INTEGRATION OF INFORMATION MANAGEMENT SYSTEMS TO ENHANCE BUSINESS INTELLIGENCE AT THE DEPARTMENT OF TRANSPORT IN SOUTH AFRICA

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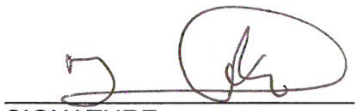
ABSTRACT

Public sector decision makers are confronted by pressures to make faster and better decisions as a result of the competitive environment they operate in. However, there is a trend in the public sector, including the Department of Transport (DoT) in South Africa, to invest in management information systems (MIS) that are highly fragmented and not aiding effective and timely decision-making. As a result, the country witnessed several service delivery protests since 2008 which also affected the public transport sector, such as the widespread burning of Metrorail trains several times by angry commuters. In most instances, poor service delivery emanates from the fact that public servants do not have information at their fingertips to make decisions. This quantitative study utilised Control Objectives for Information and Related Technologies 5 (COBIT 5) as a theoretical framework to investigate the integration of MIS at the DoT with a view to enhancing business intelligence for effective decision-making. Data were collected through a questionnaire directed at middle managers and senior managers that were selected through stratification of business units at the DoT, as well as analysis of documents such as system specifications and strategic plans. The study established that the DoT has several systems such as Alfresco, BAS, GIS, Logis and Persal to name a few, which serve different purposes. However, in most instances, the systems are not integrated as the current infrastructure did not support integration needs and plans to accommodate changing requirements. This is compounded by the system policy implementation constraints, as well as ageing legacy systems that are obsolete. The only component where MIS was found to be integrated, was in the financial business units (Supply Chain Management, Finance and Budgeting). Core business units use off-the-shelf systems and, in some cases, custom-made applications that do not integrate with any other system and thus hinder decision-making. In conclusion, decisions are made based on thumb-sucking, as management does not have access to comprehensive information that is stored in fragmented unintegrated systems. The study recommends that governance structures should be set up to deal with a more holistic business, information and technology architecture for the DoT that enable integration of various systems for effective decision-making. Failure to transform this pattern would lead to service delivery protests persisting. A further study on a framework to integrate MIS in the public sector is recommended.

Key terms: Business intelligence; management information systems; information management; systems integration; service delivery; COBIT 5

DECLARATION

I declare that **INTEGRATION OF INFORMATION MANAGEMENT SYSTEMS TO ENHANCE BUSINESS INTELLIGENCE AT THE DEPARTMENT OF TRANSPORT IN SOUTH AFRICA** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.



SIGNATURE

26 February 2018

DATE

DEDICATION

This dissertation is dedicated to my late son, Tumelo Chauke and my mother, Mantshe “N’wa-Chauke” Tshabalala, who during trying times believed in me when I enrolled for my first degree even though there was nothing to finance my studies with.

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Proverbs 13:20

Keep company with the wise and
you will become
wise.

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List of Abbreviations

ACB:	Automatic Clearing Bureau
ACL:	Audit command language
AGSA:	Auditor-General of South Africa
API:	Application programming interface
BAS:	Basic Accounting System
BI:	Business intelligence
CIO:	Chief Information Officer
CIPC:	Companies and Intellectual Property Commission
CGICTPF:	Corporate Governance of Information and Communication Technology Policy Framework
COBIT:	Control Objectives for Information and Related Technologies
COTS:	Commercial off the shelf
CSV:	Comma-separated values
CV:	Continuous variable
DAT:	Data analysis template
DHA:	Department of Home Affairs
DLCA:	Driving licence card account
DoT:	Department of Transport
DV:	Dependent variable
ECMS:	Electronic Content Management System
EDMS:	Electronic Document Management System
EIM:	Enterprise Information Management
eNaTIS:	Electronic National Transport Information System
ERP:	Enterprise resource planning
FOSS:	Free Open Source Software
FTP:	File transfer protocol
GIS:	Geography Information System
GRAP:	Generally recognised accounting practice

GWEA:	Government-wide enterprise architecture
GWM&ES:	Government-wide monitoring and evaluation systems
IBM:	International business machines
ICT:	Information and communication technology
IFMS:	Integrated Financial Management System
IMST:	Information management, systems and technology
IT:	Information technology
ITIL:	Information Technology Infrastructure Library
IS:	Information system
ISACA:	Information Systems Audit and Control Association
ISMS:	Information security management systems
ISO:	International Standards Organisation
ISS:	Institute of Security Studies
IV:	Independent variable
LOGIS:	Logistical Information System
MIS:	Management information systems
MRP:	Manufacturing resource planning
NASA:	National Aeronautics and Space Administration
NEPAD:	New Partnership for Africa's Development
NLTIS:	National Land Transport Information System
NLTSF:	National Land Transport Strategic Framework
NRC:	National Research Center
NT:	National Treasury
oCIO:	Office of the Chief information officer
PERSAL:	Personnel and Salary System
POPI:	Protection of Personal Information Act
PRC:	Presidential Review Committee
QDA:	Quantitative data analysis
RFQ:	Request for quotations
RQ:	Research question
RSA:	Republic of South Africa
SA:	South Africa
SADC:	South African Development Community
SANS:	South African National Standards

SARS:	South African Revenue Service
SITA:	State Information technology Agency
SMS:	Senior Management Service
SPSS:	Statistical Package for the Social Sciences
UNISA:	University of South Africa
UOG:	University of Glasgow
US:	United States
WC:	Western Cape

CHAPTER ONE
PUTTING THINGS INTO PERSPECTIVE

1.1 Introduction

Public sectors decision makers are confronted by pressures to make faster and better decisions as a result of the competitive environment they operate in (Lock, 2012:2). For example, in the public sector, policy makers and civil servants are encouraged to improve services provided to communities while at the same time working smarter to reduce costs (Boselli, Cesarini & Messanzanica, 2011:1). This is not always the case, especially in South Africa as the country witnessed several service delivery protests since 2008 (Institute for Security Studies, 2017). Even in the public transport sector such protests are wide spread as Metrorail trains were burnt several times by angry commuters. For instance, the Western Cape (WC) region lost 32 carriages in six separate incidents since October 2015 (News24.com, 2016). Wowczko (2013:5) states that in most instances, as in this situation, poor service delivery emanates from the fact that public servants do not have information at their fingertips to make decisions. The problem is compounded by the fact that public service decision-making is based on “gut feel” and lacks supporting data or analysis (Lock, 2012:2). Ngoepe (2012:85) further contends that without proper information, government would not be able to address social issues such as basic services including water and electricity to its population. Transport services is no exception even with the use of technology. Therefore, it is necessary that technology for managing transport is integrated to enable effective decision-making.

Mosebi and MacDonald (2009:1) state that the use of integrated technology would assist in an effective decision-making process when the correct information is available for those bus companies to receive a proper subsidy allocation from the government based on the ridership numbers since subsidies were paid according to bus tickets sold by bus operators. Furthermore, Fleisher and Hursky (2016:3) mention the key benefits of integrated technology as being producing intelligence more quickly across time zones, as well reliable and effective insights that can be directly linked from different management information systems (MIS). Tay (2016:19) argues that the benefits of enterprise information management (EIM) is maximising the value of the customer’s core digital transformation in the improvement of productivity. Willis

(2016:6) states that the integration of business ecosystems will create sustainable competitive advantage that will result in increased connections, bandwidth and business intelligence. Mudzana and Maharaj (2015:2) define business intelligence (BI) as the utilisation of a collection of technology and applications to enhance decision-making. Despite the importance of BI in service delivery in South Africa, there is a lack of integration of information systems, which has contributed greatly to the inability to share data across government and which resulted in decisions made on thumb-sucking (RSA, 2012:3).

For example, a team of experts was appointed on a Presidential Review Committee (PRC) to conduct a study, the recommendations and findings of which presented a report of "Developing a culture of good Governance" in relation to the operation, transformation and development of the South African Public Service (RSA, 2012:2). It became apparent to the PRC that, although huge financial resources had been invested in technology and systems, information technology (IT) assets were "not contributing significantly to service delivery or transformation objectives" (RSA 2007:3). These initiatives are supported by Schmitt, Borzillo and Probst (2011:58) when stating that systems are developed to assist in decision-making. Hartley and Seymour (2010:116) state that corruption and service diversion became prevalent due to weak oversight and communication by government officials regarding costs involved in projects being implemented and monitoring of service delivery patterns.

The lack of enhanced business intelligence tools is widespread due to the use of incompatible platforms, networks and applications; unnecessary duplication of functions and systems between line departments and provinces (RSA, 2012:3). Wache, Vögele, Visser, Stuckenschmidt, Schuster, Neumann and Hüebner (2001:1) advise that the following has to happen in order to achieve interoperability in a heterogeneous information system:

- Finding a suitable information source that might contain data needed.
- Bringing together heterogeneous and distributed computer systems.
- Querying the information.

Early in the first term of the democratic government in South Africa (1994 – 1999), it became apparent that the machinery of government was ineffective, inadequate and the democratic government was running at a risk of failing to deliver on its mandate to the people of South Africa (Commission of Inquiry Regarding the Transformation and Reform of the Public Service, 1996a:1). In the presentation of the PRC report, it was specified that information management, systems and technology (IMST) "can and should play an imperative role in public service reform and consolidation, not merely as an important support function but as an integral component of improved forms of governance and service delivery" (RSA, 1998:78).

Ponelis and Britz (2011:4) highlight that systems are supporting decision-making in organisations as an important component in organisational information dissemination and are considered to have the potential to impact positively on performance and competitiveness. This involves intelligence that is developed from the internal and external environment that would be combined to set a baseline for future decision-making in the organisation (Pun & Nathai-Balkinssoon, 2011:203). This study assessed the integration of information management systems at the Department of Transport in South Africa with the view to enhance BI for effective decision-making.

1.2 Background to the study

In 2009, the government of South Africa adopted the Government Wide Enterprise Architecture (GWEA) 1.2 Framework (RSA, 2009b:5) to provide guidance and development of government systems for the interoperability to be achieved. Interoperability is regarded as a process that leverages the ability of software products to work with other software products without special effort from end users, thus creating the capability to interact and exchange information (Telesca, Rana & Ion, 2007:1). To internalise the above, the office of the chief information officer (oCIO) at the Department of Transport (DoT) developed the information and communications technology (ICT) strategic plan (2013/18), with a vision to:

> Provide effective, flexible, efficient and secure information and communication technology (ICT) that will enable the Department of Transport and its partners (agencies, provinces) to respond appropriately to the needs and demands of the department mission to deliver better services to citizens.

One of the strategic objectives within the DoT IT strategic plan is to build and improve departmental ICT capabilities and skills, which are key to assist with the interoperability process (RSA, 2013b:4). Hartley and Seymour (2010:116) propose that information system (IS) development models would help to determine the state of readiness of an organisation to adopt or undergo digital systems integration. By leveraging on analytical technologies, organisations would capture and integrate multiple disparate types of data and ultimately collaborate and share insight across the silos within the organisation (Lock, 2012:3).

Van Niekerk (2015:6) further outlines that the use of management information systems for command and control of integrated cyber operations would increase the efficiency of these operations by providing commanders with better decision support tools. The South African government also proposed Government-wide Monitoring and Evaluation Systems (GWM&ES) with an aim of providing constantly updated, easily accessible information on performance and government for decision makers to enable learning and to inform policy development (RSA, 2007:39). In their study, Teklegiorgis, Tadesse, Mirutse and Terefe (2016:2) illustrate that the value of information is determined by its utilisation in decision-making. This is also evident in the DoT in South Africa's strategic plan (2015/16 – 2019/20) which indicates a strategic risk of having insufficient intelligence caused by not sharing business knowledge and not getting value (RSA, 2016a:34).

As per the constitutional mandate, the DoT in South Africa (RSA, 2016a:12) has legislative responsibilities at different levels of government with regard to airports, roads, traffic management and public transport. Many of DoT-funded services are provided by provincial and local government spheres and public entities, using various grants, agency transfers and policy interventions (RSA, 2013b:7).

> The policy mandate of the department of Transport "is to provide safe, reliable, effective, and fully integrated transport operations and infrastructure which will best meet the needs of freight and passenger customers at improving levels of service and cost in a fashion which supports Government strategies for economic and social development whilst being economically

and environmentally sustainable" (National White Paper on Transport Policy, 1996b).

According to the Transport White Paper (RSA, 1996b), the primary objectives of the DoT are the development of overarching policy and coordination of various government entities. The Centre of Excellence will provide a single coordination mechanism and interface for all transport and related sector information demands that will enable proactive responses to and decision-making regarding challenges facing the sector.

1.3 Problem statement

Public organisations are challenged by a data environment that is highly fragmented and that impedes their ability to create and share business insight across functions within the organisation (Lock, 2012:3). Pun and Nathai-Balkinssoon (2011:218) contend that, as a result, there is still a need to investigate how these critical components of knowledge can be protected as a way to benefit countries' competitiveness. Due to a lack of integration of systems, BI implementations are ad hoc and take place at departmental level and without any overall enterprise BI strategy driving the programme. Having multiple disconnected BI projects leads to inefficiencies and fragmentation firmly places the burden of integration, operation and recurring support on the ICT organisation. Generally, systems are implemented independently on the basis to respond to specific user demands and with little attention paid to projects in other areas or to existing software (RSA, 2012:3).

Huge budget amounts are invested in ad hoc, non-integrated and non-sustainable BI solutions. Procurement costs are higher and projects take longer to implement, since the solutions are bought based on wants and not needs (Hartley & Seymour 2010:120; RSA, 2012:4). In other circumstances, the BI is not available and there is a huge reliance on ad hoc data collection methods or standard application reports. The silo approach to BI is unable to realise success due to a lack of an integrated approach towards BI implementation.

Adherence to statutory obligations can be undermined when dealing with ad hoc BI solutions (i.e. the Spatial Data Act is an example such laws and regulations) (Didiza,

2016:15). The gap identified by this study is that the factors that may influence the integration of critical BI components within the DoT to enhance decision-making are still not clear. There is a need to investigate how BI as a strategic resource could be integrated and how MIS could improve enhanced the decision-making process at the DoT. The study utilised the enablers of Control Objectives for Information and Related Technologies 5 (COBIT 5) (see section 1.6 for a comprehensive discussion of the framework) as a framework to guide the objectives, literature review, data collection and reporting. The constructs utilised include policies, processes, culture, people and infrastructure.

1.4 Purpose and objectives of the study

The purpose of this study is to investigate the integration of information management systems at the DoT with the view to enhancing BI. To ensure that this purpose is achievable, the following research objectives were investigated:

- To determine the business intelligence strategies (principles, policies and frameworks) implemented in the DoT.
- To identify MIS (services, infrastructure and applications) implemented in the DoT.
- To assess how the processes for integration of MIS can effectively enhance decision-making.
- To assess the culture, ethics behaviour and organisational structures as key success factors in decision-making activities in the DoT.
- To identify people, skills and competencies required for the successful completion of BI activities for correct decision-making.

1.5 Research questions

Developing focused research questions is part of the data collection process which will help to narrow the study and guide the study design before any data can be collected (Neuman, 2014:46).

1.5.1 Primary research question

How could the integration of information management systems assist in enhancing business intelligence to improve effective decision-making processes within the DoT in South Africa?

1.5.2 Secondary research question

In ensuring that the primary research question is addressed, the following secondary questions need to be answered:

- What business intelligence strategies can be implemented in the DoT?
- What processes for the integration of management information systems (MIS) can effectively enhance decision-making?
- How can culture, ethics, behaviour and organisational structures be key success factors in decision-making activities in the DoT?
- What are the MIS (services, infrastructure and applications) implemented at the DoT to enhance BI?
- What are the skills, competencies and people required for successful completion of BI activities for correct decision-making?

1.6 Theoretical framework

A theoretical framework is regarded as “a very general theoretical system with assumptions, concepts and specific social theories” (Neuman, 2014:85). A chosen theoretical framework for the study as stated by Ridley, Young and Carroll (2014:1) defines COBIT 5 as an open standard that is being used increasingly by a diverse range of organisations throughout the world to ensure alignment between the use of information technology (IT) and its business goals. Olaitan and Flowerday (2016:1) investigated ways in which organisations can adapt a suitable IT governance framework to manage its investments. The enablers of the COBIT 5 framework were chosen because they form an integral part of enterprise governance and consist of leadership and organisational structures and processes that ensure that the organisation’s IT sustains and extends the organisation’s strategies and objectives (Devos & Van de Ginste, 2015:95). The main enablers of the COBIT 5 framework that will be used in the study are defined in seven categories in the ISACA Business Framework (2012:27) (see Figure 1.1).

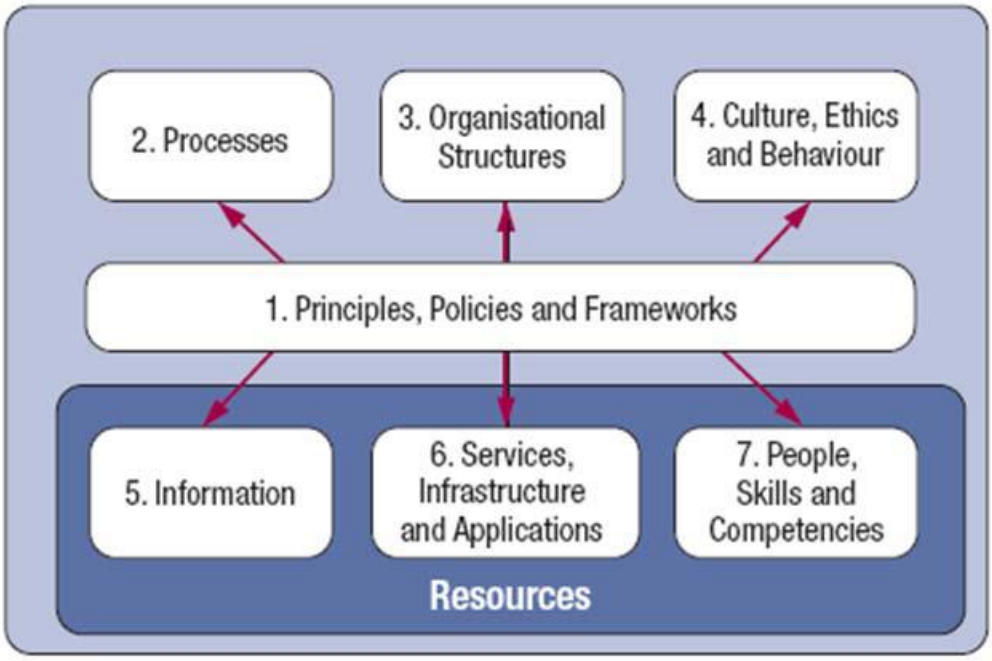

Figure 1.1: COBIT 5 Enablers
(Source: ISACA, 2012:27)

The COBIT 5 framework has five principles and seven enablers in supporting the implementation of a common governance and management system for an organisation, thereby enabling a holistic approach (Efe, 2013:38).

1.7 Justification of the study

Hartley and Seymour (2010:117) highlight that government officials must leverage and value their information assets to make use of BI to holistically understand the citizens or South African public and the ability to use resources effectively. The integrated approach to MIS would ensure that BI investments support the transport entity's efforts to improve services to citizens, simplify business processes and improve the DoT's overall interactions with its clients. It is critical that the integration of MIS should be examined and understood thoroughly before any strategies of obtaining value from enhanced BI can be realised. In the study conducted in the private sector by Venter and Tustin (2009:109), it was found that 70.7% of staff widely used BI to report back on their competitors in South Africa. What Wowczko (2013:4) found is that the public sector does not practice BI, as opposed to the private sector, and it is still struggling to recognize the worth of BI. Hartley and Seymour (2010:117) present the same idea

that government entities are measured by their ability to deliver on their mandate while the private sector is measured on profits and losses.
The intent of this research is to:

- provide a comprehensive analysis of the extent of the proposed MIS and its likeliness to affect the DoT in decision-making
- identify how other integrated systems can benefit the DoT
- identify potential risks that MIS integration brings and mitigate such risks
- formulate options on the integration of the MIS for the DoT.

1.8 Scope, delimitations and exclusions

The study is limited to a national government department as defined in the interim Constitution of the Republic of South Africa, No. 200 of 1993, which was replaced by Act No. 108 of 1996 and further amended by the 16th amendment of 2009 (RSA, 2009a:21). The purpose of the study is to investigate the integration of information management systems to enhance business intelligence. The study covered BI strategies, data warehousing, business analytics, Electronic Content Management Systems (ECMs) and Enterprise Resource Planning (ERP) solutions. The study would not provide an implementation plan for the BI for the public organisation respondents selected. Respondents were selected across the organisation among the middle management and senior management because they are regarded as organisational decision makers.

1.9 Definition of key terms

Neuman (2014:205) outlines that “a good definition has one clear, explicit, and specific meaning”. The key terms used on the study are mentioned are business intelligence, management information systems and information management.

1.9.1 Business intelligence

BI is “a collection of technology and applications used to enhance decision-making” (Mudzana & Maharaj, 2015:2). BI is also defined as a “conceptual umbrella for technology and tools fostering informed decision in business” (Wowczko, 2013:3). The knowledge and skills set created would provide value to organisations and the

potential to create and sustain competitive advantage (Mitchell & Boyle, 2009:67). Hartley and Seymour (2010:116) state that since BI is an ICT tool that allows its users to leverage the best use of the organisation's data by providing aggregation, analysis and reporting functions of such data and facilitating the achievement of mission objectives through required information or intelligence to the decision makers with regard to the evaluation and control of predefined metrics.

1.9.2 Management information system

Laudon and Laudon (2006:44) defines MIS as "the study of [computer based] information systems (IS) in business management". Webopedia (2016:1) states that MIS refers "to a computer system that provides managers with the tools to organize, evaluate and efficiently manage departments within an organisation". It is in the context that it is used in this study as indicated by French, Maule and Papamichail (2009:99) that MIS was developed for the production of reports that were organising and summarising the data necessary for management decision-making.

1.9.3 Information management

Pirttimăki (2007:2) defines information management as "identification of what information is needed, how it should be gathered, how it should be organized, where it should be stored, and who in the company should have access to it". Information is required to keep the organisation running and well governed, but at operational level, information is very often the key product of the enterprise itself (ISACA, 2012:27). This process was considered crucial by Ngoepe (2014:4) who states that a lack of proper information and record-keeping presents risks to be considered, namely, reputation, legal, financial and information loss in order to manage the information.

1.10 Research methodology

The use of research methodology assists in a process to be used to systematically solve the research problem for the study (Kothari, 2004:8). To ensure that the objectives of this study and the research questions are answered, a quantitative research approach was adopted, as this involves the collection of quantitative data through surveys and documents analysis in response to research questions (Creswell, 2014:143). Research approach would test objective theories by examining the

relationship among variables which in turn can be measured, typically on instruments, so that numbered data can be analysed using statistical procedures (Creswell, 2014:158). The sampling design for this population was single-stage sampling procedure in which the researcher had access to names in the population and selected individual respondents to take part in random sampling (Creswell, 2014:174). The study involved the stratification of middle and senior management through business units. Stratification means that specific characteristics of individuals (e.g. gender – females and males) are represented in the sample and the sample reflects the true proportion in the population of individuals with these specific characteristics. The characteristics used in stratifying the population for this study were job positions.

The study used a combination of open- and closed-ended questionnaires as a data collection tool (Creswell, 2014:18).

Literature was studied on public organisations that have managed to have proper BI and best practices. The organisation's annual reports, strategic planning documents and documents relevant to BI will be investigated. These documents assisted in obtaining themes in the area of study.

Policy and procedure documents from the DoT were assessed in comparison to other BI policies and procedures in other public organisations. These assessments of BI focused on public organisations globally. The analysis of BI assessments was sought from the literature of best practices already implemented for the methods that were used for the integration of MISs. As data were collected from respondents in the study case, preliminary versions of a measure were used to remove the ambiguities so as to improve the reliability (Neuman, 2014:212). This further showed that the quality of the measure can improve over time testing the same thing more than once and returning the same outcomes (Van Zyl, 2014:115). Neuman (2014:213) states that in order to address and improve reliability, the researcher would use a variety of techniques such as interviews and document studies to record their observations consistently. Van Zyl (2014:115) states that in this type of measure, content validity is used to evaluate on how well the items represent the entire universe. This involves giving a fair, honest and balanced account of social life from the viewpoint of someone

who lives it daily (Neuman, 2014:216). A comprehensive discussion of the research methodology employed in the current study is presented in Chapter Three.

