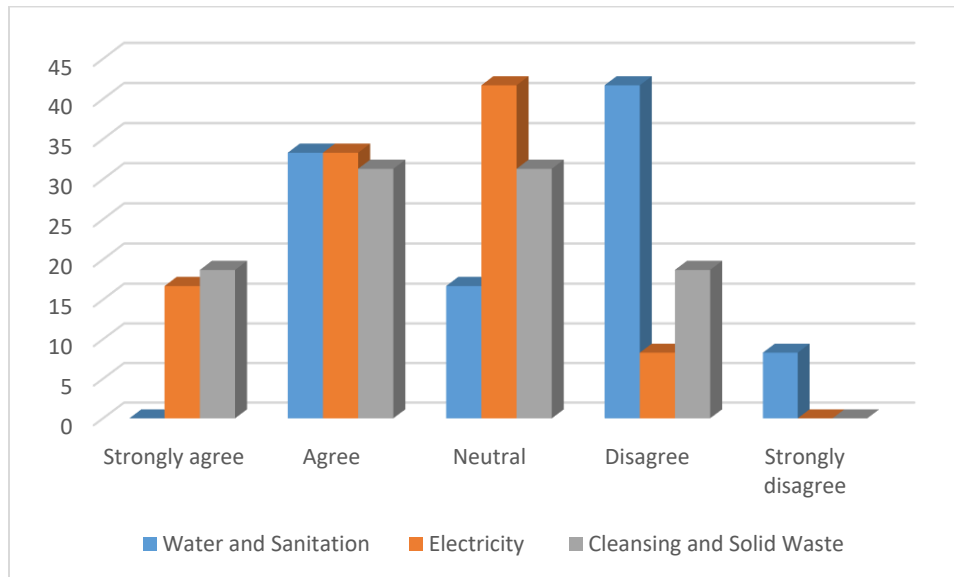
Figure 4.11: The current infrastructure asset management practices of the eThekwini Trading Cluster Services Units are effective (Q.10)

Figure 4.11. shows that (41.7%) of the respondents was neutral in their opinions on whether the current infrastructure asset management practices of the eThekwini Trading Cluster Services Units were effective. In contrast, (41.7%) of the respondents from the Water and Sanitation Unit disagreed with the statement. In general, the average percentage (30%) of respondents from all Service Unit agreed, below twenty percent strongly agreed and (8.3%) of the respondents from the Electricity Unit strongly disagreed.
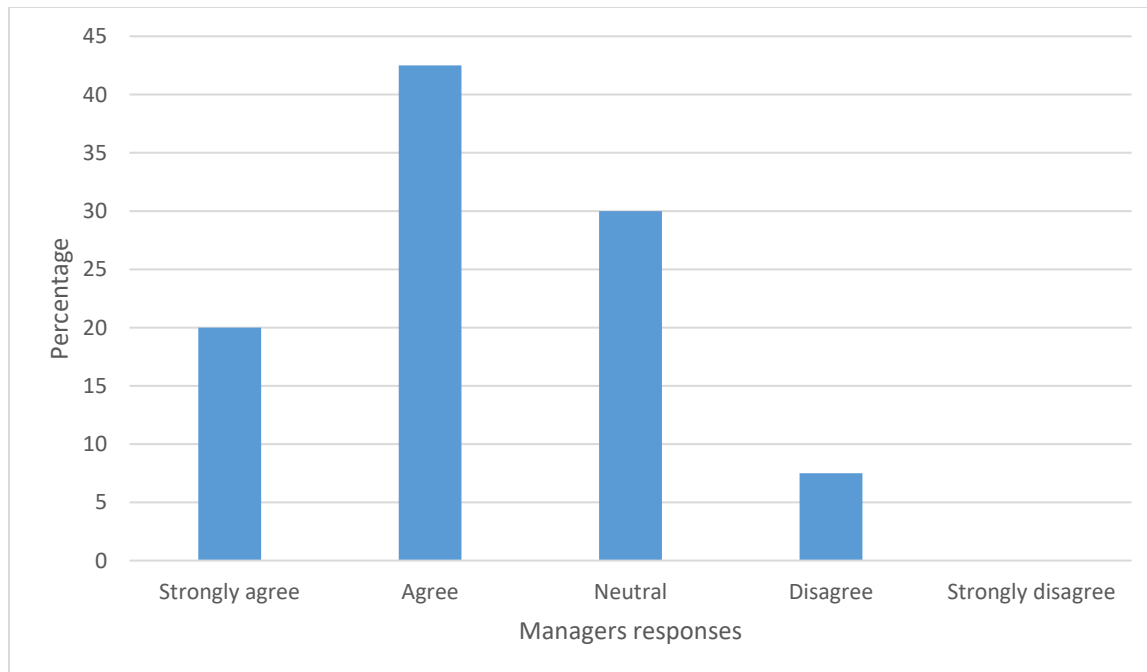
Figure 4.12: There are strategies that can be used in applying integrated and sustainable asset management practices (Q.12)

Figure 4.12. shows that 20% of the respondents strongly agreed that there were strategies that could be used in applying integrated and sustainable asset management practices; 42.5% agreed, 30% was neutral, and 7.5 % disagreed. The respondents were asked an open-ended question on whether they knew the strategies used in applying integrated and sustainable asset management practices. The analysis shows that 55% of the respondents was unsure what strategies were used; 45 % had different ideas as illustrated in Table 4.13.

