University of KwaZulu-Natal

The effectiveness of the asset management system implementation at eThekwini Electricity

By

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DECLARATION

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"I wasn't born a rich man, I ain't got no pedigree
The sweat on this old collar, that's my Ph.D"

- Bon Jovi

ABSTRACT

The government strives to meet economic growth figures and drive the country's gross domestic products index higher, lower unemployment and reduce poverty. There is one common element that links these ideals together and enables this higher standard of living, electricity. As the manufacturing sector increases, so too does electricity usage. New factories and expansion of existing organisations requires more workers, all driving the demand for electricity up and creating a critical need for a stable, secure source of power. Intermediate transit house camps, low cost housing and community improvement programmes all require more, secure sources of power.

As pressure mounts on the ageing electrical infrastructure, significantly increasing numbers of faults registered by the eThekwini call centres, indicate that maintenance practices have not kept up with the rapid infrastructure development of the mid-nineties. In order for technical decisions to have any merit, it is necessary for the decision makers to have access to accurate asset information as well as accurate geospatial information to make infrastructure and network related improvements or completely new installations.

This has resulted in the implementation of an asset and information management system at eThekwini Electricity to operate more efficiently while complying with all relevant legislation. The current asset management system was implemented in 2012. Numerous user complaints prompted the need for this study, the aim of which was to establish the effectiveness of the asset management system implementation and operation. The salient results of this study reveal several areas of improvement, such as the need for more effective training and increased communication between all stakeholders. To ensure successful usage of the system, it is recommended that training schedules be prioritised, skills transfer between consultants and internal staff be facilitated and that the asset care centre's functions be expanded. This, among other relevant changes will increase user satisfaction and improve the performance of the asset and information systems.

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LIST OF ACRONYMS AND ABBREVIATIONS

ACC	Asset Care Centre
AM	Asset Management
CSFs	critical success factors
CSIR	Council for Scientific and Industrial Research
DoE	Department of Energy
DPLG	Department of Planning and Local Government
EE	eThekwini Electricity
ERP	enterprise resource planning
ESLC	Electricity Suppliers Liaison Committee
GAAP	Generally Accepted Accounting Practice
GAMAP	Generally Accepted Municipal Accounting Practice
GIS	geospatial information system
GRAP	Generally Recognised Accounting Practice
HV	high voltage
ICT	information, communication and technology
IIMM	International Infrastructure Management Manual
IT	information technology
MFMA	Municipal Financial Management Act
MV	Medium Voltage
NER	National Energy Regulator
NERSA	National Energy Regulator of South Africa
NRS	National Regulatory Standards
OHS	Occupational Health and Safety
PAS	publicly available specification

RDP	Reconstruction and Development Programme
RSA	Republic of South Africa
SA	South Africa
TQM	total quality management
WCA	work centered analysis

CHAPTER ONE:
OVERVIEW OF THE STUDY

1.1 INTRODUCTION

With the introduction of the asset management plan at eThekwini Electricity in 2009, formal business processes were created and the existing enterprise resource planning (ERP) was re-designed and implemented with a more process orientated, asset-centric approach. The traditional method of paper based electrical reticulation records was outdated. A new geospatial information system (GIS) was adopted and records were updated and stored electronically. Without correct implementation procedures preparing the staff complement for changes and user consultation to develop the new systems, the new systems may not be as effective as possible. The study attempted to determine the effectiveness of the asset and information management systems implemented at eThekwini Electricity.

1.2 THE HISTORY OF THE COMPANY

EThekwini Electricity provides power to more than 660 000 customers. The area of supply covers almost two thousand square kilometres. This spans the regions of eThekwini Metropolitan Areas including some adjacent areas. Power is purchased in bulk for the base supply to the region. Eskom supplies this power at 275 000 volts at three main in-feed points to the city. The municipality also purchases power from Eskom for the surrounding areas of Tongaat, Winkelspruit, Mpumalanga and Magabeni. From these base points electricity is transmitted and distributed for use by the full range of customers, from the large industrial and commercial sector to the residential communities. EThekwini Electricity purchases just over 5% of the total energy generated by Eskom. EThekwini Electricity operates under the Electricity Regulation Act, 2006. Its policies are determined by the Metropolitan Council of Durban and the National Energy Regulator of South Africa (NERSA) (eThekwini Electricity, 2010).

1.3 MOTIVATION FOR THE STUDY

Municipalities in Southern Africa (SA) provide many asset-based services to the business sector, government and social institutions as well as domestic households. These services are mainly comprised of provision of water, sanitation, electricity, roads, storm water, solid-waste

treatment, street cleaning, and a wide range of public amenities such as sporting and recreational, cultural, health, educational and agricultural market services.

Since 1994, the extent to which the demand for services has grown is not always possible to determine with great accuracy (Gildenhuys, 2009). This exponential growth, together with significant industrialisation and mass electrification programmes has provided power deep within rural areas, which means demand for energy has increased, and the electricity infrastructure, which was originally designed to cater for a minority of the population, has been overloaded.

An asset management system was required to monitor and account for all operational assets. The system needed to schedule the commissioning, maintenance, repair and eventual decommissioning of the assets when useful life cycles were reached (Bekker, 2008). The asset management system enabled formal business process to be defined and integrated within an ERP system. A review of current literature pertaining to asset and information management systems provided insights regarding common problems and solutions to ERP implementation as well as methods to evaluate effectiveness of the system in normal operation (Wu & Wang, 2006). There were some areas regarding ERP and information systems which the literature did not answer fully, in fact, it was difficult to find any information evaluating both systems simultaneously. The ERP, Ellipse, was created to formalise business processes and provide far greater control over asset intensive functions, while the GIS was developed to digitise all electrical asset records from the existing hard copy design layouts. The result was an independent server providing the entire electricity service unit with viewing access to all electrical, roads, storm water, and geographic asset information. A clear research question emanating from this implementation was whether all user needs had been considered and how effective the asset management system is from an employee (user) perspective. Therefore, this study was conducted to determine the effectiveness of the implementation of asset management systems at eThekwini Electricity. The complete process was first implemented in the High Voltage Operations department of the organisation and other departments were scheduled to follow suit in the future.

1.4 PROBLEM STATEMENT

The asset and information systems have been implemented and are in operation at eThekwini Electricity. External consultants were, and still are contracted to provide and maintain the

asset management strategies, and systems governing almost all asset intensive work output in the High Voltage (HV) Operations department. The external consultants presented their findings to the upper management but for the most part, they liaise with two project executives representing eThekwini Electricity. Therefore an opportunity exists to determine if the end level user was consulted in the development of the new systems, which most of the literature alludes to. Problems that occurred both during and after the implementation can be analysed to prevent recurrences during implementations to the remaining departments or on different projects altogether.

Members of the HV Department at eThekwini Electricity who use these systems on a daily basis will benefit the most from outcomes of this research, as well as all the remaining departments yet to implement the system. The resulting research question was formulated to determine the effectiveness of the asset management system at eThekwini Electricity. This aim was addressed by evaluating the system in terms of four objectives to satisfy the reason for the research.

1.5 AIM AND OBJECTIVES

The aim of this research is to establish the effectiveness of the implementation of an asset management system within the HV Operations department of eThekwini Electricity (EE). The objectives were to:

a. Establish what processes were followed prior to the implementation of the asset management system.

b. Establish employee attitudes towards the asset management system.

c. Determine the reasons why employees have encountered problems with the asset management system.

d. Identify improvements that can be made to the existing asset management system.

The research was intended to determine what formal processes were followed prior to the launch of the new systems, what impact the processes, or lack thereof, had on the employees and the customisation of the systems to the organisation's requirements. This study discusses which problems occurred during the implementation and offers potential solutions. Benefits

achieved after the implementation are also examined. Another priority of this research was to evaluate if any immediate improvements can be executed to better meet the user needs.

1.6 POPULATION AND SAMPLE

The participants of the study were employees of eThekwini Electricity. This included everyone within the task grades 06 to 18, who have access and utilise the enterprise resource planning (ERP) software (Ellipse) and/or the geospatial information systems (GIS) within the six HV Operations sections. The total population within the HV Operations department consists of 69 potential participants.

It is critical to determine the right individuals, objects or events as representatives for the entire population (Bryman, 2012). This process of selection is referred to as sampling. It is often not possible or practical to survey the entire population. In these instances a sample of some suitable size is selected from the population and the study is carried out on the sample and those observations are used to make inferences about the entire population (Bryman, 2012). Sekaran and Bougie (2010) developed standard sample sizes for specific populations. In order to confidently generalise the findings on the entire population a minimum of 59 respondents had complete the survey for this researh study.

1.7 METHODOLOGY

This study setting was non-contrived and was directed at the three sections located at eThekwini Electricity, based in Jelf Taylor Crescent and the remaining three sections operating out of the Springfield Depot. The methodology that was employed for this study is quantitative. There are some disadvantages to this type of study (Jones, 2012) but the indisputable benefit of quantitative studies, even considering the potential pitfalls, is that in essence, they reduce a complex situation to a statistic or figure which is easy to understand, discuss and analyse. They are also more cost and time effective than qualitative studies in general (Nielsen, 2004). These concepts will be discussed in greater detail in Chapter Three.

1.8 DATA COLLECTION METHODS

Structured questionnaires are the quantitative method of research which was used to complete this study. A questionnaire is an effective means of eliciting feelings, beliefs, experiences, perceptions, or attitudes of some of the sample individuals (Sekaran & Bougie, 2010). The

questionnaire was constructed using Questionpro software. The online resource allows researchers to develop and administer surveys electronically over the internet and through the use of electronic mail. Benefits of using this type of data collection instrument are the advanced statistical analysis that the software offers on all data collected.

1.9 LIMITATIONS

A quantitative study is generally more accurate the greater the number of participants in the study in relation to the population. The only limitation experienced in this research was the response rate of respondents. The number of respondents required to generalise the results across the population was 59 (Sekaran & Bougie, 2010, p.295). This study achieved 51 completed questionnaires, however, there were strong themes and significant information to understand the main problem areas and offer solutions but the responses could not be generalised to the population.

1.10 OUTLINE

Chapter 1: Has provided a brief overview, describing the organisation environment and background history. This chapter has provided relevant information highlighting the problem areas and how the research aimed to correct this.

Chapter 2: Is an analysis of all relevant literature regarding the issues leading up to the need for asset management strategies and systems as well as examples of successful projects detailing best practices for completing processes.

Chapter 3: Details the relevant research methods that must be adopted to complete business research projects. Explaining the approach and describing the study setting are important in modern day research initiatives.

Chapter 4: Analyses the results of the survey and explores the finding in relation to the predetermined objectives of the study.

Chapter 5: Presents recommendations based on the analyses of the results and offers methods to improve the asset management system for all users. This is followed by the concluding remarks.

1.11 CONCLUSION

Asset management strategies can allow municipal entities to function as efficiently as private organisations. The global trend is in fact for utilities to privatise and be run independently from local government. This is said to allow new providers of electricity to enter the market and increase competition, driving electricity prices down. SA is not quite there yet and attempts to privatise municipalities have not been implemented at all. The efficiency, however, can be improved. This is not the only influencing factor and legislation and new accounting practices make it necessary for all municipalities and government departments to account for all assets that they are responsible for. This is quite impossible without an accurate, reliable asset management system. The research showing an ageing network, poor maintenance practices and best practices for asset and information systems is explored further in the next chapter.

CHAPTER TWO:
REVIEW OF THE LITERATURE

2.1 INTRODUCTION

According to Boshoff (2009), municipalities in Southern Africa (SA) provide many asset-based services to the business sector, government and social institutions as well as domestic households. These services are mainly comprised of provision of water, sanitation, electricity, roads, storm water, solid-waste treatment, street cleaning, and a wide range of public amenities such as sporting and recreational, cultural, health, educational and agricultural market services. These services, and the assets utilised to produce such services, should ensure social health and well-being as well as supporting economic growth (Boshoff, 2009).

The electricity distribution industry in SA is made up of Eskom (a parastatal) and a number of municipalities licensed to distribute electricity. Vecchiatto (2012) drew public attention to the industry recently under the spotlight; due to a mounting maintenance and refurbishment backlog, estimated at R35 billion. Because the distribution network is old, the risk of power outages is heightened, as the distribution infrastructure may fail when placed under pressure.

The aggregated refurbishment backlog at the end of 2005 for utilities audited was R431 million (King, Wallis, Jones & Joubert, 2005). Each year that no infrastructure asset refurbishment takes place this figure grows. Estimated figures for the average requirement to maintain the present level of service in future was R422 million annually, to which the R431 million must be added. The average age of all distribution plants in service is between 25 and 30 years. This is fairly young by international standards and the issues related with renewing and refurbishing plant and equipment in Southern Africa is, therefore, a new and rapidly growing problem (King *et al*., 2005).

Prior to the asset management system being implemented, eThekwini Electricity had out-dated methods for monitoring maintenance cycles and almost no historical records. The municipality also had no formal asset register, so determining what was deteriorating at an abnormal rate and what was due for actual refurbishment was extremely difficult.

eThekwini Electricity had implemented an ERP system to manage the business processes and streamline the organisations operations. The asset management strategy implemented by

eThekwini Electricity initiated a re-engineering of the formal business processes in the HV Operations department. The actual asset management strategy was designed and implemented by experienced external consultants who have completed many successful projects in other organisations. There are a number of experienced managers and consultants who contributed to the implementation of the asset management systems at eThekwini Electricity. However, despite this experience and capability, the extent of some of the changes required by ERP systems have often overwhelmed many organisations, resulting in ERP project failures (Maguire, Ojiako & Said, 2010).

2.2 RAPID INCREASE IN CONSUMER DEMAND IN SOUTH AFRICA

The political freedom that came with the 1994 elections brought a shared hope and an expectation that life would improve for all South Africans (Maloka, 2002). The new government that came into office developed a transformation plan, which later became known as the Reconstruction and Development Programme (RDP). The purpose of this plan, among other things, was to provide electricity to two and a half million homes by the year 2000.

Gildenhuys (2009) surmised that there is no reason to question the government's commitment towards service delivery and infrastructure provision. Infrastructure provision and municipal service delivery have always been regarded as among the highest priorities by government.

Since 1994, the extent to which the demand for services grew is not always possible to determine with great accuracy (Gildenhuys, 2009). This growth, together with significant industrialisation as well as mass electrification programmes, has taken power much further into rural areas, which means demand for energy has increased, and the electricity infrastructure, which was originally designed to cater for a minority of the population, has been overloaded. Gildenhuys (2009) anticipated that generation capacity would have peaked by 2011. However, this may have been slowed by the financial crisis during and since 2008.

In its 2001 Mid-term report to the nation (Maloka, 2002), government's summarised version of progress with regard to electricity since 1994 shows that 3.50 million electricity grid connections have been made. Post the 1994 elections, demand for electricity has increased rapidly, and maintenance and refurbishment practices have not kept pace with world standards. Figure 2.1 illustrates the steadily increasing number of electrified homes in South Africa.

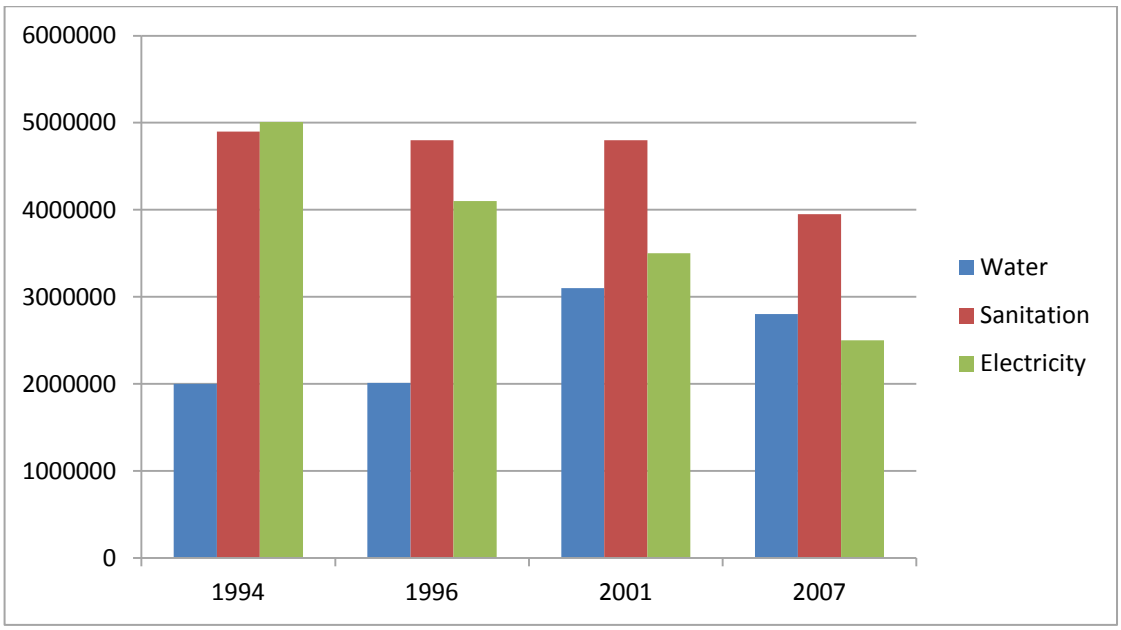


Figure 2.1: Backlogs of key services from 1994 to 2007

Adapted from Gildenhuys, B., 2009. *Municipal Infrastructure Investment Requirements (MIIR),* s.l.: World Bank Economic and Sector Work.

Guildenhuys's (2009) report shows a clear decline in people in SA with access to electricity. This is partially attributed to the department of energy subsidising electricity connections for low cost housing developments and informal dwellings.

This is indicatative of a rapidly developing electricity infrastructure, comprised of new and ageing equipment. Clearly more stringent maintenance practices need to be implemented. Unfortunately, this can only be controlled if all system assets are known and accounted for.

2.3 THE STATE OF INFRASTRUCTURE ASSETS IN SOUTH AFRICA

Infrastructure assets are complex by nature and require robust management practices. Detailed knowledge of the location, characteristics, estimated lives, capacity and utilisation, cost characteristics, risk exposure and safety requirements of assets is required to best manage them and make sustainable improvements in service delivery (Boshoff, Childs & Roberts, 2009). EThekwini Electricity did not have the systems in place to determine location, remaining useful life, capacity and all the other variables that would enable the organisation to operate at its maximum potential while delivering quality service to the customer base.

Based on the results of several municipal infrastructure assessments funded through the Department of Cooperative Governance and Traditional Affairs, the European Union, the Limpopo Government and also through direct municipal appointments, Boshoff (2009) surmised that the national municipal infrastructure portfolio had an estimated replacement value of R724 billion. This value is limited to infrastructure directly controlled by municipalities, including water, sanitation, roads, storm water, electricity and solid waste facilities. This excludes operational buildings, community facilities and investment properties (Boshoff, 2009).

The energy regulator was forced to intervene in 2005, after a spate of power outages across the country which were attributed primarily to the poor state of the country's electricity distribution infrastructure (King *et al*., 2005). Two years later, the National Energy Regulator of South Africa (NERSA) released the findings of an audit performed on eleven major electricity distributors in the country, which recommended that the government spend more than R432 million on the refurbishment of infrastructure assets.

Newbery and Eberhard's (2007) report found that comparative electricity distribution performance by municipalities is poor and could deteriorate further, at great economic cost to the country. Almost half of South Africa's electricity distribution is delegated to municipalities, which lack appropriate, politically-insulated commercial structures for the management of distribution and supply. The report showed that in many cases they have failed to maintain infrastructure and retain suitably skilled staff.

In a report commissioned by the CSIR, no record could be found of any formal audits or studies regarding the state of municipal infrastructure. However, some service authorities, among them municipalities, have performed audits in respect of their own infrastructure. Other studies and audits have been undertaken on an ad-hoc basis. What was noticeably lacking was any overview of trends in the state and performance of municipal infrastructure and its maintenance. Indeed, in many municipalities knowledge of even the extent and capacity of the infrastructure assets they possess can be patchy and unreliable (CSIR, 2007).

Many municipalities have not conformed to the requirements of the Municipal Financial Management Act (MFMA) for municipal systems, and various other legislation requiring them to ensure adequate provision is made for the long-term maintenance of their

infrastructure assets (Booyzen & Fourie, 2010). Due to the extensive municipal infrastructure, and the often poor records kept of its condition, the CSIR undertook an investigation into the state and performance of infrastructure assets and its maintenance (CSIR, 2007).

Boshoff (2009) showed that experiences of the past decade (1999–2009) have supported these findings and indications are that infrastructure assets are deteriorating much faster than planned, and that many infrastructure facilities that should be in good working order are overloaded, no longer operational or are in need of complete renewal.

Service delivery protests traditionally centred on the lack of access to services, more recently now include failing service delivery as well. The lack of routine maintenance of existing infrastructure has been highlighted as perhaps the key contributor to the current poor state of municipal infrastructure (Boshoff, 2009). Literature that exists regarding infrastructure asset management in Southern Africa indicates a number of causes for the poor level of service delivery, most notably insufficient funding and the lack of sufficient skilled technical staff (Boshoff, 2009).

According to Boshoff *et al*. (2009), the constantly increasing demand for municipal services and the national initiatives for accelerated infrastructure development and maintenance at the local level have increased. This leads to an ever increasing scale and value of municipal assets in the future.

These infrastructure assets will require a significantly higher level of expert knowledge regarding asset management and information management systems to ensure that the capacity necessary to deliver the required services at the desired standards and efficient levels of costs is achieved. Legislation governing municipalities must also ensure improved asset management from an operational and a financial perspective (Boshoff *et al*., 2009).

2.4 REGULATORY CHANGES IN THE MUNICIPAL ENVIRONMENT

Electricity distribution in SA is a monopolistic industry. Due to this, the electricity distribution industry is subject to strict regulation from authorities. In trying to achieve compliance with all the necessary legislature requirements it is very easy to lose sight of the actual service delivery function (Booyzen & Fourie, 2010).

As a direct result of the intensive compliance processes, many municipalities have tended to focus their efforts on fulfilling compliance requirements, rather than focusing on the critical issues of service delivery and enhancing performance existing assets (Booyzen & Fourie, 2010).