1.11 Research ethics

The study involved gathering information directly from human subjects by means of a survey about the integration of systems assist in the adoption of BI to improve decision-making processes within the DoT. Respondents were informed that they are participating voluntarily and can withdraw from the interview process at any time. Data used in the study was sourced from the public domain. For the ethical issues that arose during the study, the ethical clearance was requested as prescribed by the policy of the University of South Africa.

The following basic principles, as mentioned by Van Zyl (2014:85), assisted in addressing the ethical considerations:

- Respondents that were identified for this research were protected from any harm.
- Ensuring anonymity of respondents and the collected data by maintaining privacy. If it happens that the researcher wants to record the interview, the respondent must agree to it.
- Potential respondents were not forced to participate in the study.
- Informed consent through a form or a letter was read and signed by each of the respondents as the selected case study environment would have helped in addressing ethical behaviour.
- Confidentiality was maintained throughout the research.
- The results of the entire research were shared with the organisation and the respondents as it might bring benefits to the running of the organisation.

1.12 Chapters outline

- Chapter One – Introduction and relevance of study. This chapter formed the base of the study by introducing challenges that were encountered throughout the study case of the DoT in integrating information management systems to enhance business intelligence for effective decision-making. It further

presented the methodology that was used when conducting the study and addressing ethical considerations.

- Chapter Two – This chapter gave a better understanding of the literature review on integrated systems, BI, organisational culture and frameworks that assist in systems integration in private and public sector organisations.
- Chapter Three – This chapter discusses the detailed approach and design of tools that will be employed for this study with the specific reference to the selected population, the sample and the measuring instrument developed.
- Chapter Four – Presentation of results. This chapter presents the study case of the DoT in the form of findings.
- Chapter Five – Discussions. This chapter contains the discussions of the findings, together with the interpretation and analysis of the responses.
- Chapter Six – Conclusions and recommendations. This chapter includes the conclusions and the recommendations based on the research conducted.

1.13 Summary

The purpose of this chapter was to introduce the reader to the broader research area of this study. This was achieved as introduction of the study and presented the reader with the background of the study. Next, problem statement was narrowed down. The purpose and objectives of the study for the topic “Integration of information management systems at Department of Transport to enhance business intelligence” was discussed, including the main objective and sub-objectives of this research.

The research questions and secondary questions that would guide the study direction were indicated. The preliminary literature review and theoretical framework were also outlined. The author provided the justification of the study, and the scope of the study was indicated and presented. Furthermore, the definitions of terms used were clarified. Methodology selected was mentioned and the ethics that guide the research were explained.

The proposed chapters for the study were decided on and in the next chapter, the groundwork will be further expanded by reporting on the literature study conducted about the different aspects such as origins and strategies to be used on BI among

others. The following chapter will review literature in relation to the integration of information management systems to enhance business intelligence for effective decision-making.

CHAPTER TWO

LITERATURE REVIEW: THE INTEGRATION OF MANAGEMENT INFORMATION SYSTEMS TO ENHANCE BUSINESS INTELLIGENCE

2.1 Introduction

The preceding chapter has laid the foundation by providing the background to the study, contextual and conceptual setting, theoretical framework, problem statement, research objectives and questions, justification of the study, research methodology, as well as definition of key terms used in the study. Having presented the background and purpose of the study, it is appropriate to bring the reader up to date with the previous research that brought a focal point to BI, MIS, technologies and culture, ethics behaviour and organisational structures.

Bryman (2012:8) suggests that the necessity of literature review is to be knowledgeable about what is already known about the topic being studied. On the other hand, Creswell (2014:26) advises that a literature study provides insights into ways in which a researcher can limit the scope to a needed area of inquiry. The literature review process is conducted before trying to answer a question (Neuman, 2014:126).

The purpose of this chapter is to obtain an understanding from the literature about the following themes: business intelligence strategies, the existence and purposes of the MIS that can be used for decision-making. the integration of systems would assist in enhancing the adoption of BI, the processes or lack of integration of MIS hindering the adoption of BI, the skills, culture, ethics and competencies for systems for maintaining and supporting the BI integration activities. COBIT 5 framework guided the review of relevant literature for the study as indicated in Figure 2.1.

Table 2-1: Framework and literature linkage

COBIT 5 Framework enablers	**Literature themes**
Principles, policies and frameworks	2.3 Business intelligence strategies
Information	2.4 Management information systems
Services, infrastructure and applications	
Processes	2.5 System integration

COBIT 5 Framework enablers	Literature themes
Culture, ethics and behaviour	2.6 Culture, ethics behaviour and organisational structures
Organizational structures	
People, skills and competencies	2.7 People, skills and competencies

The choice of the framework was that COBIT 5 focuses on holistic approach of enterprise IT with the following: Maintaining of high quality information to support business decisions; The achievement of strategic goals through the effective and innovative use of IT; The optimisation of costs of IT services and technology and supporting the compliance with relevant laws, regulations, contractual agreements and policies (ISACA, 2018). The theoretical framework use was to address the BI challenges at DoT in a holistic manner.

According to Didiza (2016:15), BI was not available at the DoT and there was a huge reliance and ad hoc data collection methods or standard application reports from the following systems: National Land Transport Information System (NLTIS), Electronic National Transport Information System (eNaTIS), Driving Licence Card Account (DLCA), Domestic and International Licensing for Maritime and Aviation Clearances, etc.

2.2 Brief background of business Intelligence

BI and related intelligence activities are thought to have had its origins in military planning that helped with strategies in battles (Pirttimăki, 2007:4). Heinze (2014) outlines that Richard Millar Devens' 1865 work, *Cyclopaedia of Commercial and Business Anecdotes,* contained the first known usage of the term "business intelligence" when he used it to describe the way that a banker, Sir Henry Furnese, succeeded because he had an understanding of political issues, instabilities and the market before his competitors.

As stated by Shwetabh (2014:3), the term 'business intelligence' was coined in 1958 at international business machines (IBM) by Hans Luhn. It was described as "the ability to apprehend the interrelationships or presented facts in such a way as to guide action towards a desired goal". Doyle (2016) also states that, prior to BI popularity,

organisations were created to be silo based, whereby this resulted in a ‘hot potato’ syndrome.

Joly (2016) states that in the 1970s, various business applications came about and helped with putting siloed data into databases with a view that was not consistent. Kernochan (2014) states that in the late 1980s, most businesses did run-the-business order entry, manufacturing resource planning (MRP) and accounting via in-house solutions that ran during working hours or in "batch mode" after hours and on weekends. According to Wowczko (2013:1), ‘business intelligence’ is a term that was popularised in 1989 by Gartner Group, through its analyst Howard Dresner as conceptual umbrella for technologies and tools fostering informed decisions in business by organisations. According to Panian (2012:121), nowadays BI has evolved, as there is explosive growth on the web that deals with the automatic search of information resources available online namely web content mining and the discovery of user access patterns from web servers known as web usage mining. Serumaga-Zake (2017:1) emphasises that BI systems have become increasingly important over the past few decades and are nowadays one of the top spending priority areas of most organisations. Telesca, Rana and Ion (2007:1) state that organisations derive value from these investments by providing structures that facilitate the implementation of strategy and goals.

2.3 Business intelligence strategies

Thompson, Strickland and Gamble (2009:6) describe company strategy as “management’s action plan for running the business and conducting operations to pursue a particular set of actions in growing the business, attracting and pleasing customers, competing successfully and improving financial and market performance”. Pirttimǎki (2007:67) states that when an organisation has a successful strategy, it enables it to perform different from its competitors. For the purpose of this study, as indicated by Wheelen and Hunger (2012:19), the DoT would follow a cooperative strategy by forming an alliance with other agencies / entities in order to provide competitive service by receiving information from various sources to use for its decision-making process.

Information Systems Audit and Control Association (ISACA) (2012:27) explains that

strategies, with the inclusion of principles, policies and frameworks, as the vehicle to translate the desired behaviour into practical guidance for the day-to-day management for effective decision-making as indicated by Wheelen and Hunger (2012:15) (see Figure 2.1).

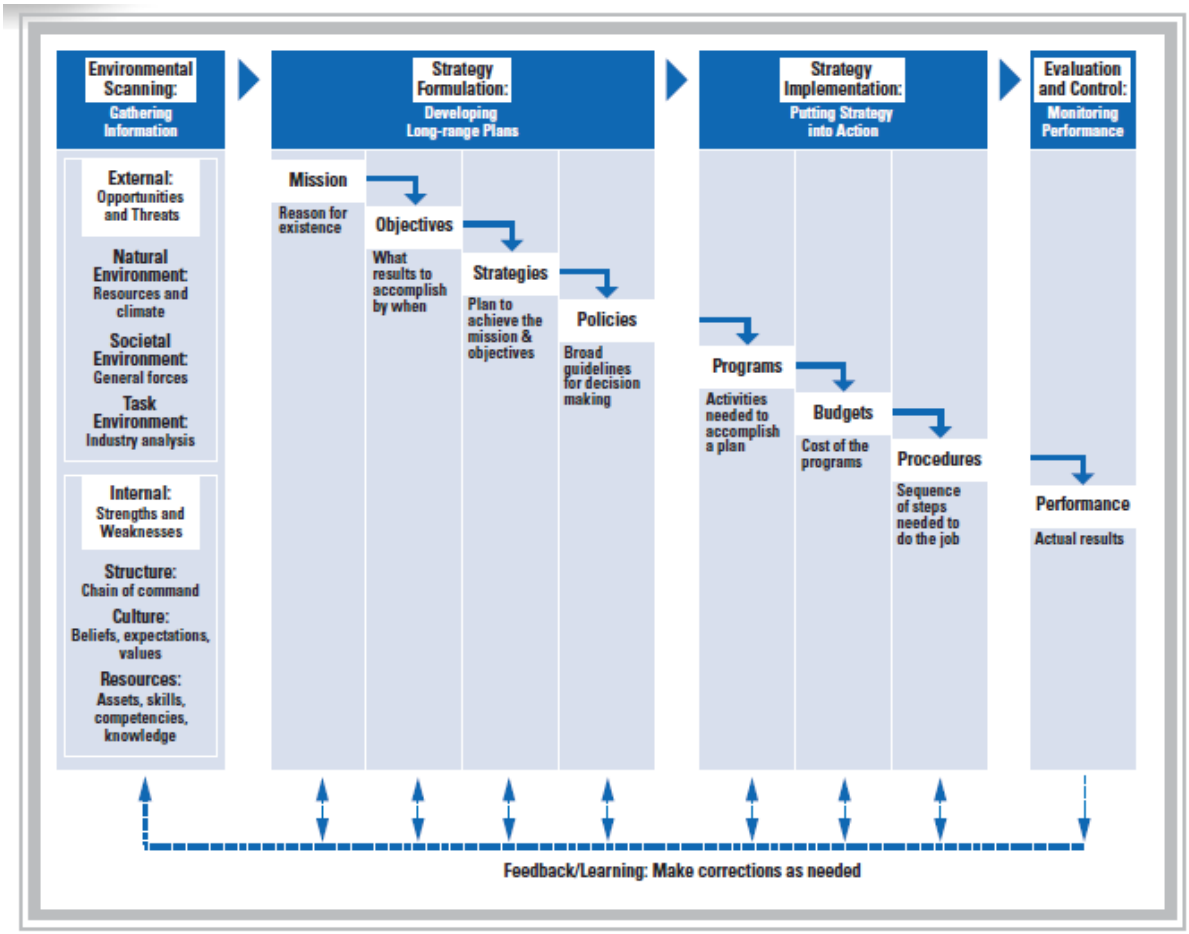

Figure 2.1: Strategic management model
Source (Olaitan & Flowerday, 2016:3)

Olaitan and Flowerday (2016:3) state that this can be achieved by having governance known as a measurement and control systems of management, accountability and supervision required to harness the complexity and competence of an organisation in order to achieve the goals of that organisation as depicted in the strategic management model in Figure 2.1.

Angelo (1999:3) highlights that, historically, governments had to be competitive in order to show their supremacy; one example was when the United States (US),

through the National Aeronautics and Space Administration (NASA), focused on winning the space race with the Soviets. This in turn ensured that NASA was rewarded with more resources due to the gains achieved when they managed to put a man on the moon and bring him back to earth successfully. Furthermore, Becerra-Fernandez and Sabherwal (2010:3) commented on how NASA undertook its efforts to elicit and capture the knowledge that was created to successfully land a spacecraft and appears appeared that knowledge created that would have assisted in future decision-making had evaporated after the successful creation of such knowledge.

On the other side of the world, a study was conducted on the Top 50 Finnish companies in 2002. These same companies were surveyed further and it was found that the use of BI has improved from 80% to 95% in 2007 (Pirttimăki 2007:16). The initial survey results in turn had brought companies to the realisation that they needed to enhance information to support their planning and decision-making.

The public sector is considered to operate in a non-competitive environment. BI can assist government entities in decreasing operational costs and increasing the quality of services provided (Wowczko 2013:3).

As it is explained by Sunassee and Sewry (2002:235), most company executives are of a view that the critical asset that separates their organisations from the competition is the intellectual capital of their employees. Managing this intangible asset involves a change in mindset, since previously managers did not encourage the dissemination and sharing of intelligence amongst employees. Boisot (1998:2) shares the same sentiments when he describes that knowledge accumulated by the organisation can be viewed as assets in their own right.

The question that might arise is whether having to share the valuable knowledge asset in your possession would lower its value or would increase to become twice as useful (Boisot 1998:74). The answer stated by Pirttimăki (2007:56) is that a lack of information capital is the main failure of business strategies. Yiu, Sankat and Pun (2013:103) consider that the foundation of organisational competitiveness in the contemporary economy has shifted from tangible resources to knowledge.

This is further illustrated by Serumaga-Zake (2017:1) when he views BI as a technologically driven process used to facilitate the organisation's objectives by the provision of the required information to the decision makers. Gartner (2011:8) saw a need to have a strategic view that must also encompass business processes and decision processes, as well as the processes for creating an information infrastructure on top of which BI and analytics initiatives are implemented.

The University of Glasgow (UOG) (2015:6) states that in order to execute a successful BI strategy, the following system output must happen:

- Analysis of competitors' data to identify strengths and weaknesses to exploit.
- Identification of gaps in markets.
- Performing of detailed what-if scenarios and the impact of different strategies.

2.4 Management information systems

According to O'Brien and Marakas (2008:102), MIS was created for the provision of real-world understanding of information systems for business in order to revitalise processes thereby improving decision-making and gaining a competitive advantage. In addition to that, Bidgoli (2015:7) describes MIS as an "organized integration of hardware and software technologies, data, processes and human elements designed to produce timely, integrated, relevant, accurate and useful information for decision-making purposes". French, Maule and Papamichail (2009:98) describes that with the advancement of computing power in the 1970s, MIS was developed to produce reports and summarise the necessary data for management decision-making. The MIS includes services, infrastructure and applications as described by ISACA (2012:27) to provide the enterprise with information technology processing and services. According to Telesca, Rana and Ion (2007:2), the enterprise software and applications are technologies used to capture, manage, store, preserve and deliver content and documents related to organisational processes. The UOG (2015:4) states that there should be a view that is persistent to improve the management of information from multiple sources to allow decision-making for the benefit of that organisation. Pirttimăki (2007:77) outlines benefits that BI systems must have for effective decision-making:

- The relevance of intelligence, timely dissemination and presentation for easy use.
- New information sources to easily integrate with existing sources that the organisation has already deployed.
- Effective MIS to combine multiple information sources with processing methods and delivery systems.

Becerra-Fernandez and Sabherwal (2010:46) state that the information technology infrastructure consists of transactional processing systems and MISs, which are directly developed to pursue management of information. Since organisations use data from a variety of sources that are fed into MISs where quality and integration become important to manage BI performance and reliability of results (Işik, Jones & Sidorova, 2013:15). For example, Becerra-Fernandez and Sabherwal (2010:48) state that there might be projects in artificial intelligence, which would try to capture an expert's knowledge in systems.

There have been studies that were done on the use and successes of BI in both the private and public sector that provided insights into the extent of South African BI adoption. Early empirical studies were conducted into the financial and other benefits of BI use in the large private telecommunications organisations using triangulation of quantitative and qualitative methods. It was further noted that the organisations studied did not fully understood BI and its benefits or, where they did, they had never used BI to its full potential (Dawson & Van Belle, 2013:2).

Mosebi and McDonald (2008:1) investigated the application of BI in subsidised bus companies in South Africa and found that the companies were relying on ad hoc reports for the supply of information to daily operations. This method was time consuming and errors were being experienced in the process. The authors indicated that BI can be applied beneficially in the subsidised bus industry since the industry is dependent on subsidies received from the state.

2.4.1 Organisational data growth

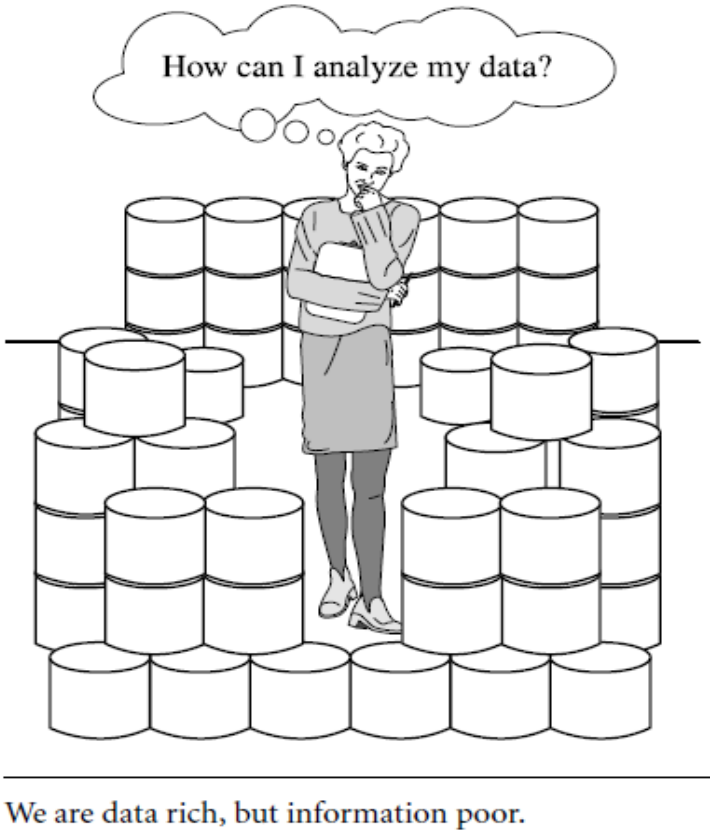

Figure 2.2: Data abundance

Source: Han, Kamber and Pei (2012:5)

An illustration in Figure 2.2 by Han, Kamber and Pei (2012:5) that the challenges that organisations encounter have accumulated large deposits of data in their databases. The Commonwealth of Australia (2013:1) states that 90% of the data in the world has been created in the last two years alone and there is a prediction that data will increase 44 times by the year 2020. There has been a tremendous, fast-growing amount of data, collected and stored in large and different repositories that have exceeded human ability to comprehend without any powerful data analysis tools (Han, Kamber & Pei, 2012:5). French, Maule and Papamichail (2009:104) advise that in order for organisations to obtain value from seldom-used archived data, they should implement data mining tools that uncover important data patterns while contributing to the organisation's strategies, knowledge bases and scientific research. According to Doyle (2016), organisations have great measures through BI systems against shared

goals and objective measures and this creates intelligence and meaningful information upon which to make informed decisions.

As highlighted by Shwetabh (2014:10) in Figure 2.3, the BI system has four major components, which are as follows:

- Data warehouse: source data. French, Maule and Papamichail (2009:102) define this as “a system in which all organisations’ databases are brought together and achieved in one place, together with the software tools to enable detailed querying, more general exploration of the data and generation of reports”.
- Business analytics: collection of tools for manipulating, mining and analysing the data in the data warehouse. Earls (2016:4) further states that business analytics is used by companies that are committed to data-driven decision-making through the practice of iterative, methodical exploration of an organisation's data with emphasis on statistical analysis.
- Business performance management: used for the monitoring and analysing of performance. Panian (2012:4) refers to this as a tracker of actual performance against expectations.
- User interface: dashboard and other information broadcasting tools. Didiza (2016:18) further states that this layer displays information in different formats to different users.

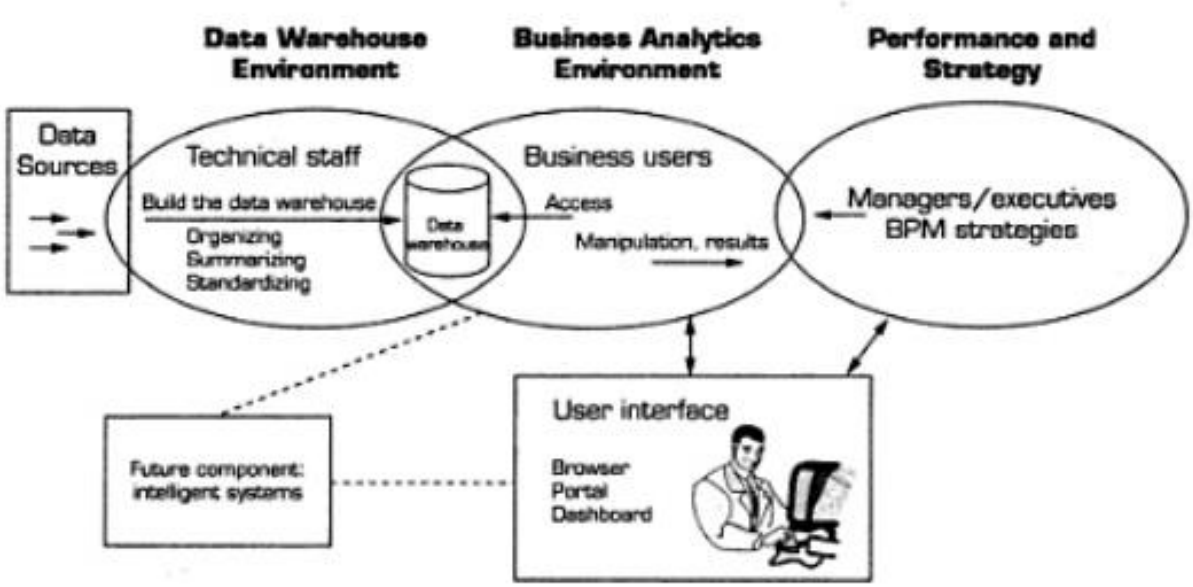

Figure 2.3: The architecture of BI

(Source: Shwetabh, 2014:10)

Boisot (1998:50) studied the value of having a discrimination and filtering of information to reduce complexity as abstraction, which is a form of reductionism. The process allows work by letting the few represent the many as depicted in Figure 2.4.

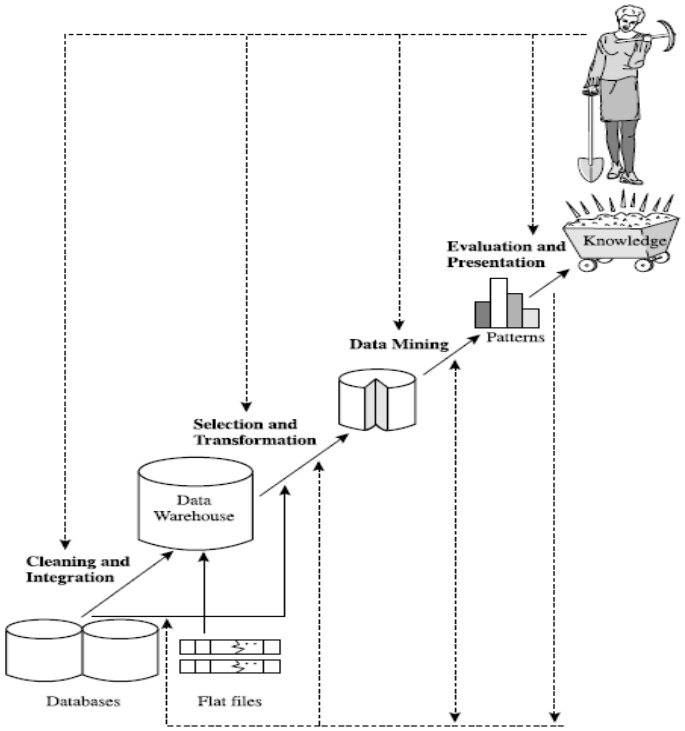

Figure 2.4: Knowledge discovery process

Source: Han, Kamber and Pei (2012:7)

As depicted, organisations would like to place value on knowledge within their domain for competitive advantage. Han, Kamber and Pei (2012:5-7) describe the steps as follows:

- Cleaning – this process involves the removal of noise and inconsistent data
- Data integration – the combination of multiple data sources
- Data selection – data that are relevant to the analysis task are retrieved from the database
- Data transformation – this takes place when data are transformed or consolidated into forms appropriate for mining by performing a summary or aggregation operations.
- Data mining – this is an essential process where intelligent methods are applied in order to extract data patterns. French, Maule and Papamichail (2009:102) names the term “tools that seek to recognise possible new patterns”. It is on that note that Panian (2012:119) regards data mining as a powerful tool that coverts detailed data into intelligence that a business can use to predict future trends and behaviours.
- Pattern evaluation – this is used to identify the truly interesting patterns representing knowledge based on interesting measures. Panian (2012:122) highlights the use of sophisticated techniques from artificial intelligence, data mining, psychology and information theory to mine for knowledge from the collected data.
- Knowledge presentation – this is where visualisation and knowledge representation techniques are used to present the mined knowledge to the user. This is further illustrated by Negash (2004:5) when he states that BI converts data into useful information, through human analysis, into knowledge.