Table 4.13: Employees' comments on the strategies used in applying integrated and sustainable asset management practices

1	The strategies are unknown	55%
2	The strategies are derived through IDP consultation	7.5%
3	The municipality uses Asset Management Plan aligned to ISO 55000 in determining integrated asset management practices	25%
4	The asset management plan is aligned with innovation and the performance of the project	7.5%
5	The strategies are politically driven	5%

Source: Researcher (2017)

4.8 Objective 4: to determine the issues impacting on the infrastructural asset management projects

Respondents were asked an open- ended question to express their opinions on issues impacting upon infrastructure asset management projects. All respondents contributed their thoughts as illustrated in Table 4.14.

Table 4.14: Employees' comments on issues impacting upon infrastructural asset management projects

1	Budget Constraints
2	Lack of skills and capacity by internal staff
3	Silo Management
4	Lengthy SCM processes
5	Poor workmanship by external service providers contracted to repair and maintain municipal infrastructure
6	Damage and theft of infrastructure resulting in diversion of resources to replace stolen assets, rather than maintaining the planned assets.
7	Lack of a standardized system
8	Poor management of ageing infrastructure
9	Public protests resulting in diversion of resources
10	New service demands from ward councillors

Source: **Researcher (2017)**

A perspective on all issues listed in Table 4.14 requires further interrogation and probing through scientific research. This process would provide future possible solutions and can be used to guide municipal employees on how to deal with these issues.

4.9 Factor analysis

Factor analysis is a statistical tool used to study the dimensionality of a set of variables (Browne, 2001). In factor analysis, latent variables represent unobserved constructs and are referred to as factors or dimensions. In this study, the principal component analysis was used to explore the dimensionality of the questionnaire, by finding the smallest numbers of interpretable factors needed to explain the correlation among a set of variables. The interpretability of the factors is improved by rotation. Varimax rotation was used as it maximised the loadings of each variable on one of the factors, whilst minimising the loadings on other factors.

In order to fully investigate asset management practises in the trading cluster, a factor analysis was initially undertaken. The Kaiser-Meyer (KMO) statistic of sampling adequacy was undertaken to establish whether the data were suitable for multivariate procedure. KMO measure of sampling was calculated at (0.73) which is regarded as satisfactory by Kaiser (1974). The Bartlett's test of sphericity (*p-value =0.000*) was significant and therefore, the set was appropriate for factor analysis. A low loading variable reduction process was used to reduce the number of variables in order to produce a more stable factor structure. Items that did not load on any factor with at least a loading of 0.50 were deleted from the item set. This procedure resulted in two distinguishable factors with an eigenvalue greater than 1. These factors were labelled infrastructure asset management (Factor 1) and budget constraints (Factor 2) as shown in Table 4.17. The rotated loading matrix illustrating the resultant factors, eigenvalues, reliabilities and means are provided in Table 4.15 In order to establish whether the summated scores demonstrated adequate internal consistency, Cronbach's alpha coefficients were calculated. From Table 4.15, it can be seen that the Cronbach's alpha coefficients scores were all greater than 0.60, the recommended minimum value for reliability (Malhotra, 2010).

By observing the correlation or lack thereof between the questions, certain assumptions could be made. These lead to determining whether it is possible to derive if events or processes were statistically significant or not. Both statistically significant and insignificant results could lead to certain outcomes being achieved.

Table 4.15: Rotated Factor loading matrix

Variable description	F1	F2	Item-total correlation	Cronbach α if item deleted	Mean Rank
The current infrastructure asset management practice of the eThekwini Trading Cluster Services units is effective	0.852	-0.006	0.688	0.832	5
The strategic asset planning processes are in place	0.779	-0.260	0.737	0.819	1
The infrastructure asset management processes are clearly defined	0.769	-0.021	0.569	0.859	4
The infrastructure asset management practices are aligned to meet the changing needs of customers	0.745	-0.049	0.704	0.827	3
There is an alignment between infrastructure objectives, situations and interventions to sustain service delivery performance	0.702	-0.61	0.711	0.825	2
There are budget constraints on the Trading Cluster Services within the municipality	0.064	0.896	0.650	0.547	6
The Trading Cluster Services of eThekwini municipality needs to effectively improve the budget allocation in all units for sustainability of public infrastructure	-0.058	0.689	0.563	0.547	8
The Budget constraints on the trading cluster within the municipality affect the positive functionality of infrastructure assets	-0.024	0.676	0.483	0.749	7
Reliability (Cronbach α)	0.862	0.738	Overall Cronbach $\alpha = 0.649$		

Note: Loadings above 0.50 and with no cross loadings were considered significant. Rotation method: Varimax. Rotation: Principal Factor analysis.

Table 4.16 shows extracted factors and their operational definitions.