Numerous regulations and guidelines have been developed to ensure government's vision for municipal infrastructure is capable of achieving certain objectives. Table 2.1 shows these objectives for municipal infrastructure in South Africa.

Table 2.1: Government's objectives for municipal infrastructure

1.	Long-term sustainability and management
2.	Performance monitoring and accountability
3.	Service delivery efficiency and improvement
4.	Interaction with the community and transparent processes
5.	Priority development of minimum basic services for all
6.	Financial support from central government

Source: Adapted from Republic of South Africa (RSA). 2004. Local Government: Municipal Finance Management Act, no.56 of 2003.

Government's vision for municipal infrastructure and service delivery is illustrated in Table 2.1. No one system can achieve these ideals. The initiation of this vision required that legislation be drafted to force municipalities, both big and small, to adopt strategies, plans and systems to conform to these goals. There are many contributing factors pertaining to the legality requirements of asset management in SA, however, the most relevant regulations pertaining to asset management are discussed in Table 2.2.

Table 2.2: Legislation pertaining to asset management to be applied to municipalities

1.	The MFMA makes it necessary for the municipality to implement and maintain management, information and accounting systems that accounts for the assets and liabilities of the municipality. The municipality must also develop and maintain an asset and liability register. In addition, the municipality must produce accurate annual financial statements.
2.	Generally Recognised Accounting Practice (GRAP17): Property plant and equipment issued by the Accounting Standards Board (2010). Generally Accepted Municipal Accounting Practice (GAMAP) and Generally Accepted Accounting Practice (GAAP) have been preceded by GRAP standards, which need to be integrated according to the MFMA. GRAP 17 deals with the compilation of an asset register for immovable assets. The expectation is that all assets should be verified and depreciated annually. Large asset values lie in underground cables, with the MV cable network comprising between 30% and 40% of asset value in a large municipality. These assets cannot be verified by physical inspection.
3.	NRS 093-1: 2009. The Electricity Suppliers Liaison Committee (ESLC) developed NRS 093: Asset Management for Electrical Infrastructure in 2007. NRS 093 focuses on assets specifically and not on the use of assets to achieve service delivery.
4.	The Department of Planning and Local Government (DPLG) guidelines for infrastructure asset management in local government 2006–2009. This document is at a more operational level than NRS 093 and draws from the experiences of Australia and New Zealand in infrastructure asset management. It introduces the concept of an asset hierarchy and proposes the use of straight line depreciation of assets.
5.	Occupational Health and Safety Act No. 85 of 1993 (OHS Act). Safety issues form an integral part of any asset management system and should be an integrated function within any system. The OHS Act requires the, "owner" to maintain a structure (including infrastructure) in such a manner that the structure remains safe for continued use. Asset management can achieve this.

Source: Various legislation.

The MFMA and GRAP 17 requirements pose great compliance challenges to most municipalities. International experiences had shown that it can take up to eight years to comply with this legislation. The challenge in the current economically as well as capacity constrained environment is thus huge (Booyzen & Fourie, 2010).

2.5 WHAT IS ASSET MANAGEMENT?

The Publicly Available Specification (PAS 55:2008) defined asset management as systematic, coordinated activities and practices thorough which an organisation optimally and sustainably manages its assets and asset systems, as well as their associated performance, risks and expenditures over their life cycles for the purpose of achieving the organisational strategic plan (BSI, 2008).

The International Infrastructure Management Manual (IIMM) specifies asset management as: The combination of management, financial, economic, 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).

Dashti and Yousefi (2013) interpret asset management as a method of regulating outcomes, while evaluating risks. Planning, network operation, providing infrastructures, forecasting, maintenance and repair assets are activities that have always played a crucial role in distribution system administration. Asset management consists of planning operation, expansion projects and determining corresponding methods as well as their constraints, considering the risk of investments.

The common threads in the various descriptions of this management activity are clearly how to best manage the physical and human assets in an organisation to derive the most sustainable production while maximising the asset life cycle.

2.6 THE NEED FOR AN ASSET MANAGEMENT SYSTEM IN A MUNICIPAL UTILITY

Nordgard (2012) pointed out how electricity distribution companies throughout the world are adopting the principles of asset management as guidance to optimally handle their infrastructures. This is due to the global trend of privatising national utilities and operating them in a more business oriented manner.

Schneider, Gaul, Neumann, Hogräfer, Wellβow, Schwan and Schnettler (2006) illustrated how asset management in electrical utility companies played an important role in the early detection and determining decisions leading to long-term economic success and best possible

earnings. For asset management to meet these expectations it has to overcome a number of challenges, foremost of which are alignment of strategy and operations with stakeholder values and objectives and balancing of reliability and maintenance, safety, and financial considerations.

Josie (2008) argues that the key financial policy objectives regarding sustainable local government in South Africa were derived from constitutional obligations. Despite much of the finance for municipal infrastructure being provided by national government through the Municipal Infrastructure Grant, recent trends show many municipalities have not shown any progress in construction, maintenance and repair of basic infrastructure. Unless these issues are addressed, the achievement of sustainable local government, as envisaged in the constitution, will be delayed and the inequalities that characterise our society will be aggravated and exacerbated.

According to figures from the Department of Energy (DoE), municipalities supply electricity to approximately fifty four percent of the country's users and had an asset maintenance backlog of R28.4-billion in 2008 (SAPA, 2012). Without a reliable, accurate and user-friendly method of tracking faults, performing maintenance and constructing new infrastructure, this backlog will continue to increase.

One report conducted by the National Energy Regulator of SA found that, “No comprehensive national data on the condition and age of [electrical distribution] infrastructure exists” (NER, 2004). This lack of information makes it impossible for municipalities to comply with the new accounting regulations.

Another report commissioned by the council for scientific research showed the replacement value of the engineering infrastructure assets of eThekwini Municipality had been calculated at R 57.4 billion. By contrast, the "book value" was recorded as R6 billion (Palmer & Balwanth, 2005; CSIR, 2007). This is a significant discrepancy and impairs the technical decision-making ability of the planning and operations staff at eThekwini Municipality as well as the financial reporting ability.

Research conducted by the Council for Scientific and Industrial Research (CSIR) also found that South African municipalities compare very unfavourably in comparison to international

benchmarks, such as New Zealand municipalities in respect of strategic planning, asset accounting, planning and making financial provision for improvement of infrastructure (CSIR, 2007).

In another report compiled by South African and Australian consultants, after auditing 11 South African utilities, it was found that by using international benchmarking a number of problem areas were identified as detailed in Table 2.3 (King *et al*., 2005).

Table 2.3: Problems identified in an audit of 11 SA utilities

1.	Data collection standards well below international standards
2.	South African networks are on average at a lower than their Australian counterparts
3.	Infrastructure asset valuations are not detailed enough to allow for in-depth analysis
4.	There is an extremely high refurbishment backlog
5.	South African municipalities do not spend enough funds on refurbishment
6.	Operating expenditure (maintenance) is much higher than the Australian utilities

Source: King, K., Wallis, R., Jones, C. & Joubert, J., 2005. *Independent Technical Audit on Eleven electricity distributors networks - Consolidated Audit Report,* s.l.: Merz and McLellan/Sinclair Knight Merz.

It is clear given from the amount of data compiled that municipalities in SA need to track, monitor and refurbish their physical assets in a more efficient and accurate manner. Many of the problems identified in Table 2.3 can be corrected or improved with a sound asset management strategy and systems.

According to Alsene (2007), adoption of asset management and ERP implementation results in improved coordination within the organisation. Achievement of the implementation stage of ERP has been shown to result in benefits and gains for the organisation undertaking the ERP project (Ram, Corkindale & Wu, 2013). This shows a clear distinction between the implementation stage and the operating stage of an ERP. This resulted in the distinction between the two objectives in this study.

Information management and planning software have been statistically proven to improve quality, to the end users (customers) and also significantly lower operational costs (Gupta, Priyadarshini, Massoud & Shivprakash, 2004). In addition to improved operational costs,

Cotteleer and Bendoly (2006) observed increases in continuous learning among employees which improves overall performance.

Rikhardsson and Kraemmergaard (2006) pointed out that another benefit of asset management is a significant reduction in inventory costs. The organisation requires an information management system to monitor stock and replenish the right quantities when necessary. Similarly, Su and Yang (2010) have proven a definite enhancement in firm competencies in supply chain management through operation process integration and customer relationship interaction.

In a separate study, Bendoly, Rosenzweig and Stratman (2009) have proven that the efficient use and management of asset information leads to organisational profitability. Spathis and Constantinides (2003) identified areas for organisational optimisation through the use of asset and information management strategies and systems. Some of the improvements observed were:

a) A significantly more positive effect on accounting processes through:

   - An increase in flexibility of information generation;
   - An increased integration of accounting system application;
   - A higher quality of reports.

b) Improved decision making on timely and reliable accounting information.

c) Therefore the implementation of an asset management strategy at eThekwini Electricity was necessary to operate more efficiently and improve the quality of service to customers.

2.7 THE DEVELOPMENT OF AN ASSET MANAGEMENT SYSTEM

In order to initiate a process to better equip the organisation to optimise performance, it was necessary to first examine all the current methods of work execution. Formal business processes were mapped and processes developed in line with industry best practices. An external consultant was recruited to develop asset management strategies, plans and systems to enable the organisation to adopt a strategy that has been successfully implemented in other organisations.

The individual best practice of each work function was adapted to eThekwini Electricity's needs, based on industry accepted standards. According to Reijers and Mansar (2004), the resultant effect of each best practice should be evaluated along the dimensions of cost, flexibility, time and quality. A conceptual framework needs to be developed to synthesise views from areas such as information systems development, enterprise modelling and workflow management. These best practices have a wide applicability across various industries and business processes.

Perhaps the most important element of redesigning business processes, creating work and asset management systems, is to obtain input from the end level user. In this situation, as Figure 2.2 illustrates, the users of the system are represented as participants in the system design.

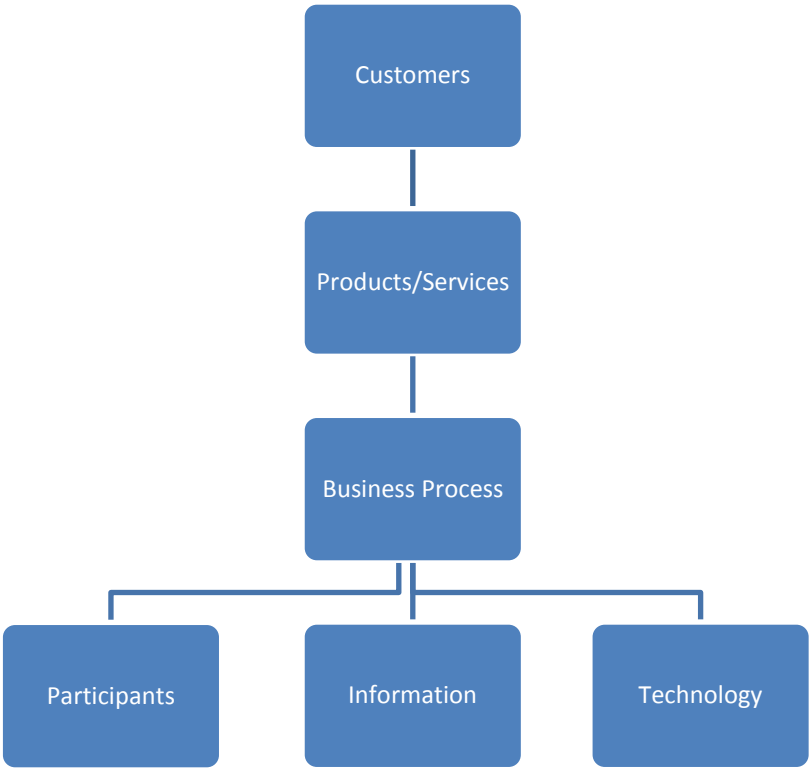


Figure 2.2: A work centred analysis framework

Source: Adapted from Reijers, H. & Mansar, S. L., 2004. Best Practices in business process redesign: an overview and qualitative evaluation of successful redesign heuristics. *The International Journal of Management Science,* Issue 33, pp.283-306.

The work centred analysis (WCA) framework depicted in Figure 2.2 consists of six business areas, the customers of the business process, the products or services generated by the

business process, the steps in the business process, the participants in the business process, the information the business process uses and the technology the business process uses. If all areas are not considered, the process being developed will be misaligned to an organisation's existing structure, people, communication and technology (Reijers & Mansar, 2004).

A popular management tool, total quality management (TQM), promotes three principles, namely customer satisfaction, employee involvement and process improvement. TQM is a system that emphasises process improvement, whereas an ERP system is an IT mechanism that implements enterprise-wide process management. Both TQM and ERP initiatives require the commitment from the senior leadership to be successful (Li, Markowski, Xu & Markowski, 2008).

ERP systems streamlines business processes to facilitate the flow of data and information among all avenues of an organisation. An ERP system enables organisations to integrate all its business processes to enhance efficiency and maintain a competitive position (Gupta & Kohli, 2006).

Without successful implementation of the ERP system, the projected benefits of improved productivity, increased efficiency and competitive advantage would not be forthcoming and could even result in system failure (Moon, 2007). Figure 2.3 illustrates the role of total quality management in an ERP implementation.

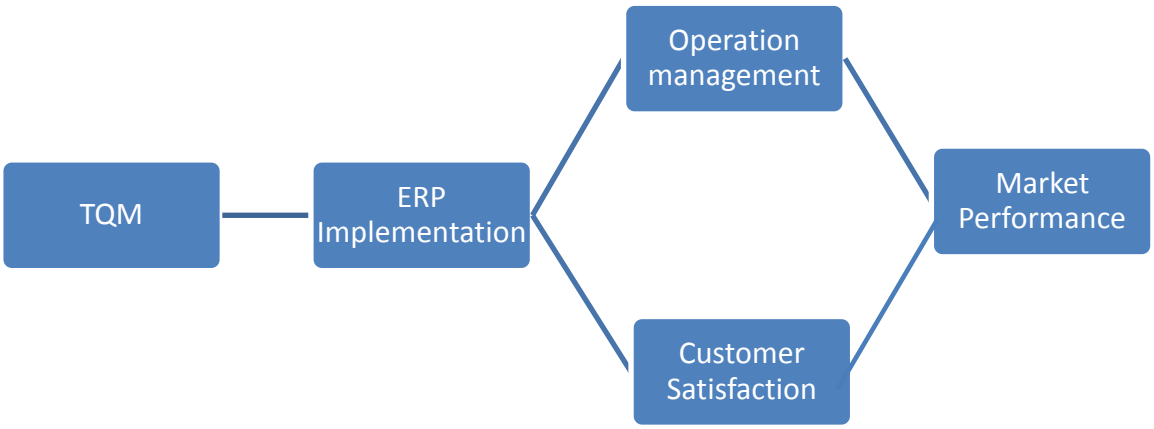


Figure 2.3: TQM and ERP implementation – A conceptual model

Source: Li, L., Markowski, C., Xu, L. & Markowski, E., 2008. TQM-A predecessor of ERP implementation. *Int. J Production Economics,* Issue 115, pp.569-580.

Figure 2.3 above solidifies the preceding sentiment, in that, before implementing a system, all the relevant business processes that the new system has incorporated to streamline work flow and efficiency, must be aligned to needs of the organisation, users and the end customer. In the case of eThekwini Electricity, poor ERP implementation would lead to operations (maintenance and construction) not performing optimally, creating backlogs in service delivery, subsequently leading to reduced customer satisfaction.

Ramirez, Melville and Lawler (2010) proved how the interaction between an organisation's information technology and process redesign portfolios is positively and significantly associated with organisational performance. The next section identifies critical success factors (CSFs) for successful implementation and operation of asset and information systems.

2.8 ASSET AND INFORMATION MANAGEMENT SYSTEMS AND THE POTENTIAL PITFALLS ASSOCIATED WITH IMPLEMENTATION

ERP entails gaining knowledge of best business practices and using technology to improve or completely replace existing legacy practices. The implementation projects of ERP in the 1990s and early 2000s faced challenges such as shortages of experienced project managers and limited vendor support capability.

Today, experienced managers and consultants are easily available and vendor implementation support protocols are very well developed. However, despite this increase of experience and capability, the changes required by ERP systems have often overwhelmed many organisations, resulting in more ERP project failures (Maguire *et al*., 2010).

The failures and implementation difficulties attached with ERP projects have attracted much research interest (Liu & Seddon, 2009), which has resulted in the accumulation of a substantial body of literature that identifies a large number of critical success factors (CSFs) for ERP implementation and project success.

Some CSFs were essential to achieve success in ERP implementation and others were essential to help an organisation achieve performance improvement from an ERP system. Additionally, it was also proved that achieving successful ERP system implementation significantly increases the likelihood of ERP output performance improvement (Ram *et al*., 2013).

The current level of knowledge concerning the influence of CSFs and their effects on ERP implementation success as well as post-implementation performance outcomes has not been well established (Finney & Corbett, 2007; Soja & Paliwoda-Pekosz, 2009). However, research has developed some valuable indicators and the criteria that have been selected as significant to successful ERP project endeavours are listed in Table 2.4 below.

Table 2.4: Critical success factors for ERP implementation and operation

1	Project management
2	Organisational culture and change management programmes
3	Enterprise-wide communication
4	Enterprise-wide participation
5	Business process mapping and use of best practice
6	Training employees and user training and education
7	Vendor support
8	Sustained top management support
9	Fit between information systems and host organisation

Source: Ram, J., Corkindale, D. & Wu, M.-L., 2013. Implementation critical success factors (CSFs) for ERP: Do they contribute to implementation success and post-implementation performance. Int. J Production Economics.

Esteves and Bohorquez (2007) developed similar criteria regarding implementation strategies and approaches, knowledge management, culture and organisational ERP fit. Their research has also developed models and frameworks to facilitate ERP, strategies, and the post-implementation organisational performance of ERP.

2.9 GAPS IN THE EXISTING BODY OF KNOWLEDGE

There have been numerous studies carried out on ERP and information system management implementations, successes and failures. The literature is considerable and varied. The central theme identified emerged as the distinction between pre-implementation processes and the link to post-implementation success or failure (Dezdar & Sulaiman, 2009). This resulted in a research objective to determine eThekwini Electricity's processes prior to the implementation of the asset management system.

Among the CSFs (Table 2.4), organisational culture and change management is of significant importance although not thoroughly understood. Projects can experience resistance from

employees due to any number of reasons which are logical or illogical, socially or politically motivated. It is therefore necessary to determine the attitude of users to the asset management system.

There is no one way to initiate and carry out asset or information management projects. The literature highlights the importance of these systems and potential setbacks that were experienced in other specific cases. Each implementation is, however, unique and an organisational fit is necessary between systems, users, customers and management.

Another researchable objective was to identify industry specific problems that employees of eThekwini Electricity may have encountered with the asset management system. Common problems emanate from user training, formulating formal business processes and redesigning jobs. Enterprise-wide communication is also a significant aspect when regarding critical success factors but there is little research to determine the post implementation results of good or bad communication between system champions and end level users (Finney & Corbett, 2007; Snider, Da Silveira & Balakrishnan, 2009).

Perhaps the least researched area of this asset and information management initiative is how to determine failings in the system other than loss of profits. Unlike typical commercial enterprises, which may experience bottom line losses and take corrective measures, a municipality can still operate with a poor ill-fitting ERP and asset management system. Staff morale and the resulting service delivery will, however, suffer. This leads to an objective to determine what corrective measures employees would appreciate, if any at all.

2.10 SUMMARY

The current state of the national and local electrical infrastructure has been discussed. New regulations and amendments pertaining to municipal management and revised accounting standards in municipalities have been highlighted. Without accurate asset registers and reliable information management tools, it is not possible to function efficiently. Relevant issues such as over-spending or under-spending will be easier to uncover and may reveal financial baggage.

All modern literature indicates as much employee participation as possible in order to best align the asset management system with the organisation objectives. After the employees

initial contributions, efforts must made to provide timeous feedback and updates to the staff population.

Pre-implementation attitudes regarding new technologies may be the first step in developing attitudes which shape future implementation phases. These early attitudes may be critical in shaping behaviours early on and is important to understand the nature and origins of such attitudes (Herold, Farmer & Mobley, 1995).

Enthusiasm and interest in a new technology will wax and wane throughout the implementation process as employees gain more information and direct experience. The key organisational challenge is to maintain interest and support in the ERP system throughout the implementation process (Abdinnour-Helm, Lengnick-Hall & Lengnick-Hall, 2003).

In uncovering the relevant literature related to asset management several gaps in the general body of knowledge have been identified. The next chapter will clarify the research objectives that have emanated from the literature and define formal measures for the research study that was conducted.

CHAPTER THREE:
RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter discusses the research methodology and data-collection techniques that were used to determine the effectiveness of the asset management system implemented by eThekwini Electricity. The chapter outlines the aims, objectives and methods that were used to address the research problem.

3.2 AIM AND OBJECTIVES

The aim of this research was to establish the effectiveness of the implementation of an asset management system within the HV Operations department of eThekwini Electricity. The objectives were to:

a. Establish what processes were followed prior to the implementation of the asset management system.

b. Establish employee attitudes towards the asset management system.

c. Determine the reasons why employees have encountered problems with the asset management system.

d. Identify improvements that can be made to the existing asset management system.

3.3 LOCATION AND PARTICIPANTS IN THE STUDY

This study setting was non-contrived and was directed at the three sections located at eThekwini Electricity, based in Jelf Taylor Crescent and the remaining three sections operating out of the Springfield Depot. EThekwini Electricity has currently implemented asset management strategies and systems within the HV Operations department of the organisation (Figure 3.1). Therefore any evaluation of the level of effectiveness was also limited to this sphere of the organisation.