2.4.2 Business intelligence technologies

Mangalaraj, Singh and Taneja (2014:2) state that technology plays an important role in collecting and processing data and information, and its availability to the right people in the right format at right time to support business decisions and strategic thinking. As with the evolution of technologies around BI and the perception that it emerged from decision support systems as highlighted in Figure 2.5, any BI solution should

combine with a data warehouse to transform data into usable, actionable business information (Wowczko, 2013:2). Venter and Tustin (2009:95) acknowledge that IT in the form of hardware and, especially, software is playing a key role in ensuring that BI is gathered, stored, analysed and presented in a simple, useful manner.

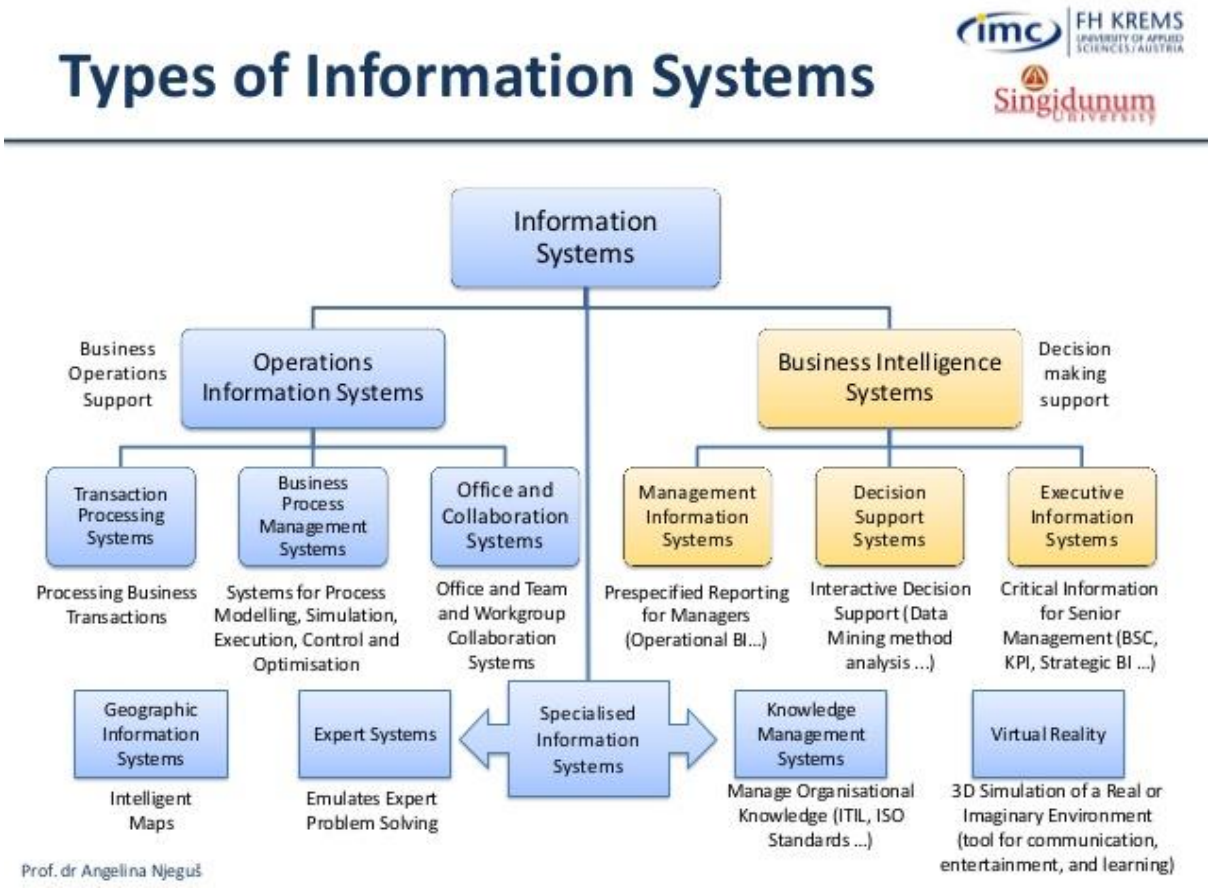

Figure 2.5: Types of information systems
(Source: Njeguš, 2013:1)

Yiu, Sankat and Pun (2013:106) state that technology can be used systematically in managing individual, group and organisational knowledge. The overview of the types of information systems is depicted in Figure 2.5 (Njeguš, 2013:1). For the purpose of this study, only business intelligence systems will be discussed. For example, there might be projects in artificial intelligence that would attempt to capture an expert's knowledge in systems (Becerra-Fernandez & Sabherwal, 2010:48). While there are many systems that are used in the context of BI, the typical BI would consist of executive information systems (EIS), online analytical systems, decision support

systems and knowledge management systems to give better insight into business operations as depicted in Figure 2.5 (Pirttimăki, 2007:80).

2.4.2.1 Management information systems in use at the Department of Transport

RSA (2003:86) presents the four main transversal systems used by South African government departments and their strive towards obtaining a better understanding of the study. The system's role, functionality and shortcomings are explained in detail (RSA, 2003:86) (see Table 2.2).

Table 2-2: Financial administration and management information systems

System	Main functions	Functionality	Shortcomings
Personnel and Salary System (Persal)	• Total human resource planning (Organisational structure and establishment administration). • Personnel administration: appointments promotions terminations, personnel development, service conditions and benefits. • Salary administration: all types of payment of allowances and deductions and correct tax and fringe benefit calculations. • Programmatically adjustment, i.e. salaries	• Caters for: • Magnetic tape interface for • insurance companies. • Senior management salary packages. • Subsistence and travelling claims to comply with SARS requirements. • Access and profile enhanced. • Interface with Government Employee Pension Fund. • Introduction of "entire" facility allows for transfer of data between bureaus. • Persal notices and manuals available in intranet. • Provides for reprint of IRP5 certificates and local printing. • Skill development • Enhancements.	• Does not cater for total personnel administration of educators • Does not optimally cater for certain control measures • Scanning facilities not available

System	Main functions	Functionality	Shortcomings
	and state contributions of medical and housing allowances. • Management Information: various reports are available.	• Various reports available in • electronic format. • Verification of data with Home Affairs.	
Basic Accounting System (BAS)	• Cash-based online • system • Accounting • Transactions • Payments • Debtors • Bank reconciliation • Detailed reports • Online enquiry • Maintenance of code files • Various management reports available • Budget-capturing tool available. • Various levels of authorisation of payments	• Budget blocking. • Commitments and liabilities • GG transport interface • Debit order interface • Budget interface • Procurement/Logis interface • Standard chart of accounts	• Does not cater for Generally Recognised Accounting Practice (GRAP). • Not a full-fledged accrual accounting system. • Scanning facility not available
Logistical Information System (Logis)	• Provisioning and procurement system. • Control over consumables and movable assets. • Provides for management information regarding stock and assets.	• Managing stock by means of minimum and maximum stock levels. • Over-stocking is minimised and predetermined as only a determined amount of stock can be held. • Moving of assets is controlled. • Availability of audit trails on all actions. • Flexible infrastructure • Access and profile control	• Not a financial budgetary control system. • Does not interface up to minor item level. • Not an asset management system. • No bar-coding functioning. • No BAS interface.

System	Main functions	Functionality	Shortcomings
		The following functionalities are available: • Online printing • Guarantee register • Petty cash • FMS interface report • A4 order forms	
Management Information System (Vulindlela).	Integrated management Information - Drill-down functionalities] - Online, printing and downloading functionalities - Information available at all levels - Relevant and up-to-date information - Standard reports available - Help function	Web-enabled - In-year monitoring system - Monthly employment equity stats available on national web - Availability of Persal, Logis information	No access and profile control per institution - No management information on ledger accounts - Slow response time

(Source: RSA, 2003a:86)

2.4.3 Data warehouse

According to Bidgoli (2015:55), the concept data warehouse is known as a repository of data that is organised to be readily acceptable for analytical processing activities by decision support system, querying and data mining.

2.4.4 Data marts

Bidgoli (2015:59) defines data mart as a simple form of a data warehouse that is focused on a single subject. The specific data needed for BI are downloaded to a data mart used by decision makers (Didiza, 2016:18).

2.5 Systems integration

French, Maule and Papamichail (2009:105) state that many executives were disappointed that the systems implemented focused on operational data instead of providing sufficient high-level summaries that would support strategic decision-

making. In order to achieve the competitive advantage on information gathered, the transportation department would have to establish a competitive base of infrastructure, human resources who will improve departmental ICT capabilities and skills, and regulatory frameworks to be involved in the running of the critical government infrastructure. Işik, Jones and Sidorova (2013:15) state that systems integration involves a combination of systems applications or data sets, either physically or functionally, so that value can be attained instead of having an individual system. Pirttimăki (2007:81) lists the integration service as one of the features to consider because it facilitates the gathering and integration of data and information from several sources. It is on that note that RSA (2012:23) adopted COBIT 5 to provide an integrator framework to ensure seamless integration with other relevant standards and other frameworks such as information technology infrastructure library (ITIL) for service management, International Standards Organisation (ISO) 15504 for maturity Assessments and ISO 27001 for security to assist organisations in the governance of IT.

According to Telesca, Rana and Ion (2007:1), interoperability leverages the ability of software products to work with other software products without special effort from end users and thus creating the capability to interact with and exchange information both internally and with external organisations. Gartner (2011:13) advices that creating an information infrastructure will unify all the technologies, services and schemas, as it would make interfaces with other departments of the organisation and permit the automated exchange of data, documents and other forms of content.

Wache, Vögele, Visser, Stuckenschmidt, Schuster, Neumann and Hüebner (2001:2) suggest three different ontological approaches, namely single ontology approaches, multiple ontologies approaches and hybrid approaches. These approaches help in providing the integration task to describe the semantics of the information sources (Kabmala, Manmart & Chirathamjaree, 2006:258).

Single ontological approach – All source schemas are directly related to a shared global ontology that provides a uniform interface to the user; however, this approach requires that all sources should have almost the same view on a domain, with the same level of granularity.

Multiple ontology approach – Each data source is described separately by its own ontology, while local ontologies are mapped to each other.

Hybrid ontology approach – A local ontology is built for each source schema, which, however, is not mapped to other local ontologies, but to a global shared ontology.
Kabmala, Manmart and Chirathamjaree (2006:256) state that an ontology can be considered to be suitable for information integration tasks because of its potential to describe the semantics of data sources and to solve the data meaning heterogeneity problems.

Subhashini and Akilandeswari (2011:2) describe the advantages of ontologies as follows:

- They can be reused
- Formal community time – Shared viewpoint over a certain universe of discourse
- Interoperability – Supporting of communication and cooperation among different systems.
- Knowledge level validation and verification – Checks for the completeness of domain discourse.

Pirttimăki (2007:58) elaborates that integration of internal and external information assists an organisation to adapt quickly to accelerate changes and have a holistic picture of such change and the success thereof. Hendriks (2012:3) states that one of the benefits identified when systems are integrated is increased detection of risk of fraud and theft while cross-referencing between the systems.

The DoT's ICT strategic plan (2013b:1) has put up a vision of "providing and effective, flexible and secure information and communication technology that would enable the organisation and its partners to respond appropriately to the needs and demands of the organisational mission to deliver better services to citizens."

The DoT developed the electronic National Transport Information System (eNaTIS) over a period of five years (1 June 2002 to 11 April 2007) at a cost of R594 million to centralise the management of the vehicle and driver's licensing records of the Republic of South Africa. The eNaTIS replaced the NaTIS as from 12 April 2007. According to the Auditor-General of South Africa's (AGSA) report (2011/12), one of the most significant features of the new eNaTIS system was that the 15 databases of the previous NaTIS system were consolidated and migrated into one national database. According to the DoT's IT tactical plan (2013a:13), this initiative has started the building blocks for e-transport that will integrate the following siloed systems:

- The electronic national transportation information system
- Drivers licensing card production
- Public land operator's transportation information system
- Road asset management system
- Proposed integrated incident management system
- National traffic contravention register system

The DoT's strategic plan (2013b:7) further highlights that the electronic transportation system, which will serve as a baseline for integration with other mentioned systems to enhance, improves government's coordination of other spheres and the engagement with the South African Development Community (SADC). The electronic system is currently accessed at post offices, driver's license testing centres, vehicle registration authorities, vehicle testing centres. The system provided a wide range of services: vehicle registration, vehicle licensing, roadworthiness, trade plates, permits, personalised numbers and driving licenses.

In order to achieve the competitive advantage on information gathered, the transport department would have to establish a competitive base of infrastructure, human resources who would improve departmental ICT capabilities and skills, and regulatory frameworks to be involved in the running of the critical government infrastructure.

2.5.1 Issues in integration

According to Wache, Vögele, Visser, Stuckenschmidt, Schuster, Neumann and Hüebner (2001:1), the problem of integrating heterogeneous and distributed computer systems is known as an interoperability problem. Telesca, Rana and Ion (2007:3) indicate that an application from company X uses resources of another application in company Y, then a challenge would be how it will be ensured that the documents accessed by X are the latest ones. Hyvönen (2010:2) identifies a problem regarding how to deal with situations where multiple entity names and identifiers are used for a single, real-world object and where different objects have the same name or identifier. This problem is sorted by having metadata management, which Gartner (2011:14) states “contributes to information sharing, presenting a common face to customers, linking structured and unstructured information, and other efforts that require bridging gaps among different pools of information”.

Sherman (2013:11) indicates that another problem is that the spreadsheets are not being included as part of the BI strategy where users are found to be copying data from various sources into a spreadsheet and integrating it into worksheets, then manipulating data by doing analyses on their own versions of information. While Didiza (2016:14) indicates that having multiple, disconnected BI projects would lead to inefficiencies, fragmentation firmly placed the burden of integration, operation and recurring support on the ICT organisation. Hendriks (2012:3) indicates that the number of integration problems mentioned are the following:

- Functional duplication and technological proliferation that has a negative impact on the cost-effective spending of public funds.
- Difficulties in the implementation of uniform norms and standards across systems and operations.
- Poor inherent systems of inter-operability and aggregating of data that seriously compromise operational integrity and the generation of management information.
- Difficulty in synchronising the implementation of new legislation and regulations with the capabilities of multiple systems, each on its independent evolutionary path.

Many problems were identified when Kabmala, Manmart and Chirathamjaree, (2006:255) did a study on the Khon Kae provincial government in Thailand as stated:

> Inadequate data, which is partly the result of insufficient budget for data gathering and processing; data is not systematically kept; unwillingness to disclose data due to the lack of proper definition of secrecy; inability to directly exchange data because of differences in data formats, as a result of development and design autonomy; uncertainty about the quality of data; uncertainty about the accuracy of the information summarized by those at the lower levels; lack of coordination with agencies in joint-development as well as lack of improvement in information management.

2.5.1.1 Shortfalls in integration of Basic Accounting System and Vulindlela

As indicated by Youngblood Consultants (2013), it can take up to two weeks to formulate a complete and correct response when information is requested from financial managers. The following are experienced:

- A spreadsheet is compiled manually from actual expenditure and budget records on monthly basis, which results in high error levels and inconsistent data.
- Information provided by the Vulindlela system is more up to date, but it has no drill-down capacity.
- Certain reports from BAS must be scheduled and received the following day through the file transfer protocol (FTP) website.
- There is no simple way to compare budgets, forecasts and actuals, which is a fundamental requirement of good financial management.

2.5.2 Compliance

While collaborating with other stakeholders in the sharing of intelligence, there should be ways of managing risks associated with major integrated information systems to have compliance with protection of personal information (PoPI) act (RSA, 2013c:16). Telesca, Rana and Ion (2007:3) state that for IT to be accountable there is a need for a system to raise the visibility of controls and provide a clear report to all stakeholders

that the controls are working. It is on that note that RSA (2012:26) states that the chief information officer becomes part of the executive management of the organisation.

According to ISACA (2012:89), a control is defined as, "… policies, procedures, practices and organisational structures designed to provide reasonable assurance that business objectives will be achieved and undesired events will be prevented or detected and corrected."

The Spatial Data Act, No. 54 (RSA, 2003b:2), was enacted to have compliance with the South African government and state organs to deal with:

> Spatial Data Infrastructure, the Committee for Spatial Information and an electronic metadata catalogue; to provide for the determination of standards and prescriptions with regard to the facilitation of the sharing of spatial information; to provide for the capture and publishing of metadata and the avoidance of duplication of such capture.

One of the controls as stated by RSA (2004:15) is ensuring that copyright of the state and other interested parties of information in the user's custody is protected. Hendriks (2012:5) states that there should be a coherent legal framework that governs the overall system integration activities. It is in this context that data exchanged between the systems would be protected by copyright law for the intellectual works of such data produced (Leedy & Ormrod, 2015:354).

2.5.3 Technological barrier

French, Maule and Papamichail (2009:102) state that, originally, databases were a single physical system. Now, with the advancement of technology, this has meant that they are virtually available across multiple systems. According to Hyvönen (2010:1), while the power of the web came with freedom for anybody to publish and link their own content as the web pages, this has created interoperability problems on the semantic web as different vocabularies are used in metadata descriptions.

Burns (2013:4) indicates that IT departments tend to deliver expensive and sophisticated BI tools that are not always necessary for business users while

simplification can be a solution to deliver better results. Sherman (2013:11) states that BI system users would revert back to their spreadsheet applications if they think BI software is too difficult to use or if there are limitations in the analytical capabilities provided by BI implementations. Gartner (2011:9) states that most organisations have struggled to model decision processes effectively, especially when they occur outside end-to-end business processes and this led to a lower than expected uptake of analytical technologies and processes among business process users. This is evident when Hendriks (2012:4) indicates that challenges involved in the implementation of the Integrated Financial Management System (IFMS) pose significant challenges due to its sheer size and complexity.

According to Didiza (2016:14), the same is evident in the study case where a large amount of money was invested in ad hoc, non-integrated and non-sustainable BI implementation that took longer to implement where information inconsistency was rampant. The other important technology aspect as outlined by Teklegiorgis, Tadesse, Mirutse and Terefe (2016:2) is that when a software solution is implemented, it is not necessarily user-friendly and results in an analysis that does not provide meaningful conclusions for decision makers due to a lack of proper processing of such information.

2.5.4 Security

Due to the fact that information is received from different data sources, RSA (2003:15) states that reasonable steps must be taken to secure data against any loss and ensure the protection of the copyright of the state and interested parties on such information. The International Standardization Organisation (ISO) has published and released a code of practice for information security management known as ISO/IEC 27001:2005 and, in South Africa, the standard is called SANS 27001:2006. ISO/IEC 27001 (2005:20) states that there are five ways for exchanging information and its controls, namely:

- To have formal information exchange policies and controls shall be in place to protect the exchange of information through the use of all types of communications facilities.

- Agreements shall be established for the exchange of information and software between the organisation and external parties.
- Media containing information shall be protected against unauthorized access, misuse or corruption during beyond an organisation's boundaries.
- Information involved in electronic messaging shall be appropriately protected.
- Policies and procedures shall be developed and implemented to protect information associated with the interconnection of business information systems.

ISO 27001 is an international standard that represents a management system for information security (Arnason & Willett 2008:104). This standard specifies "the requirements for establishing, implementing, operating, monitoring, reviewing, maintaining and improving a documented Information Security Management Systems (ISMS)" (ISO 27001, 2005:1). Furthermore, the view of RSA (2004:15) on the security of data is that reasonable steps need to be taken to effect adequate and appropriate security against the loss of information or any unauthorised or unlawful access to and modification or disclosure of such information. RSA (2013c:16) has enacted PoPI to protect information that is shared through collaborations or systems among different stakeholders.

2.5.5 Information quality

Pirttimăki (2007:44) states that every organisation has information needs for the different management levels, namely strategic, tactical and operational for decision-making at those levels. By referring to the origin relationship of data lineage, Serumaga-Zake (2017:2) states that origin has an effect on the reliability of data and the trust one can place in it. The problem noted by Sherman (2013:11) was that users copy data from various sources and then manipulate is, which creates data inconsistencies and inconsistent BI findings. The UOG (2015:4) advices that there should be a consistent request for the need to link improved data quality to the BI strategy. In their study, Teklegiorgis, Tadesse, Mirutse and Terefe (2016:7) describe data quality as having four dimensions (consistency, completeness, timeliness and accuracy of information) that are essential for organisational decision-making and action taking. Pirttimăki (2007:55) emphasises that the quality of information is determined by its relevance, reliability and validity. Mosweu, Mutshewa and Bwalya

(2014:238) argue that the use of ICT tools assists public sector organisations to produce accurate, reliable and timely information for the efficient and effective delivery of services to the public. RSA (2003b:15) has given guidelines on data quality of spatial data as follows:

- Reporting of any deficiency in the quality of data supplied
- Provision of specific and sufficient information to be reported in order to identify the record concerned and the correct record
- To respond to the user of such information timeously after receiving the report on the deficiency
- Taking remedial action if the data custodian did not respond within the prescribed time when noticing the deficiency

In order to achieve quality information, there should be an enabling culture and better aligned structures which are explained in the next section.

2.6 Culture, ethics behaviour and organisational structures

Efe (2013:40) states that culture, ethics, moral values, religion, attitude and behaviour of individuals, the organisation and stakeholders are very often underestimated as a success factor in organisational activities. Venter and Tustin (2009:94) advise that commitment of top management to the culture of the organisation is crucial to ensure buy-in throughout the organisation. Teklegiorgis, Tadesse, Mirutse and Terefe (2016:2) allude to the fact that behavioural determinants like systems users directly demand confidence, motivation and competence to perform systematic tasks, processes and performance. Codes of conduct or ethics are key issues for development of corporate culture since these are considered to be beliefs and shared values in an organisation (Smit, Cronje, Brevis & Vrba, 2007:225).

2.6.1 Organisation culture

The culture, ethics and behaviour of individuals and the enterprise are often underestimated as a success factor in governance and management activities (ISACA 2012:27). McLaughlin (2017:1) states that organisational culture is considered as a system of shared assumptions, values and beliefs which governs how people behave

in organisations. Thompson, Strickland and Gamble (2009:386) refer to organisational culture as "the character of a company's internal work climate and personality as shaped by its core values, beliefs, business principles, traditions, ingrained behaviours, work practices and style of operating". Du Plessis and Mabunda (2016:55) advise organisations to follow a phased approach in introducing change so that barriers can be overcome.

All of these are considered to be part of cultural elements, where trust is an important contributing factor that strengthens the relationships (Baskerville & Dulipovici, 2006:91). Serumaga-Zake (2017:1) states that one of the drawbacks to the availability of most research from developed countries is that it does not apply to the developing countries, due to cultural differences and the fact that it focuses on technological and operational features rather than on human, managerial and strategic factors.

According to Ipe (2003:40), the culture of an organisation can be reflected at three levels of the organisation, namely:

- The first level would be the visible aspects of the organisation, like the mission and vision statement and the espoused values.
- The second level, which lies deeper than the first level, includes the embedded way in which people behave, their expectations of each other and how they make sense of each other's actions.
- The third level is the core values and assumptions of the organisation. These core values and assumptions of the organisation are often not only unarticulated, but also so taken for granted that they are hard to articulate and are not visible to the members of the organisation.

Yiu, Sankat and Pun (2013:106) outline that knowledge often becomes embedded not only in documents or repositories, but also in organisational routines, processes, practices and norms. Mosweu et al. (2014:240), outlines that one of the findings of a study conducted in New Zealand was that the adoption of the electronic document management system (EDMS) was affected by communication, management support, change management, emotions, attitudes to computer information systems and the

project management approach that was employed. This revelation illustrates that corporate culture, best practices, core competencies, skills and strategic visions are critical parts of the total stock of knowledge in an organisation. Wowczko (2013:7) states that culture determines the conditions under which organisations exist and the values they hold and promote via their daily operations.