Table 4.16: Extracted Factors and description

Factor	Description
1	Infrastructure asset management
2	Budget constraints

Figures 4.13 and 4.14 show the managers' responses to factor one and factor two respectively.
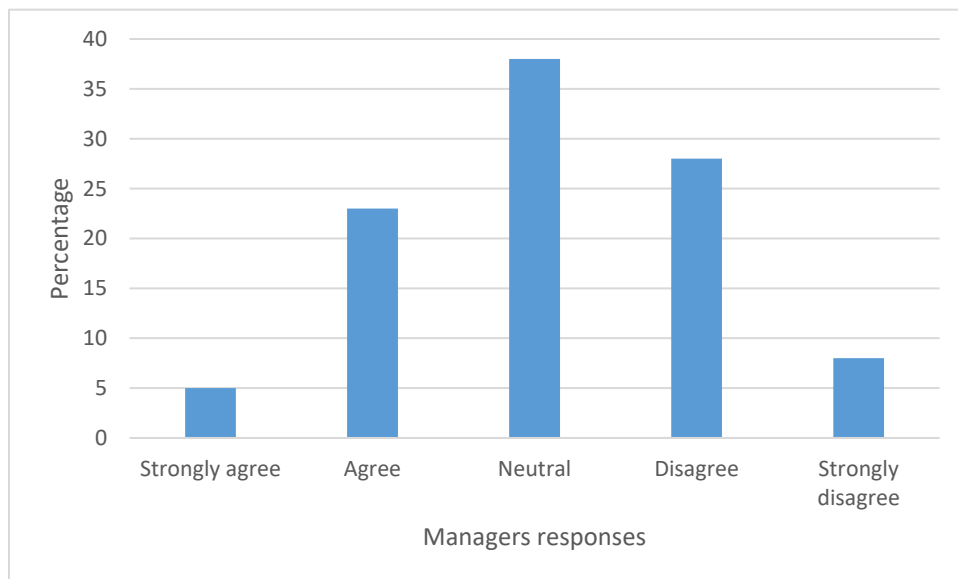
Figure 4.13: Managers' responses to Factor 1
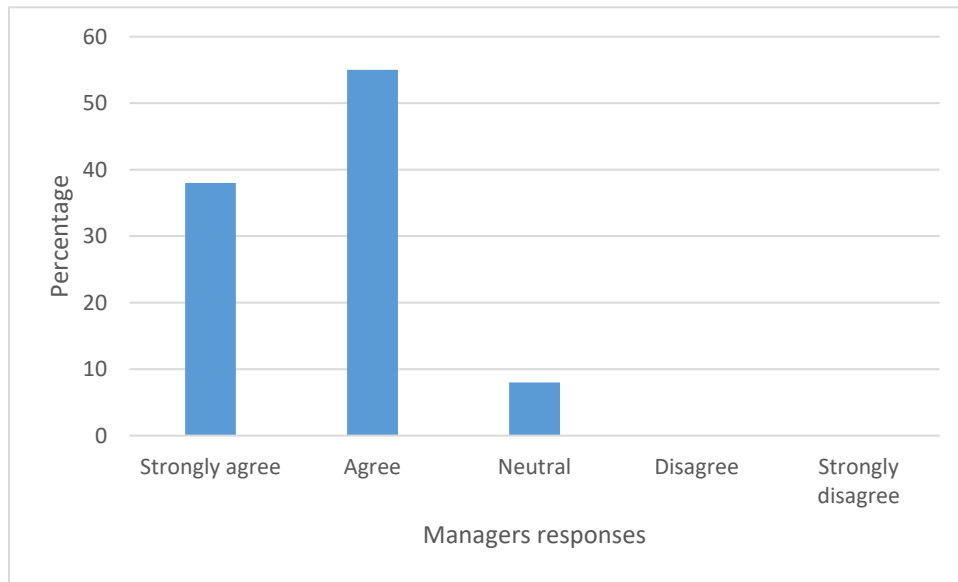
Figure 4. 14: Manager's responses to Factor 2

In order to check for association between the demographic variables and the identified factors, the researcher used Pearson's Chi-square statistics. The null hypothesis of no association between the demographic variables and the factors is rejected at 10% level of significance. Table 4.17 shows the results of testing for association between demographic variables and factors using Pearson's chi-square test. At 10% level of significance, there is an association between factor 1 and task grade. At 10% level of significance, there is an association between factors 1 and 2 with the trading cluster. Multivariate analysis of variance (ANOVA) was conducted to determine which of demographic variables were related to the factors and the results are shown in Table 4.19.

Table 4.17: Test for association between demographic variables and factors using Pearson's chi-square test

Demographic variable	p value of the Chi-square statistic	
	Factor 1	Factor 2
Gender	0.719	0.653
Age (years)	0.755	0.693
Race	0.923	0.132
Task grade	0.068**	0.309
Period of service	0.264	0.745
Trading cluster	0.086**	0.021***

Note: ** and ***indicate significant at 10 % and 5% level of significance respectively

From Table 4.17, it is evident that the task grade and trading cluster have a statistically significant relationship with factors. Since their *p-values* were lower than the significance value of 0.10. The univariate ANOVA results of the two demographic variables found to be significantly related to the factors are reflected in Table 4.17. Statistically significant relationships can be seen between task grade and Factor 2, (p-value=0.068<0,100) as well as between trading cluster and Factor 1 (p-value=0.086<0,100 and p-value=0.021<0.05 respectively). The result shows that there is a significant association budget constraints (Factor 2) in the Trading Service Cluster. This result suggests that different Units experience different budget constraints. Therefore, there is a need to address budget constraint issues for each Unit with the Trading Services Cluster.