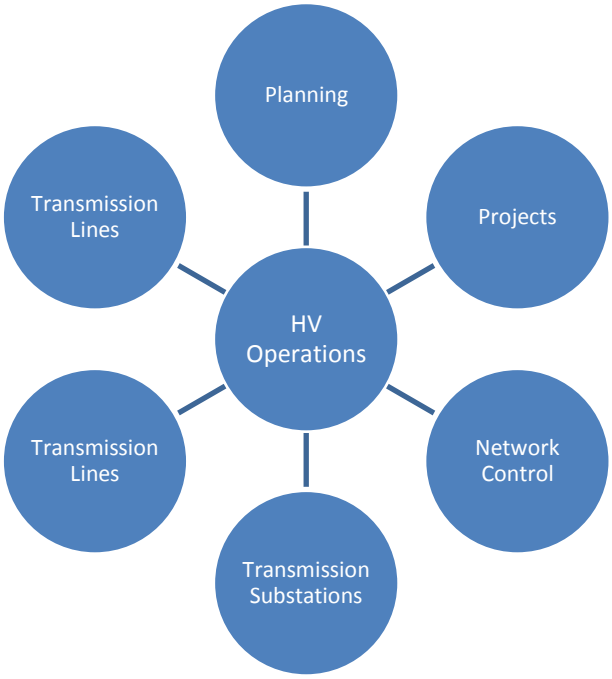


Figure 3.1: The six departments that form HV Operations

The HV Operations department is divided into six separate sections, each headed by a senior manager. HV Planning, Projects and Network Control are design and monitoring departments in the sense that they are not as asset intensive as the other three departments. Transmission Substations, Cables and Lines are extremely asset intensive and are more operational departments.

These sections consist of engineers, chief technical/project officers, technicians, superintendents and clerks. There are also a number of artisans, assistants and other staff who do not have access to a computer and therefore fell outside the parameters of this study due to the lack of direct utilisation of the asset management systems.

All participants of this study were employees of EE. The study included everyone within the task grades 06 to 18, who have access to and utilise the ERP software (Ellipse) and/or the GIS within the six HV Operations sections. The total population within the HV Operations department comprised of 69 suitable participants.

3.4 TYPE OF STUDY

The goal of research is to further understand various types of situations and concepts. There are various methods to accomplish this. Research can, for instance, predict outcomes or even provide explanations (Strauss & Corbin, 1998). The purpose of this study was to establish the objectives as identified in Section 3.2 above and this report is primarily descriptive in nature. A descriptive study is undertaken to ascertain and describe the characteristics of the variables of interest in a particular situation and is used quite frequently in organisations. Descriptive studies are also undertaken to understand the characteristics of organisations that follow some common practices (Verma, 2013). In this instance, a descriptive study was selected to describe the characteristics of the organisation that has implemented an asset management system and the level of effectiveness it has achieved.

Descriptive studies offer the following benefits:

- They enable one to understand the characteristics of the group.
- They enable one to think systematically about aspects in a given situation.
- They enable one to offer ideas for further probe and research.
- They can assist one in making simple decisions.

Descriptive studies are undertaken when the characteristics which are being evaluated in a particular situation are known to exist and the purpose of the research is to describe these characteristics better by offering a profile of the factors (Sekaran & Bougie, 2010). The type of study conducted at EE is set in a municipal environment and aims to better describe the asset management system and the situation. This study does not make any predications nor does it determine cause and effect relationships.

There are three main types of descriptive study methods, namely observational methods, case-study methods and survey methods (Hall, 2013).

3.5 SURVEY METHOD

This type of study requires participants to answer questions administered through a survey or questionnaire. Upon completion of the survey the responses provided can be described (Sekaran & Bougie, 2010). The survey method was used for this study. It is a particularly useful method to adopt in an organisational environment. This type of study offers benefits in

terms of its economical and practical nature and it also has a shorter research period in comparison with other study methods (Nielsen, 2004).

3.6 APPROACH

There are two approaches used to attempt a research study, quantitative (statistically) and qualitative (insights). Each has their own advantages and disadvantages. It is dependent, however, on what the research aims to uncover.

3.6.1 Qualitative

The analysis of qualitative data is used to make valid inferences from data in the form of words (Jones, 2012). There are relatively few well-established, commonly accepted rules for the collection and analysis of qualitative data (Sekaran & Bougie, 2010).

Qualitative studies are far less sensitive and thus less likely to break under the strain of a few methodological weaknesses (Nielsen, 2004). The qualitative approach is too labour intensive and the benefit would not exceed the cost for the purposes of this specific research study.

3.6.2 Quantitative

The approach undertaken for this report was quantitative. There are some arguments against quantitative studies inferring that they are too narrow to be of any use and the subsequent results may be misleading (Nielsen, 2004).

The quantitative finding may be statistically insignificant due to the design of the experiment. In order to obtain good statistical data, the experiment needs to be tightly controlled (Jones, 2012). This often results in such a controlled study, that the results do not generalise to practical problems in real life scenarios.

The indisputable benefit of quantitative studies, even considering the potential pitfalls, is that in essence they reduce a complex situation to a statistic or figure which is easy to understand, discuss and analyse. They are also more cost and time effective than qualitative studies in general (Nielsen, 2004).

3.7 SAMPLING

According to Sekaran and Bougie (2010), in statistics, quality assurance, and survey methodology, sampling is primarily concerned with the selection of a subset of individuals from within a statistical population to estimate characteristics of the whole population.

Sampling can be divided into two methods, namely random sampling and non-random sampling. In random sampling, the elements in the population have some known non-zero chance of being selected as a participant. Further, probability sampling works with very accurate and an up-to-date sampling frame and is the preferred method to carry out any form of statistical analysis (White, 2002).

3.8 DESCRIPTION OF THE POPULATION

The population comprised of the members of the HV Operations department. This group was selected due to the fact that asset management systems have been formally implemented within this sphere of the organisation. The survey population included all senior managers, engineers, technical officers, technicians, superintendents, draughtsman and work planning clerks. These are the staff that have been identified to actively use the new asset management systems. Staff with little or limited access to a computer were excluded from the total population as their input would not affect the current area of study. The population comprised of 69 individuals.

3.9 NEED TO SAMPLE

It is critical to determine the right individuals, objects or events as representatives for the entire population (Bryman, 2012). This process of selection is referred to as sampling. It is often not possible or practical to survey the entire population. In these instances a sample of some suitable size is selected from the population and the study is carried out on the sample and those observations are used to make inferences about the entire population (Bryman, 2012).

Sampling offers significant, practical advantages over conducting the research on the total population. Primarily, sampling reduces costs and saves time. Working with a smaller sample rather than the total population is much less time consuming and more cost efficient while still maintaining an acceptable level of accuracy in the study. By collecting data from a

sample only, certain inferences can be made about the total population and generalisation is made possible (Sekaran & Bougie, 2010).

3.10 PROBABILITY VS. NON-PROBABILITY APPROACH

The selection of a subset of individuals from a total population to form the sample for the survey can be achieved in two ways, namely probability sampling and non-probability sampling.

3.10.1 Probability sampling

Probability sampling always requires a sampling frame, which is a list of the total population of interest (Trochim, 2006). Probability methods rely on random selection in a variety of ways from the sample frame of the population. The use of higher level statistical techniques which require random selection is permitted with this technique allowing one to calculate the difference between the sample results and the population equivalent values enabling confident statements regarding population values. Non-probability methods tend not to provide this (Trochim, 2006).

Probability sampling in this context usually means that everyone in a given population has an equal chance of being surveyed for a particular piece of research. This method was successfully adopted for this study. Results from a probability sample may not be accurate for a number of reasons. Use of probability sampling procedures is necessary but not sufficient for obtaining results that can be generalised with confidence to the entire population. One of the major concerns about a probability sample is ensuring that its response rate is sufficiently high (Sekaran & Bougie, 2010).

3.10.2 Non-probability sampling

Non-probability samples can never be dismissed by an apparent lack of rigour (Trochim, 2006) and are available even when there is no sample frame. They are generally less complicated to undertake (Trochim, 2006) and may minimise the preparation cost of a survey, and be employed when the researcher is unsure of the population of interest (University of the West of England, 2007). Non-probability sampling varies, but the essence of it is that a bias exists in the group of people the researcher is surveying (Ryan, 2011).

3.11 SAMPLING METHOD

Probability sampling methods use any method of sampling that uses some form of random selection. In order to have a random selection method, a process or procedure must be pre-defined to assure that the various units in the population have equal chances of being chosen (Trochim, 2006).

- Simple random sampling
- Systematic random sampling
- Stratified random sampling
- Cluster (area) random sampling
- Multi stage sampling.

The most familiar type of probability sample is the simple random sample, for which all elements in the sampling frame have an equal chance of selection. Sampling is done in a single stage with each element selected independently (Trochim, 2006). The advantages are that it is free of classification error, and it requires almost no advance knowledge of the population aside from the sample frame. Simple random sampling is best suited to situations where not much information is available about the population and data collection can be efficiently conducted on randomly distributed items. Alternatively it can also be used where the cost of sampling is minimal enough to make efficiency less important than simplicity. If these conditions are not true, stratified sampling or cluster sampling may be a better choice (Trochim, 2006). This type of sampling was adopted to conduct the survey at eThekwini Electricity.

3.12 SAMPLING FRAME

The sampling frame is a representation of all the elements in the population from which the sample is drawn. For this study, the sampling frame was the staff list of the HV Operations department with computer access and an ERP login. This information was obtained from the relevant senior managers of each of the six sections within HV Operations. The sampling frame defines the target population from which the sample is taken and to which the sample data will be generalised (Trochim, 2006).

3.13 SAMPLE SIZE

The sample size is typically governed by the extent of the precision and confidence which is desired (Beri, 2008). Increases in the precision and confidence can only be achieved by increases to the sample size. A confidence interval gives an estimated range of values which is more than likely to include an unknown population parameter, with the estimated range being calculated from a given set of sample data (Easton & McColls, 2013).

In practice, the theoretical framework has multiple variables of interest and the corresponding sample size needs to account for all the factors of interest. Krejcie and Morgan (1970) determined a table of sample sizes that greatly simplifies the decisions required for a sample size (Sekaran & Bougie, 2010). This study had a population of 69 prospective respondents and based on the sample size table, this would require a sample of 59 respondents in order to generalise the results across the entire population.

3.14 DATA COLLECTION

Formal data collection processes are critical to ensure that the data collected are both defined and accurate and that resulting decisions based on arguments emerging from the findings are valid. The process provides a baseline from which to measure as well as a target to improve on.

3.14.1 Instrument

All data collection methods have an inherent amount of bias. A questionnaire was used to collect data (Appendix 1) for this research study. This is a very efficient data collection mechanism when trying to establish specific objectives and measuring known variables (Ong'anya & Ododa, 2009). Questionnaires can be administered personally, mailed to the respondents, or electronically distributed to the target population (Ong'anya & Ododa, 2009). The questionnaire was designed to minimise respondent bias and measurement errors. Table 3.1 shows the advantages and disadvantages regarding the use of a questionnaire in the data collection process.

Table 3.1: Advantages and disadvantages of using electronically designed and administered questionnaires

Advantages	Disadvantages
Easy to administer	Computer literacy is necessary
Can reach globally	Respondents must have access to the facility
Very inexpensive	Respondents must be willing to complete the survey
Fast delivery	Low response rate typically
Respondents can answer at their convenience	

Source: Sekaran, U. & Bougie, R. 2010. *Research Methods for Business -A skill building approach.* 5th ed. s.l.: John Wiley and Sons Ltd.

3.14.2 Instrument construction

A questionnaire could be structured or unstructured (Timpany, 2011). Structured questionnaires are a quantitative method of research. A questionnaire is a means of eliciting the feelings, beliefs, experiences, perceptions, or attitudes of some sample of individuals (Sekaran & Bougie, 2010). The instrument for this study was constructed using Questionpro software. The online resource allows researchers to develop and administer surveys electronically over the internet and through the use of electronic mail.

The software allows the use of various scales and the construction of logic breaks within the instrument. There are primarily closed questions with the opportunity of expressing the participant's opinion if so desired at the end of the questionnaire.

3.15 RELIABILITY / VALIDITY

Validity establishes the effectiveness of a technique, instrument, or process to measure a particular concept, and reliability indicates how stably and consistently the instrument exploits the variable, White (2002). Low validity can be observed if the questionnaires do not explore questions in any detail or depth. However, the anonymous nature of the questionnaire administration process can encourage a more truthful, realistic response and thereby increase validity (Sekaran & Bougie, 2010).

Reliability of a measure often indicates the extent to which it is without bias (error free), enabling consistent measurement across time and the various items in the instrument. The

reliability of a measure is also an indication of the stability and consistency with which the instrument effectively measures the concept and helps to assess the quality of a measure (Sekaran & Bougie, 2010). This was established in the pilot study, which registered similar findings albeit in a smaller population. This proves the re-test reliability ensuring a measure of reliability.

3.16 PRE-TESTING/PILOT

Pretesting usually involves the use of a small number of respondents to test the appropriateness of the questions and their level of comprehension (Grimm, 2010). This helps to correct any inadequacies prior to administration of the instrument, thereby reducing bias. For this reason the survey was administered to a pilot group consisting of 15 random participants, from the actual population in the HV Operations department. The results were inconclusive as almost 50% of the respondents did not complete the survey. This low response rate was attributed to the organisation's protection software blocking the on-line survey. Due to this occurrence determined by the pilot study, measures were taken to circumvent this in the formal study.

3.17 DISTRIBUTION / ADMINISTRATION OF THE INSTRUMENT

The live link to the electronic survey was sent to the six senior managers at their request, via electronic mail. The managers cascaded the live link to the pre-determined members of their staff for completion. Individual participants experienced some problems as a result of connectivity issues due to IT related problems at eThekwini Electricity. Participants were given the opportunity to complete the survey during an open session.

3.18 DATA ANALYSIS

When analysing descriptive statistics of variables, it is often necessary critical to determine how one variable is related to another. It is important to establish the nature, direction and significance of the bivariate relationships of the variables used in any study (Sekaran & Bougie, 2010).

There are many statistical test to test the relationships between variables in a study. The Chi-square test, central tendency are some of the methods built into the Questionpro software, enabling ease of data analysis. For this research, all of these different steps of computation

and comparison were achieved with the built in statistical analyses software inherent in Questionpro.

3.19 CHI-SQUARE TEST

This indicates a very significant statistic to quantitative analysis. The higher the chi-square value, the greater the likelihood that there is a statistically significant difference between the two groups being compared (Franke, Ho & Christie, 2012). This test was performed on the data that was collected to determine if any relationship emerged from the data. A correlation may enable the researcher to infer a statement or support a finding.

3.20 MEASURES OF CENTRAL TENDENCY

The mean, or average, is a measure of central tendency that offers a general picture of the data without unnecessarily inundating one with each of the observations in a data set. (Upton & Cook, 2008). This is useful in determining the average statistics pertaining to certain objectives, enabling the generalisation of findings or results to as much of the population as possible.

3.21 SUMMARY

In order for a survey to be both reliable and valid, it is necessary to construct the questions properly. Questions for this research were designed to be clear and easy to comprehend. Another consideration when designing questions is whether to include open-ended, closed-ended, partially open-ended, or rating-scale questions.

Advantages and disadvantages can be found when using each type. Open-ended questions generally allow for a greater variety of responses from participants but are also more difficult to analyse statistically because the data must be coded or reduced in some manner. Closed-ended questions are easy to analyse statistically, but they seriously limit the responses that participants can give. One option open-ended question was included in this study to allow flexibility in response and to try and establish a wider range of solutions. It is important to emphasise that descriptive research methods can only describe a set of observations or the data collected.

Whether data are collected through face-to-face interviews, telephone interviews, or mail-in surveys, a high response rate is extremely important when results need to be generalised to a larger population. The lower the response rate, the greater the sample bias (Fowler, 1984). In order to ensure a high quality of information (discussed in next chapter), all efforts were made to obtain as high a percentage of the sample as possible without skewing or influencing the data in any way.

This chapter has described the research methodology used to conduct the survey, the research aims and objectives, the sample and population and the type of research conducted. The next chapter analyses the raw data collected and will draw meaningful conclusions from this information.

CHAPTER FOUR:
PRESENTATION AND DISCUSSION OF RESULTS

4.1 INTRODUCTION

The preceding chapter established the data structure, detailing the research tools that were used for this study. The quantitative data is presented using descriptive and inferential statistical tools (Pearson correlation) to examine and analyse the quality of the data that was collected. Analysis is performed on the data and each question is presented in the form of table or graphs with a brief explanation. This information brought out a much deeper understanding of the research objectives which shows the level of effectiveness achieved by the implementation of the asset management systems at eThekwini Electricity.

4.2 RESEARCH AIM

The aim of this research was to establish the effectiveness of the implementation of an asset management system within the High Voltage Operations department at eThekwini Electricity. This was accomplished by developing a means to measure respondents' views on the four main objectives detailed in Section 3.2. The four objectives were structured around the main aim of the study, allowing deeper insight into the subject matter.

4.3 DESCRIPTION OF SAMPLE

The total population comprised of 69 members of eThekwini Electricity's HV Operations department. The online questionnaire was viewed 78 times. From the total population of 69, 60 people started the survey, with 51 completing it. The required sample for a population of this size is 59. The sample was not met and the results cannot be generalised across the entire population. The first part of the study analyses demographic information such as age and salary grade of the respondents actively involved with asset management systems at eThekwini Electricity.

Table 4.1: Demographic information of respondents

Characteristic	**Percentage**
Age	
20 – 29	10%
30 – 39	50%
40 – 49	31.67%
50 – 59	6.67%
60 and over	1.67%
Task grade	
06 – 08	13.33%
09 – 10	6.67%
11 – 13	48.33%
14 – 16	30%
17 – 18	1.67%
GIS	
Percentage of sample that uses GIS	70%
Percentage of sample that does not use GIS	30%

Table 4.1 shows that 10% of the respondents fell into the 20–29 age group, 50% were between the ages of 30 and 39, 30% were between the ages of 40 and 49, while only 2% of the respondents were 60 years of age and older. Eighty percent of the respondents were between the ages of 30 and 49. There were a total of 60 respondents for this question.

eThekwini Electricity uses the task grade system to determine employee remuneration. Task grades 6 to 8 are mainly clerical and administrative functions and respondents would have limited exposure to the development of systems and procedures. This group of staff was represented by 13% of the respondents. Task grades 9 and 10 are skilled posts with designations such as draughtsmen and maintenance inspectors and comprised 7% of the respondents. Task grades 11 to 13 are typically technical positions consisting of technicians, superintendents, clerk of works and project officers. These comprised 48% of the respondents making this the largest group of the sample. Task grades 14 to 16 are technical as well as management positions, and engineers, technologists and managers fall within this category. They were represented by 30% of the respondents. Grades 17 and 18 are senior manager

positions and there was only one respondent from this group, representing 1.67% of the total responses. There were a total of 60 respondents. Also shown is the percentage of people in the sample that use the GIS system. From the responses, 70% of the sample actively uses the GIS in their daily work function.

4.4 INFERENTIAL STATISTICS

The reporting framework was based on the research objectives. These were obtained using primarily descriptive statistics, however, inferential statistical techniques were also helpful for interpreting the data. For each of the objectives, the numerical sequence of the questionnaire has been followed by the presentation of data factor analysis which has also been used.

By observing the correlations 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 4.2: The questions from the survey pertaining to each objective

	Questions											
Objective 1	3	4	5	6	7							
Objective 2	8	9	10	11	12	13	15	17	19	23	24	30
Objective 3	14	16	20	25	28							
Objective 4	18	21	26	27	29	31	32	33	34			

Correlation or statistical relevance can be regarded as the main input for causal induction processes. Correlation itself is not sufficient to infer a causal link. Further processes are needed to discriminate between causal and non-causal correlation (Perales, Catena & Maldonado, 2003). The final results of the study by Perales *et al*. (2003) proved that people do not obtain correlation knowledge exclusively from observed correlations, but also, indirectly, from complex scenarios. Once correlation is known it can be used to make predictions. When one knows a score on one measure, a more accurate prediction of another measure that is highly related to it can be made. The stronger the relationship between variables, the more accurate the prediction (Marshall & Jonker, 2010).

Significant correlations can be observed between questions 9 and 23 as well as 10 and 23. These correlations do not relate to the objectives conclusively and are not used to infer any causal relationships.

4.5 DESCRIPTIVE STATISTICS

Trochim (2006) stated that descriptive statistics are used to state the basic features of data in a study. They provide easy to understand summaries about the sample and the measures. Together with simple graphics analysis, they can form the basis of 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 and thereby narrows the theory-practice gap. Descriptive statistics are perfectly suited for collating and summarising quantitative data (Marshall & Jonker, 2010).

4.6 OBJECTIVE 1: TO ESTABLISH WHAT PROCESSES WERE FOLLOWED PRIOR TO THE IMPLEMENTATION OF THE ASSET MANAGEMENT SYSTEM

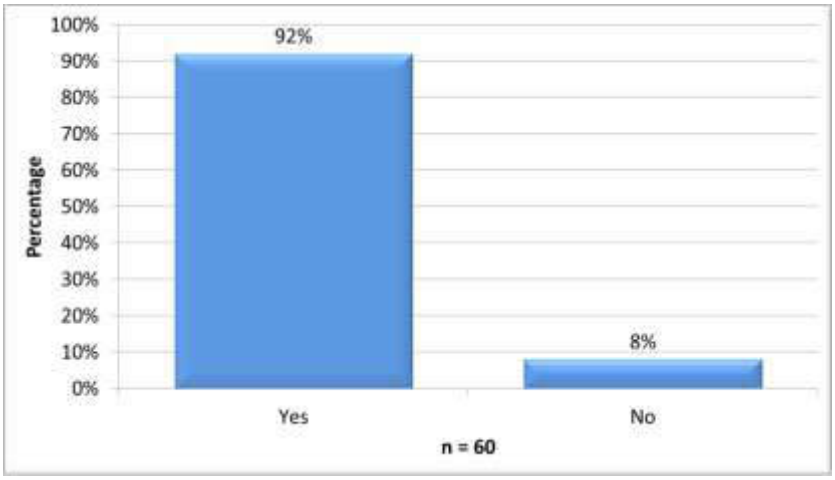


Figure 4.1: Awareness of new system implementation

Figure 4.1 shows the percentage of respondents who were aware of the introduction of the new systems prior to their implementation. Ninety-one percent of the respondents were aware

that a new system was going to be implemented. The remaining 8.33% of the respondents had no idea that their way of working would be changed.