As Jalaldeen, Karim and Mohamed (2009:128) point out that there should be an understanding that introducing any change in any organisation is difficult and, therefore, leaders are encouraged to assess the readiness of their organisation to adopt those changes in advance. A change in culture will take a long time to happen. The objective of any change is not to change the organisational culture drastically, but to modify the behaviour of people in a way that suits the demands in the context of the organisation in the same way that the strategy needs to be compatible with the organisational culture (Sunassee & Sewry, 2002:240). Baskerville (2006:91) views organisational culture as a web of several elements: paradigm, symbols, power structures, organisational structures, control systems, routines, rituals and myths. These elements are said to coexist, overlap and even support each other.

2.6.2 Organisational structure

Morgan (2006:12) defines this form of structure as a bureaucratic form that emphasises precision, speed, clarity, regularity, reliability and efficiency and that is achieved through the creation of fixed divisions of work, hierarchical supervision and following formalised rules and regulations. According to Wren and Bedeian (2009:229), Weber coined “bureaucracy” out of a reaction of the earlier systems of administration such as monarchies and dictatorships in which lives and fortunes depended on the ruler’s discretion. This is discussed further in the next section.

2.6.3 Decisions and power

Wildavsky (1973:132) argues that there can be no planning without the ability to cause other people to act differently than they would otherwise. He further says that planning is assuming power and politics. Politicians are elected by the nation to deliver on promises made during elections. RSA (2012a:2) clarifies that, while in government, all ICT strategic decisions should be decided by senior political and managerial leadership. The public entities are mandated by the government of the day to prioritise

infrastructure development to improve the economy and the lives of the citizens (RSA, 2012b). Komanyane (2010:10) states that the mandate of the public service has always rested on social responsibility and ensuring a better life for all citizens of the country. Bwalya, Du Plessis and Rensleigh (2013:61) outlines that the use of ICT allows the citizens to participate in decision-making and that the government is afforded timely information on those decisions at a comparatively low cost.

As stated by Khadermian (1998:117), those mandated by the electorate create a situation where delivery must take place through a chain of command in the form of bureaucracy, and this becomes the order of the day. Khadermian (1998:117) further states that.

> Any solution is political, requiring governments to grapple with the definitions of accountability, the appropriate distribution of executive and legislative powers in government, the identification of chains of command…

This is further illustrated by Cook (1998), who does a comparative assessment that public management is the same as a political institution in order to reach collective ends. The Commonwealth of Australia (2013:14) shows that it is important for government agencies to utilise data analysis in innovative ways that take advantage of patterns and correlations by providing greater evidence to decision makers, in order for effective decisions to be made about how to tailor services reflecting the specific community needs and interests.

This is the case when there is a change in guard. It can be accepted that, in a stable environment, rational planning may require that a single view of objectives and strategies for their achievement can be embraced by the whole organisation (Boyne & Gould-Williams, 2003:117).

However, most public sector organisations consist of rival factions that are competing for power and resources. Miller, Hickson and Wilson (1996:295) further cement the argument that decision-making may be seen as a game of power in which competing interest groups vie with each other for the control of scarce resources.

2.7 People, skills and competencies

People, skills and competencies are required for successful completion of all activities and making correct decisions and taking corrective actions (ISACA, 2012:27). Adoption of BI happens when the information is presented in the most usable formats and attention is paid to the efficiency of the processes and technologies through which information is provided (Gartner, 2011:16). The UOG (2015:7) considers that the correct approach for organisations would be to ensure that the right information is made available to the right decision makers at the right time and in the right context in order to drive an organisation forward and to support the strategic goals of such organisation.

Hartley and Seymour (2010:116) introduce seven elements that can be used by public organisations. Those elements are as follows: information; technology; processes, objectives and values; staffing and skills; management systems and structures, and other resources.

In the context of South Africa (SA), Samuel (2013:173) states that the continued shortage of skills in South Africa has necessitated the former Deputy President of South Africa (2009-2014), Mr Kgalema Motlanthe, to call for a scientific investigation on the issue so as to enable the government to make an informed decision on the real reasons for the scarcity of essential skills required to drive economic growth. Smit, Cronje, Brevis and Vrba (2007:223) advise organisations that people need to be educated to overcome resistance to change, innovation and technology, and to have communication strategies aimed at different levels of employees.

Venter and Tustin (2009:92) state that data and information obtained from various sources are usually centralised and made available in a format that could be easily extracted. This process is explained better in Figure 2.6.

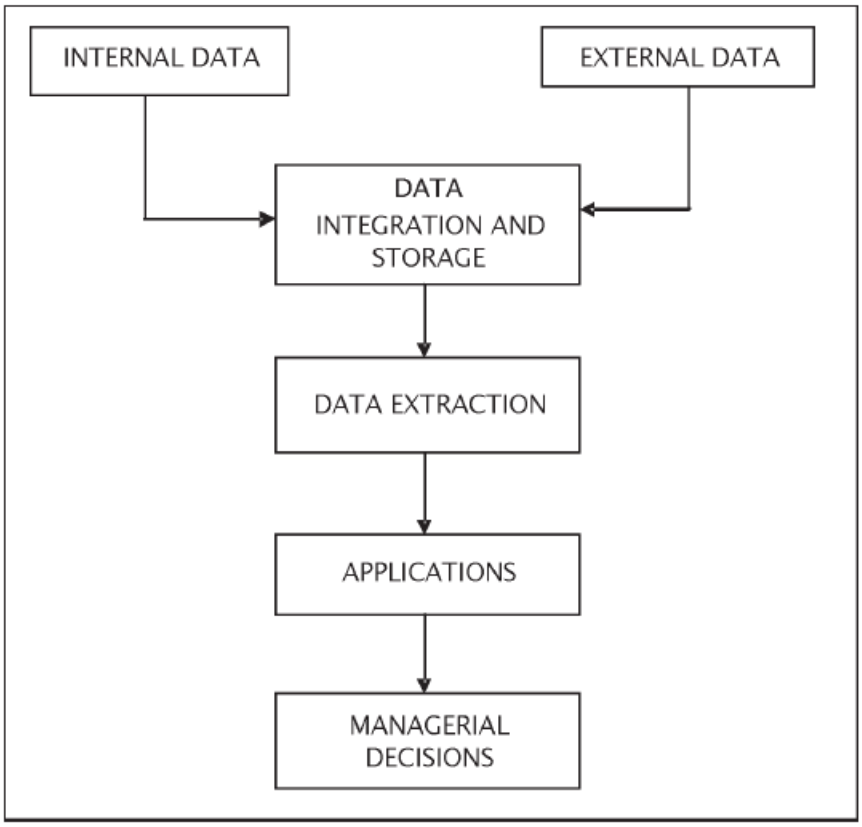

Figure 2.6: Components of business intelligence
(Source: Venter & Tustin: 2009:92)

RSA (2012:23) has gone to great lengths through the Department of Public Service and Administration (DPSA) to prepare a Corporate Governance of Information and Communication Technology Policy Framework (CGICTPF) for the implementation of a governance of ICT system to incorporate authority and accountability in support of the elements by:

- facilitating to achieve the organisation's strategic goals
- giving rise to the efficiency and effectiveness of management of ICT service delivery.

ISACA (2012:25) advices on a single, integrated framework so that the systems can work consistently and coherently intertwined and interconnected with a single sign-on entry.

2.8 Summary

The review of literature in the activities of BI has shown a long history that spans over a century. This also presented competitive advantage to those who had prior knowledge over their competitors. With a standard BI architecture, multiple projects share agreed metadata, resulting in less duplication. A standard approach makes it much easier to obtain the full value of information in the organisation. Businesses that have identified BI as a strategic initiative, forge an alignment of goals, objectives and resources to better support the enterprise with insight.

Compliance issues were discussed in relation to the sharing of data across organisational boundaries. This gave rise to defined specification of vocabulary used for the sharing of data called ontology. The issues of security of information from unauthorised access, modification or destruction in BI systems were presented. It is the system owner's responsibility to maintain trust in its services by protecting these systems from unauthorised access and by protecting data integrity and confidentiality. Interoperability challenges were discussed to show the benefits of software interoperability to access data from different data sources. The other aspect that was considered is the organisational culture that governs how people behave through shared assumptions, values and beliefs in organisations.

Technology was discussed in length to outline of techniques and processes to assist in the integration and challenges thereof. The final aspect was how the adoption of BI can help the decision makers to receive the right information. The following chapter examines and justifies the research methodology utilised in this study.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

The previous chapter highlighted the literature on the system integration processes and management information systems' organisational structures. This would assist in the formulation of a questionnaire that will be used in the study to answer the questions stated in Chapter One. A brief discussion of the research methodology was outlined in Chapter One. This chapter discusses the detailed systematic approach and design that were employed for the purpose of this study.

Kothari (2004:8) states that a way to systematically solve the research problem involves the understanding of various steps that are generally adopted by a researcher in studying a research problem, along with the logic behind them. It is necessary for the researcher to know not only the research methods/techniques, but also the useful starting steps to be followed when the methodology is applied (Bryman, 2012:160). Pickard (2013:99) further states that the research method used by a researcher follows the process and structure of that method, regardless of the environment in which it is applied.

This chapter covers the research paradigm, research approach, research design, population and sampling techniques, data collection tools used by the researcher in answering questions, reliability, ethical issues and the validity of data collection.

3.2 Research paradigm

Neuman (2014:96) defines paradigm as a whole system of thinking, which includes basic assumptions, the important questions to be answered or puzzles to be solved, the research techniques to be used and examples of what good scientific research is like. Creswell (2014:6) defines a paradigm as "a basic set of beliefs that guide action based on discipline orientation and past research experiences".

There are three types of paradigm approaches, namely positivism, interpretivism and pragmatism, as detailed in Table 3.1 (Bryman, 2012:28-30). Positivism is an

> organized method for combining deductive logic with precise empirical observations of individual behavior in order to discover and confirm a set of probabilistic causal laws that can be used to predict general patterns of human activity (Neuman, 2011:95).

Interpretivism is known as an approach where emphasis is placed on how respondents in a study make sense of or understand the world as others experience it (Wagner, Kawulich & Garner, 2012:55). Pragmatism is the combination of interpretive and positivist approaches where problems are studied through the use of a variety of methodologies (Bryman, 2012:629).

Table 3-1: Differences between paradigms

Positivism	Interpretivism	Pragmatism
• There is one reality. • Knowledge is external. • There is a believe that information from a sample can be generalised.	• Participants in a study make meaning of a situation. • Knowledge is subjective. • There are multiple realities.	• Combination of positivist and interpretive approaches. • Knowledge is viewed pragmatically. • There are multiple ways of seeing and knowing
Source: Leedy & Ormrod, 2015:99-101		

The research paradigm chosen for the study is positivism, because the research is straightforward in terms of planning and data are collected in a natural setting, while data are analyzed statistically at the same time (Leedy & Ormrod, 2015:25).

3.3 Research approach

Creswell (2014:3) defines approaches as plans and procedures that connect the steps from broad assumptions to detailed methods of data collection, analysis and interpretation. Three research approaches are identified as quantitative, qualitative and mixed method research (see Table 3.2).

Creswell (2014:3) describes quantitative research as an approach for testing objective theories by examining the relationship among variables that in turn can be measured, typically on instruments, so that numbered data can be analysed using statistical procedures.

Van Zyl (2014:213) defines qualitative research as social research that explores the processes that underlie human behaviour using exploratory techniques such as interviews, surveys and case studies.

Creswell (2014:2) describes mixed methods research as an approach to inquiry involving collecting both quantitative and qualitative data, integrating the two forms of data and using distinct designs that may involve philosophical assumptions and theoretical framework.

According to the University of Southern California (2018), theoretical framework is

> theories formulated to explain, predict and understand phenomena and in most cases, to challenge and extend existing knowledge within the limits of critical bounding assumptions that can hold or support a theory of a research study.

The theoretical framework chosen for the study was clarified in section 1.6 as the COBIT 5 Framework. Ridley, Young and Carroll (2004) state that COBIT 5 has been chosen as an appropriate, trusted IT governance framework to help organisations ensure alignment between the use of IT and its business goals due to the fact that it places emphasis on the business need that is satisfied by each control objective (see Figure 1.1)

Table 3-2: Research approaches

Methods	Benefits	Disadvantages
Quantitative	It allows the researcher to objectively measure the variable(s) of interest. Data are collected from a large sample that is presumed to represent a particular population so that generalisations can be made. (Leedy & Ormrod, 2015:99)	It fails to distinguish people and social institutions from 'the world of nature'. The measurement process possesses an artificial and spurious sense of precision and accuracy. The reliance on instruments and procedures hinders the connection between research and everyday life.

Methods	Benefits	Disadvantages
		The analysis of relationships between variables creates a static view of social life that is independent from people's lives. (Bryman, 2012:178-179)
Qualitative	• It helps in gaining initial insights through exploration. • It can reveal a complex multi-layered nature of certain processes. • It helps to enable the development of theoretical perspectives. • It allows the testing of the validity of certain assumptions within a real-world context. (Leedy & Ormrod, 2015:271)	It requires more effort and rigor than quantitative study. Data collection alone takes longer over a course of months. (Leedy & Ormrod, 2015:99)
Mixed methods	• There is a clear link between each strand and element in the research design. • The research questions relate not only to the methods used in the analysis of data, but also to how evidence from different strands will be integrated. • The samples of evidence are clearly and logically defined and selected. • The samples of evidence are verifiable by other data. • The instruments are valid and reliable and produce data that are accurate, stable and consistent. • The analyses are validly conducted and results are clearly reported. • The integration of results from different analyses are conducted logically and validly as a basis for inference and limitations are identified and stated. (Wagner, Kawulich & Garner, 2012:173)	• The representation arising from the sampling problems which characterise both quantitative and qualitative research. • There legitimacy issues arising from threats to validity. • There are challenges of integration happening when triangulating, expanding and comparing quantitative and qualitative data. • The challenge of politics arising from tensions in triangulation within and across data sources, indicators, samples of evidence and instruments. (Wagner, Kawulich & Garner, 2012:173)
Source: Leedy and Ormrod (2015:99)		

The research approach chosen for the study is the quantitative method. Leedy and Ormrod (2015:103) state that the value that would be brought to the study is that a survey would be used to determine the incidence, frequency and distribution of certain characteristics in a population. Furthermore, it is to discover laws that are

generalisable and governing the selected sample out of the population at the DoT (Wagner, Kawulich & Garner, 2012:54)

3.4 Research design

Research design is an architecture for the collection and analysis of data (Bryman, 2016:40). Leedy and Ormrod (2015:102) define a design as "a systematic process of collecting, analysing and interpreting data for the purpose of increasing the understanding of the phenomenon of concern." Table 3.3 provides the design type and the purpose of the research design.

Table 3-3: Common research design/approaches

Design	Purpose
Action research	This is a type of research that focuses on finding a solution to a local problem in a local setting.
Case study	It is a type of qualitative research in which in-depth data are gathered relative to a single individual, programme or event for the purpose of learning more about an unknown or poorly understood situation.
Content analysis	It is considered to be a detailed and systematic examination of the contents of the particular body of material like: • television shows • magazine advertisement • internet websites • works of art for the purpose of identifying patterns, themes or biases within that material.
Correlational research	A statistical investigation of the relationship between two or more variables that looks at surface relationships, but does not necessarily probe for causal reasons underlying them.
Design-based research	It is a multistep, iterative study in which certain instructional strategies or technologies are implemented, evaluated and modified to determine possible factors influencing learning or performance.
Developmental research	An observation-descriptive type of research that either compares people in different age groups or follows a particular group over a lengthy period of time.
Ethnography	A type of qualitative inquiry that involves an in-depth study of an intact cultural group in a natural setting.
Experimental research	It is a study in which participants are randomly assigned to groups that undergo various research-imposed treatments or interventions, that are followed by observations or measurements to assess the effects of the treatment.

Design	Purpose
Ex post facto research	An approach in which one looks at conditions that have already occurred and then collect data to investigate a possible relationship between these conditions and subsequent characteristics or behaviours.
Grounded theory research	It is a type of qualitative research aimed at deriving theory through the use of multiple stages of data collection and interpretation.
Historical research	It is an effort to reconstruct or interpret historical events through the gathering and interpretation of relevant historical documents and/or oral histories.
Observation study	It is a type of qualitative research in which a particular aspect of behaviour is being observed systematically and with as much objectivity as possible.
Phenomenological research	It is a qualitative approach that attempts to understand participant's perspectives and views of physical or social realities.
Quasi-experimental research	It is an approach similar to experimental research, but without random assignment to groups.
Survey research	This is a study that is designed to determine the incidence, frequency and distribution of certain characteristics in a population, especially common in business, sociology and government research.
Leedy & Ormrod, 2015:102	

The choice of this design, survey research, is based on Leedy and Ormrod (2015:159) that, in survey research, a researcher would ask a series of questions to willing respondents and summarising the responses with frequency counts and, percentages and drawing inferences from the sample, like what this study intends to achieve. Wagner (2012:22) contend that the benefit of a survey is that it is used to gather data from a larger sample in a relatively short period of time using questionnaires to answer questions of interest as asked by the researcher. Furthermore, survey is the preferred type of data collection procedure for this study due to the rapid turnaround in data collection (Creswell, 2015:157).

3.5 Population and sampling

The sampling design for this population is single-stage sampling procedure in which the researcher has access to names in the population and can sample the people directly. The researcher obtained the list of different population levels and names of individuals within those clusters, and then samples within them. Van Zyl (2014:33) regards samples as smaller group that is selected from a population in such a way that it maximises the likelihood of the sample being as representative as possible.

3.5.1 Sampling techniques

The process used to select individual respondents was through stratified random sampling (Creswell 2014:174). The study showed that stratification is done through business units before selecting the sample. Stratification means that specific characteristics of individuals (e.g. gender – females and males) are represented in the sample and the sample reflects the true proportion in the population of individuals with certain characteristics. The characteristic used in stratifying the population for this study is income levels. With the use of stratified sampling, the standard error of the mean would be smaller since the variation between strata is essentially eliminated because the population would be accurately represented in the sample in terms of the stratification criterion (Bryman, 2012:197).

The following strata have been identified: business units and thereafter the organisational middle management and senior management. The sample contains individuals with the characteristic in the same proportion as the characteristic appears in the entire population within each stratum. The researcher chose a sample size of 50% of the eligible population based on the same proportion of each strata of the organisation's middle and senior managers (see Table 3.6). The population where the study was conducted was 345. Eleven (11) of respondents were selected to pilot the research instrument. The final population from which a sample was selected for the survey was 334.

While there is no straightforward way to determine the sample size, Bryman (2012:197-198) provides tips to consider when determining a sample, which are:

- Time and cost that deal with larger samples that would have been drawn and become uneconomic to conduct.
- Non-response that occurs when returned questionnaires are unsuitable or no response from the selected sample.

Creswell (2014:159) indicates that the strategy used to select the sample is as follows: Selecting of 50% of population in each stratum. Raosoft (2017) sample size calculator

was used to select a sample for this study under conditions as indicated in the Table 3.4.

Table 3-4: Sample size calculator

Margin of error that can be accepted	5%
Confidence level needed	95%
Population size	334
Response distribution	50%
Recommended sample size	179

The following are the respondents chosen for surveys (See Table 3.5):

Table 3-5: Overall population classification

Stratum	Total population
Senior management	93 [54]
Middle management	241 [125]
TOTAL	334 [179]*

* *The sample selection was done as recommended by Raosoft sample calculator.*

The selection of the sample from a population was stratified on two layers, according to division (business units) and according to management level (Van Zyl, 2014:102). The sample size is shown in brackets in the table (see Table 3.6). Bryman (2012:192) highlights the advantage of stratified random sampling as ensuring that the resulting sample is distributed in the same way as the population being studied in terms of the stratified criterion.

The table lists respondents in diverse roles within the transportation entity to ensure representativity of knowledge areas. As presented in Table 3.6, the stratified random sampling provides the advantage that it guarantees equal representation of each of the identified strata (Leedy & Ormrod, 2015:179). This method avoids sampling bias

because there will not be any distortion in the representativeness of the sample that may arise from the whole selection process of respondents (Bryman, 2012:187).

Table 3-6: Business units' population

Business Unit name	**Stratum**	**Business Unit total Population**
Administration	Senior management	30 [16]
	Middle management	84 [44]
Integrated Transport Planning	Senior management	23 [14]
	Middle management	32 [15]
Rail Transport	Senior management	8 [6]
	Middle management	13 [7]
Roads Transport	Senior management	7 [4]
	Middle management	51 [26]
Civil Aviation	Senior management	6 [3]
	Middle management	24 [11]
Maritime Transport	Senior management	4 [2]
	Middle management	13 [6]
Public Transport	Senior management	15 [9]
	Middle management	24 [16]

Respondents had to respond to a survey that in turn provided data mine of views on what was collected. Most of these respondents interact with a diverse of their peers in

the transportation industry, hence their exposure has made it necessary for them to be selected for the study.

3.6 Data collection methods

This research made use of the survey methods outlined in Chapter One to investigate the integration of information management systems at the DoT with the view to enhancing BI for effective decision-making. The study used questionnaires and surveys with open- and closed-ended questions (Creswell, 2014:18). Leedy and Ormrod (2015:159) define a survey research as any descriptive research that involves acquiring information about one or more groups of people regarding their experiences, by asking questions and tabulating the answers. The researcher would pose a series of questions to respondents, summarise their responses with frequencies, percentages and statistical indexes and, lastly, draw inferences about a particular population from the responses of a sample (Leedy & Ormrod, 2015:159). Data collection tools used in the study are questionnaire and document analysis.

3.6.1 Questionnaire

A questionnaire was designed for staff at the DoT with the aim of gathering information on the integration of information management systems and assisting in enhancing business intelligence to improve effective decision-making processes within the DoT in South Africa (see Annexure A).

The questionnaire was designed in a way that the objectives of the research in the form of questions were answered. The content of the questionnaire was mostly determined from the literature review and a combination of closed- and open-ended questions were provided. With reference to open-ended questions, these were provided to give respondents the freedom to answer according to their preference, while closed-ended questions had limitations and were precise in the approach, with predetermined answers. Wagner, Kawulich and Garner (2012:109) state the advantages and disadvantages of open- and closed-ended questionnaires in Table 3.7.

Table 3-7: Advantages and disadvantages of closed- and open-ended questions

Questionnaire type	Advantages	Disadvantages
Open-ended questions	• Permit unlimited number of answers. • Respondents can qualify and clarify responses. • Enable in-depth exploration of a topic. • Reveal respondents' thinking processes.	• Respondents give answers with different levels of detail. • Answers can be irrelevant. • Requires more time and effort from respondents. • May intimidate respondents. • Requires more time for data analysis.
Closed questions	• Easy and quick to answer. • Answer easy to compare. • Response choices make question clearer. • Easy to replicate study.	• Can put ideas in respondent's head. • Respondents with no opinion answers anyway. • Respondents can feel constrained. • Many choices can be confusing. • Fine distinctions may be lost. • Forces respondents into simple responses. • Can lead to bias in respondent's answers to open-ended questions presented later in the survey.

(Source: Wagner, Kawulich and Garner, 2012:109)

Having been exposed to types of questionnaires that can be used to collect data, Bryman (2012:253) presents different types of classification of questions that can be asked as follows:

- Personal factual questions
- Factual questions about others
- Informant factual questions
- Questions about attitudes
- Questions about beliefs
- Questions about normative standards and values
- Questions about knowledge

There are three types of quantitative research questions, namely:

- Descriptive questions – This is the type of research whose purpose is to paint a picture using words or numbers and present a profile to answer question such as who, when, where and how (Neuman, 2011:38).
- Comparative questions – Bryman (2012:710) explains this as a design that involves the comparison of two or more cases in order to generate theoretical insights as a result of different findings.
- Relationship-based questions – It aims to establish the relationship or association or interaction between two or more variables on one or more groups (Bryman, 2012:710).

Table 3-8: Sections covered in questionnaire

Section	Components
A	Demographic information
B	Business intelligence strategies
C	MIS (services, infrastructure and applications) implemented
D	Processes for integration of MIS
E	Culture, ethics, behaviour and organisational structures
F	Skills, competencies and people

The rationale behind using COBIT 5 framework enabler constructs was to investigate the integration of information management systems at the DoT with a view to enhancing BI for effective decision-making. The questions asked to respondents were aimed at soliciting answers to the research question: “How could the integration of information management systems assist in enhancing business intelligence to improve for effective decision-making *processes within the* DoT in South Africa?”