Table 4.18: Multivariate analysis of variance for the relationship between demographic variables and factors

Demographic variables	F	p-value
Gender	1.230	0.305
Age	1.395	0.239
Race	2.162	0.131
Task grade	6.504	0.004***
Period of service	0.141	0.785
Trading cluster	4.087	0.025***

Note: ***and **indicate significant at 5% and 10% of significance respectively

Table 4.19: Univariate analysis of variance results

Factor	Task grade		Trading cluster	
	F	p-value	F	p-value
1	2.225	0.145	6.146	0.018***
2	9.946	0.003***	1.487	0.231

Note: *** and **indicate significant at 5% and 10% level of significance respectively

Table 4.18 shows statistics for factors i.e. infrastructure and budget constraints related to the demographic variable.

Cohen's d statistic is used to indicate the standardised difference between two means. It can be used to accompany the reporting of the t-test and ANOVA results. A small practically significant difference can be seen when Cohen's d statistic falls in the interval $0.20 < |d| < 0.50$ and a moderate practically significant difference is found when Cohen's d statistic falls in the interval $0.50 < |d| < 0.80$.

Table 4.20: Statistics for factors related to demographics variable

Category by demographic variable	Sub-category	n	Mean	sd	Mean difference (above diagonal) and Cohen's value			
					1	2	3	4
Factor 1 by trading cluster	Water and sanitation	12	3.75	1.215	-	1.483	0.591	-
	Electricity	12	2.25	0.754	1.483	-	1.629	-
	Cleansing and solid waste	16	3.75	1.125	0.418	1.720	-	-
Factor 2 by task grade	TK 14-15	12	1.58	0.668	-	0.214	0.018	0.961
	TK 15-16	7	1.71	0.488	0.233	-	0.238	0.984
	TK 16-17	14	1.57	0.646	0.018	0.262	-	0.994
	TK 17-18	7	2.14	0.378	1.110	0.984	1.1880	-

Table 4.20 shows that managers from Water and Sanitation perceive infrastructure asset management as more important (Cohen's d- value= 1,483>0, 80) than managers from Electricity Unit. However, managers from Water and Sanitation Unit perceive infrastructure management moderately important (Cohen's d-value=0,591 which lies between 0, 5<d<0, 80) than managers from Cleansing and Solid Waste Unit. The results reported in Table 4.20 also show that managers from Electricity Unit perceive infrastructure asset management as more important (Cohen's d-value=1.629>0, 80) than managers from Cleansing and Solid Waste. In general, the results suggest that managers from Water and Sanitation perceive infrastructure asset management as very important.

Table 4.20 also shows that managers in the Task Grade 14-15 perceive budget constraints as less important (Cohen's d-value=0, 214 which lies in the range 0, 20</d|<0, 50) than managers in the Task Grade 15-16 and Task Grade 16-17. However, the results also show that managers in the Task Grade 14-15 perceive budget constraints as very important (Cohen's d-value= 0, 961>0, 80) than managers in Task Grade 17-18. In general, the results suggest that managers in Task Grade 14-15, TK 15-16 and TK 16-17 perceive budget constraints as very important as their counterparts in TK17-18.

4.10 Summary

The analysis of data collected for this study has met all the predefined objectives and the data showed the need for areas of improvement. The data also revealed employees' attitudes and concerns regarding infrastructure asset management practices. The next chapter thus discusses the findings of the study.

CHAPTER 5

DISCUSSION OF RESULTS

5.1 Introduction

This chapter provides a discussion of the research findings of the study. The research investigated infrastructure asset management practices used within the Trading Services Cluster.

5.1.1 Objective (i): to establish the criteria used in the allocation of infrastructural projects funding

The primary objective was to determine the criteria used to fund infrastructural projects in the Trading Cluster Services. Over eight percent (8%) of the participants highlighted that infrastructure asset management decision take into account the cost and benefit of the asset life cycle. This indicates a positive outcome, an effective asset management is measured by its ability to forecast cost and the performance of the asset (Asset Management Framework, 2003:12). Fifty percent (50%) of the respondents indicated neutral feelings on whether the infrastructure asset management processes were clearly defined, while over 32% of the respondents agreed with this statement.

Forty-five (45) of the respondents indicated that they were neutral on whether infrastructure asset management practices were aligned to meet the changing needs of customers; thirty- five (35) of the respondents disagreed and only twenty percent (20%) of the respondents agreed. Furthermore, 37.5% of respondents indicated that they were neutral on whether the alignment between infrastructure objectives, situation and intervention to sustain service delivery exist. This may be as a result that asset management procedures are not geared towards improving efficiency and effectiveness of service delivery (Summervell, 2005). Too (2010) stated that "the strategic infrastructure asset management is aimed at achieving organisational long-term goals and effectiveness through dynamic alignment of the required infrastructure assets to meet changing customer needs". The results of this study showed that the alignment is insufficient.

Over thirty percent (30%) of the respondents agreed that strategic planning processes are in place. However, 42 % of respondents indicated that they were neutral that strategic planning processes were in place and just over 30% disagreed in response to the statement that strategic planning processes were in place. This is a negative response, considering that just above the fraction of the respondents' agreed that strategic planning process were in place. A possible explanation for this attitude may be attributable to the fact that employees holding executive positions (strategic management of the Trading Cluster Services such as the Heads of the Units) were excluded from the sample. However, a smaller percentage of the respondents believed that there was strategic planning in place. The contrasting views may be due to information dissemination, which is crucial for openness and unbiased reporting (Crous, 2004).