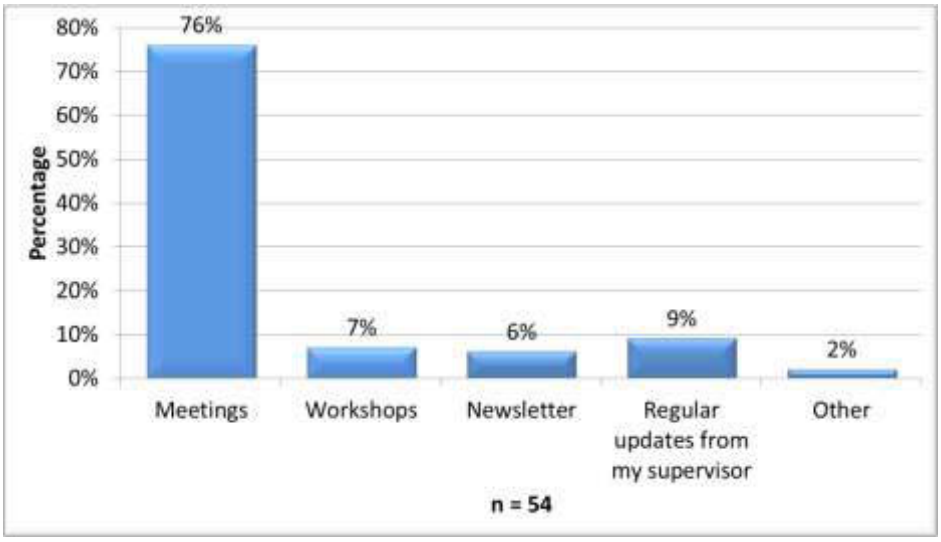


Figure 4.2: Medium via which respondents were made aware of implementation

Figure 4.2 refers to the various methods used to inform the respondents of the impending implementation of the new systems. The largest group of respondents (75.93%) were made aware of the implementation during meetings, 7.41% at workshops, 5.56% were alerted through a newsletter, while 9.26% were made aware via regular updates from their supervisor. Fewer than 2% of respondents were made aware by other means, which includes word of mouth.

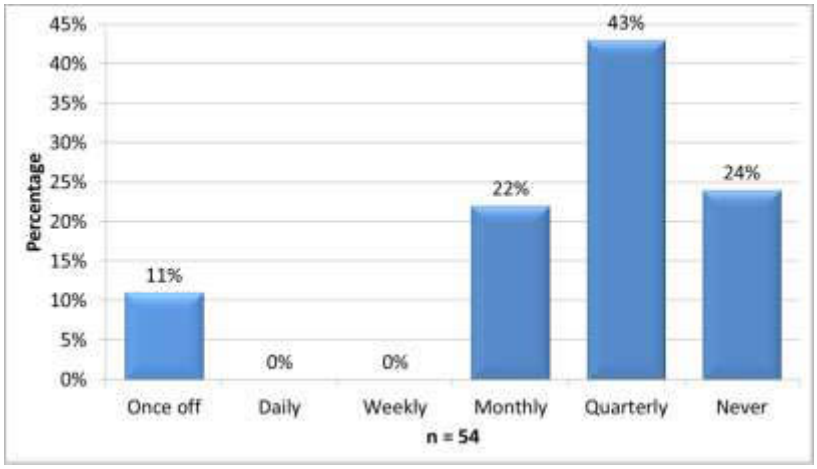


Figure 4.3: The frequency of the updates that the respondents received

The frequency of updates regarding the new system implementation can be observed in Figure 4.3 which shows that 11.11% of respondents indicated that they were updated once. No one in

the entire population reported being updated on progress of the system on a daily or weekly basis. Twenty-two percent of respondents were updated on a monthly basis, with the majority (42.59%) being updated quarterly. Twenty-two percent of respondents indicated that they never received formal updates from their supervisor, management or the consultant handling the implementation.

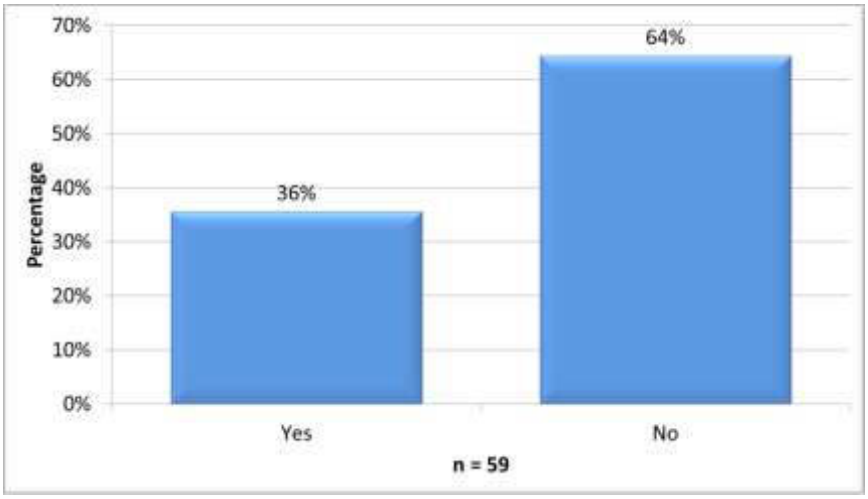


Figure 4.4: The number of respondents consulted in the development of the systems

The percentage of respondents who were consulted in the development of the systems is shown in Figure 4.4. Thirty-five percent of the respondents were consulted and the remaining 64.41% indicated that they were not consulted in the development of the systems.

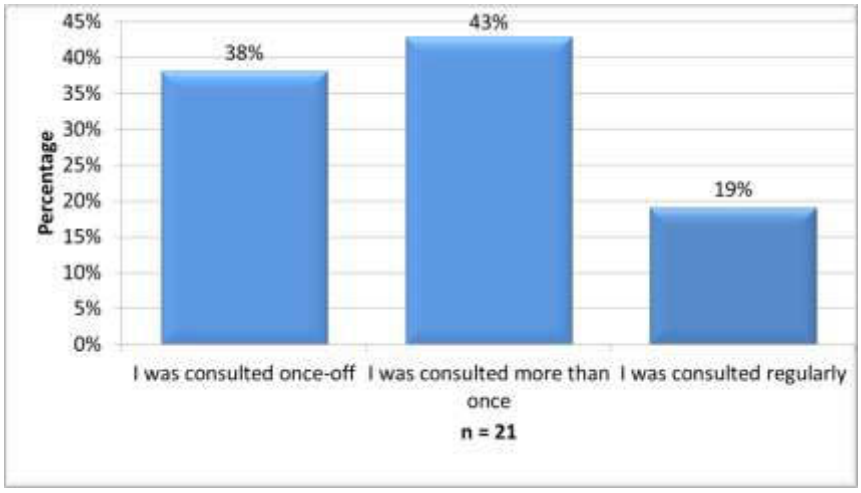


Figure 4.5: The level of consultation if involved in the development of systems

Figure 4.5 shows that 38.10% of respondents were consulted once-off, with 42.86% of respondents indicating that they were consulted more than once. Nineteen percent of respondents indicated that they were consulted on a regular basis.

DISCUSSION OF OBJECTIVE 1

To understand if the first objective was accomplished, it is necessary to interpret these results collectively. Figure 4.6 shows that 91.67% of the respondents were aware that a new system was going to be implemented, which means that clearly some process or method existed to let the employees know there was a change occurring.

Current literature regarding ERP implementations indicates that success can be measured from different perspectives, including end level user satisfaction, system acceptance, integration and use, individual impact, organisational impact, as well as implementation on time (Soltani, Elkhani & Bakri, 2013). For this study, the level of effectiveness has been determined by user satisfaction with the asset and information management systems.

The majority of the sample surveyed indicated that the method in which they were made aware of the new system was via meetings. It is interesting to note the low rates due to the other means of communicating the implementation. Only 5.56% of respondents were made aware by the formal newsletter designed to keep the organisation abreast of the new asset management system. This is clearly not a preferred medium for communicating to the department. The frequency of these updates was established quarterly as 42.59% of the participants indicated.

The next part of establishing the preceding processes leading up to implementation of the new system is the staff participation. In the review of literature, Figure 2.2 illustrates the significance of incorporating the end level user in development of a work centred analysis framework. Of the total sample for which data was collected only 35.59% claimed to have been consulted in the development of the system, and of this 35.59% only 42.86% were consulted more than once.

- The majority of the sample was informed of the new implementation. This was achieved via meetings, workshops, an electronic newsletter and also through updates from supervisors.

- The majority of the sample also indicated that they were informed via formal meetings and the frequency of these updates was quarterly.

- The data revealed that a low percentage of the sample had been consulted in the development of the new systems and of this less than half had consulted more than once.

Ram *et al*. (2013) proved that ERP project implementation and ERP output performance improvement are distinct, separate entities and are measurable as such. This means that ERP projects are not directly linked to their implementation plans. This illustrates the importance and independence of the two project stages. These findings prove that there were processes in place prior to the system implementation at EE. The effectiveness of these processes show that not all respondents were consulted. This may have caused apprehension and mistrust prior to the launch of the system, due to the critical feedback from all users being ignored (Wu & Wang, 2006).

The objective has been met and the processes prior to the implementation have been identified. Ninety percent of the respondents were aware that a new system was going to be implemented. It is clear from the responses that meetings and workshops were provided to inform the population and ease the transition into the new system. A regular newsletter was also distributed to keep the users up to date. So the processes preceding the implementation of the asset management system have been identified.

4.7 OBJECTIVE 2: TO ESTABLISH EMPLOYEE ATTITUDES TOWARDS THE ASSET MANAGEMENT SYSTEM WITH REGARDS TO BENEFITS AND PROBLEMS

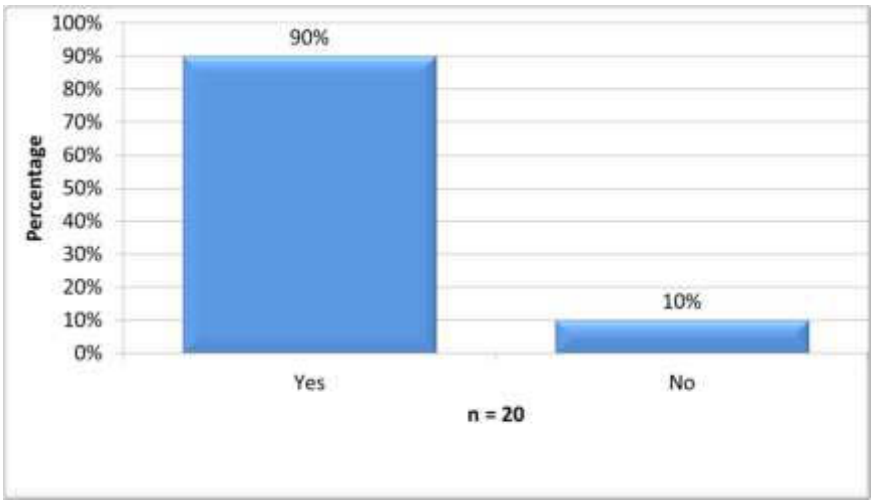


Figure 4.6: Respondents believed their opinions were valued

As Figure 4.6 shows, 90% of respondents believed that their opinions had been taken into consideration when systems were developed. Ten percent of respondents did not share this view.

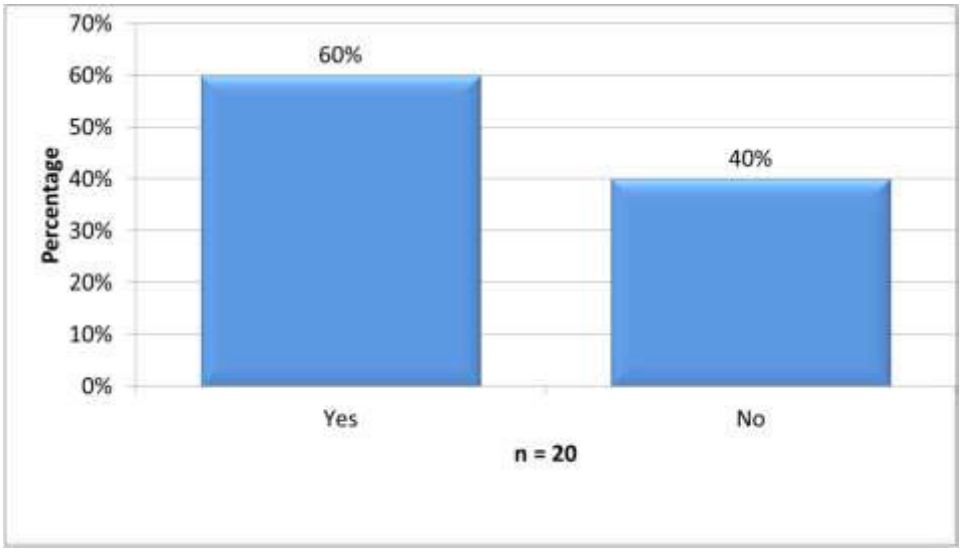


Figure 4.7: The percentage of respondents who believed their concerns regarding the new system were addressed

Figure 4.7 above illustrates the respondents' views on whether their concerns raised prior to the implementation were addressed when the system was implemented. Sixty percent of respondents believed that their opinions had been addressed, while 40% felt that their concerns had not been addressed.

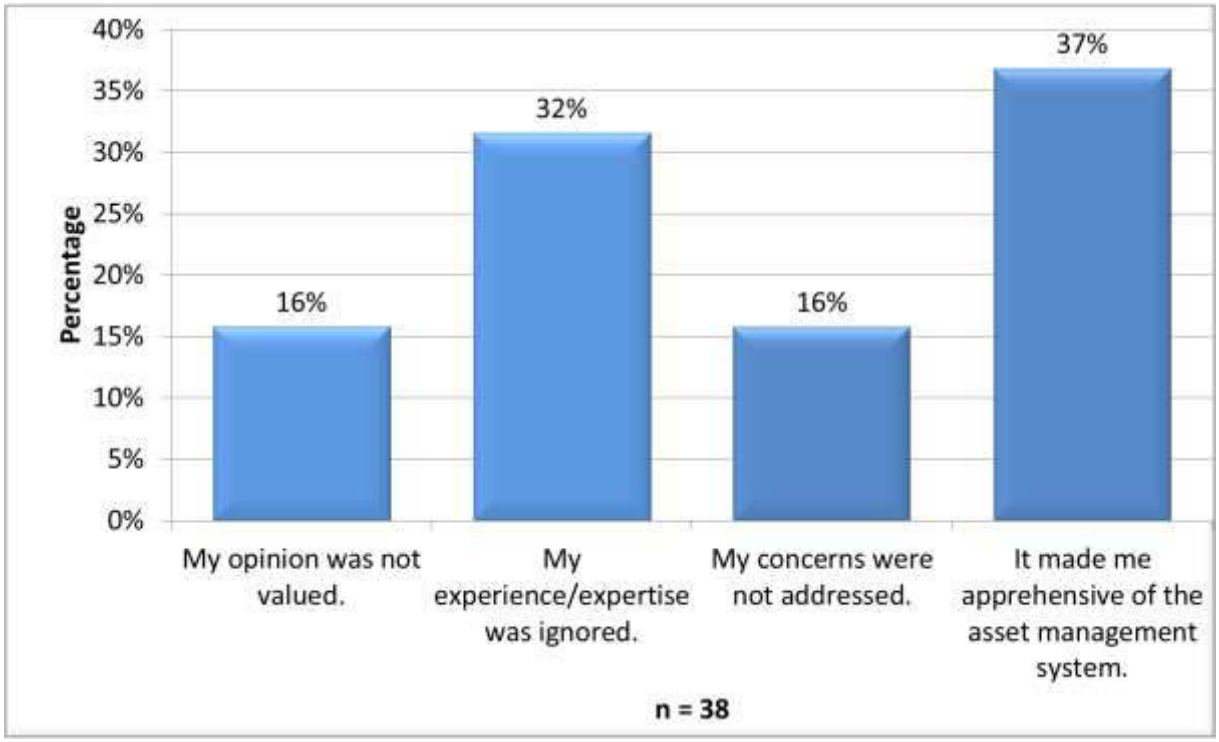


Figure 4.8: Feelings of respondents who were not consulted

As Figure 4.8 shows, 15.79% of the respondents felt that their opinion was not of any value. Thirty-two percent of respondents thought that their experience or expertise had been ignored, 15.79% were of the opinion that their concerns had not been addressed. Thirty-seven percent of these respondents commented that their exclusion made them apprehensive of the asset management system.

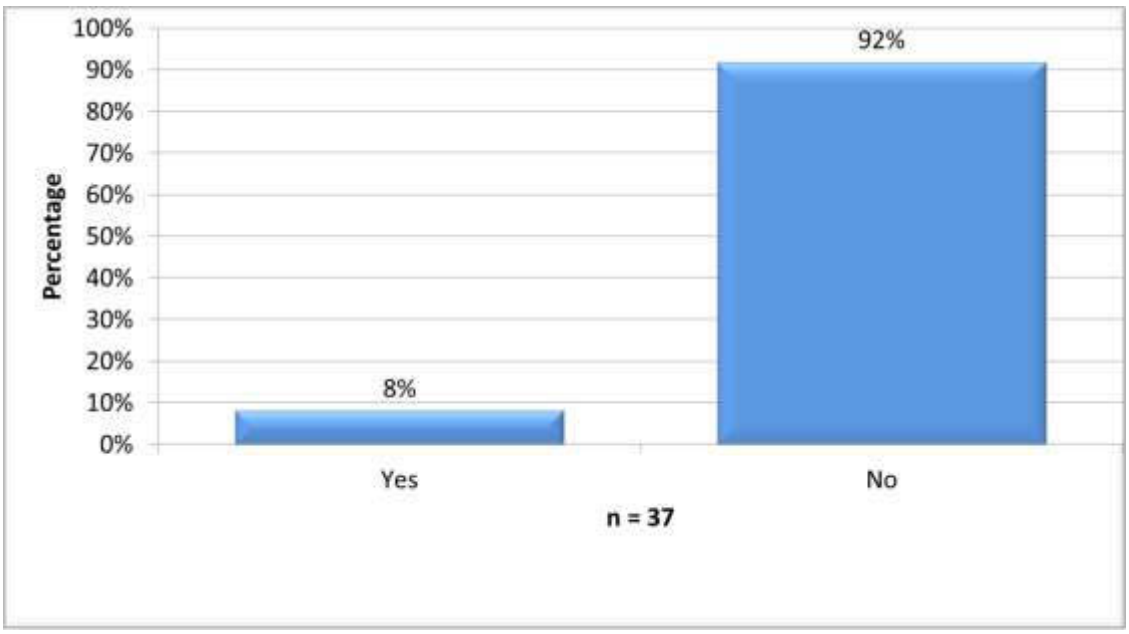


Figure 4.9: Respondents who made attempts to contribute to the development of the system

As a follow up question, respondents were asked if they had made any attempt to get involved in the process. Figure 4.9 shows that 8.11% tried to become involved in the process, while 91.89% did not try and get involved at all.

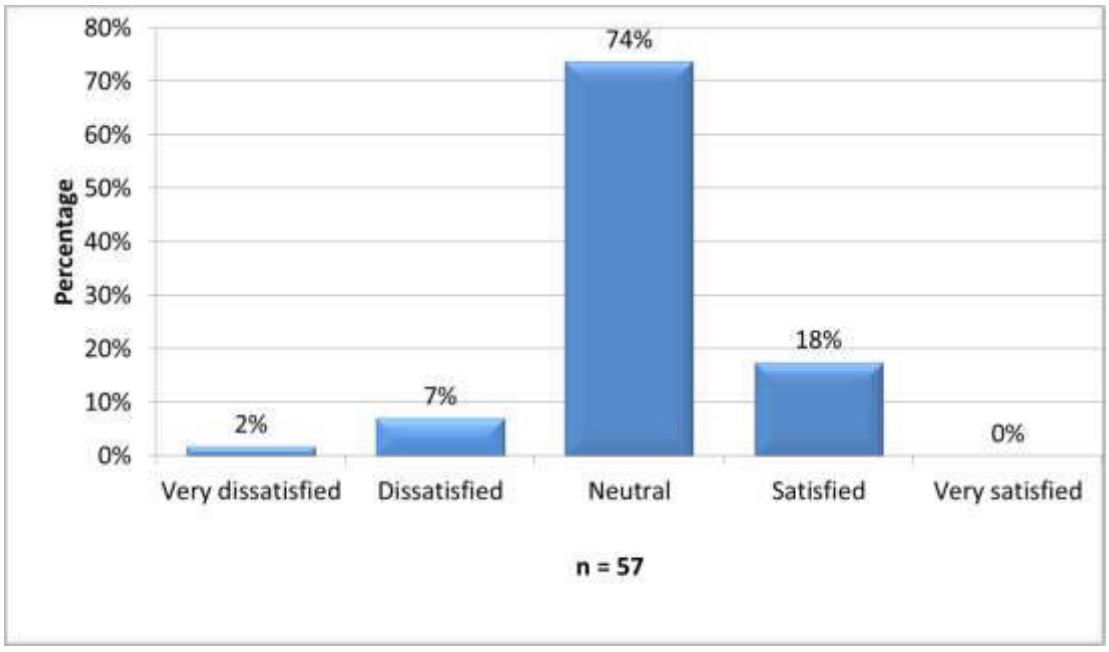


Figure 4.10: Satisfaction with the asset management system

Figure 4.10 above illustrates how the respondents rated their satisfaction with the asset management system. Under 2% of the sample were very dissatisfied with the system, 7.02% were dissatisfied, 73.68% were neutral with the system, 17.54% were satisfied and none of the respondents were very satisfied with the system.