In addition, COBIT 5 framework enterprise provided the following elements: principles, policies and frameworks; services, infrastructure and applications; processes; culture, ethics, behaviour and organisational structures; skills, competencies and people; which are the main focal points of the study (ISACA, 2012:27).

The study used closed- and open-ended questions and answers were post-coded where the process involves content analysis to identify themes on the basis of

developing codes to be entered on to a spreadsheet for further analysis (Bryman, 2012:247).

3.6.2 Document analysis

Leedy and Ormrod (2015:275) describe document / content analysis as an approach to identify the specific characteristics of a body of material with a focus on verbal, visual or behavioural forms of communication. The researcher used informal interviews and documents analysis to supplement questionnaire data from respondents upon integration of financial systems (see Figure 5.1). Bryman (2016:70) considers this form of approach important on a single case with a view to revealing important features about its nature.

3.7 Pre-testing of data collection tools

Leedy and Ormrod (2015:166) state that a pilot test questionnaire should be developed to find weak spots by asking volunteers to answer before the main data collection. Neuman (2014:320) explains that test respondents are asked if questions are clear. There is a need for exploration in their interpretation to ascertain whether the intention was clear. The pre-testing of a questionnaire is deemed crucial in relation to research based on the self-completion questionnaire, since there would not be an interviewer present to clear up any confusion (Bryman, 2012:263).

Due to diversity of the respondents, 11 respondents from the population were selected to pre-test the questionnaire. The pilot test questionnaire was distributed to the 11 selected respondents on 14 August 2017. Five (5) completed questionnaires were returned to the researcher. The inputs provided were incorporated into the final questionnaire. Those that were selected for pilot testing were excluded from the main survey data collection.

3.8 Modes of survey administration

A web-based portal and email were used as modes of survey administration. Wagner, Kawulich and Garner (2012:102) present five benefits of using email and web-based surveys, namely:

- A web-based survey is a quicker and more cost-effective way to distribute the questionnaires.
- Greater responses can be received quicker than other forms of survey.
- The use of technology reduces error of handwritten responses and data can be captured and analysed immediately.
- The reduction of the identification of respondents based on the handwriting.
- Questions can be customised according to a specific population.

An invitation email together with ethical clearance approvals and a welcome letter were used to distribute the hyperlink of the online survey tool (LimeSurvey) to the 179 potential respondents. As benefits were indicated by Leedy and Ormrod (2015:170), the LimeSurvey website was used because the tool reduces the burden of data collection and analysis. The use of the online survey would provide anonymity to ensure that the respondents cannot be identified through their email addresses because they are employees at the employer where the researcher is also employed. Other factors in relation to anonymity are discussed in the section on ethical consideration later on in this chapter.

3.9 Survey response improvement

Caldwell (2017) mentions types of survey fatigue and ways the researchers can overcome them as implemented at the National Research Centre (NRC). Table 3.9 indicates the survey risk and the description for the researcher to be aware of when conducting a survey.

Table 3-9: Survey fatigue

Survey risk	Description
Survey response fatigue	This happens when the same question is asked in different ways throughout the same survey.
Survey taking fatigue	This form of fatigue happens when respondents burn out due to a survey taking too long.
Over-survey of audience	This is asking the same audience to take surveys multiple times in a year.

Survey risk	Description
Survey value	Not clearly communicating the importance of the survey.
Questions relevance	Not asking relevant questions from the respondents and from those who will be using the results gathered.
Survey vetting	This involves taking surveys and asking your peers or colleagues to also take a survey to obtain a better understanding of challenges before survey rollout.

(Source: Caldwell, 2017)

Leedy and Ormrod (2015:172) provide these guidelines to maximise the return rate of questionnaires:

- Consideration of the timing away from peak periods of potential respondents.
- Making of good first impression with the respondents.
- Motivation of potential respondents.

3.10 Data analysis

Quantitative data analysis involves the collecting of data in the form of numbers (Neuman (2011:46). While Leedy and Ormrod (2015:231) contend that data analysis is organising data that have been collected to make it easy for interpreting and answering a research question. The analysis of quantitative data as stated by Bryman (2012:330), brought about the following two factors to consider before anything can happen:

- The techniques have to be appropriately matched to the variable types that are created for in the study.
- The limitations of the kind of techniques that can be utilised depend on the size and nature of the sample selected.

While there are different types of data analysis, the focus of the study was on survey research which is discussed in the next section (Van Zyl, 2014:198).

A survey is regarded as efficient as data collection is completed after first contact is made with respondents and information is collected (Van Zyl, 2014:203). The researcher utilises a written questionnaire or formal interviews to learn people's backgrounds, beliefs or opinions in research situations (Neuman, 2014:320). It is on this note that Leedy and Ormrod (2015:159), support the fact that survey research involves acquiring information through a questionnaire about one or more groups of people about their characteristics, opinions, attitudes or previous experience and presenting their answers. Bryman (2012:173) indicates that, for the analysis of data to be believable, a measure needs to be reliable and it would need to make it valid.

3.10.1 Variables

According to Leedy and Ormrod (2015:237), a variable is known as a characteristic in a research investigation that has two or more values. There are different types of categories of variables, namely interval/ratio, ordinal variable, nominal variables and dichotomous variables (Bryman, 2016:334). Table 3.10 presents the description of categories of variables. Leedy and Ormrod (2015:110) contend that virtually all forms of measurements fall under variables as described in Table 3.10. With any variables, there are statistical tools for use of the analysis of data.

Table 3-10: Variable category descriptions

Variable	Description
Interval/ratio	This is a variable where the distances between the categories are identical across the range (Bryman, 2012:336).
Ordinal variable	This is a variable with an inherent order of its categories; for example, job positions, age groups, work experience and opinion measures (Neuman, 2014:223).
Nominal variable	This is a variable with no logical or inherent order of its categories; To name the few examples: gender, ethnicity, eye colour, marital status, nationality (Leedy & Ormrod, 2015:111).
Dichotomous variable	Variables containing data that have only two categories; for example, gender (Bryman, 2012:336).

The constructs opined in COBIT 5 for the study were included in the design of the data collection instrument. The 7 constructs of COBIT 5 enablers were linked to 5

secondary research questions as stated in Table 3.11. Further explanation of variables can be found in Table 3.15.

Table 3-11: COBIT 5 Constructs - Research questions linkage

COBIT 5 Framework constructs	Research questions
Principles, policies and frameworks	What business intelligence strategies can be implemented in the Department of Transport?
Information Services, infrastructure and applications	What are the MIS (services, infrastructure and applications) implemented at the Department of Transport to enhance BI?
Processes	What processes for the integration of MIS can effectively enhance decision-making?
Culture, ethics and behaviour Organizational structures	How organisational ethos can be a key success factor in decision-making activities in the Department of Transport?
People, skills and competencies	What are the skills, competencies and people required for successful completion of BI activities for making the correct decisions?

3.10.2 Statistical tools for analysis

There are three types of variable analysis and those depend on the type of research question and the number of variables (Leedy & Ormrod, 2015:113). Bryman (2012:337-345) describes the types of analysis as described in Table 3.12.

Table 3-12: Variable analysis

Analysis	Description
Univariate	This is the analysis of one variable at a time.
Bivariate	This form of analysis is concerned with the analysis of two variables at a time in order to uncover whether or not two variables are related.
Multivariate	This is the simultaneous analysis of three or more variables

Wagner (2012:204-205) mention that statistical hypothesis consists of two forms:

- Null hypothesis
- Alternative hypothesis

According to Bryman (2012:347), the null hypothesis is known as the hypothesis of no difference between groups or no association between variables. While alternative hypothesis states that there is a difference or an association (Leedy & Ormrod, 2015:58).

3.10.3 Nature of variables

Continuous variable (CV) is a numerical variable can take on an infinite number of values that flow along the continuum (Neuman, 2011:218). Wagner, Kawulich and Garner (2012:75) define the dependent variable (DV) as the variable of primary interest to the researcher where it is assessed to determine the effect of the independent variable. The DV in the above example can be measured by “High”, “Medium” and “Low”. Therefore, the DV is ordinal. The DV can be nominal or continuous.

Leedy and Ormrod (2015:59) define an independent variable (IV) as a variable that can influence or explain the DV. Pickard (2013:120) regards IV as the situation manipulated by the researcher to determine the extent to which manipulation effects the DV.

If the single variable is categorical, nominal or ordinal, the best tools are percentages or proportions. If the single variable is continuous, the appropriate tool is ‘mean’, which, as defined by Wagner, Kawulich and Garner (2012:271), is an average that is calculated by adding together all the scores and then dividing that total by the number of individual scores. For bivariate and multivariate analyses, the choices made are shown in Table 3.13.

Table 3-13: Bivariate and multivariate analysis

		Dependent Variable (DV)		
		Continuous	**Ordinal**	**Nominal**
Independent Variable	**Continuous**	Pearson’s correlation coefficient	-	Chi-square

		Dependent Variable (DV)		
		Continuous	**Ordinal**	**Nominal**
	Ordinal	-	Spearman's correlation coefficient	Chi-square
	Nominal	Analysis of variance; T-test & regression	Mann-Whitney U	Chi-square
Sources: Leedy and Ormrod (2015:259), Wagner, Kawulich and Garner (2012:271)				

The statistical procedures and their purposes are explained by Leedy and Ormrod (2015:259) in Table 3.14.

Table 3-14: Statistical procedure and purpose

Statistical procedure	Purpose
Analysis of variance (Anova)	This is to examine the difference among three or more means by comparing the variances *(s^2)* both within and across groups.
Chi-square	This is used to determine how closely observed frequencies or probabilities match expected frequencies or probabilities.
Mann-Whitney U	This is used to compare the medians of two groups when the data are ordinal rather than interval in nature.
Pearson's correlation coefficient	This is used to investigate whether a Pearson product moment correlation coefficient *(r)* is larger than would be expected from chance alone.
Regression	This is used to evaluate how accurately one or more variables enable predictions to be made regarding the values of another (dependent) variable.
Spearman's correlation coefficient	This is used to describe the relationship the relationship between two variables (Pickard, 2013:304).
T-test	This is used to determine whether a statistical significant difference exists between two means.
Source: Leedy and Ormrod (2015:259)	

3.10.4 Data analysis template

The data analysis template (DAT) is used to evaluate research questions (see Table 3.15 for reference).

Table 3-15: Data analysis template

	Research question (RQ)	Variables in RQ	Categories of variables	Types of variables	No of variables	Type of analysis	Stat tools
1	What business intelligence strategies can be implemented in the Department of Transport?	Business intelligence strategies implementation	7-Point Likert scale used from 1 – Extremely poor, and 7 – Excellent.	Nominal	One	Univariate	Percentages
2	What are the MIS (services, infrastructure and applications) implemented at the Department of Transport to enhance BI?	MIS implementation	System implementation, characteristics, experience, challenges, system role, integrity & decision implications		Four	Multivariate	Proportions
3	What processes for the integration of MIS can effectively enhance decision-making?	Integration process	7-Point Likert scale used from 1 – Extremely poor, and 7 – Excellent.	Nominal	One	Univariate	Percentages
4	How organisational ethos can be a key success factor in decision-making activities in the	Organisational ethos can be key success factors in decision making	7-Point Likert scale used from 1 – Extremely poor, and 7 – Excellent.	Nominal	One	Univariate	Percentages

	Research question (RQ)	Variables in RQ	Categories of variables	Types of variables	No of variables	Type of analysis	Stat tools
	Department of Transport?						
5	What are the skills, competencies and people required for successful completion of BI activities for making the correct decisions?	Skills, competencies and people	Required skills, training, information updates and system ownership	Nominal	Three	Multivariate	Proportions
Adapted from Ugwu, 2017:31							

3.11 Reliability and validity of the research findings

Validity means truthfulness on how well the idea fits into actual reality (Neuman, 2011:208). Reliability is concerned with the consistency with which a measurement instrument produces a certain result consistently when the entirety being measured has not changed (Leedy & Ormrod, 2015:116). Neuman (2011:314) states that the validity and reliability mean that the respondents should quickly grasp each question's meaning as the researcher has intended by answering completely, honestly and having a believe that their answers are meaningful. Bryman (2016:41) brings a new aspect called replication, where researchers must spell out their procedures in detail for the original results to match an existing evidence since this is close to reliability.

For the purpose of the study, Table 3.16 defines validity and reliability in quantitative study (Neuman, 2011:212).

Table 3-16: Measurement reliability and validity types

Reliability (Dependable measure)	Validity (True measure)
Stability over time (verify using test-retest method)	Face (Making sense in the judgement of others)
Representative across subgroups (Verification using split half method)	Content (captures the entire meaning)

Reliability (Dependable measure)	Validity (True measure)
Equivalence – across indicators	Criterion – agrees with an external source
(Verify using subpopulation analysis)	Construct – has consistent multiple indicators

3.11.1 Reliability of instrument

The statistical methods used to test for reliability of the questionnaire and the constructs were done using the Cronbach's alpha (α), also known as coefficient. The reliability of the questionnaire used to collect data according to Statistical Package for the Social Sciences (SPSS) results has an α-coefficient of 0.951, which is above the average of 0.700. Table 3.17 illustrates the results of the questionnaire.

Table 3-17: Reliability statistics of the questionnaire

Cronbach's Alpha	Cronbach's Alpha based on standardised items	N of Items
.951	.952	24

Table 3.18 presents the construct results that have α-coefficients of above 0.700 as follows: BI = Business intelligence strategies, MIS = Management information system implementation, PIM = Processes for integration of MIS, and CEB = Culture, ethics and behaviour. All constructs show good reliability measures that were above the recommended threshold of 0.7. There was no need to delete any item from the analysis.

Table 3-18: Cronbach's Alpha reliability of the constructs

	Cronbach's Alpha	Cronbach's Alpha based on standardized items	No. of items
BI	.912	.916	5
MIS	.847	.859	5
PIM	.934	.934	4
CEB	.953	.953	10

3.12 Ethical considerations

Historical research studies were littered with lapses in ethical judgement, like faking of data, inaccurately reporting or obtaining data illegally, which has led to the development of ethics committees and a code of ethics to govern any study going forward (Wagner, Kawulich & Garner, 2012:62). Ethical considerations require the researcher to balance two values such as the pursuit of scientific knowledge and the rights of the respondents being studied (Neuman, 2014:145). According to Van Zyl (2014:89), the researchers must ensure that high ethical standards are maintained when conducting a research study.

Leedy and Ormrod (2015:121-123) present the following four categories that are widely accepted in the scientific community as fundamentals of the enquiry process and are regarded as ethical foundations:

- Protection of respondents from any harm
- Voluntary and informed participation
- Respect right to privacy
- Honesty with professional colleagues

One of the ethical principles in governing research is that people should never participate in research unless they had voluntarily agreed to do so (Neuman, 2011:149). Bryman (2012:137) provides tips on protecting data and confidentiality, which include the following:

- No storage of respondents' details on unencrypted hard drives
- The researcher should use identifier codes on data files and separate the list of respondents and their identifier codes in a locked safe storage
- The researcher should ensure that the note takers sign a letter that they will abide by the PoPI Act
- To make sure that notes taken do not have respondents' names
- The transcripts must be kept in a locked safe storage

Unisa has developed a code of ethics that was approved by the Unisa Council, setting out the university's ethic values and standards of ethical conduct (Schellnack-Kelly, 2017:3). The policy indicates that the researcher is responsible for ensuring that he or she does not undertake any research without ethical clearance (Unisa, 2016:5). The researcher observed the policy by requesting ethical clearance from Unisa (Annexure B) and the DoT to access the population (Annexure C). Furthermore, the consent form addressed that data collected would be used anonymously for other purposes and individual respondents would not be identifiable in such reports.

3.13 Summary

The research methodology was discussed and the choice of the data collection tool explained. The study used a survey questionnaire to collect data as informed by the research problem. The study population was stratified on two layers, namely gender and management level. The importance of pre-testing a questionnaire was discussed for ironing out potential problems that may occur and ensuring that the research instrument is functional. The ethical considerations of the study were explained as well as that the values and standards would be held high when conducting the research.

The following chapter will focus on the presentation of the survey results that were obtained from the questionnaires sent to the selected sample using stratified sampling from the DoT.

CHAPTER FOUR
ANALYSIS AND PRESENTATION OF RESULTS

4.1 Introduction

The previous chapter described the methodology that was applied for this study and data collection tools used to find answers to the research questions. This chapter focuses on the analysis and interpretation of data collected from the selected respondents in the study to draw conclusions and make generalisations of findings to a problem statement (Creswell, 2014:163). The survey contained two sections, namely, demographic and sections B to F were addressing the research objectives as adopted from COBIT 5 framework. The questions asked were a combination of open-ended and closed-ended questions.

Furthermore, the results of data collected from respondents were presented in the form of charts, tables and graphics to assess whether the research questions were adequately addressed and responded to. The responses were captured on a spreadsheet where a cleaning process was conducted. Data were coded into numeric values and exported into SPSS software for further analysis and presented according to the objectives of the study.

4.1.1 Response rate and respondents' profile

The response rate for the study was 50% (89). According to Leedy and Ormrod (2015:171), the return rate of 50% or less is considered normal when using questionnaires. Therefore, data collected for the study were sufficient to be analysed. The demographic profile of middle and senior managers at the DoT comprised gender, designation level, age and branch, which are provided in Table 4.1.

Table 4-1: Demographics of respondents

Factor	Item	Frequency	Per cent	Valid percentage	Cumulative percentage
Gender	Female	44	49.4	49.4	49.4
	Male	45	50.6	50.6	100.0
Level of Management	Middle manager	74	83.1	83.1	83.1
	Senior Manager	15	16.9	16.9	100.0
Age	30-39	37	41.6	41.6	41.6

Factor	Item	Frequency	Per cent	Valid percentage	Cumulative percentage
	40-49	38	42.7	42.7	84.3
	50 and above	14	15.7	15.7	100.0
Branch	Administration	39	43.8	43.8	43.8
	Civil Aviation	5	5.6	5.6	49.4
	Integrated Transport Planning	15	16.9	16.9	66.3
	Maritime Transport	5	5.6	5.6	71.9
	Public Transport	10	11.2	11.2	83.1
	Rail Transport	5	5.6	5.6	88.8
	Road Transport	10	11.2	11.2	100.0

The graphical representation of each element from Table 4.1 is represented under below sub-sections.

4.1.1.1 Gender

Of the 100% (89) of respondents, as reflected in Table 4.1 and Figure 4.1, 51% (45) were males and 49% (44) were females. There were 90 males and 89 females from the stratified sample selected as potential respondents.

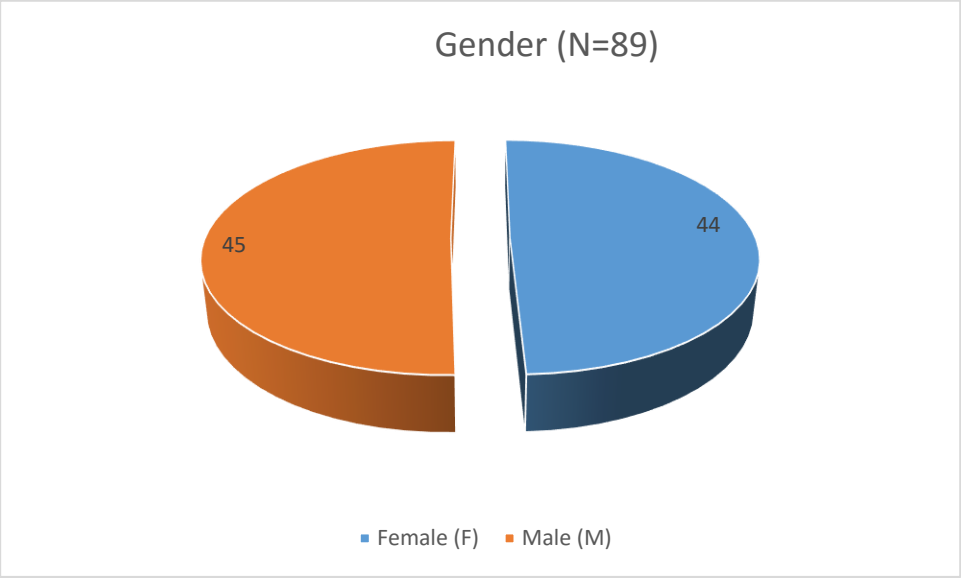

Figure 4.1: Gender

4.1.1.2 Level of management

Of the 89 respondents indicated in Figure 4.2, 83% (74) were junior or middle managers and 17% (15) by senior managers of the organisation. It was expected that

junior and middle managers would have a better response rate indicated by the stratified sample. There were 125 junior or middle managers, as opposed to 54 senior managers in the sampled data.

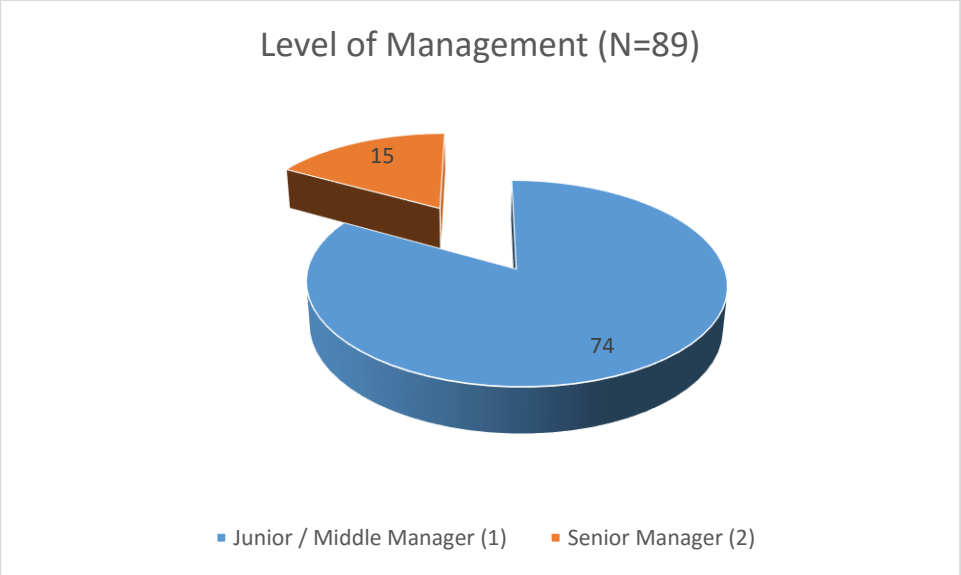

Figure 4.2: Level of management

4.1.1.3 Age group

The age of respondents was derived from their responses to the variable question of age on the questionnaire. The age profile as depicted in Table 4.1, was calculated when the survey closed. Out of the 89 respondents whose age group was asked, the graphical representation is indicated in Figure 4.3.

No person indicated age group 20–29 years'. A total of 42% (37) indicated the age group of 30–39 years, 43% (38) indicated 40–49 and 16% (14) indicated 50 years' and above. A total of 43% (38) of respondents in the age group 40-49 have made up the highest number of responses on the variable of age to the questionnaire.

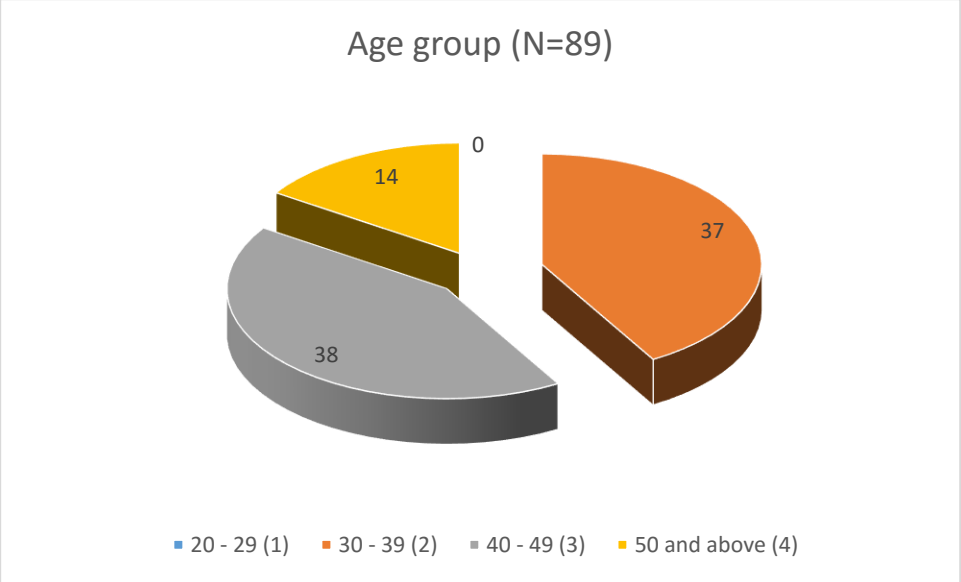

Figure 4.3: Age group

There was no selection of respondents in the age group 20-29. The answer lies in the standards that have been set by the Department of Public Administration that an individual is not appointed to higher positions in the age group 20-29 years, in this case from junior management to senior management (RSA, 2014:9).