With regards to the transparency of criteria used to fund infrastructural projects, 42.5 % of the respondents was neutral, 30% agreed that the criteria were transparent and 27.5% disagreed. This prompted a follow up question to get respondents' opinions on whether they knew the criteria in place to fund infrastructure project. Respondents had different views, however, a greater percentage (35%) indicated that projects were funded based on service demands; 22.5% indicated that the criteria used was solely based on budget availability. Over 20% indicated that the criteria used were informed by the strategic planning framework used by the municipality and 7.5% indicated that the criteria used were based on the political affiliation. According to Schick (1966), public budgeting systems have two additional purposes (transparency and communication) and these are generally not found in the public budgeting systems.

5.1.2 Objective (ii): to determine whether the budget is aligned with service delivery performance.

The focus of this objective was to determine if the budget allocation is aligned with service delivery performance. Over 90% of the respondents agreed that the Trading Cluster Service needed to improve the budget allocation in all its service units. This explanation may be that the equitable share funding formula used by the National Treasury to allocate resources between the municipalities to fund basic services is not in line with the scale of the household growth (National Treasury, 2011).

Currently, the municipality has no scientific model that is utilised to allocate the budget. This is one of the shortcoming identified by this study. Walker's (1930:30) classic theory indicated that economic and scientific approaches were the most preferred methods for budgets and the allocation of resources. Walker also cited that the problem of allocation results from the proportion of revenue each function should receive. In his study, he recommended that the budget allocation should include four values: honesty, economy, efficiency and proportion. However, Key posed an important question "on what basis shall it be decided to allocate X dollar to activity A instead of activity B? (Key, 1987: 117). In order to address Key's concerns, Walker's research found that to the extent that outcomes and their attendant costs hold promise for determining how X dollar are to be allocated between activity A instead of Activity B.

Ninety percent (90%) of the respondents agreed that there were budget constraints within the Trading Cluster Services units. Over 90% indicated that the budget constraints affected the functioning of infrastructure assets. This prompted a follow up question to determine if the budget allocation was aligned with the service delivery performance. Over 57% of the respondents indicated that there was no alignment. The majority of the respondents advocated that the Trading Cluster Services needed to improve its budget allocation to improve service delivery. Kettner et al., (1990) support the notion that outcome-based budgeting should be linked to the outcome of goals and the objectives,

in order to derived unit cost per outcome. Kettner further argued that outcome budgeting is the only public budgeting system that makes outcome the primary focus.

5.1.3 Objective (iii): to identify the possible strategies for the application of integrated and sustainable asset management practices.

The key focus of this objective was to identify the strategies used in applying integrated and sustainable asset management practices. Respondents were asked if the current infrastructure asset management practices were effective. Over 37% of the respondents disagreed that the current infrastructure asset management practices were effective. Over 32% percent of the respondents agreed, while 30% indicated that their feelings were neutral. The negative responses from the respondents may be as a result that the municipality does not have appropriate capability to support the infrastructure asset management process. In objective 4, respondents highlighted the skills shortage as one of the factors impacting on infrastructure assets management. This finding is supported by Collis (1994) and Porter (1991), who argued that the effectiveness of infrastructure asset management processes is inseparable from the appropriate capabilities that support them.

A higher percentage of the participants agreed that there were strategies which can be used in applying integrated and sustainable asset management practices. Over 60% of the respondents agreed, while 30% of the respondents was neutral. This prompted a follow up question to establish if the respondents knew the strategies used in applying integrated and sustainable asset management practices. The outcome in Table. 4.6 shows that 55% of the respondents was unsure of what strategies were used and the balance of the respondents had different views; 7.5 % of strategies were derived through IDP consultation; 25% respondents indicated that the municipality used Asset Management Plan aligned to ISO 55000 in determining integrated asset management practices; 7.5 % indicated that the asset management plan was aligned with innovation and the performance of the project and 5 % indicated that strategies were politically driven. According to Brown (2005), the goals of infrastructure asset management must be established first before the strategies are identified. These strategies would therefore

prescribe how these goals can be achieved. He further argued that these strategies within the context of asset management framework are in fact processes in which an asset is effectively managed throughout its entire life cycle.

5.1.4 Objective (iv): to identify issues impacting on infrastructural asset management projects.

This study uncovered several issues impacting on infrastructural asset management projects which require improvements. Various issues impacting on infrastructure projects were highlighted in Table 4.7 and these results indicated that budget constraints; lack of skills and capacity by internal staff; Silo Management; lengthy supply chain management processes; poor workmanship by external service providers contracted to repair and maintain municipal infrastructure; damage and theft of infrastructure resulting in diversion of resources to replace stolen assets rather than maintaining the planned assets; lack of a standardized system; poor management of ageing infrastructure; public protests resulting in diversion of resources and new service demands from ward councillors, largely impact on infrastructure projects.