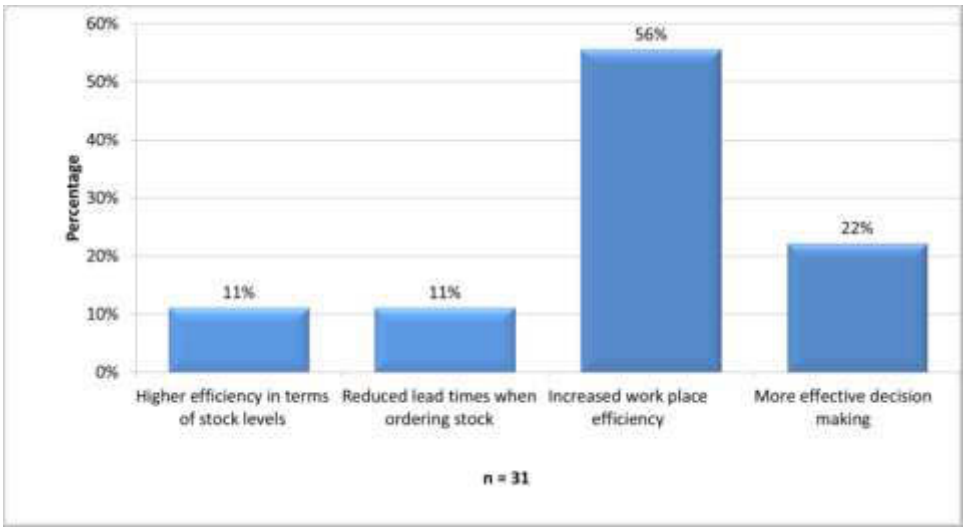


Figure 4.11: Reasons why respondents were satisfied with the system

Respondents were asked to comment on the main reasons for their satisfaction with the systems. A total of 11.11% of respondents felt that they achieved a higher efficiency in terms of stock levels while 11.11% thought that lead times were reduced when ordering stock and 55.56% thought that there was a general increase in workplace efficiency. Twenty-two percent of respondents felt that they were able to make more effective decisions.

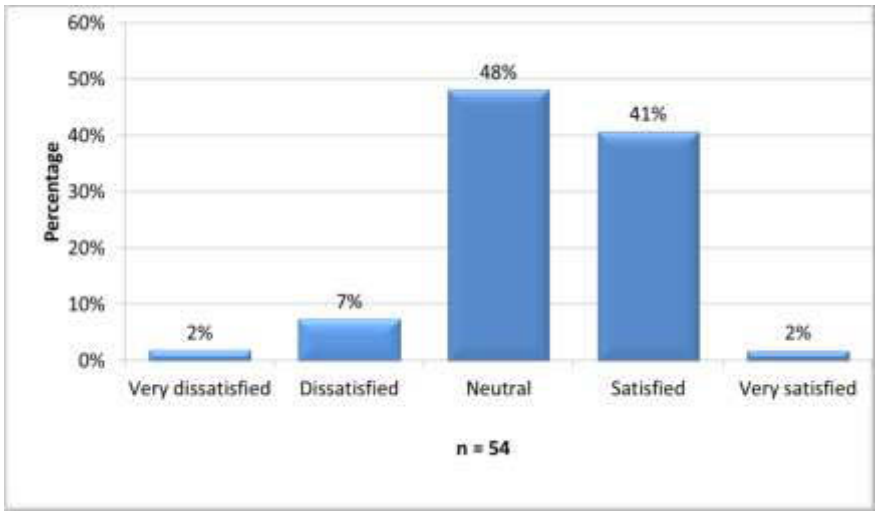


Figure 4.12: Respondents' satisfaction with the ERP system

As illustrated in Figure 4.12, respondents rated their level of satisfaction with Ellipse, the ERP system. Less than 2% of respondents expressed that they were very dissatisfied and 7.41% were dissatisfied. Forty-eight percent of respondents were neutral while 40.74% were satisfied and 1.85% were very satisfied.

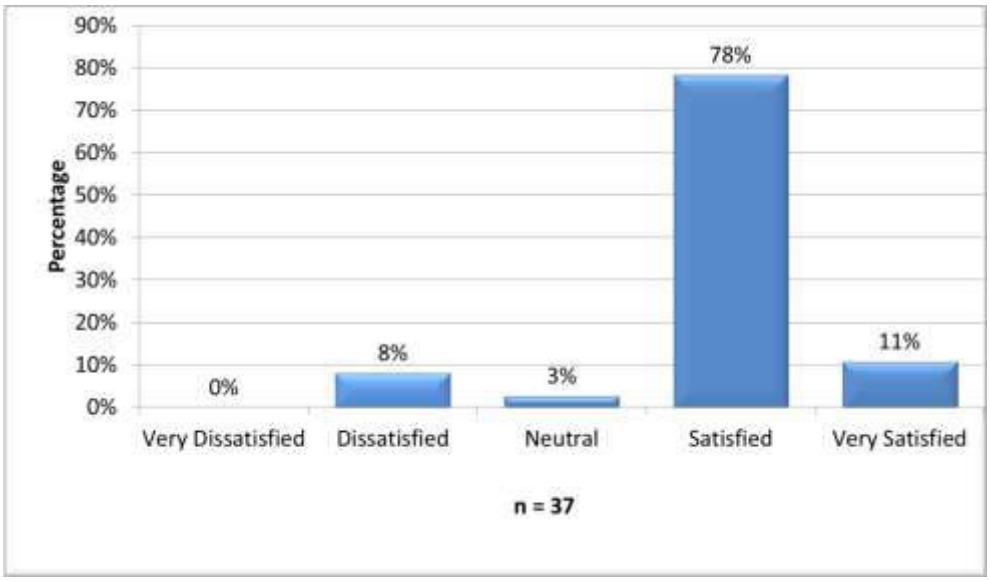


Figure 4.13: The respondents' level of satisfaction with the GIS package

Figure 4.13 describes respondents' level of satisfaction with the GIS package. None of the respondents were very dissatisfied, 8.11% were dissatisfied, while 2.70% were neutral in this regard. A high percentage of 78.38% were satisfied with the package and 10.81% were very satisfied.

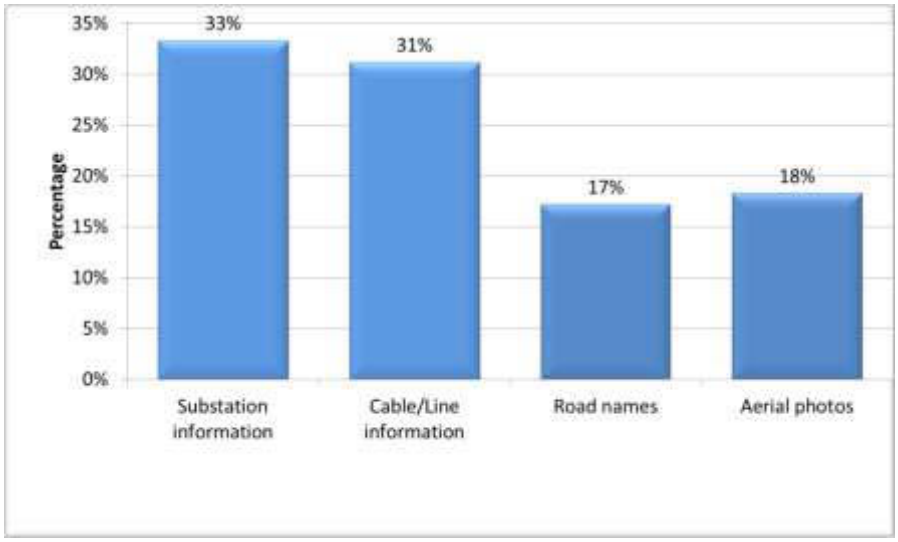


Figure 4.14: The features of the GIS that respondents used most

When asked which features respondents used most in the GIS systems, 33.33% said they used substation information most, 31.18% ranked cable/line information as most used, 17.20% rated road names as most used and 18.23% claimed that aerial photos from the program were used most often.

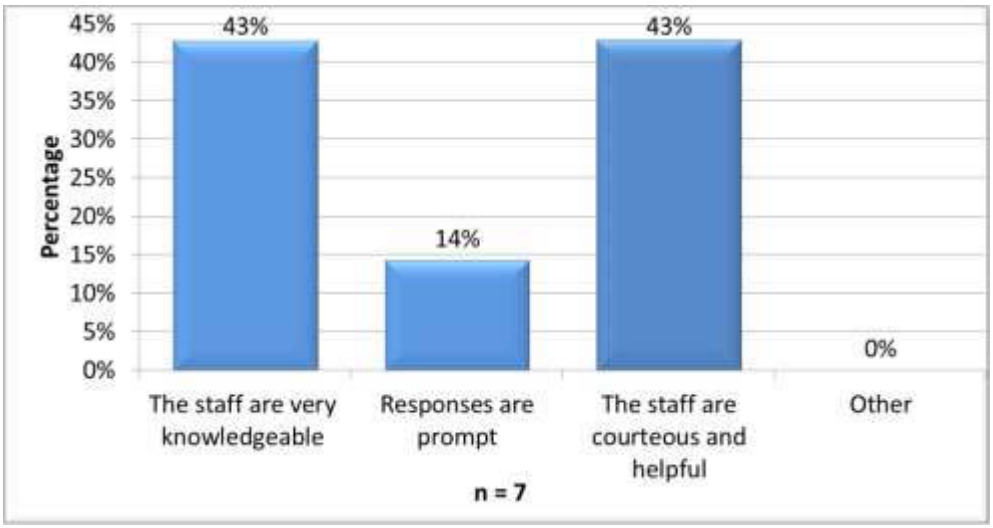


Figure 4.15: Respondents' impressions of the asset care centre and the services offered

As seen in Figure 4.15, only 42.86% of respondents who used the ACC service found the service to be good or excellent and have indicated that ACC staff were knowledgeable, 14.29% indicated that the responses from the ACC staff were prompt, and 42.86% felt the ACC staff were courteous and helpful.

DISCUSSION OF OBJECTIVE 2

When employees have little direct experience with a new technology, their attitudes toward it are likely to be general and based on few attributes (Vance, 2006). A substantial cost is associated with pre-implementation involvement and training designed to encourage acceptance and effective implementation of the system (Ram *et al*., 2013). The results of this study (refer Figures 4.11 and 4.12) indicate that, contrary to conventional wisdom, extensive organisational investments in shaping pre-implementation attitudes do not always achieve the desired effects. The findings show that even though 70% of respondents were not consulted, only 7.4% registered dissatisfaction with the ERP system and 56% claimed to experience a greater efficiency in the workplace since the implementation.

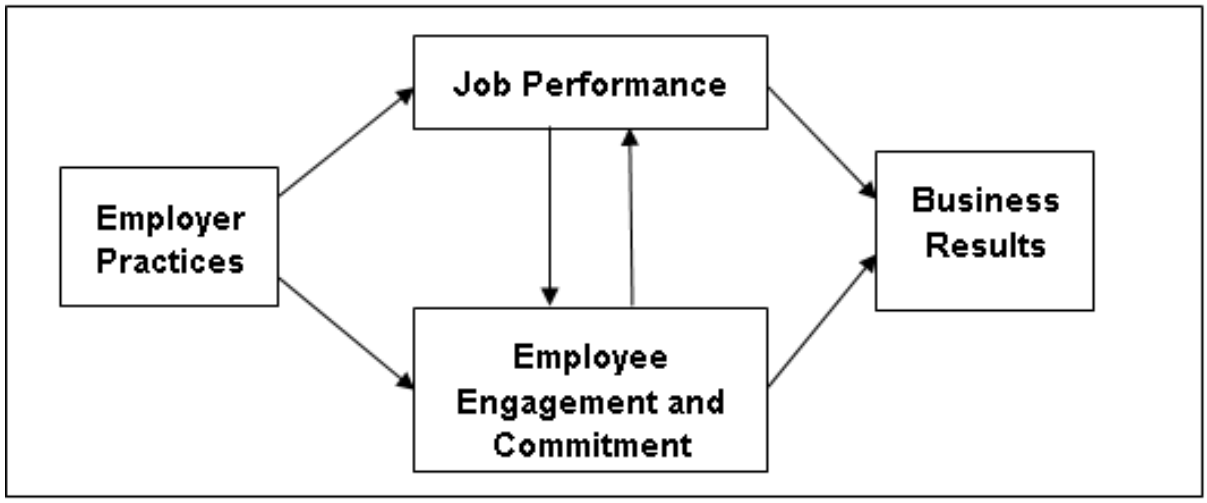


Figure 4.16: The effect of employee engagement in business results

Source: Vance, R.J., 2006. Employee engagement and commitment, s.l.: SHRM Foundation.

As Figure 4.16 describes how engagement in employer practices can solidify commitment. This study does not dispute these finding as business results were determined from the employee perspective and not bottom line earnings, with regard to their attitudes toward the new systems.

Technological implementations such as the asset management initiative have different components associated with them. There are technical components as well as social aspects to consider prior to implementation. These social components consist of the relevance that people attach to the technology, which often affects how they feel about the technology and their behaviour toward it (Ram *et al*., 2013).

Of the respondents that contributed to the development of the system, 90% felt that their opinion was valued. Over half of that same sample indicated that their concerns had been addressed when the system was implemented. This corresponds with the same group of people who were consulted more than once. This is indicative of a small group of the population contributing to the majority of the development of the new system.

A large proportion of the sample, 74%, indicated that not being consulted in the development of the new system elicited a range of feelings. This included feeling that their opinions were not valued and their experience had been ignored. The majority (37%), however, stated that they were apprehensive of the new system as they had not had input in its development. From the data presented, it is clear that consultation was not extensive but the few that did

contribute, felt that their opinion was valuable. The ERP may not be a perfect "fit" currently but users are managing to effectively continue their duties and have indicated a higher level of efficiency post implementation. The respondents that are apprehensive of the new technology need to be engaged to commit to the project as these respondents (75%) indicated a neutral response (refer Figure 4.10).

To fully ascertain the respondents' attitudes toward the system, follow up questions were asked to try and determine if any of those not consulted, had tried to contribute in other ways. It was established that 91.89% of those not consulted had made no other efforts to contribute to the system development. These respondents cited reasons such as being too junior in the organisation or indicating that they were of the opinion that this was a top down process and that they were not needed. A very small percentage were not consulted but still, in their opinion, managed to contribute noticeably to the development process.

The employees' attitude toward the ERP system was difficult to ascertain. Almost 50% of the sample indicated a neutral attitude towards the system and 40% of the sample indicated that they were satisfied. This is a positive statistic, since more than 80% were satisfied with the system when such a small percentage of the sample contributed to the development of the system. As previous responses illustrated attitudes of apprehension and dissatisfaction with the implementation process, such a high number of neutral responses show that employees are utilising the system without serious complaints. This is especially significant as there is ample evidence to demonstrate that perceptions of employees who are expected to use a new IT system can have a critical impact on the degree to which an implementation effort succeeds or fails (Abdinnour-Helm *et al*., 2003).

The majority of the sample, at 78.38%, was satisfied with the GIS package offered by eThekwini Electricity, with the most used asset class being substation information. The attitude of the respondents toward the service of the asset care centre was positive, with majority of those people that interacted with the asset care centre indicating a satisfied attitude toward them. The issue emerging in this category is that such a low response rate (7 respondents in total), especially following an implementation of this nature, indicated satisfied service from the asset care centre.

As 90% of the respondents were satisfied and a high percentage reported an increase in general workplace efficiency after the implementation of the asset management system, it is evident that a positive attitude toward the project exists. This is despite the low level of consultation with the majority of the end users.

Objective two was satisfied due to the information emerging from the survey. Employees' attitudes toward the system were not dissatisfaction despite the lack of consultation. Combined with a clear increase in efficiency, better stock level management, reduced lead times and effective decision making, the study reveals new areas on which to focus the continuous improvement aspects of asset management, such as increasing the efficiency with regard to lead times as this represents a critical business function.

- A select few were chosen to consult and develop the new system.
- The exclusion in the pre-implementation created an attitude of apprehension toward the new system by the majority of the staff when the system was implemented.
- Staff are reserved in their assessment of the ERP system.
- The majority of the employees are satisfied with the GIS software.
- Of the respondents surveyed, 35% noted positive effects post implementation, with an increase in general workplace efficiency being the most represented category.
- A low percentage of staff used the asset care centre support service. The small number that used it, reported positively on their experience.

4.8 OBJECTIVE 3: TO DETERMINE THE REASONS WHY EMPLOYEES HAVE ENCOUNTERED PROBLEMS WITH THE ASSET MANAGEMENT SYSTEM

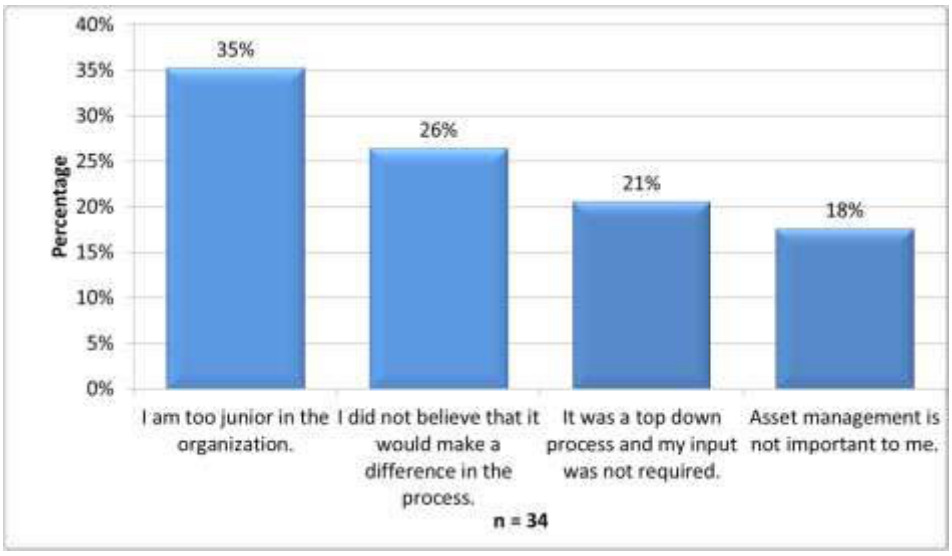


Figure 4.17: Reasons for not getting involved with the system development

Figure 4.17 shows that 35.29% of respondents cited that they were too junior in the organisation to try and get involved in the process. Twenty-six percent of the sample believed that it would not make a difference if they got involved or not. Twenty-one percent were of the opinion that it was a top down process and their input was not required at all, while 17.55% of respondents indicated that asset management is not important to them.

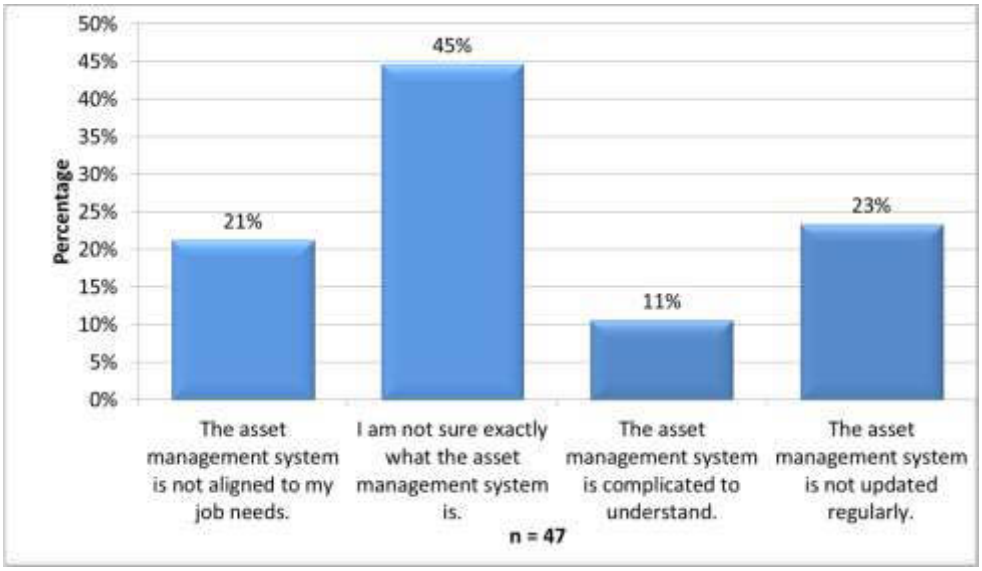


Figure 4.18: Reasons for dissatisfaction with the asset management system

Respondents who indicated a lack of satisfaction with the asset management system were given the opportunity to comment on some possible reasons causing the dissatisfaction. Twenty-one percent of respondents felt that the system was not aligned to their job needs. Forty-five percent of respondents were not sure what the asset management system was. Eleven percent of the sample believed that the asset management system was too complicated to understand. Twenty-three percent of respondents were of the opinion that the asset management system was not updated regularly.