4.1.1.4 Branch

In the variable branch type, the respondents were requested to provide the business unit they belonged to at the time of the administration of the survey. The researcher decided to group the categories according to DoT's approved organisational structure, as indicated in Figure 4.4.

At 44% (39), the administration branch accounted for the highest number of respondents, which could be because they are supporting the core business units of the department. Administration consists of the following business units: Legal, Finance, Office of Audit Executive, Communications, International Relations, Corporate Services and Office of the Director-General.

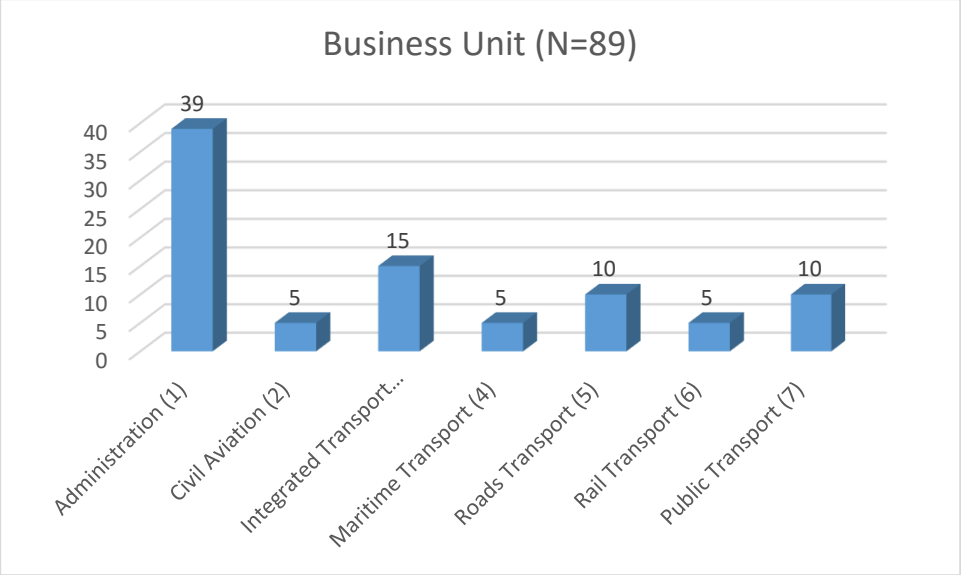

Figure 4.4: Business Unit

4.2 Descriptive analysis

Since the population being studied was large, stratified sampling was conducted to ensure that the final sample of 179 respondents was manageable. An introduction email containing a cover letter, ethical clearance from the university and the permission approval to conduct the study from the employer was sent to selected respondents in a phased approach between 29 August and 3 November 2017. There were a total of 123 respondents and 34 were partially completed and discarded, as indicated in Figure 4.5. Completed response datasets were considered when the respondent had pressed the submit button at the end of the survey.

Only eighty-nine (89) online questionnaires were completed, which represented a 50% response rate. The remaining completed datasets obtained from the study were deemed to be sufficient to produce reliable results. The completed dataset was downloaded from LimeSurvey free open source software (FOSS) into a Comma-separated values (CSV) softcopy document. Document analysis, strategic planning documents, treasury regulations and public service documents were used to supplement the questionnaire data.

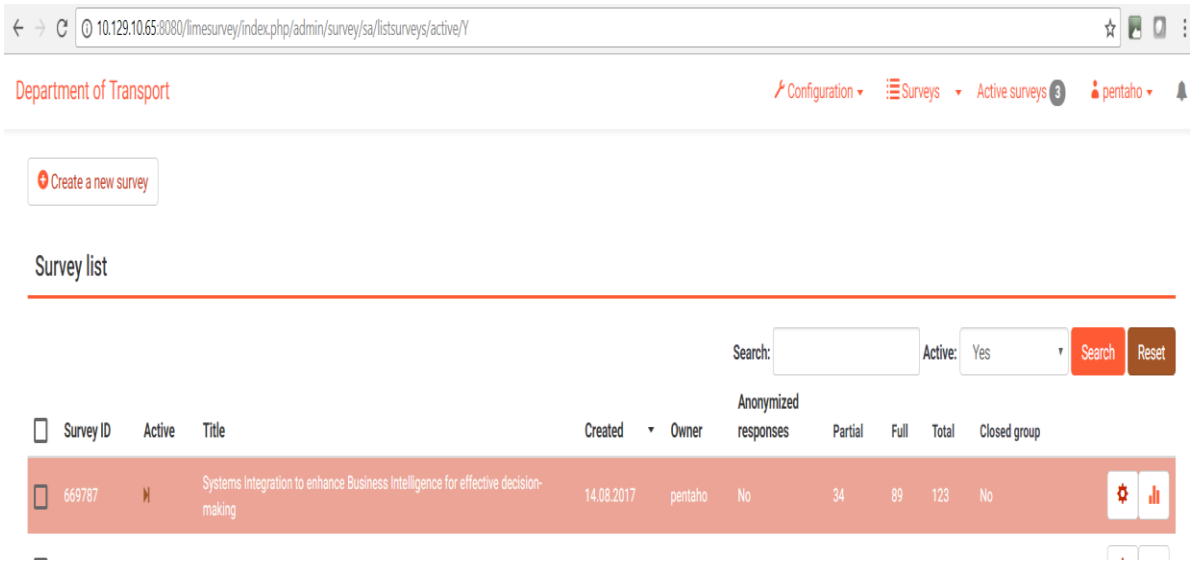

Figure 4.5: Response statistics

Quantitative data from online questionnaires were downloaded already analysed by LimeSurvey system and graphs were produced using a Microsoft Excel® spreadsheet. Thematic analysis was done by creating themes on responses that were similar. Thematic diagrams were produced on Microsoft Visio®. Data were separated into two and analysed statistically through SPSS, and open-ended responses were analysed thematically.

4.2.1 Construct items

The questionnaire had four parts that assessed how the respondents answered each construct. The description of each construct covered in the questionnaire is: BI = Business intelligence strategies, MIS = Management information system implementation, PIM = Processes for integration of MIS, and CEB = Culture, ethics and behaviour.

Only constructs that were qualified for further analysis were analysed to obtain its descriptive analysis statistics. The descriptive statistics results as per the qualified constructs are presented in Tables 4.2; 4.4; 4.6 and 4.7. A 7-Point Likert scale ranges from 1 to 7, which is used as: 1 – Extremely poor, 2 - Very poor, 3 – Poor, 4 – Average, 5 – Good, 6 – Very good, and 7 – Excellent.

According to Arnold, Chapman and Clive (2012:241), the mean determines the average score that represents the central value of the data collected based on the Likert scale. As defined by Roberts, Edgerton, Peter and Wilkinson (2015:100), the standard deviation is a measure of distribution and it gives a way to determine the distance between each value of the response. The deviation above implies a strong variation between the responses, and the lower standard deviation scores show a little variation between the responses from the respondents.

4.2.2 Normality Test

Normality testing involves investigation of Skewness and kurtosis z-values which should be somewhere in the span of -1.96 to +1.96. The BI construct z-values for females on skewness is 0.32 and kurtosis is 0.12 while the male's skewness is -1.93 and kurtosis is 0.48. Table 4.2 describes the normality test descriptives for the study. The MIS construct z-values for females on skewness is 1.53 and kurtosis is 0.20 and the male skewness value is 0.95 while kurtosis is -0.96. PIM construct z-values for females on skewness is 0.01 and kurtosis is -0.31 and the male skewness value is -1.28 while kurtosis is -0.77. CEB construct z-values for females on skewness is -2.69 and kurtosis is 5.04 and the male skewness value is -2.39 while kurtosis is 4.15.

Table 4-2: Normality Descriptives

Gender				Statistic	Std. Error
Business Intelligence strategies	Female	Mean		25.3000	.61831
		95% Confidence Interval for Mean	Lower Bound	24.0493	
			Upper Bound	26.5507	
		5% Trimmed Mean		25.2778	
		Median		25.0000	
		Variance		15.292	
		Std. Deviation		3.91054	
		Minimum		16.00	
		Maximum		35.00	
		Range		19.00	
		Interquartile Range		4.75	
		Skewness		.120	.374
		Kurtosis		.853	.733
	Male	Mean		24.3171	.93537
		95% Confidence	Lower Bound	22.4266	

Gender				Statistic	Std. Error
		Interval for Mean	Upper Bound	26.2075	
		5% Trimmed Mean		24.5732	
		Median		25.0000	
		Variance		35.872	
		Std. Deviation		5.98932	
		Minimum		10.00	
		Maximum		35.00	
		Range		25.00	
		Interquartile Range		8.00	
		Skewness		-.713	.369
		Kurtosis		.344	.724
Management Information System implementation	Female	Mean		24.4750	.62016
		95% Confidence Interval for Mean	Lower Bound	23.2206	
			Upper Bound	25.7294	
		5% Trimmed Mean		24.3333	
		Median		24.0000	
		Variance		15.384	
		Std. Deviation		3.92224	
		Minimum		18.00	
		Maximum		35.00	
		Range		17.00	
		Interquartile Range		4.75	
		Skewness		.574	.374
		Kurtosis		.145	.733
	Male	Mean		24.0488	.83590
		95% Confidence Interval for Mean	Lower Bound	22.3594	
			Upper Bound	25.7382	
		5% Trimmed Mean		24.0799	
		Median		24.0000	
		Variance		28.648	
		Std. Deviation		5.35234	
		Minimum		13.00	
		Maximum		34.00	
		Range		21.00	
		Interquartile Range		9.00	
		Skewness		-.035	.369
		Kurtosis		-.696	.724
Processes for integration of Management Information Systems	Female	Mean		18.4250	.69696
		95% Confidence Interval for Mean	Lower Bound	17.0153	
			Upper Bound	19.8347	
		5% Trimmed Mean		18.4167	

Gender				Statistic	Std. Error
		Median		18.5000	
		Variance		19.430	
		Std. Deviation		4.40796	
		Minimum		8.00	
		Maximum		28.00	
		Range		20.00	
		Interquartile Range		6.75	
		Skewness		.002	.374
		Kurtosis		-.224	.733
	Male	Mean		18.6341	.71887
		95% Confidence Interval for Mean	Lower Bound	17.1813	
			Upper Bound	20.0870	
		5% Trimmed Mean		18.8130	
		Median		19.0000	
		Variance		21.188	
		Std. Deviation		4.60302	
		Minimum		8.00	
		Maximum		28.00	
		Range		20.00	
		Interquartile Range		6.50	
		Skewness		-.471	.369
		Kurtosis		-.056	.724
Culture, Ethics, and Behaviour	Female	Mean		46.2250	1.57606
		95% Confidence Interval for Mean	Lower Bound	43.0371	
			Upper Bound	49.4129	
		5% Trimmed Mean		46.5833	
		Median		46.0000	
		Variance		99.358	
		Std. Deviation		9.96787	
		Minimum		10.00	
		Maximum		68.00	
		Range		58.00	
		Interquartile Range		10.00	
		Skewness		-1.007	.374
		Kurtosis		3.692	.733
	Male	Mean		49.4146	1.55468
		95% Confidence Interval for Mean	Lower Bound	46.2725	
			Upper Bound	52.5568	
		5% Trimmed Mean		49.8062	
		Median		50.0000	
		Variance		99.099	

Gender			Statistic	Std. Error
		Std. Deviation	9.95484	
		Minimum	14.00	
		Maximum	69.00	
		Range	55.00	
		Interquartile Range	12.50	
		Skewness	-.882	.369
		Kurtosis	3.003	.724

According to Razali and Wah (2011), Table 4.3 presents the results from the two tests, namely, Kolmogorov-Smirnov and the Shapiro-Wilk which should be above 0.05 in order to be accepted. All the constructs that are not significantly different from normal distribution, the null hypothesis is accepted. For the constructs that the significant is lower, the null hypothesis reject which means that data is not normally distributed.

Table 4-3: Tests of normality

	Gender	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Business Intelligence strategies	Female	.181	40	.002	.960	40	.173
	Male	.120	41	.142	.952	41	.084
Management Information System implementation	Female	.147	40	.030	.965	40	.251
	Male	.091	41	.200*	.977	41	.573
Processes for integration of Management Information Systems	Female	.115	40	.200*	.983	40	.800
	Male	.117	41	.173	.956	41	.113
Culture, Ethics, and Behaviour	Female	.148	40	.027	.927	40	.013
	Male	.098	41	.200*	.943	41	.039

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

4.3 Data presentation

The results are presented in numeric values, figures and written descriptions. The results of the study are presented as per the objectives in section 1.4 of Chapter One. The objective study was to investigate the integration of information management systems at the DoT with the view to enhancing BI.

The specific research objectives were to:

- BI strategies (principles, policies and frameworks) implemented in the DoT

- assess how the processes for integration of MIS can effectively enhance decision-making
- identify MIS (services, infrastructure and applications) implemented in the DoT
- assess the culture, ethics behaviour and organisational structures as key success factors in decision-making activities in the DoT
- identify people, skills and competencies required for the successful completion of BI activities for making the correct decisions.

4.3.1 Business intelligence strategies

The purpose of this objective was to determine the BI strategies (principles, policies and frameworks) implemented in the DoT. The study presented strategy as an important aspect to decision-making. Findings were presented according to the sub-themes as stated below to implement BI strategies in effective decision-making:

- Policies/information-gathering strategies implemented
- Strategy used to collect information for decision-making
- Policies for governing the systems
- Review the adopted strategies

4.3.1.1 Policies/information-gathering strategies implemented

Respondents were asked if they had any policies/information-gathering strategies implemented within their section/branch. An overwhelming majority of 91% (81) did indicate having a policy or some form of information-gathering strategy implemented. Only 9% (8) of the respondents indicated that they do not have a policy nor an information-gathering strategy. The researcher did not request to be shown any information-gathering policy, the ownership of such policy, whether there were different policies and, lastly, if there was a single policy for the organisation in relation to the question asked due to the survey being completed online.

4.3.1.2 Business intelligence strategies

Table 4.4 represents a description of BI construct. The mean distribution of the analysed BI construct ranged between 4.62 to 5.10, which implies that respondents within this construct ranged from average (4) to good (5). The lower standard deviation

scores showed that there was little variation between the responses from the respondents.

Table 4-4: BI descriptive analysis

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
This system is easy to change for supporting your business strategies **(BI1)**	81	1	7	4.62	1.328	-.834	.267
This system helps you improve reliability of decision processes or outcomes **(BI2)**	81	1	7	5.01	1.124	-.946	.267
This system helps you use more sources of information in decision making. **(BI3)**	81	2	7	5.05	1.094	-.628	.267
This system provides you with accurate content to make decisions **(BI4)**	81	2	7	5.10	1.168	-.727	.267

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
The information this system provides is easily comprehends for users **(BI5)**	81	2	7	5.02	1.162	-.736	.267

4.3.2 Management information system implementation

The purpose of this section of the questionnaire was to establish whether there were MIS (services, infrastructure and applications) implemented to enhance BI. A thematic analysis method was used to assess the IT system's usage.

4.3.2.1 IT systems' usage

All the respondents confirmed that they have IT systems in their divisions. This skill often allows respondents to get work done in a more organised, efficient and timely manner in jobs that require the frequent use of a computer device and information analysis for decision-making. It was found that 100% (89) of the respondents surveyed indicated that they used or had IT systems.

4.3.2.2 IT systems implementation

The respondents were asked about the types of systems that were implemented. Table 4.3 presents email, intranet and spreadsheet as the most used IT applications by 96% (85), 79% (70) and 73% (65), respectively. Government transversal systems were as follows: 28% (25) used BAS, 11% (10) used Logis, 11% (10) used Vulindlela, 7% (6) used Persal and 8% (7) used Central Supplier Database. The other systems were specifically used by core business units. The interesting IT system, Pastel, was not used by any of the respondents selected due to most users using the system have been transferred to one of the transport agencies. Table 4.3 indicates that 35% (31) of respondents chose the option "Other" for the system they were using and those

systems would not have been specified on the stated applications on the survey (see Figure 4.5).

Table 4-5: IT systems implemented

IT system(s) / application(s) implemented (N=89)	Count	Percentage
BAS	25	28%
Logis	10	11%
Email	85	96%
NLTIS	6	7%
SafetyNet	5	6%
Libwin	3	3%
Spreadsheet	65	73%
Vulindlela	10	11%
Pastel	0	0.%
Barnowl	4	5%
NTF portal	8	9%
SAS	2	2%
eNaTIS	6	7%
Paradox	2	2%
Intranet	70	79%
ACL	4	5%
Road Asset Management System	3	3%
Central Supplier Database	7	8%
Other	31	35%

As Figure 4.6 illustrates, there were responses on questionnaires where respondents were given the option “Other” to add systems they used that were not mentioned on the survey. It was revealed that 7% (6) of the respondents were using Persal and 5% (4) were using Alfresco Document Management System, followed by 3% (3) who were using a website. The other systems were used by either 2% (2) and the majority of the systems were used by 1% (1) of the respondents.

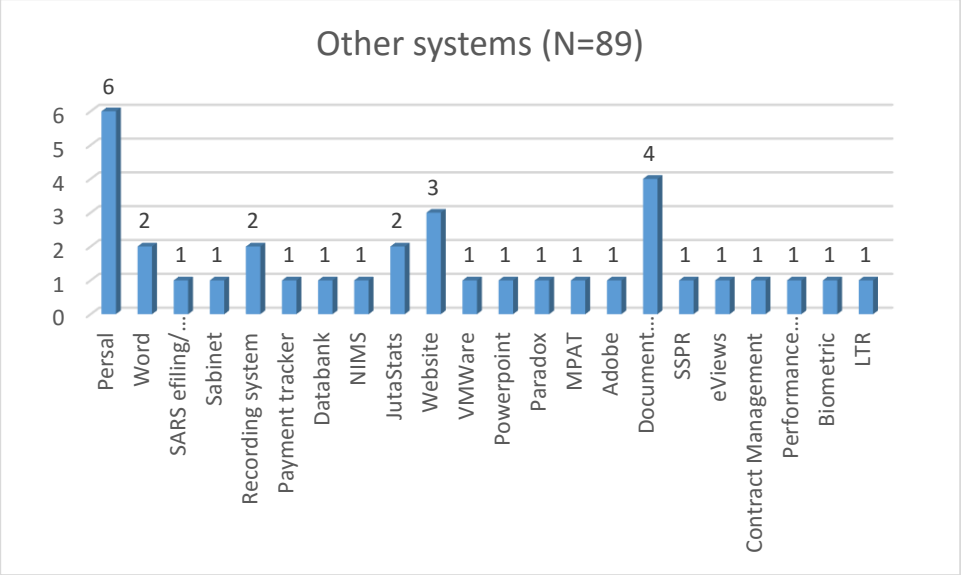

Figure 4.6: Other systems

4.3.2.3 MIS characteristics construct

In the MIS implementation construct analysis in Table 4.6, the mean ranged between 4.53 to 5.12 which clearly suggests that responses within these constructs ranged from average (4) to good (5). The lower standard deviation scores showed that there was little variation between the responses from the respondents.

Table 4-6: MIS construct

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
This system is easy to change for users' requirements **(MIS1)**	89	1	7	4.56	1.500	-.618	.255
This system supports your needs completely **(MIS2)**	89	2	7	5.12	1.096	-.357	.255

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
This system is reliable **(MIS3)**	89	3	7	5.08	1.058	-.101	.255
This system is error free **(MIS4)**	89	1	7	4.53	.990	.208	.255
The system displays information whenever you do a search **(MIS5)**	89	1	7	4.81	1.167	-.320	.255

4.3.2.4 Year system(s) in usage

Eighty-nine per cent (79) of the respondents in Figure 4.7 indicated that they have been using computer systems for 4 years and more, as compared to 2% (2) who used systems 3 years ~< 4 years, 6% (5) for 2 years ~< 3 years and 1% (1) for those who used the systems less than six months. The interesting thing is that there was no one who had used the system in 1 year~< 2 years.

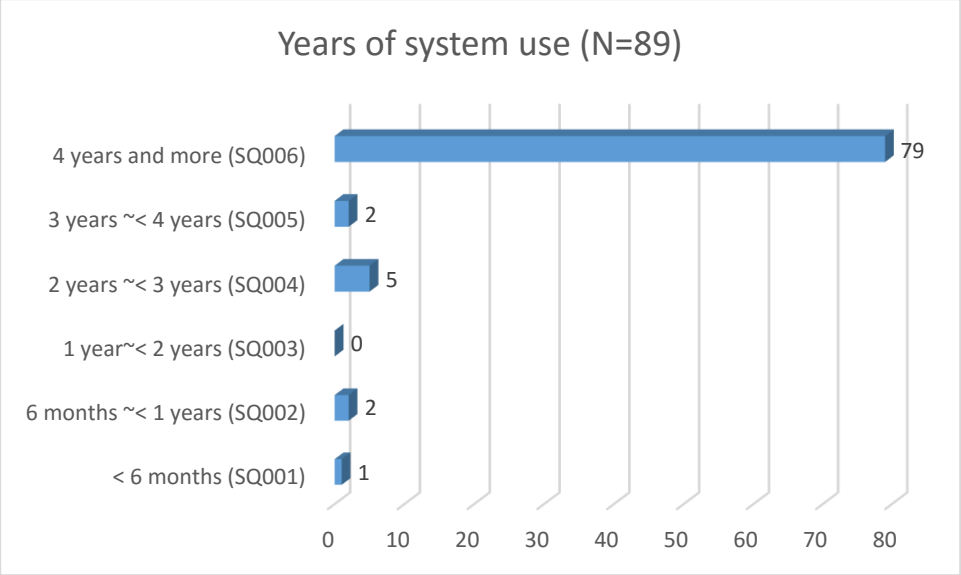

Figure 4.7: Year of system use

4.3.2.5 System integration

This question was answered by 93% (83) of the respondents who completed the survey. Only 7% (6) chose not answer this question. Figure 4.8 provided thematically analysed answers to an open-ended question that investigated systems that are integrated. Twenty-five per cent (22) of the respondents had integrated systems. This consisted of the following systems: MIS 12% (11), Decision Support System: 5% (4), internet 5% (4), Geographic Information Systems 2% (2) and Knowledge Management Systems 1% (1). System analysis on those systems was not done and the researcher relied on National Treasury documentation that was publicly available (RSA, 2010:17-27). It was found that systems that were integrated are financial systems that are implemented by the National Treasury for use by all national and provincial departments (RSA, 2010:17-27). The strength of these integrated systems is that funds allocated and used can be traced and accounted. The weaknesses of this integration are the following:

- There was no bi-direction flow of Information between systems.
- The systems are legacy systems and cannot support new interoperability standards.
- It takes at least one day for information to be updated to other systems.

Other respondents, who make up 65% (58), indicated that their systems are not integrated with any system. The answers given was that 30% (27) indicated “None”, 18% (16) indicated “No”, 6% (5) indicated “Not”, 5% (4) indicated “Independent systems”, 5% (4) indicated “do not think…” and 2% (2) indicated “Nothing”. Of the 7% (6) respondents did not respond to the question and at least 3% (3) of the respondents stated that the question was not applicable to them.