The responses concur with different studies, the most apparent being the lack of funding and increasing service demands. Based on the current literature, factors such as increasing service demands, ageing infrastructure and inadequate funding, negatively impact on infrastructure (Nishimu et al., 2015). Some respondents indicated that lengthy supply chain management processes negatively affect infrastructure projects. Academic studies have proven that delays that result from restrictive compliance do hamper efficiency of the provision of services (Nzewi, 2013:18). The study by Schraven et al., (2015) found that due to the complexity and sophistication of infrastructure, management process requires engineering knowledge. The issue of skills shortage has also been indicated in eThekwini Municipality publication (eThekwini, 2016). The municipality has a scarce skills allowance incentive in place, used as a measure to retain skills. According to Ostrom et al. (1993), incentives can play an important role in retaining skills. The municipal line management reporting structure has become identifiably vertical in each area. The danger is rigid and isolated silos which can affect service delivery (E-Myth,

2010). The issue of public infrastructure theft and vandalism was also pointed out by respondents. Van Vuureen (2009) suggests that municipalities should consult with communities before implementing any decisions. He further added that if decision makers implement inappropriate decisions, this may lead to misuse, neglect or even vandalism of infrastructure.

The need for the infrastructure budget alignment with the service delivery performance was highlighted. There is a lack of research in South Africa, to examine the budget impact for green infrastructure projects and incentives provided by the National Treasury to encourage "ecological budgeting". The findings could therefore not be compared to the private sector, due to different dynamics applied to various infrastructure asset management practices.

The result of this study indicated that 57.5% of the participants, thought the infrastructure budget was not aligned with the service delivery performance. Ninety percent (90%) of the respondents indicated the need to improve the budget allocation for the sustainability of infrastructure assets. The infrastructure asset management plan was developed to support sustainable, social and physical infrastructure plans, while conforming to an accrual accounting system. This plan enabled the municipality to quantify the asset life cycle in response to service needs within each cluster. This study uncovered several issues impacting on infrastructural asset management projects which require improvements. While most participants felt that inadequate funding impacted negatively on infrastructure inventory, there were some respondents who felt that the Supply Chain Management (SCM) process was negatively impacting on service delivery performance.

The result emerging from the data analysis was the alleged lack of communication between the executive and the middle management. This emerged when the respondents were asked to comment about the strategies used in applying integrated and sustainable asset management practices, where 55% of the respondents was unsure about the strategies used by the municipality. There was no apparent cascading of information protocol and this should be flagged as a recommendation for future planning.

5.2 Summary

The information provided reveal that although an asset management plan is in place, there is no evidence to prove that the plan is aligned with the Integrated Development Plan and to the Service Delivery Budget Implementation Plan. The result was that infrastructure budget is misaligned with the customer service needs. Respondents also disagreed that existing asset management practices were effective. On the issues impacting on infrastructure asset management, the respondents highlighted inadequate funding as one of the main factors.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

EThekwini Municipality implemented the infrastructure asset management plan (IAMP) in line with the changes in the municipal accounting practices. The adoption of the IAMP plan necessitated a new approach, which required the municipality to quantify asset life cycle in response to service needs. The study investigated the infrastructure asset management practices in the Trading Cluster of the eThekwini Municipality, by determining if the Trading Cluster budget is aligned with the sustainability of public infrastructure assets. The study uncovered that the budget allocation is somewhat misaligned with the sustainability of the public infrastructure and this points to the need for future models of resource allocation.

In view of that, this chapter concludes the study by highlighting the summary of findings, the recommendations, based on the findings, the limitations of the study, as well as the areas for further research.

6.2 Summary of findings and recommendations

Municipalities are mandated with the role of providing basic service to their communities through prudent collection and allocation of resources. Asset management is crucial to the service delivery, the recommendations therefore seek to improve the current methods used to allocate infrastructure funding to the Trading and Services Cluster.

6.2.1 The need for a balanced budget

There was consensus from the respondents that the Trading Cluster Services needs to improve its budget allocation to improve service delivery. Thus, the need for a balanced budget, the Trading Cluster Service budgets need to be geared towards the delivery of effective service to the community.

It is the recommendation of the researcher, that an "Ecological budget" system be implemented, which incorporates the needs of all the stakeholders. Thus, all relevant stakeholders would share information, future development plans and resource logistics. A task team could be developed to represent all the relevant parties, with the aim of transparency. This approach is holistic and would possibly reflect future resource needs that are aligned with the constitutional rights of all citizens in South Africa. The budget would allow for prediction of future resource allocation priorities. In doing so, this process would ultimately be more cost effective in the municipality because duplication of services, outsourcing of services and maintenance of infrastructure would be implemented in a more balanced way. The resultant benefit of this re-alignment is a more sustainable system in a resource challenged country. Several studies, for instance, Ross, Westerfield and Jaffe (1996:686); Brower, Garrison and Noreen (2010:28) all agreed on the importance of effective financial planning in the municipality to deliver sustainable basic service and keep within the restricted budget.

6.2.2 The need to implement sustainable and resilient infrastructure

The need to provide infrastructure such as roads, utilities and drainage system has become a primary issue for the sustainability of our cities (Yeang, 2008). What has emanated from this study is the urgent need to clear service backlogs. In view of the budget constraints highlighted in the study, the municipality needs to implement dynamic and innovative ways to clear these backlogs. Therefore, a need to implement cost effective and resilient infrastructure strategy that would be integrated into the strategic planning has arisen (Herder, de Joode, Ligtvoet, Schenk, & Taneja, 2011). The study conducted by the World Bank found that the eThekwini global biodiversity hotspot is degrading due to rapid urbanization and climate change (World Bank report, 2016). Therefore, the implementation of sustainable and resilient infrastructure could be a solution to mitigate risks arising from climate change.