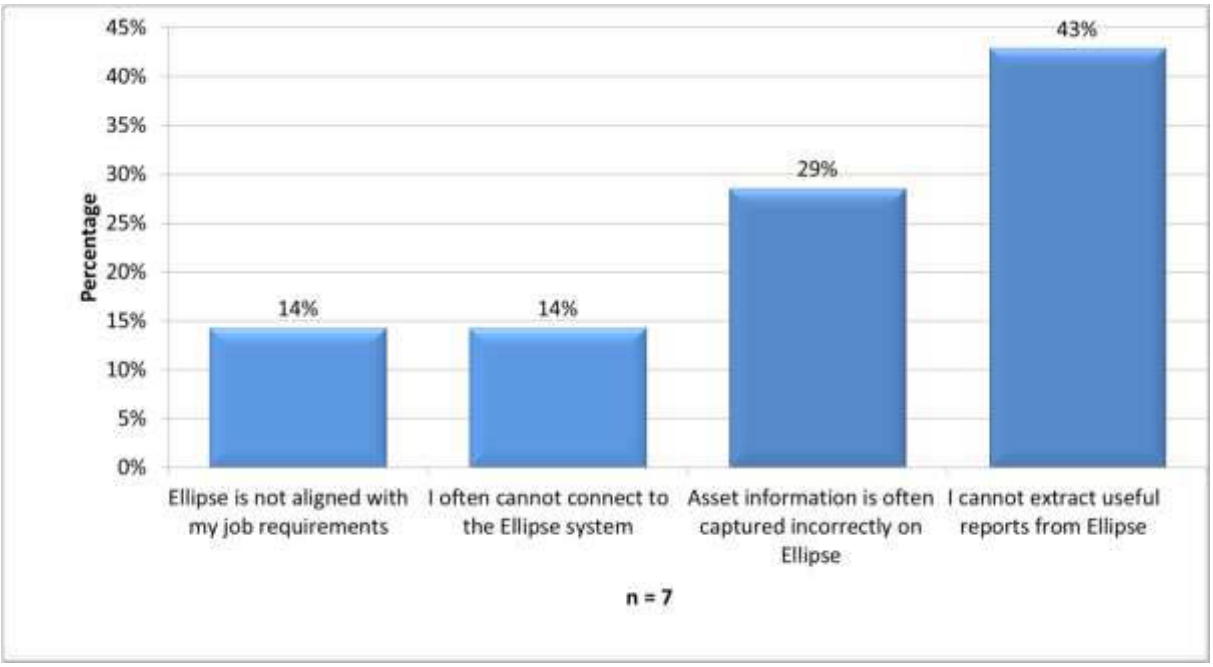


Figure 4.19: Reasons for dissatisfaction with the ERP package

When given the opportunity to offer insight as to why they felt the ERP system used by EE was unsatisfactory, 14.29% of the sample believed that Ellipse is not aligned with their job needs. Fourteen percent indicated that they often could not connect to the Ellipse system. Twenty-nine percent of the sample felt that asset information was not captured correctly in the system and 42.86% of respondents said that they could not extract useful reports from the system.

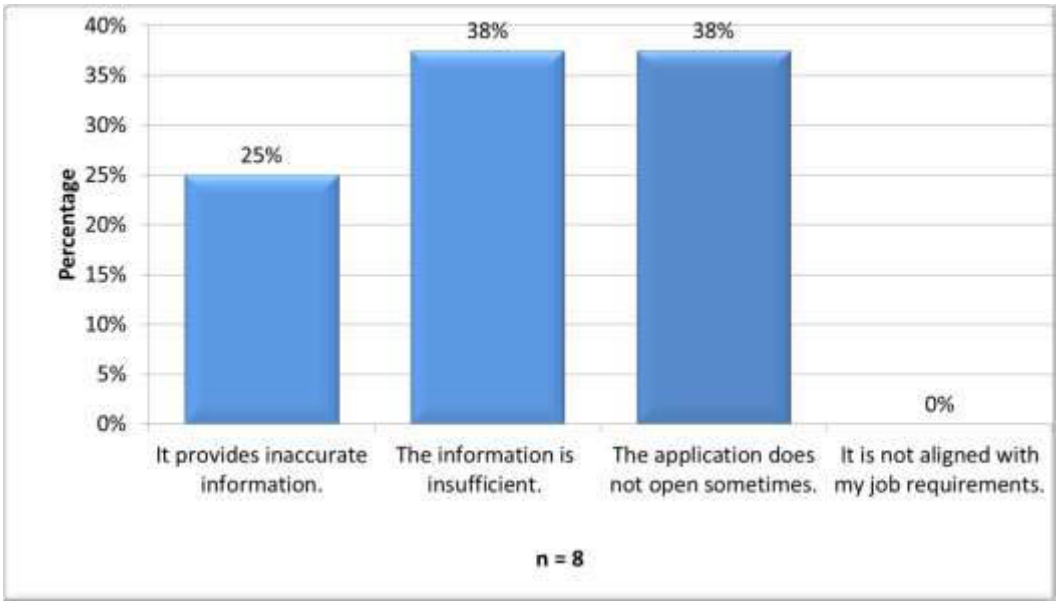


Figure 4.20: Reasons for dissatisfaction with the GIS package

When asked to provide possible reasons for the dissatisfaction with the GIS package, 25% of respondents said that it provided inaccurate data. Thirty-eight percent of the respondents indicated that the information provided was insufficient, while 37.50% of the sample stated that the application does not start up sometimes. No one commented that the software was not aligned to their job requirements.

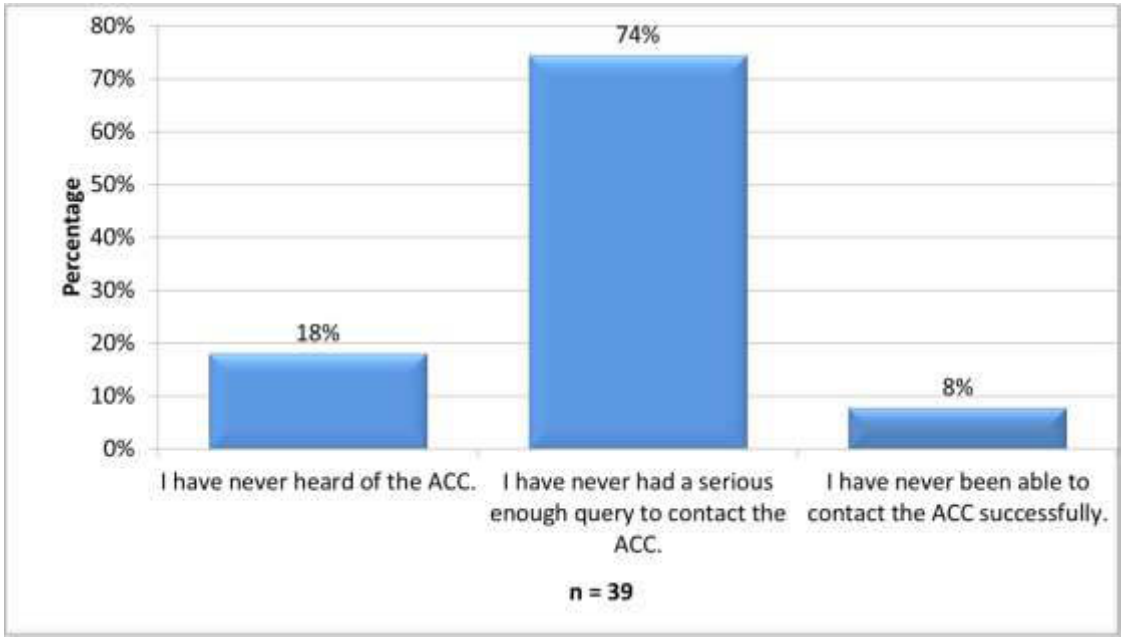


Figure 4.21: Respondents' reasons for not using the ACC service

Figure 4.21 shows the reasons for respondents not using the ACC. Eighteen percent of the sample said that they had never heard of the ACC. Seventy-four percent of the sample indicated that there was never a serious enough query to contact the ACC with, while 7.69% of the sample indicated that they could never get in contact with the ACC.

DISCUSSION OF OBJECTIVE 3

The primary outcome of this objective is to determine possible reasons why employees encountered problems with the new systems. When it was determined in objective 2 that 64.4% of respondents were not consulted, follow up questions revealed the main reason for not contributing was primarily that respondents felt that they were too junior in the organisation or that they felt it would not make a difference to the process. This may be attributed to a non-participative management style (Spathis & Constantinides, 2003).

A very high percentage of the participants indicated their feelings were neutral regarding the implementation of the new system. This prompted a follow up question to determine the reason for the less than satisfied response. Ninety-two percent of the respondents responded to this question and just over 40% were not entirely sure what the asset management system comprised of. Over 20% of the respondents regarded the system as being not aligned to their job needs and 20% were of the opinion that it was not updated properly. This result shows a clear misunderstanding between management and employees. After being informed of the implementation through meetings, workshops and newsletters, 40% of the participants were not sure what asset management was, which revealed a significant communication breakdown.

Eight percent of the respondents were not satisfied with the GIS package, indicating the main reasons as the software that did not open sometimes and that there was not enough information in the software. As this represented approximately 13% of the participants, there does not appear to be enough justification to investigate the unrelated incidents.

Another system related aspect of the ERP uncovered that 42.86% of respondents felt that the ERP did not allow flexible reporting and they would like to extract asset specific or useful customised reports from the system. Of concern is that 28.57 of the respondents were of the opinion that asset information was not captured correctly in the system itself. Adherence to the critical success factors would have created a more suitable end product. However, not

everyone can always be satisfied as ERP projects are notorious for being extended past the originally intended launch time, escalating costs exponentially (Ram *et al*., 2013).

Of further concern is the apparent lack of communication with the employees about the purpose of the asset care centre. Eighteen percent of the participants have never heard of the ACC. It is unclear whether these employees are new or old employees. In retrospect, a question regarding the respondent's length of service would have contributed to the sample demographics constructively. Three quarters of the respondents felt that they never had a query serious enough to warrant help from the ACC. The internal staff were of the opinion that the ACC is for reporting serious problems with the system only.

Both TQM and ERP initiatives require the commitment of senior leadership to be successful (Li *et al*., 2008). Management buy-in is a prerequisite for any new initiative to be successful. The sample demographic table shows a 1.67% representation of respondents in the task 17 -18 category, which is senior management. This response shows a lack of management support in establishing vital information required to improve the asset management project. One out of six senior managers completed a research study, endorsed by the head of the department, to determine the effectiveness of asset management within eThekwini Electricity. There is not enough data to draw a conclusion regarding this statistic but perhaps future studies could examine the commitment of senior management to new system implementations and the resulting success of projects.

eThekwini Electricity has unique requirements that cannot be adequately satisfied by existing available templates. Fourteen percent of respondents felt that the current package can be more effectively tailored to better meet the department's needs. Such customisation is critical for employee satisfaction and improved business performance (Trickett, 2011).

- Fourteen percent of respondents felt that the ERP system was not aligned to their individual job specification.
- Forty four percent of respondents were not sure what the asset management systems comprised of, even though they were using it daily.
- Thirty-five percent of respondents would have liked to extract more flexible reports from the ERP system.

- The majority of respondents, at 48.4%, felt that the ERP needed to be more user-friendly.
- Twenty-three percent of respondents felt that asset information is not captured accurately.
- Three quarters of participants have never used the asset care centre, which is a service to assist staff with asset management queries.

The objective was to determine the reasons why employees have encountered problems with the asset management system. From the points listed above, the objective has been met. Possible reasons why employees have encountered problems or were dissatisfied have emerged from the data that was collected, satisfying the objective.

4.9 OBJECTIVE 4: TO IDENTIFY IMPROVEMENTS THAT CAN BE MADE TO THE EXISTING ASSET MANAGEMENT SYSTEM

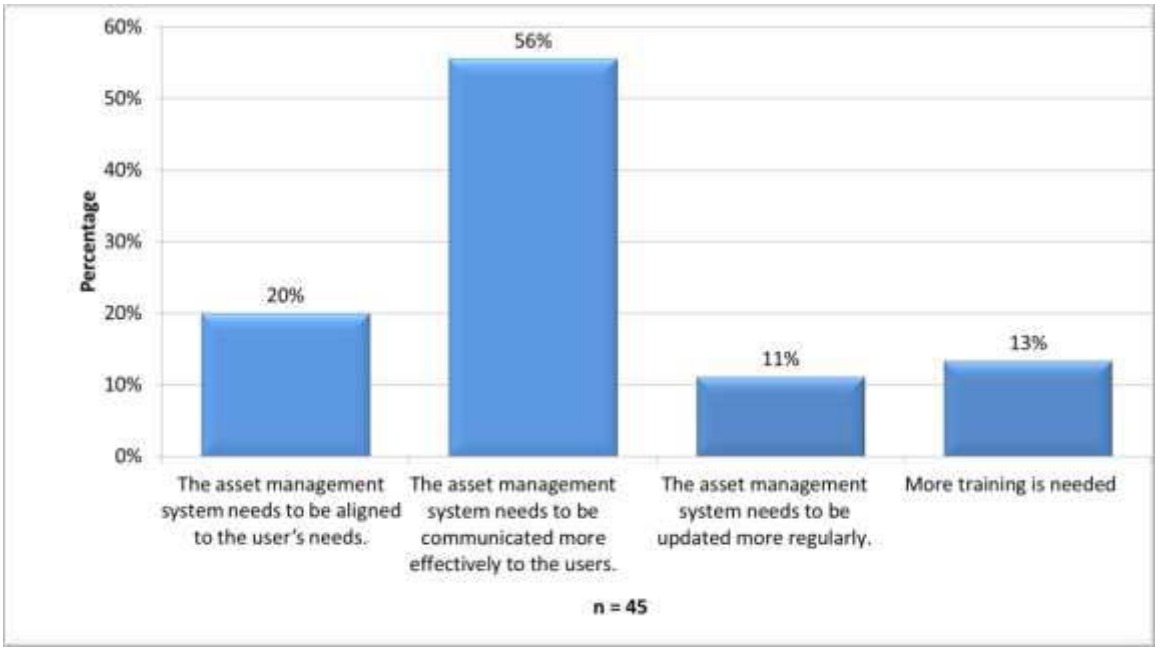


Figure 4.22: Immediate improvements that can be made to the asset management system

When asked how the asset management system could be improved, 20% of the respondents felt that the system needs to be more aligned to user needs, 55.56% of the respondents felt that the system needs to be communicated more effectively to users. Eleven percent of the

respondents thought that the system needed to be updated more regularly, while 13.33% of the respondents believed that more training was needed.

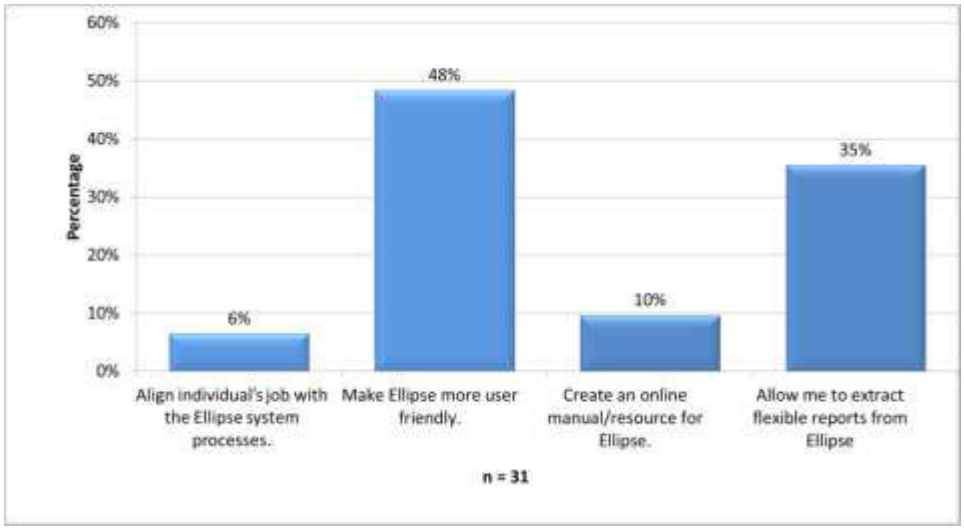


Figure 4.23: The respondents' impressions of immediate improvements that can be made to the Ellipse system

Figure 4.23 shows respondents' opinions of what improvements needed to be made to the ERP system, with 6.45% who felt that the ERP was not aligned to individual job functions and 48.39% who believed that Ellipse needed to be more user-friendly. Ten percent of the sample said that an online manual should be created to assist them and 35.48% were of the opinion that the ERP should allow them to extract more flexible reports.

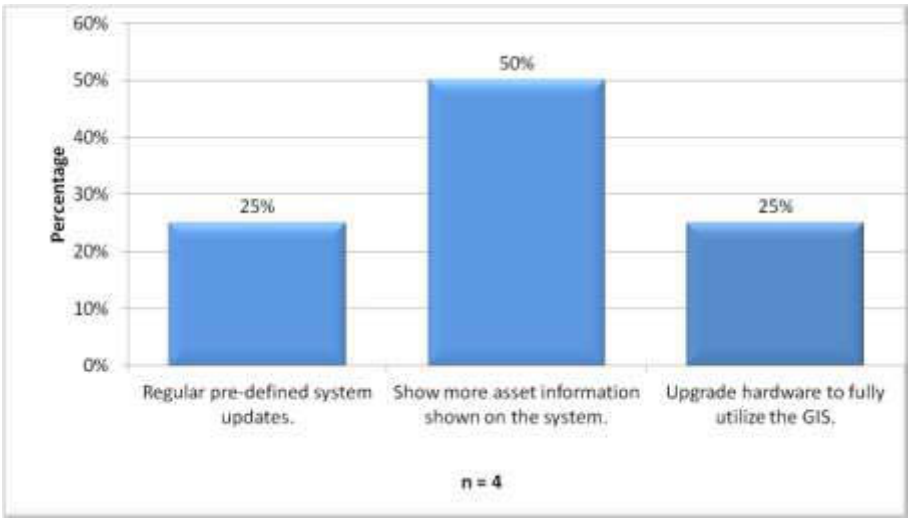


Figure 4.24: The respondents' views on what improvements need to be made to the GIS package

Figure 4.24 shows that 25% of respondents wanted regular pre-defined system updates, 50% wanted more asset information shown on the GIS package and 25% felt that their hardware did not allow them to fully utilise the software package.

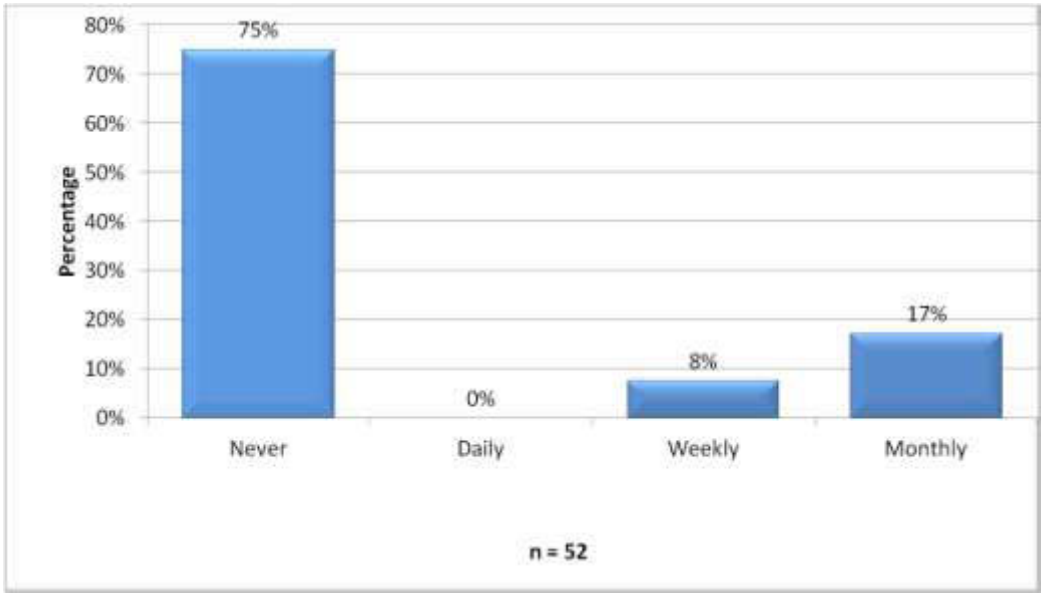


Figure 4.25: Frequency that the respondents used the ACC

Figure 4.25 shows respondents' replies when asked how often they utilised the ACC. Seventy-five percent of the sample had never used the service, none had used it on a daily basis, 7.69% had used it on a weekly basis and 17.31% claimed to have used it on a monthly basis.

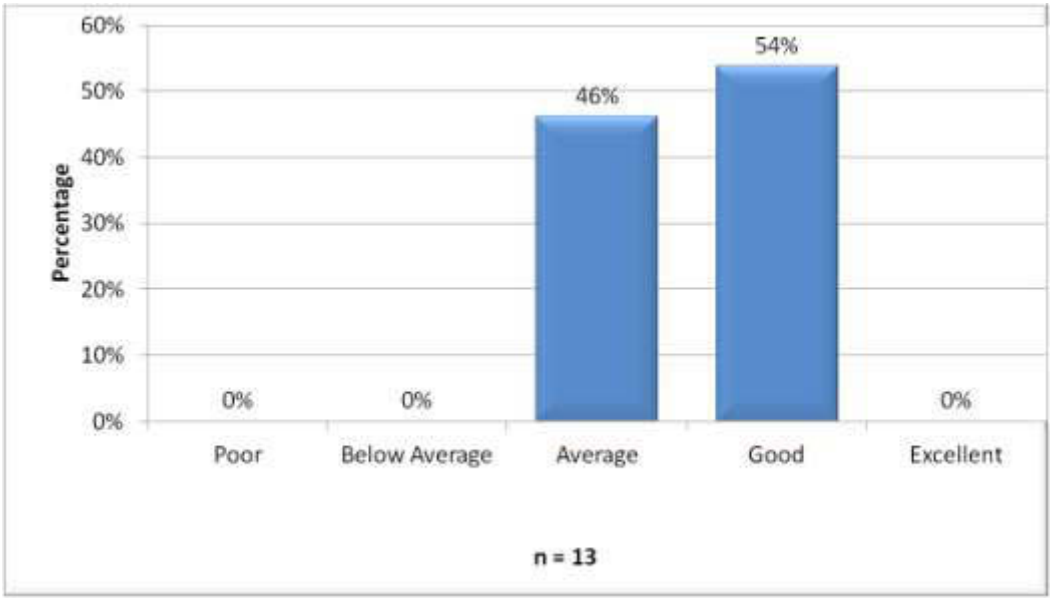


Figure 4.26: The respondents' opinions of the service received from the ACC

Figure 4.26 shows that of the 13 respondents that completed this question 46.15% found the service received from the ACC average and 53.85% commented that the service was good. No replies were logged for poor or excellent.