(See Figure 4.8)

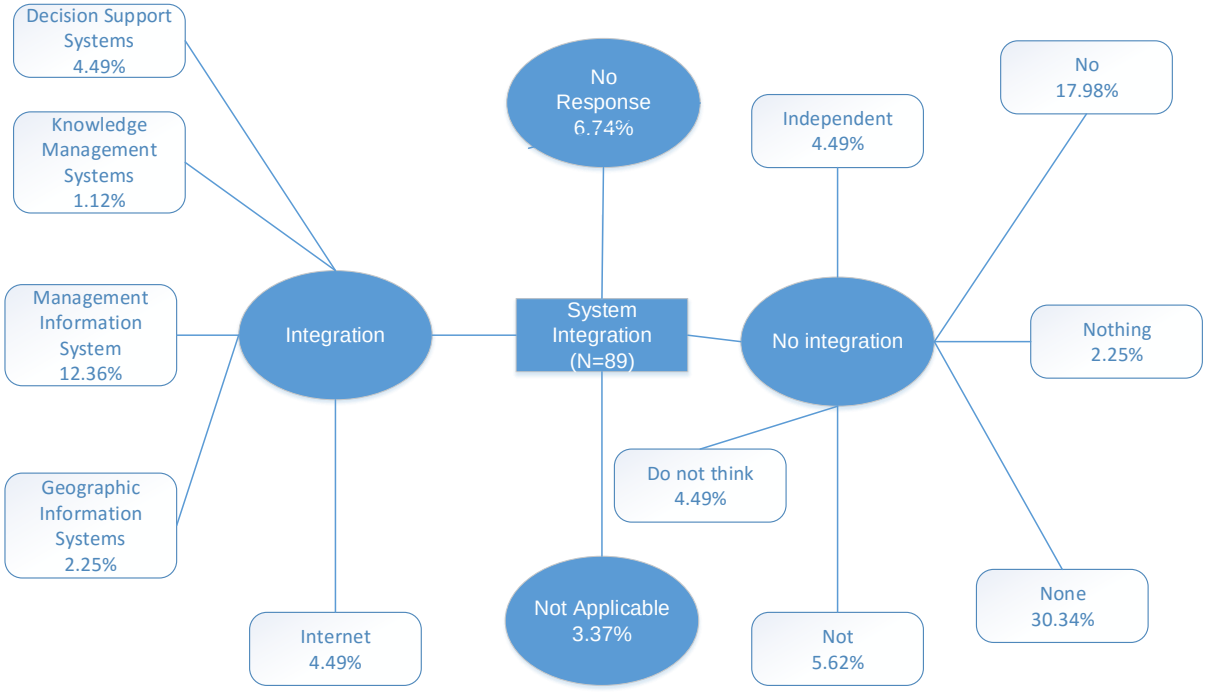

Figure 4.8: System integration

4.3.2.6 System challenges

The question gave respondents the option to choose any system problem that applies to the system they are using. There was no restriction on the number of problems encountered that the respondents had to choose. Over-dependence on IT ranked the highest, while systems integration capability is indicated as the second most system problem encountered (see Table 4.7).

Table 4-7: System problems encountered

System problem encountered (N=89)	Count	Percentage
Inadequate reporting capability	16	18%
Data quality	19	21%

System problem encountered (N=89)	Count	Percentage
Over-dependent on IT	33	37%
Limited decision-making support capability	18	20%
Systems Integration capability	30	34%
Poor analysis capability to support decision-making	12	13%
Incompatible information	4	5%
Incomplete information exist in different systems	15	17%
Poor software functionality	23	26%
Inadequate training	29	33%

4.3.2.7 System and application's role

Figure 4.9 presents the results of an open-ended question that asked the respondents what assistance they derive from the system(s) they use. Some respondents derived more than one benefit from the systems in use. It is clear that 64% (57) of the respondents use the system for daily functions. Only 31% (28) use the system for data analysis, reporting and monitoring, 30% (24) of the respondents were doing research and 11% (10) of the respondents indicated that they use the system(s) for decision-making.

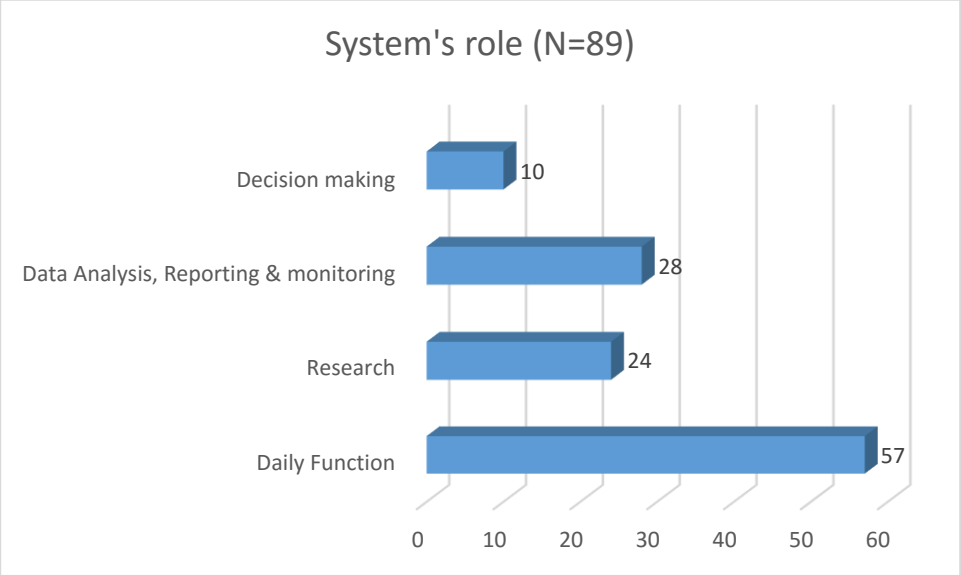

Figure 4.9: System's role

4.3.2.8 Decision-making implications

When asked about the implications of making a decision without using any system, as reflected in Figure 4.10, the answers were grouped into six themes as indicated,

namely: decision-making 22% (20), time management 9% (8), duplication 2% (2), financial management 12% (11), information 45% (40) and productivity 9% (8).

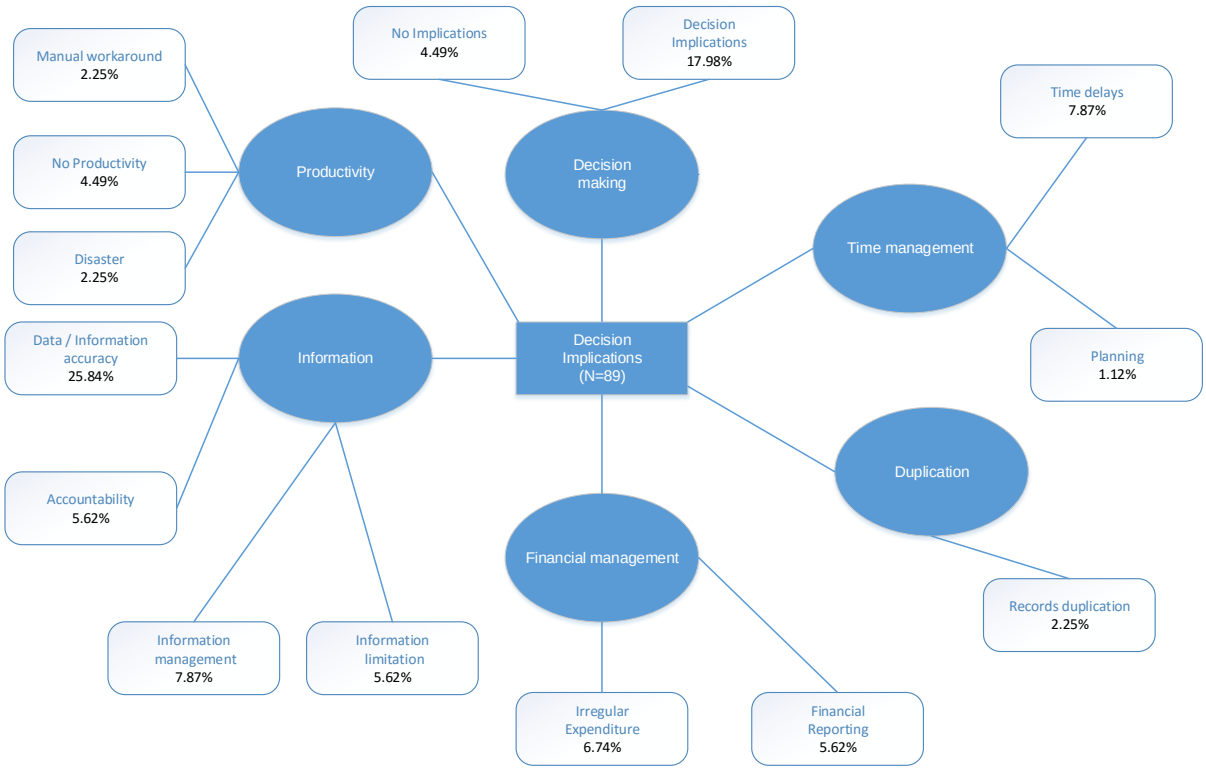

Figure 4.10: Decision implications

4.3.3 Processes for the integration of management information systems

The purpose of this section of the questionnaire was to assess how the processes for the integration of MIS can effectively enhance decision-making as per the objective in section 1.4. The evaluation was how the organisation could make a comprehensive assessment of current decision-making support from MIS. The section covers the following: systems integration challenges and process for integration of MIS construct.

4.3.3.1 Systems integration challenges from stakeholders and systems

The responses were organised thematically as reflected in Figure 4.11. There were no integration challenges from 22% (20) respondents. Only 2% (2) of the respondents did not respond to the question due to the fact that the question was not indicated as compulsory. The other responses ranged from Inaccuracies (16% (14)), Incompatibility (15% (13)), Integration difficulties (13% (12)), Time (10% (9)), Support (10% (9)), Information availability (8% (7)) and Skills (3% (3)).

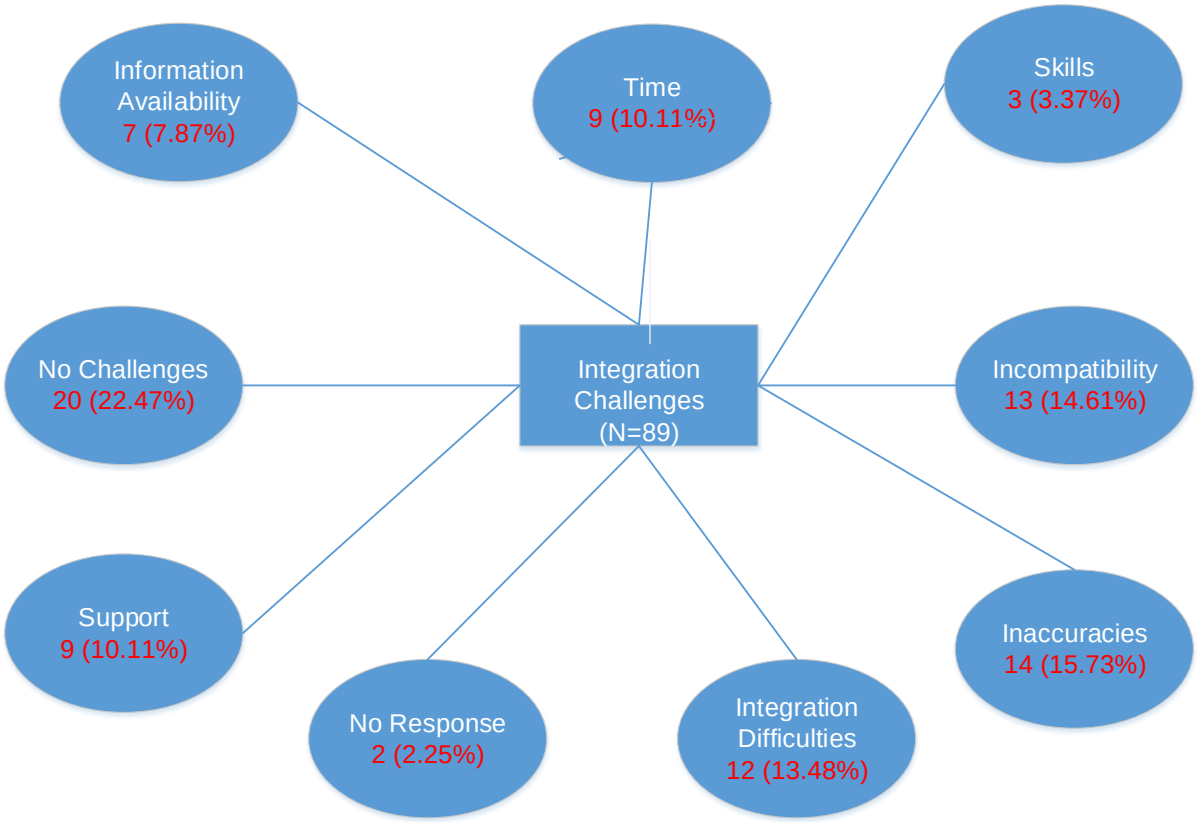

Figure 4.11: Integration challenges

4.3.3.2 PIM construct

In the PIM construct, the mean ranged between 4.44 to 4.76, which suggests that the PIM construct was mostly average (4). The lower standard deviation scores showed that there was little variation between the responses from the respondents (see Table 4.8).

Table 4-8: Process of integration construct

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
This system helps you to identify potential	89	2	7	4.71	1.150	-.457	.255

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
problems **(PIM1)**							
This system provides alternative solutions for you to make decisions **(PIM2)**	89	2	7	4.51	1.253	-.013	.255
This system can help you forecast the future consequences of using various alternatives **(PIM3)**	89	2	7	4.44	1.288	-.023	.255
Your system helps you improve the reliability of decision processes or outcomes **(PIM4)**	89	2	7	4.76	1.262	-.375	.255

4.3.4 Culture, ethics and behaviour

The CEB construct in Table 4.7 ranged from 4.60 to 5.11, which also implies that respondents' responses within this construct ranged from average (4) to good (5). The lower standard deviation scores showed that there was little variation between the responses from the respondents.

Table 4-9: CEB construct

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
Improves your organisation's awareness of shared vision, objectives and values. **(CEB1)**	89	1	7	4.80	1.208	-.590	.255
Increases communication across your section/branch by sharing of knowledge. **(CEB2)**	89	1	7	5.11	1.220	-.796	.255
Improves the capabilities of data analysis and interpretation. **(CEB3)**	89	1	7	4.71	1.189	-.614	.255
Improves availability of the information in you section/branch. **(CEB4)**	89	1	7	5.04	1.224	-.772	.255
Increases the understanding of the problem you face. **(CEB5)**	89	1	7	4.60	1.105	-.532	.255
Stimulates new ways of thinking about a problem or a decision	89	1	7	4.69	1.202	-.690	.255

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
context. **(CEB6)**							
Enhances the decision-maker's ability to process knowledge. **(CEB7)**	89	1	7	4.72	1.108	-.548	.255
Increases your confidence in making decisions. **(CEB8)**	89	1	7	4.83	1.180	-.642	.255
Changes your attitude in your job. **(CEB9)**	89	1	7	4.76	1.168	-.488	.255
Speeds up problem-solving and improves decision quality. **(CEB10)**	89	1	7	4.82	1.248	-.583	.255
Valid N (listwise)	81						

4.3.5 Skills, competencies and people

The responses below were to satisfy the objective in section 1.4 of Chapter One to identify people, skills and competencies required for successful completion of BI activities for making the correct decisions.

4.3.5.1 Skills

Figure 4.12 presents the responses about skills, competencies and people required for successful BI activities. Nine themes were identified as skills, competencies and

people required. The responses were retrieved from an open-ended question. Only 2% (2) of the respondents indicated that no skills are needed. Fifty-four per cent (48) of the respondents considered information technology skills highly, as follows: Computer literacy 43% (38) and technical skills 11% (10), Communications 40% (36), knowledge management 37% (33), analytical 25% (22), management 17% (15), strategic management 10% (9), problem-solving 8% (7) and 8% (7) project management.

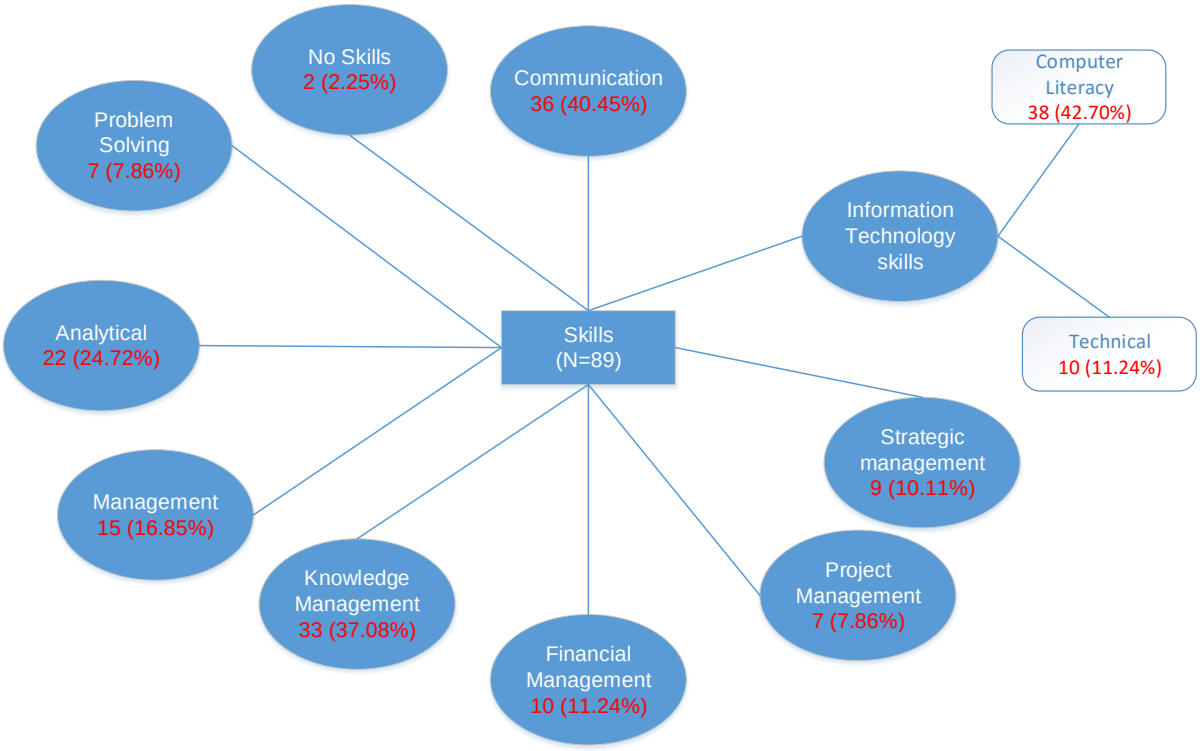

Figure 4.12: Skills

4.3.5.2 Resources training

The respondents were asked the open-ended question of whether training was provided on the system(s) they were using. At least 62% (55) of the respondents indicated that they were trained on the system(s) they were using. Some respondents 11% (10) indicated that they had received some training on certain system(s) and 27% (24) were not trained on any system.

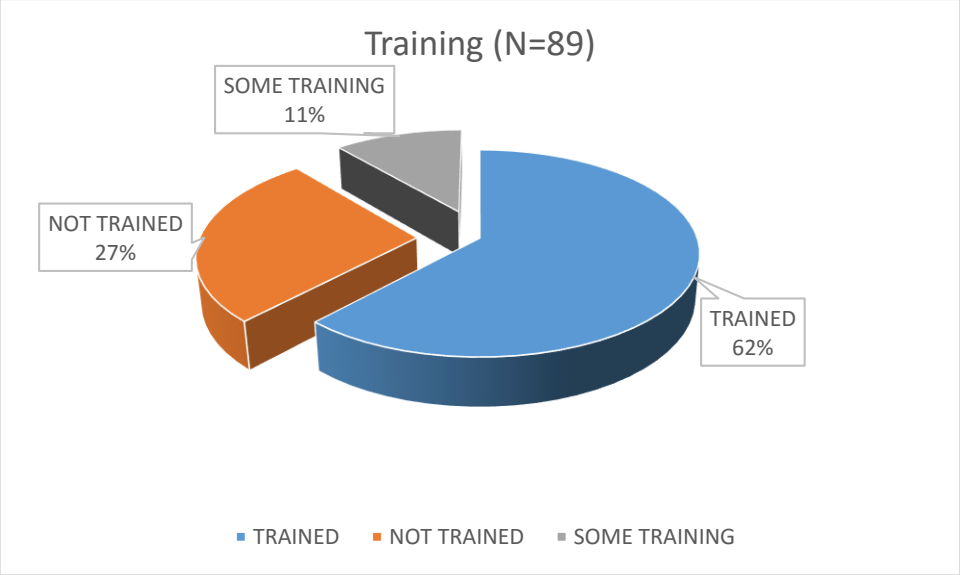

Figure 4.13: Training

4.3.5.3 System operation

Four themes were identified in Figure 4.14 regarding how the respondents learnt how to operate the system(s). As much as 44% (39) of the respondents attended training to learn the skills to operate the system(s). An interesting observation was that 41% (37) of the respondents taught themselves to use the systems they were using. At least 9% (8) of the respondents' knowledge was derived through formal education of previous experience and the question was not applicable to 6% (5) of the respondents. One respondent mentioned that due to delegation of authority, the function was delegated to a subordinate.

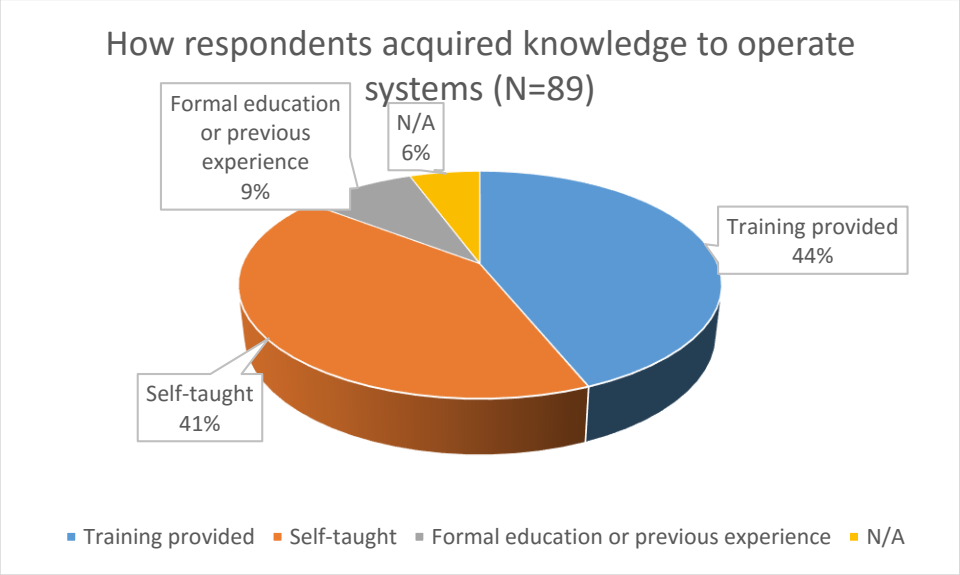

Figure 4.14: System operation

4.3.5.4 System update

Figure 4.15 presents responses to the question on the responsibility of an individual or service provider to update information on the system(s). There were instances where the responsibility to update was spread throughout different stakeholders as indicated below. The users of this system ranked the highest at 47% (42), the information technology department was 38% (34), while 30% (27) of the systems were updated by the service provider. Only 1% (1) of the respondents indicated that the question was not applicable.

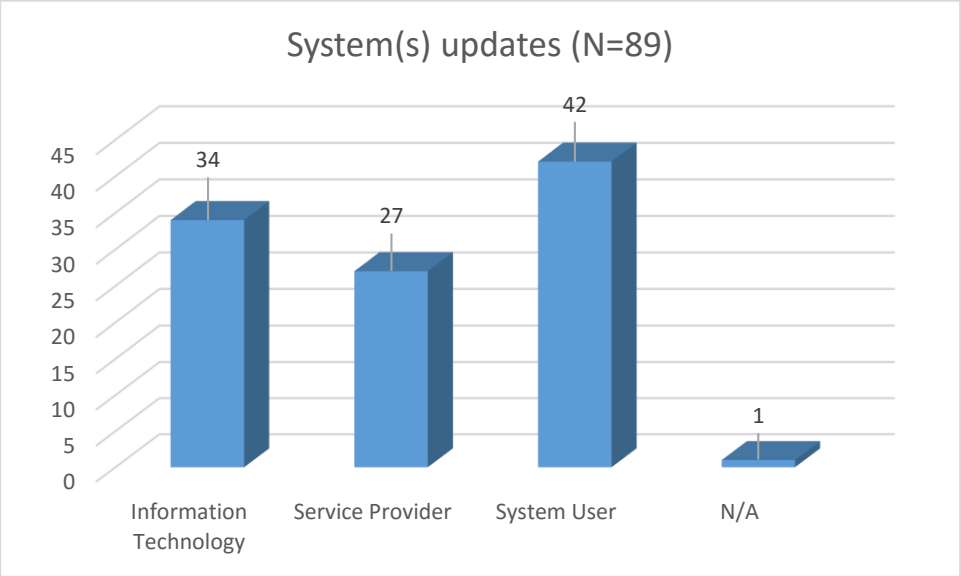

Figure 4.15: System updates

4.3.5.5 System management

The thematically analysed responses in Figure 4.16 indicated that 84% (75) of the respondents indicated that the system(s) used were owned by Department of Transport and its agencies. A total of 18% (16) of the systems were owned by state entities such as the State Information Technology Agency (SITA), the National Treasury, and so on. The remaining systems, 8% (7), were owned by service providers. Only 1% (1) of the responses indicated that the question was not applicable.