6.2.3 The need for common assessment of infrastructural project

The researcher recommends that Trading Cluster Delphi Committee be implemented to assess and prioritize infrastructural project within this Cluster. In this study, 7.5 % of the respondents believed that the budget allocation for projects was driven by political affiliation. A multi-criteria system could be used to prioritise project according to three factors: economic value, environmental and social factors. This method could assist with the decision making in terms of determining the return on investment for each project to be implemented; will ensure that the alignment of the budget is done properly and would potentially reduce public service protest because the project would also consider social factors. This holistic approach would drive the municipality towards having an efficient and effective infrastructure management (Zeb, Froese & Vanier, 2010).

The Trading Cluster project assessment can be conducted quarterly and be linked with Service Delivery and Budget Implementation review forum, which is conducted on a quarterly basis. This would enhance a better understanding of the execution and implementation of the approved budget that has been aligned with the IDP, for effective service delivery to the community. Currently, the only platform available for the municipal officials to be acquainted with the budget is during the public budget presentation, which is conducted once a year. This seems inadequate.

6.2.4 The need to streamline Supply Chain Management process

Concerns were raised by the respondents, regarding the lengthy SCM processes that were in place. An option is therefore to streamline the existing processes in such a way that these processes are not cumbersome. The streamlined processes should ensure that project managers comply with SCM policy, while being able to deliver services timeously. Another possible option maybe to privatise the whole SCM department, meaning that experienced external service providers maybe appointed to procure all the services required by the municipality. The external service providers may be appointed on performance basis and penalties be applied in case of non-performance. This might address the issues of delays often encountered when projects are to be implemented.

6.3 Limitations

The study focused on the eThekwini Municipality environment and the surveyed group seemed appropriate. However, if the study were to include other municipalities in KwaZulu Natal, it would have made a better indication on whether the budget alignment for the whole province is geared towards the sustainability of public infrastructure.

6.4 Recommendation for further studies

The development of a future "Ecological budget" model could be the focus of future research. The study would include other stakeholders such as eThekwini residents, Councilors and investors, to gain a broader view on understanding their perspectives regarding issues impacting on the infrastructure asset management practices. These stakeholders are at the receiving end of the public infrastructure and would therefore provide a sound and meaningful information in terms of their opinion regarding the sustainability of public infrastructure. The researcher therefore suggests that further studies investigate this issue from the consumers/ public's perspectives, since this study examined the issue from the perspectives of management/employees.

6.5 Summary of the study

The aim of this study was to investigate infrastructure asset management practices employed in the Trading Cluster Services of eThekwini Municipality. This was achieved by the analyses of the questionnaire. The main objective was to determine whether the budget allocation was aligned with the sustainability of the public infrastructure. The key take away from this study is that the budget allocation was somewhat misaligned with the sustainability of the public infrastructure and this points to the need for future models of resource allocation.

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Dissertation RTG

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UNIVERSITY OF KWAZULU-NATAL
GRADUATE SCHOOL OF BUSINESS AND LEADERSHIP

Dear Respondent,

MBA Research Project
Researcher: Name (Telephone number)
Supervisor: Name (Office Telephone number)
Research Office: Ms P Ximba 031-2603587

I, Thandeka Gwamanda an MBA student, at the Graduate School of Business and Leadership, of the University of KwaZulu Natal. You are invited to participate in a research project entitled   investigating the infrastructure assets Management practices in the Trading Cluster of EThekwini Municipality.   The aim of this study is to: establish the kind of practice employed by the EThekwini Municipality trading cluster and how it impact on the management of infrastructure assets, with the intention to improve the budget allocation in all its units for sustainability of public infrastructure assets.

Through your participation I hope to understand the effectiveness of the infrastructure assets management practices in the EThekwini Municipality Trading Cluster Units. The results of the study is intended to enhance the current policies and future practices with regards to infrastructure assets management practices.

Your participation in this project is voluntary. You may refuse to participate or withdraw from the project at any time with no negative consequence. There will be no monetary gain from participating in this survey. Confidentiality and anonymity of records identifying you as a participant will be maintained by the Graduate School of Business and Leadership, UKZN.

If you have any questions or concerns about completing the questionnaire or about participating in this study, you may contact me or my supervisor at the numbers listed above.

The survey should take you about 30 minutes to complete. I hope you will take the time to complete this survey.

Sincerely

Investigator's signature_____ Date_____

UNIVERSITY OF KWAZULU-NATAL
GRADUATE SCHOOL OF BUSINESS AND LEADERSHIP

MBA Research Project
Researcher: Name (Telephone number)
Supervisor: Name (Office Telephone number)
Research Office: Ms P Ximba 031-2603587

<u>CONSENT</u>

I…………………………………………………………………… (full names of participant) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.

I understand that I am at liberty to withdraw from the project at any time, should I so desire.

SIGNATURE OF PARTICIPANT   DATE

…………………………………………………………………………………………

UNIVERSITY OF
KWAZULU-NATAL

INYUVESI
YAKWAZULU-NATALI

08 March 2017

Ms Thandeka Gwamanda (215066644)
Graduate School of Business & Leadership
Westville Campus

Dear Ms Gwamanda,

Protocol reference number: HSS/0192/017M
Project title: Investigating the infrastructure assets management practices in the Trading Cluster within eThekwini Municipality

Full Approval – Expedited Application

In response to your application received on 01 March 2017, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and FULL APPROVAL for the protocol has been granted.