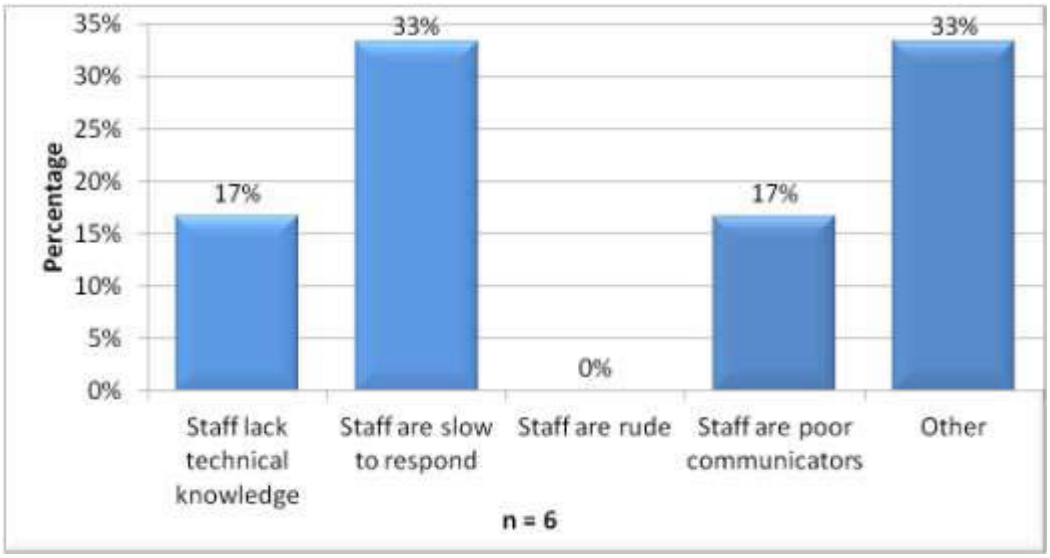


Figure 4.27: The respondents' views on what needs to be improved in the ACC

Of the six respondents who completed this question, 16.67% stated that staff lacked technical knowledge, 33.33% claimed that staff are slow to respond, 16.67% indicated that the ACC staff are poor communicators and none found them to be rude.

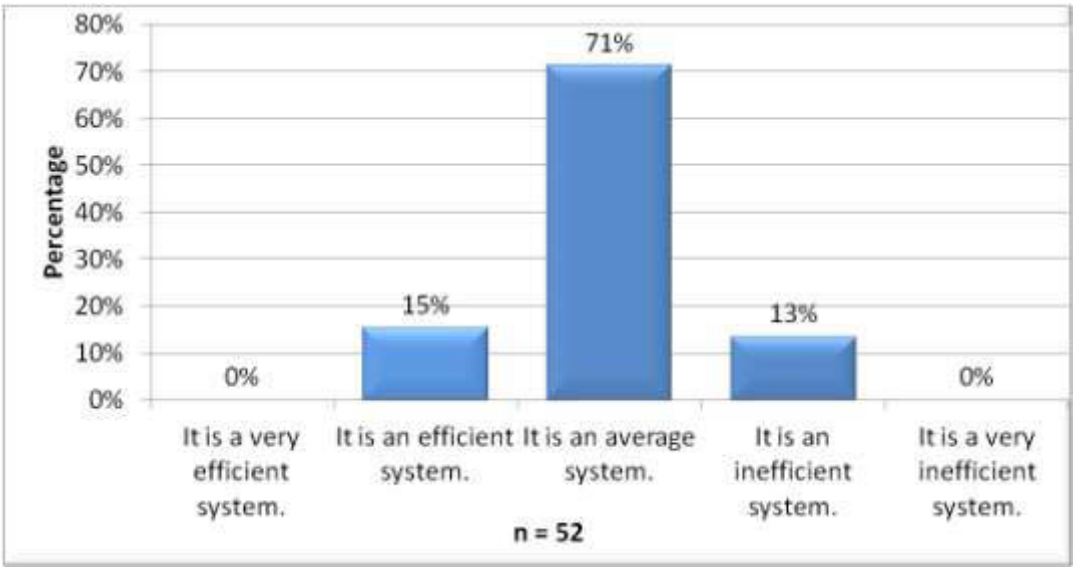


Figure 4.28: Respondents' overall assessment of the asset management system

Figure 4.28 indicates that 15.38% of the respondents found the asset management system to be efficient, 71.15% were neutral and 13.46% believed it to be an inefficient system. None found the system to be very efficient or very inefficient.

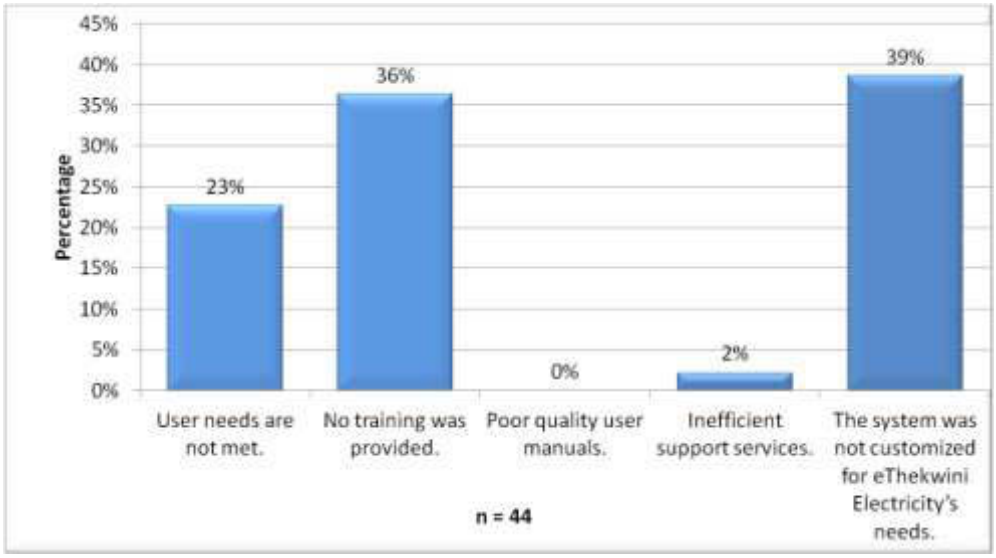


Figure 4.29: Main reasons contributing to inefficiencies of the asset management system

Figure 4.29 shows that 22.73% of the respondents felt that the users' needs were not met, 36.36% indicated that no training was provided and 38.647% believed that the system was not customised for eThekwini Electricity. None of the respondents thought that the user manuals were of poor quality.

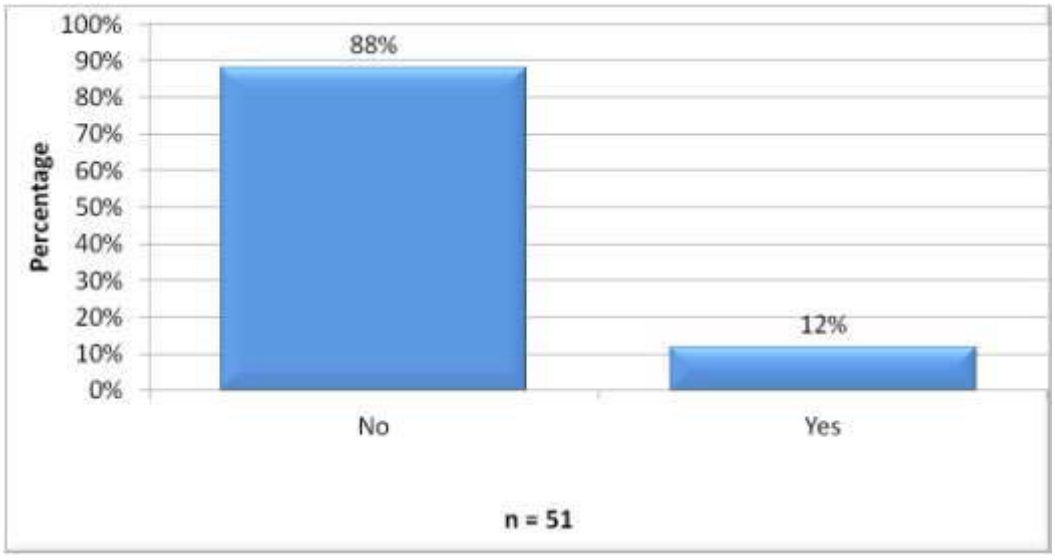


Figure 4.30: Percentage of respondents offering additional comments or suggestions

Figure 4.30 shows that 88.24% of the respondents had no additional comments or suggestions to improve the asset management system. Twelve percent contributed their own thoughts toward improving the system, as illustrated in Table 4.3.

Table 4.3: Employee comments for improvement of the system

1.	ACC is not coordinating work amongst divisions. Some information is not readily available such as information from other divisions within HV Operations maintenance
2.	More user-friendly and less user intensive
3.	Personalised and customised requirements need more attention
4.	Senior management need to buy into the asset management and ensure subordinate staff adopt and accept this new culture of working
5.	Since this project is managed by an external organisation it might fall flat when the current service provider's contract ends because currently there are no internal skills transfer or internal training of internal staff to be the drivers of this program
6.	I have never been on Ellipse or GIS training. I was just expected to learn along the way

Source: Author derived.

Table 4.3 provides a summary of the main points as indicated by the respondents. A number of issues and valuable information emerge from this employee contribution. It can be seen that the general ideas or themes are reiterated in the theorisation of data in the next section. This lends support to the conclusions reached and helps to determine corrective measures and improvements to the asset management system.

DISCUSSION OF OBJECTIVE 4

The purpose of this objective was to identify possible actions to improve the existing asset management system immediately. The participants highlighted two main areas of improvement, with 20% believing that the system needs to be more aligned to user needs and 55.56% feeling that the system was not effectively communicated to them.

When the sample population was asked what improvements should be made to the ERP system, 35.48% stated that they would like to be able to extract more flexible reports from the ERP and 48.39% were of the opinion that the ERP needs to be more user-friendly. Table 4.1 shows that a high proportion (over 80%) of the respondents were between the ages of 30 and 49. This is attributed to why the need for more user-friendly systems was indicated so strongly. There was also normal resistance to change in staff that have effectively done their

job for many years and were now asked to work in a different way (Spathis & Constantinides, 2003). This can also be attributed to the lack of consultation established in objective 1.

There was a small percentage of respondents who were not satisfied with the GIS software and 50% of those respondents wanted more asset information accessible to them. As part of the asset management initiative, another outside consultant (Aurecon) was designated the task of capturing all relevant asset information in the field. The delay is due to the eThekwini Electricity IT department, so this issue is in the process of being corrected. The participants who were not satisfied with the current version of GIS, due to the lack of asset information, would have a greatly enhanced experience when the technical issues were resolved. The current status of the upgrade needed to be communicated to the staff population more efficiently.

All respondents answered the question of whether they ever used the asset care centre, with 75% stating that they had never utilised the centre. There is a link between this result and the pre-implementation process. More direct communication between the users and the system champions would have created a greater awareness of the asset care centre, subsequently increasing interaction between the two units. In earlier discussions users expressed that there had never been a serious enough query to contact the asset care centre. The asset care centre needs to be more effectively utilised. This is a valuable resource and their functions need to be broadened to facilitate more interaction with the employee base.

When asked to rate the overall effectiveness of the asset management system utilised by eThekwini Electricity, 71% of the participants were neutral. This was explored further and respondents were asked to isolate particular reasons why they had given a neutral response which indicated that they felt that the system was not satisfactory. The highest proportion of the results was 36.36% who believed that no training was provided and 38.64% who were of the opinion that the system was not customised to eThekwini Electricity's needs. This may be attributed to legacy systems, resistance to change or even apprehension caused by the initial lack of consultation.

Based on what has been determined, the following actions need to be considered:

- More effective communication of the asset management plan, system and proposed upgrades and features.
- Enable the easy extraction of flexible reports from the ERP.
- Expand the ACC area of work and make them more approachable to internal technical and administrative staff.
- Provide user specific training for the different AM systems.

The objective was to identify improvements that can be made to the existing asset management system. Clearly, certain actions could be taken to improve the asset management system in terms of user satisfaction and organisation customisation. There is a definite link between objective 3, where 48.4% of system users called for a more user-friendly ERP system and objective 5, where 36.3% claim that no formal training was provided. It is reasonable to assume that if a formal training programme in place, there would be no need to simplify the system processes.

4.12 SUMMARY

Based on current literature, factors such as project management, training and education, business process re-engineering and system integration have been proven to be extremely significant for the success of ERP projects (Ram *et al*., 2013). The open-ended responses (Table 4.3) concur with the statistical findings on a few key points, most apparent being a lack of training (Figure 4.29) and a need for more user-friendly systems.

The research supporting the notion that pre-implementation factors have a direct bearing on post-implementation results has been not been proven (Soltani *et al*., 2013). Several of the critical success factors have not been satisfied (training, consultation and engagement of staff), yet the users did not indicate high dissatisfaction with the ERP system, while high levels of satisfaction were shown for the GIS system. Respondents' responses toward the overall implementation were somewhat neutral. This is a positive response, considering the low consultation conducted. Possible explanations for this attitude may be attributed to the smaller percentage that was consulted, having a sound understanding of the business requirements. Participation from all stakeholders is still, however, necessary as a high percentage of the respondents felt that the system was not aligned to the municipality

requirements and the individuals' job specifications in general. Obtaining input, feedback and buy-in from all stakeholders may present a better system "fit" for all and result in a more improved efficient system.

The analysis of the data collected for this study has met all predefined objectives. Analysis of the data has shown definite areas of improvement and revealed the employees' attitudes and concerns regarding the asset management system. Many avenues exist for improving and refining the system.

CHAPTER FIVE:
RECOMMENDATIONS AND CONCLUSIONS

5.1 INTRODUCTION

Due to a combination of factors, it was necessary for eThekwini Electricity to devise an asset management strategy. Changes to the municipal accounting practices and new legislature requiring accurate details of public assets made it a mandatory requirement for a more asset-centric approach to operations. Many municipalities, including eThekwini, were realising that the ageing infrastructure was failing sooner than industry norms. This was attributed to poor maintenance practices. It became a critical task to develop systems and processes that allow work to be conducted based on accurate information and sound asset management principles.

The main reason for conducting this study was to determine if the asset management systems developed and implemented for eThekwini Electricity were effective. The main objective was to establish the processes followed prior to implementation as well as the problems and benefits experienced post implementation. A secondary objective was to determine what measures were immediately necessary to improve the asset management system for the employees of eThekwini Electricity.

5.2 KEY FINDINGS

The research evaluated best practices when implementing a new technology that would replace existing legacy systems. The need for the new system was detailed as well as potential problems common to ERP and asset information launches. There is a lack of research examining effects and results of technology implementations within a municipal environment. The findings were therefore industry specific, having a different work dynamic when compared to private sector initiatives.

Most current literature claims that organisation-wide participation is a critical component of developing and implementing new information and asset management systems. Participants indicated that they were aware of the new system prior to implementation. The results of this study indicate that although a low percentage of participants (35%) were consulted during the development of the new system, this did not, however, result in a poor application of the new systems. Respondents indicated feelings of apprehension and dissatisfaction with the new

systems, yet 10% expressed dissatisfaction with the actual system operation. This finding differs from that of current literature, indicating that consultation with a few, key individuals who are familiar with the organisation practices and procedures can result in an effective and useful system.

Asset management systems were developed to support the organisation's business objectives, while complying with the required accounting and technical requirements, which allow the delivery of services to the constituents of eThekwini. This study has uncovered several areas for improvement within the asset management system. While the participants were not completely dissatisfied with the system, there were some respondents who felt that the system needed more customisation to eThekwini Electricity's specific business operations. The most evident result emerging from the data is the serious lack of communication between different sections and departments. There was no apparent cascading of information from management level down the ranks.

The study has differed from some conventional opinions and unearthed several areas of improvement, which will be explored further as possible recommendations in the next section.

5.3 LIMITATIONS OF THIS STUDY

The study was quantitative in nature. A minimum of 59 respondents were required to complete the questionnaire to enable the generalisation of results across the population of 69. While 60 participants began the survey only 51 completed all questions. Although the information collected can still be used to develop practical, useful improvements to better suit the asset management systems to eThekwini Electricity's individual requirements, the results cannot be statistically generalised across the target population.

5.4 RECOMMENDATIONS BASED ON FINDINGS

5.4.1 Non-consultative management approach

Many of the issues arising from the study could have been prevented had more of the end level users of the system been included in the development process. There was a high awareness of the impending launch of a new information management system or ERP but many did not know what this meant and how it would affect them. An alternate method to ensure that all stakeholders contribute to the development of new technologies and processes

would be to elect champions from each respective section. A non-consultative management approach may benefit certain job specific roles but in an organisation wide technology implementation it was not conducive to a higher level of process and system integration.

A more consultative attitude will also address the large number of employees concerned that there is a poor organisational "fit" with the ERP system and respondents that claimed the system is not customised for eThekwini Electricity.

5.4.2 More functionality from the asset care centre

The asset care centre was created to service the needs of employees affected by asset management strategies and systems implemented at eThekwini Electricity's HV Operations department. Three quarters of respondents had never contacted the asset care centre, although aware of its existence. The responses indicate that the respondents were under the impression that the asset care centre was used for large system problems or serious network/server failures. The asset care centre needs to be utilised in an effective manner, possibly expanding its core functions. The employees require a full set of contact details for the asset care centre along with a breakdown of specific people for the various specialist problems. The asset care centre needs to also increase its visibility by visiting the different departments regularly or scheduling regular feedback meetings. Weekly checks with each of relevant departments will create a more approachable attitude to the service centre.

5.4.3 Increase usability of the ERP system

Almost half the respondents felt that the ERP system needed to be more user-friendly. This may be attributed to the high number of respondents falling into the 30 to 49 age group. Combined with a lack of formal training, it may be confusing to new users accustomed to the previous legacy systems. The ERP may be simplified to suit the users' needs. Comprehensive user manuals must be developed for each system to complete the increase in usability of these systems. Other possible options may be an online repository for user manuals and self-help guides.

5.4.4 Enable the extraction of flexible reports from the ERP

During the course of everyday work various work functions are controlled and/or assisted by the ERP system. This results in vastly differing needs across the HV Operations department.

For whichever reason, 35% of respondents wanted to extract more flexible reports from the ERP system. The system has all the raw data available, but it was not always possible to extract only the required information to develop reports customised to individual, section or departmental needs. A platform needs to be created for users to extract the necessary data only from the asset management system.

5.4.5 Mandatory training for users in asset intensive departments

A central theme emerging from the questionnaire as well as the open-ended text was the lack of adequate training. The new asset and information management systems were brought online and very little training was provided. This may be attributed to the slow transitioning of the old legacy systems and the gradual introduction of the new systems. The GIS was not being used to full functionality due to the lack of users training on the new system. Again this may be attributed to the transition from the older corporate GIS package which only provided basic functionality for the entire municipality, whereas the new eThekwini Electricity GIS software provides electricity specific assets and information. The software may be similar in appearance but it is quite different. Therefore, the most important recommendation is to formulate formal training schedules for all system users. During these sessions, valuable experience and skills can be transferred to other users. Possible glitches and improvements can be determined by the training groups, while also increasing users' participation in the system improvement.

Other possible options may be the development of an online help forum, whereby users can ask questions and the respective specialist from the asset care centre can respond. The benefits are that if other users experience the same problems, they can simply read the solution and correct the situation independently.

5.4.6 Skills transfer from external consultants

A valid concern emerged from the open-ended text regarding the lack of skills between the external consultants (Pragma) and eThekwini Electricity. An organisational concern to be guarded against is not to become completely dependent on external service providers. At some point eThekwini Electricity needs to be weaned from the consultants' assistance. The strategy, business plans and best practice processes have been implemented. The training and system maintenance can be handled in house through the eThekwini Electricity Information,

Communication and Technology (ICT) department. Once the organisation has developed an asset-centric culture, supported by reliable, relevant and useful systems, it is necessary to function independently from external consultants. A new organogram must be included within the department's hierarchy to deal with all asset related issues.

5.5 RECOMMENDATIONS FOR FUTURE STUDIES

The link between pre-implementation processes and post-implementation system success can be further researched. The asset management model will be implemented across the remaining four departments of eThekwini Electricity.

Serious technical difficulties were experienced at an organisational level when the electronically distributed questionnaire was received by the respondents. Municipal ICT procedures classified the questionnaire or possibly the Questionpro website as "Business/Education" and prevented some respondents from completing the questionnaire. Future studies should be cognisant of this and adopt other forms of data collection.

A contributing factor to any asset or information management system is the support of senior management. This study was unable to conclusively address that area of concern. Any future studies conducted must include management buy-in as a significant driver for effective change.

5.6 SUMMARY

The aim of this study was to determine the effectiveness of the asset management system implemented at eThekwini Electricity. This was achieved by adopting an industry specific view of the implementation as well as the post implementation results as defined by the end level users of the system. The objective was to understand what pre-implementation processes were completed prior to the system launch, identify problems and benefits arising from the implementation of the new system and provide immediate solutions to improve the system.

The data collected has answered the objectives of the study. This will enable the organisation to improve the systems, enabling a more efficient and effective operation and resulting in improved maintenance functions, less outages and quicker restoration of supply to homes and businesses. Therefore, the research can improve the level of service delivery in the eThekwini Electricity sphere of local government.

REFERENCES

Abdinnour-Helm, S., Lengnick-Hall, M.L., & Lengnick-Hall, C. 2003. Pre-implementation Attitudes and Organisational Readiness for Implementing an Enterprise Resource Planning System. European Journal of Operational Research, vol. 146, no. 2, pp. 258-273. Elsevier, Europe.

Alsene, E. 2007. ERP Systems and the Coordination of the Enterprise. Business Process Management Journal, vol. 13, no. 3, pp. 417-432. Emerald Group Publishing Limited, Bingley.

Bekker, A. 2008. A Standardised Industry Approach Towards Asset Management. Eskom, Midrand.

Bendoly, E., Rosenzweig, E., & Stratman, J. 2009. The Efficient Use Enterprise Information for Strategic Advantage: A Data Envelopment Analysis. Journal of Operations Management, vol. 27, no. 4, pp. 310-323. Elsevier, USA.

Beri, G. 2008. Marketing Research. 4th ed. McGraw Hill, New Delhi.