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

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

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

Dr Shenuka Singh (Chair)

/ms

Cc Supervisor: Mr Christopher Chikandiwa
Cc Academic Leader Research: Dr Muhammad Hoque
Cc School Administrator: Ms Zarina Bullyraj

Humanities & Social Sciences Research Ethics Committee
Dr Shenuka Singh (Chair)
Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001, Durban 4000
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Website: www.ukzn.ac.za

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11 January, 2017

UKZN MBA Research Clearance

TO WHOM IT MAY CONCERN

This letter serves to confirm that EThekwini Municipality is supporting Ms. Thandeka Gwamanda to undertake research titled *"Investigating the infrastructure assets management practices in the Trading Cluster of EThekwini Municipality"*

The output of the research will add value to the Municipality and will be used in improving existing assets management practices. The Municipality will also gain a broader understanding on issues impacting upon infrastructure assets managements projects.

EThekwini Municipality will provide full support needed for MS. Gwamanda to successfully complete her dissertation.

Regards

Mr. Phil Mashoko (Pr Eng)

Deputy City Manager Trading Services

Investigating the infrastructure asset management practices in the Trading Cluster of eThekwini Municipality

Questionnaire

Section A: Biographical Information

Date of the questionnaire filled												**2**	**0**	**1**	**7**
Age Group.	22-25 years		26-29 years		30-33 years		34-37 years		38-41 years		42-45 years		46-49 Years		50 years and over	
Race	African		White		Indian		Coloured		Other: (Please specify below)							
Gender	Female		Male													
Position																
Task grade	TK 14-15		TK 15-16		TK 16-17		TK 17-18									
Period of service.	01-06 years		07 -12 years		13-18 years		19-24 years		+25 years							
Trading Cluster	Water and Sanitation		Electricity Department		Cleansing and Solid Waste											
Office Address / Office Location Number						Postal Code.									

Questionnaire

Section B: Investigating the infrastructure asset management practices in the Trading Cluster within eThekwini Municipality.

Please place a cross (x) where relevant number applies regarding infrastructure asset management practices in your service unit where numbers indicate the following 1= Strongly Agree (SA), 2 = Agree (A), 3 = Neutral (N), 4 = Disagree (D) and 5 Strongly Disagree (SD).					
Questionnaires	Answer by placing a (x) inside the box provided.				
Do you agree with the following statements	1. Strongly Agree (SA)	2. Agree (A)	3. Neutral (N)	4. Disagree (D)	5. Strongly Disagree (SD).
1. The Trading Cluster of eThekwini Municipality needs to effectively improve the budget allocation in all its Units for sustainability of public infrastructure					
2. There are budget constraints on the Trading Services Cluster within the Municipality					
3. The budget constraints on the Trading Cluster within the Municipality affect positive functionality of infrastructure assets					
4. There is a need to improve budget allocation in all Units for sustainability of the public infrastructure assets					
Questionnaires	Answer by placing a (x) inside the box provided.				
Do you agree with the following statements	1. Strongly Agree (SA)	2. Agree (A)	3. Neutral (N)	4. Disagree (D)	5. Strongly Disagree (SD).

	1. Strongly Agree (SA)	2. Agree (A)	3. Neutral (N)	4.Disagree (D)	5. Strongly Disagree (SD).
5. The Infrastructure assets management decisions take into account the cost and benefit of the assets life cycle.					
6. The Infrastructure asset management processes are clearly defined.					
7. The Infrastructure asset management practices are aligned to meet changing need of customers.					
8. There is an alignment between infrastructure objectives, situation and interventions to sustain service delivery performance.					
9. The strategic asset planning processes (to analyse demand needs as well as current asset conditions) are in place.					
Questionnaires Do you agree with these statements	Answer by placing a (x) inside the box provided.				
	1. Strongly Agree (SA)	2. Agree (A)	3. Neutral (N)	4.Disagree (D)	5. Strongly Disagree (SD).
10. The current infrastructure assets management practice of the EThekwini Trading Cluster Units is effective.					
11. The criteria followed in funding infrastructure projects is transparent and well known.					
12. There are strategies that can be used in applying integrated and sustainable assets management practices.					

13. According to your knowledge, what is the criteria followed in funding infrastructural projects?

_____

_____

_____

_____

14. Is the budget allocation aligned to service delivery performance? Please give reasons.

_____

_____

_____

15. What are the strategies used in applying integrated and sustainable assets management practices?

_____

_____

_____

16. What are issues impacting on infrastructure assets management projects?

_____

_____

_____

Thank you for completing the questionnaire. Please return it to Thandeka Gwamanda – DSW Head Office, 17 Electron Road, Springfield, or scan and email to thandeka.gwamanda@durban.gov.za.

If you have any concerns regarding this research please contact me or my supervisor, details provided on the first page. If you are not entirely happy with a response please contact. Mr Christopher Chikandiwa (UKZN)

University of KwaZulu Natal

Graduate School of Business and Leadership

Tel: +27 31 260 8882

Email Address: chikandiwa@ukzn.ac.za