Booyzen, A. & Fourie, S. 2010. Asset Management Regulatory Compliance Challenges. Association of Municipal Electricity Utilities 62nd Annual Convention. Association of Municipal Electricity, Stellenbosch.

Boshoff, L., Childs, R., & Roberts, L. 2009. Guidelines for Infrastructure Asset Management in Local Government 2006-2009. Department of Provincial and Local Government, Republic of South Africa.

Boshoff, L. 2009. Municipal Infrastructure Asset Care in South Africa: A Reality Check. Development Bank of Southern Africa, Midrand.

British Standards Institute (BSI). 2008. Specification for the Optimized Management of Physical Assets. British Standards Institute, London.

Bryman, A. 2012. Social Research Methods. 4th ed. Oxford University Press, New York.

Cotteleer, M. & Bendoly, E. 2006. Order Lead-time Improvement Following Enterprise Information Technology Implementation: An Empirical Study. MIS Quarterly, vol. 30, no. 3, pp. 643-660. Management Information Systems Research Centre, University of Minnesota.

Council for Scientific and Industrial Research (CSIR). 2007. The State of Municipal Infrastructure in South Africa and its Operation and Maintenance - An Overview. CSIR, Stellenbosch.

Dashti, R. & Yousefi, S. 2013. Reliability Based Asset Assessment in Electrical Distribution Systems. Reliability Engineering and System Safety, vol. 112, pp. 129-136. Bowen Publishing, New York.

Dezdar, S. & Sulaiman, A. 2009. Successful Enterprise Resource Planning Implementation: Taxonomy of Critical Factors. Industrial Management & Data Systems, vol. 109, no. 8, pp. 1037-1052. Emerald Group Publishing Limited, Bingley.

Easton, V.J. & McColls, J.H. 2013. Confidence intervals. [Online]. Available WWW: http://www.stat.yale.edu/Courses/1997-98/101/confint.htm (Accessed 30 April 2013).

Esteves, J. & Bohorquez, V. 2007. An Updated ERP Systems Annotated Bibliography. Communication of the Association for Information Systems, vol. 19, no. 1, p. 18. Association for Information Systems, Atlanta.

eThekwini Electricity. 2010. EThekwini Electricity Annual Report. EThekwini Municipality, EThekwini.

Finney, S. & Corbett, M. 2007. ERP Implementation: A Compilation and Analysis of Critical Success Factors. Business Process Management Journal, vol. 13, no. 3, pp. 329-347. Emerald Group Publishing Limited, Bingley.

Fowler, F.J. 1984. Survey Research Methods. Sage Publications Inc., Thousand Oaks.

Franke, T.M., Ho, T., & Christie, C.A. 2012. The Chi-Square Test: Often Used and More Often Misinterpreted. American Journal of Evaluation, vol. 33, no. 3, pp. 448-458. Sage Publications, Thousand Oaks.

Gildenhuys, B. 2009. Municipal Infrastructure Investment Requirements. s.l.: World Bank Economic and Sector Work.

Grimm, P. 2010. Pretesting a questionnaire. [Online]. Available WWW: http://onlinelibrary.wiley.com/doi/10.1002/9781444316568.wiem02051/abstract (Accessed 16 June 2013).

Gupta, M. & Kohli, A. 2006. Enterprise Resource Planning Systems and its Implications for Operations Function. Technovation, vol. 26, no. 5/6, pp. 687-696. Elsevier, s.l.

Gupta, O., Priyadarshini, K., Massoud, S., & Shivprakash, A.K. 2004. Enterprise Resource Planning: A Case of a Blood Bank. Industrial Management & Data Systems, vol. 104, no. 7, pp. 589-603. Emerald Group Publishing Limited, Bingley.

Hall, J. 2013. The 3 basic types of descriptive research methods. [Online]. Available WWW: http://psychcentral.com/blog/archives/2011/09/27/the-3-basic-types-of-descriptive-research-methods/ (Accessed 30 April 2013).

Herold, D., Farmer, S., & Mobley, M. 1995. Pre-implementation Attitudes Towards the Introduction of Robots in a Unionized Environment. Journal of Engineering and Technology Management, vol. 12, no. 3, pp. 155-173.

Jones, C. 2012. Advantages and disadvantages of qualitative and quantitative research. [Online]. Available WWW: http://www.ehow.com/info 8091178 advantages-disadvantages-qualitative-quantitative (Accessed 14 June 2013).

Josie, J. 2008. The Intergovermental Context of Municipal Infrastructure Grants in South Africa. Conference Workshop Cultural Initiative Fund, Cape Town.

King, K., Wallis, R., Jones, C., & Joubert, J. 2005. Independent Technical Audit on Eleven electricity distributors networks: Consolidated Audit Report. Merz and McLellan/Sinclair Knight Merz, Cramerview.

Krejcie, R. & Morgan, D. 1970. Determining Sample Size for Research Activities. Educational and Psychological Measurement, vol. 30, no. 3, pp. 607-610.

Li, L., Markowski, C., Xu, L., & Markowski, E. 2008. TQM: A Predecessor of ERP Implementation. International Journal of Production Economics, vol. 115, pp. 569-580. Elsevier, International.

Liu, A. & Seddon, P. 2009. Understanding How Project Critical Success Factors Affect Organisational Benefits from Enterprise Systems. Business Process Management Journal, vol. 15, no. 5, pp. 716-743. Emerald Group Publishing Limited, Bingley.

Maguire, S., Ojiako, U., & Said, A. 2010. ERP Implementation in Omantel: A Case Study. Industrial Management & Data Systems, vol. 110, no. 1, pp. 78-92. Emerald Group Publishing Limited, Bingley.

Maloka, E. 2002. The fruits of freedom. [Online]. Available WWW: http://www.sahistory.org.za/archive/chapter-4-fruits-freedom (Accessed 29 December 2012).

Marshall, G. & Jonker, L. 2010. An Introduction to Descriptive Statistics: A Review and Practical Guide. Radiography, vol. 16, no. 10, pp. e1-e7. Elsevier Health, UK.

Moon, Y. 2007. Enterprise Resource Planning: A Review of the Literature. International Journal of Management and Enterprise Development, vol. 4, no. 3, pp. 235-263. Inderscience Enterprises Ltd, United Kingdom.

National Energy Regulator (NER). 2004. South African National Electricity Distribution Infrastructure: Status Report. National Energy Regulator, Pretoria.

Newbery, D. & Eberhard, A. 2007. South African Network Infrastructure Review: Electricity. Department of Public Enterprises, Hatfield.

New Zealand Asset Management Support. 2011. International Infrastructure Management Manual. [Online]. Available WWW: http://www.nams.org.nz/pages/273/international-infrastructure-management-manual-2011-edition.htm (Accessed 5 January 2013).

Nielsen, J. 2004. Risks of quantitative studies. [Online]. Available WWW: http://www.nngroup.com/articles/risks-of-quantitative-studies/ (Accessed 30 April 2013).

Nordgard, D.E. 2012. A Framework for Risk-informed Decision Support in Electricity Distribution Companies Utilizing Input from Quantitative Risk Assessment. International Journal of Electrical Power & Energy Systems, vol. 43, no. 1, pp. 255-261.

Ong'anya, G.V. & Ododa, H.O. 2009. Questionnaire as a data collection instrument. [Online]. Available WWW: http://onganya.blogspot.com/2010/03/questionnaire-as-data-collection.html (Accessed 16 June 2013).

Palmer, L. & Balwanth, J. 2005. eThekwini Municipality. Presentation at DBSA. s.n., s.l.

Perales, J.C., Catena, A., & Maldonado, A. 2003. Inferring Non-Observed Correlations from Causal Scenarios: The Role of Causal Knowledge. Learning and Motivation, vol. 35, pp. 115-135. Elsevier, International.

Ram, J., Corkindale, D., & Wu, M.L. 2013. Implementation of Critical Success Factors (CSFs) for ERP: Do They Contribute to Implementation Success and Post-Implementation Performance. International Journal of Production Economics, vol. 144, no. 1, pp. 157-174. Elsevier, International.

Ramirez, R., Melville, N., & Lawler, E. 2010. Information Technology Infrastructure, Organisational Process Redesign and Business Value: An Empirical Analysis. Decision Support Systems, vol. 49, no. 4, pp. 417-429. Elsevier, USA.

Reijers, H. & Mansar, S.L. 2004. Best Practices in Business Process Redesign: An Overview and Qualitative Evaluation of Successful Redesign Heuristics. The International Journal of Management Science, vol. 33, no. 4, pp. 283-306. Elsevier: Omega, Philadelphia.

Republic of South Africa (RSA). 2004. Local Government: Municipal Finance Management Act, no.56 of 2003.

Rikhardsson, P.M. & Kraemmergaard, P. 2006. Identifying the Impacts of Enterprise System Implementation and Use. International Journal of Accounting Information Systems, vol. 7, no. 1, pp. 36-49. Elsevier, USA.

Ryan, M. 2011. Insightful analytics. [Online]. Available WWW: http://blog.insightexpress.com/2011/01/research-minute-probability-vs-non-probability-sampling/ (Accessed 30 April 2013).

SAPA. 2012. NERSA queries municipalities electricity tariffs. [Online]. Available WWW: http://www.engineeringnews.co.za/article/nersa-queries-municipalities-electricity-tariffs-2012-11-02 (01 January 2013).

Schneider, J., Gaul, A.J., Neumann, C., Hogräfer, J., Wellβow, W., Schwan, M., & Schnettler, A. 2006. Asset Management Techniques. Electrical Power and Energy Systems, vol. 28, pp. 643-654. Elsevier, Europe.

Sekaran, U. & Bougie, R. 2010. Research Methods for Business: A Skill Building Approach. 5th ed. John Wiley and Sons Ltd, Sussex.

Snider, B., Da Silveira, G.J., & Balakrishnan, J. 2009. ERP Implementation at SME's: Analysis of Five Canadian Cases. International Journal of Operations & Production Management, vol. 29, no. 1, pp. 4-29. Emerald Group Publishing Limited, Bingley.

Soja, P. & Pekosz-Paliwoda, G. 2009. What Are Real Problems in Enterprise System Adoption?. Industrial Management & Data Systems, vol. 109, no. 5, pp. 610-627. Emerald Group Publishing Limited, Bingley.

Soltani, S., Elkhani, N., & Bakri, A. 2013. How Consultant Participation Lead to ERP Implementation Satisfaction: A Study Upon The Iranian Industries. Internation Journal of Computer Science Issues, vol. 10, no. 2, pp. 313-323. SoftwareFirst Limited, Mauritius.

Spathis, C. & Constantinides, S. 2003. The Usefulness of ERP Systems for Effective Management. Industrial Management and Data Systems, vol. 103, no. 9, pp. 677-685. Emerald Group Publishing Limited, Bingley.

Strauss, A.L. & Corbin, J.M. 1998. Basics of Qualitative Research. 2nd ed. Sage Publications Inc, Thousand Oaks.

Su, Y. & Yang, C. 2010. Why Are Enterprise Resource Planning Systems Indispensable to Supply Chain Management?. European Journal of Operational Research, vol. 203, pp. 81-94. Elsevier, Europe.

Timpany, G. 2011. Structured vs. unstructured questionnaires. [Online]. Available WWW: http://survey.cvent.com/blog/customer-insights-2/stuctured-vs-unstructured-questions (Accessed 16 June 2013).

Trickett, R. 2011. Identifying misalignments in ERP implementations. University of Cape Town, Cape Town.

Trochim, W.M. 2006. Research Methods Knowledge Base. [Online]. Available WWW: http://www.socialresearchmethods.net/kb/sampprob.php (Accessed 14 June 2013).

University of the West of England. 2007. [Online]. Available WWW: http://ro.uwe.ac.uk/RenderPages/RenderLearningObject.aspx?Context=7&Area=1&Room=3&Constellation=28&LearningObject=159 (Accessed 30 April 2013).

Vance, R.J. 2006. Employee Engagement and Commitment. SHRM Foundation, Alexandria.

Vecchiatto, P. 2012. Cabinet approves plan to refurbish power distribution infrastructure. [Online]. Available WWW: http://www.bdlive.co.za/business/energy/2012/11/22/cabinet-approves-plan-to-refurbish-power-distribution-infrastructure (Accessed 6 January 2013).

Verma, J. 2013. Data Analysis in Management with SPSS Software. Springer, India.

White, B. 2002. Writing Your MBA Disseration. Continuum, New York.

Wu, J.H. & Wang, Y.M., 2006. Measuring ERP Success: The Ultimate Users View. International Journal of Operations & Production Management, vol. 26, no. 8, pp. 882-903. Emerald Group Publishing Limited, Bingley.

APPENDIX 1:
INTRODUCTORY LETTER

Informed Consent Letter 3C

UNIVERSITY OF KWAZULU-NATAL

GRADUATE SCHOOL OF BUSINESS AND LEADERSHIP

Dear Respondent,

MBA Research Project

Researcher: Rishendren Reddy (073 850 4558)

Supervisor: Prof Anesh Maniraj Singh (031 260 7061)

Research Office: Ms P Ximba 031-2603587

I, RISHENDREN REDDY am 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 "The effectiveness of the asset management system at eThekwini Electricty. The aim of this study is to establish the benefits and shortcomings of the implementation of eThekwini Electricity's asset management system within the High Voltage Operations department at eThekwini electricity.

Through your participation I hope to understand how effective the implementation of the asset management system was and if any improvements can be made to the system. The results of the focus group are intended to contribute to the overall improvement of the asset management system at eThekwini Electricity.

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/focus group. 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 5 minutes to complete. Please take the time to complete this survey.

Sincerely

R. Reddy

Investigator's signature_____

Date_____

This page is to be retained by participant

APPENDIX 2:
CONSENT LETTER

UNIVERSITY OF KWAZULU-NATAL
GRADUATE SCHOOL OF BUSINESS AND LEADERSHIP

MBA Research Project

Researcher: Rishendren Reddy (073 850 4558)

Supervisor: Prof Anesh Maniram Singh (031 260 7061)

Research Office: Ms P Ximba 031-2603587

CONSENT

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 _____

This page is to be retained by researcher

APPENDIX 3:
ETHICAL CLEARANCE

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

17 April 2013

Mr Rishendren Reddy 211523914
Graduate School of Business and Leadership
Westville Campus

Dear Mr Reddy

Protocol reference number: HSS/0209/013M
Project title: The Effectiveness of the Asset Management Implementation at eThekwini Electricity

EXPEDITED APPROVAL

I wish to inform you that your application has been granted Full Approval through an expedited review process.

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 school/department for a period of 5 years.

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

Yours faithfully

.....
Professor Steven Collings (Chair)

/pm

cc Supervisor: Professor Anesh Maniraj Singh
cc Academic Leader: Dr E Munapo
cc School Admin.: Ms Wendy Clarke

APPENDIX 4:
GATEKEEPERS PERMISSION

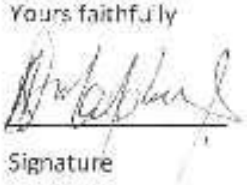
GATEKEEPERS PERMISSION

I Sandile Maphumulo the undersigned, hereby give permission for Rishendren Reddy to conduct research at eThekwini Electricity towards his/her dissertation entitled The Effectiveness of Asset Management at eThekwini Electricity. He may collect data from our staff provided that it does not interfere with the normal operations of the business.

I am aware that dissertations and subsequent academic papers based on this data will be available in the public domain; the following conditions apply in this regard:

- ☑ The work may be freely published in the public domain
- ☐ The work may be published in the public domain provided the company is kept anonymous
- ☐ The work may not be published in the public domain within five years of completion

Yours faithfully



Signature

Sandile Maphumulo

Full Name

HEAD: Electricity

Designation

APPENDIX 5:

QUESTIONNAIRE

Question	Responses
1. Age	20 – 29 30 – 39 40 – 49 50 – 59 60 and over
2. *Please indicate your task grade	(a) Task 06-10 (b) Task 11-13 (c) Task 14-16 (d) Task 17-18
3. *Were you aware that the asset management system was going to be implemented?	YES NO
IF YES, question 4 IF NO, question 10	
4. How were you made aware of the new system implementation?	(a) Meetings (b) Workshops (c) Newsletter (d) Regular updates from my supervisor (e) Other
5. How often were you updated on the new system implementation?	(a) Once off (b) Daily (c) Weekly (d) Monthly (e) Quarterly (f) Never
6. Were you consulted in the development of the asset management system?	YES NO
IF YES then question 7 IF NO then question 10	
7. You mentioned that you were consulted. How would you describe the consultation process?	(a) I was consulted once-off. (b) I was consulted more than once. (c) I was consulted regularly.
8. Do you feel that your opinion was valued?	Yes No
9. Were your concerns addressed when the system was implemented? GO TO question 14	Yes No
10. *How did not being consulted in the development of the asset	(a) My opinion was not valued. (b) My experience/expertise was ignored.

Question	Responses
management system make you feel?	(c) My concerns were not addressed. (d) I was apprehensive of the new asset management system.
11. Did you make any attempt to get involved in the process?	Yes No
IF YES then question 12 IF NO then question 14	
12. How did you attempt to contribute to the project?	(a) I volunteered my service to assist in the new system development (b) I regularly asked my supervisor questions regarding the status of the new system. (c) I provided feedback to my supervisor when called upon. (d) I contacted the Asset Care Center with suggestions/improvements. (e) Other
13. Were your attempts to get involved in the process successful? GO to question 15	Yes No
14. Why did you not attempt to get involved in the asset management system implementation?	(a) I am too junior in the organization. (b) I did not believe that it would make a difference in the process. (c) It was a top down process and my input was not required. (d) Asset management is not important to me.

15. How would you rate your satisfaction with the asset management system?
IF (a & b) THEN question 16
IF (d & e) THEN question 17
IF (e) THEN question 19
	(a) Very dissatisfied
	(b) Dissatisfied
	(c) Neutral
	(d) Satisfied
	(e) Very satisfied

16. What is the reason for your dissatisfaction?	(a) The asset management system is not aligned to my job needs. (b) I am not sure exactly what the asset management system is. (c) The asset management system is complicated to understand. (d) The asset management system is not updated regularly.
17. What is the reason for your satisfaction?	(a) Higher efficiency in term of stock levels (b) Reduced lead times when ordering stock (c) Increased work place efficiency (d) More effective decision making
18. What immediate improvements should be made to the asset management system?	(a) The asset management system needs to be aligned to the user's needs. (b) The asset management system needs to be communicated more effectively to the users.

Question	Responses
	(c) The asset management system needs to be updated more regularly. (d) The asset management needs to be communicated more effectively to the users (e) More training is needed
19. How would you rate your satisfaction with the enterprise resource planning (ERP) system (Ellipse)?	(a) Very dissatisfied (b) Dissatisfied (c) Neutral (d) Satisfied (e) Very satisfied

IF (d) or (e) THEN question 20
IF (a) or (b) THEN question 21
IF (c) THEN question 23	

20. You have indicated that you are satisfied with the Ellipse system. Please rank how Ellipse has benefited you, with 1 being the greatest benefit and 4 the least. GO TO question 23.	(a) Ellipse is well aligned with my job requirements. (b) It is easier for me to track the progress of my projects/jobs. (c) Ellipse allows me to make more informed business decisions. (d) I can extract useful reports.
21. What are the main reasons for saying that Ellipse is unsatisfactory? You may select more than one.	(a) Ellipse is not aligned with my job requirements. (b) I often cannot connect to the Ellipse system. (c) Asset information is often captured incorrectly on Ellipse. (d) I cannot extract useful reports from Ellipse. e) Other.
22. What immediate improvements do you think need to be made to Ellipse?	(a) Align individual's job with the Ellipse system processes. (b) Make Ellipse more user friendly. (c) Create an online manual/resource for Ellipse. (d) Allow me to extract flexible reports from Ellipse
23. Do you use the geospatial information system (GIS)? IF YES THEN question 23 IF NO THEN question 27	YES NO
24. Which features of the system do you use most often? You may select more than one.	Substation information Cable/Line information Road names Aerial photos
25. How would you rate your satisfaction with the GIS system provided by eThekwini Electricity?	(a) Very dissatisfied (b) Dissatisfied (c) Neutral (d) Satisfied (e) Very satisfied
IF (a or b) then question 25 IF (c, d, e) then question 27	

Question	Responses
26. What are the reasons for your dissatisfaction with the GIS?	(a) It provides inaccurate information. (b) The information is insufficient. (c) The application does not open sometimes. (d) It is not aligned with my job requirements.
27. What immediate improvements would you recommend for the GIS?	(a) Regular pre-defined system updates. (b) Show more asset information shown on the system. (c) Upgrade hardware to fully utilize the GIS.

28. How often do you use the asset care centre (ACC)?
IF (a) THEN question 28
IF (b, c, d, e) THEN question 29
	(a) Never
	(b) Daily
	(c) Weekly
	(d) Monthly
	(e) Other

29. Why have you never used the ACC?	(a) I have never heard of the ACC. (b) I have never had a serious enough query to contact the ACC. (c) I have never been able to contact the ACC successfully.

30. How would you rate the service from the ACC?
IF (d or e) THEN question 30
IF (a, b, c) THEN question 31
	(a) Poor
	(b) Weak
	(c) Average
	(d) Good
	(e) Excellent

31. What aspects of the service are good or excellent?	(a) Very knowledgeable staff (b) Very prompt response (c) Very courteous helpful staff (d) Other
32. What aspects of the service are average, weak or poor?	(a) Lack technical knowledge (b) Slow to respond (c) Discourteous manner (d) Other

33. What is your overall assessment of the asset management system?
IF (a or b) THEN question 34
IF (c, d, e) THEN question 33
	(a) It is a very efficient system.
	(b) It is an efficient system.
	(c) It is an average system.
	(d) It is an inefficient system.
	(e) It is a very inefficient system.

34. What do you believe is the main reason for assessing the asset management system as average, inefficient or very inefficient?	(a) User needs are not met. (b) No training was provided. (c) Poor quality user manuals. (d) Inefficient support services. (e) The system was not customized for eThekwini Electricity's needs.
35. Are there any additional comments /suggestions you wish to make to improve the asset management system?	