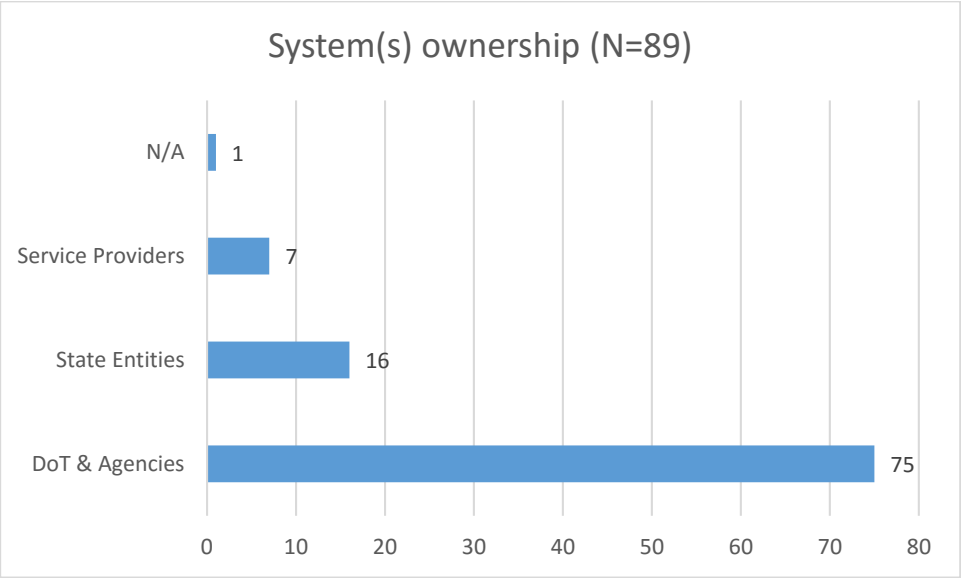

Figure 4.16: System ownership

4.4 Correlation analysis of the constructs

The relationship between the constructs are evaluated in this section. The results of the survey are analysed using correlation to determine the linear relationship between two or more constructs. The significant correlation was flagged by SPSS with two asterisks (0.01) level. This study used the Pearson's correlation for coefficient, as demonstrated in Table 4.8. The correlation results between the qualified model constructs. The results indicated that there is a clear correlation between the BI and MIS constructs. The correlation significance levels between these two constructs were at 0.00 level (2-tailed), that is, $p< 0.01$. Looking at the other results in Table 4.10 it can be seen that the BI construct is also significant to the two remaining constructs, which are PIM and CEB, the correlation significant level of those relationships were at 0.00 level (2-tailed) that is $p<0.01$.

Table 4-10: Pearson's correlation coefficient for all constructs items

		Business Intelligence strategies **(BI)**	Management Information System implementation **(MIS)**	Processes for integration of Management Information Systems **(PIM)**	Culture, Ethics, and Behaviour **(CEB)**
Business Intelligence strategies **(BI)**	Pearson Correlation	1			
	Sig. (2-tailed)				
	N	81			
Management Information System implementation **(MIS)**	Pearson Correlation	.558**	1		
	Sig. (2-tailed)	.000			
	N	81	89		
Processes for integration of Management Information Systems **(PIM)**	Pearson Correlation	.475**	.530**	1	
	Sig. (2-tailed)	.000	.000		
	N	81	89	89	
Culture, Ethics, and Behaviour **(CEB)**	Pearson Correlation	.504**	.446**	.612**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	81	89	89	89

**. Correlation is significant at the 0.01 level (2-tailed).

4.4.1 Linear regression

The linear model summary results in Table 4.11 suggest that the value of R square is 39.6%. The R square indicates how well the dependent variable BI strategies performed, this can be explained by the independent variables which are culture, ethics and behaviour (CEB), management information System implementation (MIS), processes for integration of management information systems (PIM).

Table 4-11: Linear model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.629[a]	.396	.372	4.01226	.396	16.798	3	77	.000

a. Predictors: (Constant), Culture, Ethics, and Behaviour, Management Information System implementation , Processes for integration of Management Information Systems

The analysis of variance (ANOVA) results indicated that the regression model predicts the independent variables very well in Table 4.12. The ANOVA table results show that p= 0.000 <0.01, which implies that the model significantly predicts the dependent variable, business intelligence strategies.

Table 4-12: Anova analysis

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	811.276	3	270.425	16.798	.000[b]
	Residual	1239.563	77	16.098		
	Total	2050.840	80			

a. Dependent variable: Business intelligence strategies

b. Predictors: (Constant), culture, ethics and behaviour, management information System implementation, processes for integration of management information systems

Table 4.13 presents the unstandardised and standardised coefficients which are the estimates that resulted from the regression analysis. The model tab indicates the multiple models that are being reported on. The unstandardised coefficients (**B**) are the values for the regression equation for predicting the dependent variable from the independent. The column of estimates provides the values for MIS, PIM and CEB for this equation. The coefficient for MIS is .407. Therefore, for every unit increase in MIS, a 0.41 unit increase in BI is predicted, keeping all other variables constant. For every increase in PIM, there is a unit increase expectation of .136. Thus, a .14 point increases in the BI score. The last value, the coefficient for CEB, is .129. For every unit increase in CEB, there is an expectation of .13 point increase in the BI score.

Standardised (beta) coefficient variables in Table 4.13, were put on the same scale to compare the magnitude of the coefficients to see which one has more of an effect. It can be noticed that the larger betas are associated with the larger t-values and lower p-values. The **t** and Sig are the t-statistics and their associated 2-tailed p-values in testing whether a given coefficient is significantly different from zero. The 95% confidence intervals for B are related to the p-values such that the coefficient will not be statistically significant if the confidence interval includes zero.

Table 4-13: Coefficients analysis

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	6.241	2.660		2.346	.022	.944	11.538
	Management Information System implementation **(MIS)**	.407	.115	.376	3.540	.001	.178	.636
	Processes for integration of Management Information Systems **(PIM)**	.136	.136	.121	1.006	.317	-.134	.406
	Culture, Ethics, and Behaviour **(CEB)**	.129	.058	.255	2.206	.030	.012	.245

a. Dependent Variable: Business Intelligence strategies

4.4.2 Chi-square test analysis

The analysis of the chi-square (x^2) results is discussed in this section. Leedy and Ormrod (2015:259) define the chi-square test as one being used to determine how closely observed frequencies or probabilities match the expected frequencies or probabilities between two variables. In this case, the cross tabulation of BI and the independent variables, business intelligence strategies, which can be explained by the independent variables of culture, ethics and behaviour (CEB), management information system implementation (MIS), processes for integration of management

information systems (PIM) were carried out to establish where relationships exist. A summary of cross tabulation of independent variables with the dependent variable business intelligence (see Table 4.14).

Table 4-14: Chi-squared case processing summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Business Intelligence strategies * Management Information System implementation	81	91.0%	8	9.0%	89	100.0%
Business Intelligence strategies * Processes for integration of Management Information Systems	81	91.0%	8	9.0%	89	100.0%
Business Intelligence strategies * Culture, Ethics, and Behaviour	81	91.0%	8	9.0%	89	100.0%

Table 4.15 demonstrates the results of chi-square as tested on SPSS between BI and MIS.

Table 4-15: BI and MIS chi-squared test analysis

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	603.333[a]	441	.000
Likelihood Ratio	235.955	441	1.000
Linear-by-Linear Association	24.870	1	.000
N of Valid Cases	81		

a. 484 cells (100.0%) have expected count less than 5. The minimum expected count is .01.

The results produced the reported value of chi-square(x^2) of 603.333 with 441 degrees of freedom (df) at p= 0.000 < 0.01. The implication is that the relationship between BI and MIS is significant. In the BI and PIM chi-square test analysis in table 4.14, the value of chi-square(x^2) of 356.475 with 336 degrees of freedom (df) at p= 0.000 < 0.212. The implication is that the relationship between BI and MIS is not significant. (see Table 4.16).

Table 4-16: BI and PIM chi-squared test analysis

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	356.475[a]	336	.212
Likelihood Ratio	218.296	336	1.000
Linear-by-Linear Association	18.067	1	.000
N of Valid Cases	81		

a. 374 cells (100.0%) have expected count less than 5. The minimum expected count is .01.

In the BI and CEB chi-square test analysis in Table 4.17, the value of chi-square(x^2) of 749.655 with 672 degrees of freedom (df) at p= 0.000 < 0.020. The implication is that the relationship between BI and MIS is not significant.

Table 4-17: BI and CEB chi-squared test analysis

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	749.655[a]	672	.020
Likelihood Ratio	277.109	672	1.000
Linear-by-Linear Association	20.346	1	.000
N of Valid Cases	81		

a. 726 cells (100.0%) have expected count less than 5. The minimum expected count is .01.

4.5 Summary

This chapter presented the results of the demographics of the respondents, followed by the analysis of all four constructs, which were further tested for correlations. The questionnaires were analysed and presented according to the research objectives as

indicated in section 1.4 of Chapter One. Key issues found from the survey are as follows:

- An overwhelming majority of respondents have business intelligence strategies implemented.
- There are systems implemented to assist with business intelligence; however, integration challenges are still there.
- There are challenges that respondents realised in the process of integration that would affect effective decision-making.
- Culture, ethics behaviour and organisational structures were considered as key success factors in decision-making activities in the Department of Transport.
- There are skills, competencies and people to operate IT systems assessed and those systems are owned by Department of Transport and its agencies.

The next chapter interprets and discusses the research findings.

CHAPTER FIVE

INTEPRETATION AND DISCUSSION OF RESEARCH FINDINGS

5.1 Introduction

The previous chapter analysed and presented the study results obtained from data collected from the online survey. This chapter focuses on the interpretation and discussion of the results. Babbie (2016:439) emphasises that data interpretation represents the research outcome in which a test or control variable is discovered to be a mediating factor through which an independent variable has its effects on a dependent variable. Furthermore, Leedy and Ormrod (2015:351) highlight that the interpretation of data is essential because without enquiring into the intrinsic meaning of data, there will be no possibility of resolution of the research problem or its sub-problems. Creswell (2014:178) concurs that interpretation is to address whether the hypothesis or questions were supported or whether they were proved to be in error. Leedy and Ormrod (2015:24) emphasise the significance of data analysis on how the researcher extracts meaning from it, because the uninterpreted data are considered worthless in research. Therefore, once facts, knowledge and understanding have been established, they are presented to the audience in an objective manner (Pickard, 2013:175).

The results are interpreted and discussed based on the following research objectives:

- The business intelligence strategies (principles, policies and frameworks) implemented at the Department of Transport.
- The MIS (services, infrastructure and applications) implemented in the Department of Transport.
- The processes for integration of MIS can effectively enhance decision-making.
- The culture, ethics behaviour and organisational structures as key success factors in decision-making activities in the Department of Transport.
- The identification of people, skills and competencies required for successful completion of BI activities for the making of correct decisions.

5.2 Business intelligence strategies

Strategy is a function that the COBIT 5 enabler regards as a vehicle that would assist the DoT in translating the desired behaviour into practical guidance for day-to-day management.

The findings on this objective are presented and discussed according to the following sub-themes: policies or information-gathering strategies implemented, business strategy support, decision reliability processes, information sources in decision-making, accurate content to make decisions and information provision.

5.2.1 Policies/information gathering strategies implemented

Policies ensure that the right information is available to the right decision makers at the right time in order to drive an organisation forward and, in particular, to support its strategic plan. While ISACA (2012:67), through COBIT 5 enablers, advises that policies provide a more detailed guidance on how principles are put into practice and the influence that decision-making has in the alignment with those principles (see Table 5.1).

Table 5-1: Principles, policies and frameworks

Enabler	Goals	Good practices
Principles, policies and frameworks	Principles, policies and frameworks of the organisation translate stakeholders behaviour's into practical guidance for the DoT's day-to-day management.	• Written policies are in existence to support principles, policies and frameworks. • Organisational policy statements have helped the respondents interviewed to comprehend the organisational principles and goals.
Based on: Brown W.C. 2014. "The failed Vasa: COBIT 5 Governance and the Seven Enablers (Part 3)"		

It is further stated that good policies achieve the following:

- They achieve the stated purpose

- They ensure that principles are implemented in the most efficient way
- They do not create unnecessary resistance

It should be noted that 91% (81) of the respondents had indicated that they have a policy or information-gathering strategy to support the business vision and goals. Having a single authoritative, certified source of data is important, as Hou (2009:27) indicates, that availability of reliable information sources is a key component of executive decision-making. The use of BI systems means the streamlining and increasing of accuracy planning, forecasting and reporting mechanisms.

The mean scores of the questions asked were 4.62, 5.01, 5.10 and 5.02 for system support, improved system reliability, usage of more information sources, content accuracy and information provision, respectively. This implies that, in general, the respondents were satisfied with the information-gathering strategies. The limitation of in this study was that the respondents were not asked by the researcher to produce the policy, and it is not known if the contents of such policy covers integration. The author had an assumption that all the respondents selected in the study knew what BI is and what it entails. This was noted that 9% (8) respondents indicated that DoT did not have any policy or information-gathering strategy.

5.3 Management information system

According to Department of Public Service and Administration (DPSA), computer literacy known as the ability and knowledge to use computing and related technologies efficiently, starting from basic use to programming and advance use RSA (2014:7). This rapid rate of using computers is clear because 100% (89) of the respondents in the study confirmed that they use computers in the organisation. MIS is included in COBIT 5 enablers to provide the organisation with information technology processes and services. Further to that, information produced and used by the DoT is required for keeping the organisation running and well governed (see Table 5.2).

Table 5-2: Services, infrastructure, applications and information

Enabler	Goals	Good practices
Services, infrastructure and applications	Applications, infrastructure, technology, service levels	• Stakeholders delivered and used the services associated with the infrastructure. • The infrastructure and services supporting organisational ICT needs. • Transition support and other needs defined by systems users should be in existence.
Information	Information that is in use meets the following requirements: • Intrinsic • Contextual • Secure and accessible qualities	• MIS in use do not cover the current expanding requirements due to "requirements creep" from the system's users and changing business operations. • Sub-section **4.3.3.1** outlined the challenges that respondents encountered when working with the information.
Based on: Brown W.C. 2014. "The failed Vasa: COBIT 5 Governance and the Seven Enablers (Part 3)"		

The graphical representation in Figure 5.1 highlights the replies of the 65% (58) of the respondents who completed the survey and who are using government transversal systems in different capacities. The transversal system is not managed as a single, integrated system, but there are interfaces of these systems with BAS (RSA, 2003:83) (see Figure 5.1)

5.3.1 Procurement process

When there is a request for quotations (RFQ) for a service, the suppliers are requested from the Central Supplier Database (CSD) system. Then the following verification is done in the background for compliance purposes (see Figure 5.1):

- The Company and Intellectual Property Commission (CIPC) checks if the company is registered.
- Whether the company is tax compliant through South African Revenue Services (SARS).

- That there are no ghost shareholders or directors on Department of Home Affairs (DHA) population register.
- That tender defaulters and restricted suppliers are verified through the process.
- The correctness of the banking details of companies are verified with the banks for account status and ownership.

Upon receiving a positive response, the requester is assisted to make a proper decision to obtain RFQs from compliant service providers.

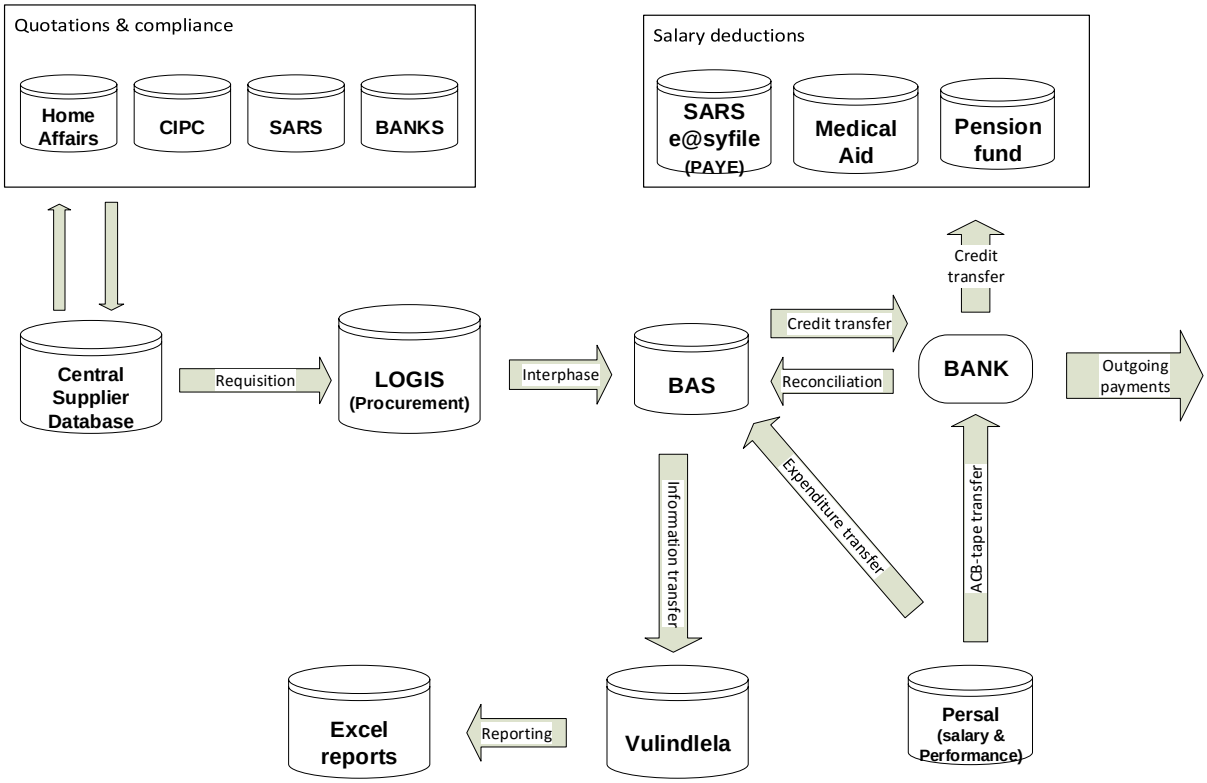

Figure 5.1: Financial systems integration

5.3.2 Logis

Logis retrieves the supplier master and banking details from the CSD. The purchase order is processed within Logis for the winning bidder and issued. Verification still takes place to confirm whether the details of the winning tenderer have not changed. Logis sends transaction information such as: financial commitments, payment advices and so on to BAS, together with information received from the CSD, as illustrated on Figure 5.1. All transactions processed on Logis are updated on BAS after 5 pm daily.

5.3.3 Human resources process

The Persal system contains modules that deal with staffing matters such as salaries, performance management and leave management (RSA, 2010:18). The following happens when salaries are processed:

- The gross amount due to an employee is posted to expenditure and Persal communicates the information through its expenditure interface to BAS as per Figure 5.1.
- The payment information of employees, employee names, bank details and amount due, including pension, medical contribution and other debit amounts, is relayed through the automatic clearing bureau (ACB) tape in preparation for the upcoming pay day.
- The organisation's banking account is debited through the ACB-tape to pay salaries and institutions such as medical aid and pension contributions.
- The ACB-tape is used to make the necessary payments sent from Persal to BAS.
- The bank sends the updates back to BAS and the current reconciliation process is recorded in Persal, which assists decision-making if there are under- or overpayments.

5.3.4 Vulindlela

The Vulindlela system received the latest data from other transversal systems (BAS, Persal, Logis and CSD) as consolidated information from BAS on daily basis. The information cannot be transformed inside the system. The data are downloaded into a Microsoft Excel application where pivot tables are created. Reports are sent to managers on a monthly basis or when the need arises. The purpose of the system is to provide better accountability on finances and personnel matters.

However, there are challenges with the current system as indicated by respondents. The following are some of the challenges:

- There is no uniformity of systems between the national and local government.
- Municipalities receive conditional grants for roads construction projects and reports of those projects and the expenditure on it cannot be verified.

It becomes difficult to ascertain what the grants were used for. The other challenges identified by the research respondents are limited available information and the fact that once data is synchronized into Vulindlela, it becomes read only.

5.3.4 Basic Accounting System

BAS is an integrated system that helps with daily monitoring to ensure electronic transfers and online enquiry by managers to make financial decisions. The system runs from centralised mainframe systems with are not applicable to current information needs. There is a limited flexibility of the system. If it happens that staff work overtime, the system will lock them out due to daily updates that come to BAS from other systems. Staff are required to pre-book their overtime slot and their organisation's updates will take place after other departments' update run has occurred. What is interesting is that verification of details take place until the supplier or receiver of any amount due to them receives the money (RSA, 2016:4). The information is further updated to Vulindlela MIS for managers to view consolidated reports.

5.4 Processes for integration of MIS

The key aspect as it was shown through challenges encountered by respondents to the integration of MIS in section 4.3.2.6 have been identified by Didiza (2016:10) long ago. He also indicated that there should be compliance with government-wide standards that would facilitate interoperability and consistency across solutions to improve system maintenance and support, and promote information-sharing among organisations within the state, and thus reduce total cost of ownership. It is a great concern that 65% (58) of the respondents stated that their systems were not integrated. In Table 5.3 a clear indication is given of how the COBIT 5 process enablers describe an organised set of practices and activities that can be used to produce a set of outputs in support of achieving Bi-related goals.

Table 5-3: Processes

Enabler	Goals	Good practices
Processes	Leverage COBIT 5 processes to enable the creation of a strategic plan and the capability	• Internal stakeholders included the public administrators / managers,

Enabler	Goals	Good practices
	of staff to achieve the organisational goals.	transport managers, transport planners, transport economists, legal / policy developers and the executive authority. External stakeholders included other government agencies and the citizens. • Process goals (strategic planning development) do exist, but the need for the latest information takes time due to system incompatibilities. • Current basic technologies implemented have not assisted more in integrating data from different sources due to outdated architectures.
Based on: Brown W.C. (2014:3). "The failed Vasa: COBIT 5 Governance and the Seven Enablers (Part 3)"		

5.4.1 Auditing integration

The organisation is using ACL software as an audit analytical tool that is specific to trace exceptions on transactions. The reports are requested monthly or quarterly. The trend analysis on different systems happens as follows:

- BAS – checking if there are duplicate payments.
- Persal – Trend analysis on salary payments to check any anomalies.
- Logis – The payments done are within the stipulated 30 days' cut-off period to service providers on the receipt of an invoice and the rotation of suppliers.

The 5% (4) of the research respondents who uses the application are from audit, risk and governance directorates, playing an oversight role over the financial operations of the department. The current challenges identified are that data received from different systems are as follows:

- There is no seamless integration between the ACL system and other systems to access data that must be analysed.
- There is human intervention that could lead to integrity issues.
- There information is not received timeously.

5.5 Culture, ethics, behaviour and organisational structures

It is important that the political heads, administrative heads and the personnel align with good practices for culture, ethics and behaviour. Brown (2014:5) states that good practices are compromised, thereby leading to higher risk and, ultimately, failure due to inconsistent behaviour. These are part of the organisational ethos that were identified in the COBIT 5 framework (see Table 5.4 and Figure 1.1)

Table 5-4: Culture, ethics, behaviour and organisational structures

Enabler	Goals	Good practices
Culture, ethics and behaviour	Expressed values for quality and risk-taking behaviours are consistent with high standards of culture, ethics and behaviour. The collective behaviour of the DoT should embrace those standards. The organisational ethos, culture and behaviour are resilient to failure and ongoing changes in the environment.	The respondent's response with a standard mean of 4.8 clearly shows that they are in line to support the organisational vision (See Table 4.7).
Organisational structures	The outcome of the organisational enabler should include an annual performance that meets or exceeds stakeholders' goals.	• The organisation is bureaucratic in nature. • It showed on the results of the survey that the respondents are clearly aligned to the goals of the organisation. • The mandate of the organisation is clear on the provision of policy direction

Enabler	Goals	Good practices
		on transportation matters and it is supported by the operating principles and good practices.
Based on: Brown W.C. (2014:5). "The failed Vasa: COBIT 5 Governance and the Seven Enablers (Part 3)"		

5.6 People, skills and competencies

Decision-making activities rely heavily on skilled people with adequate knowledge of BI. The qualifications of key personnel would help to steer the ship in the right direction. Table 5.5 identifies some of the generic skills standards that must be in place as identified in COBIT 5 as an enabler of people, skills and competencies.

Table 5-5: People, skills and competencies

Enabler	Goals	Good practices
People, skills and competencies	Qualifications, including technical, experience, knowledge and behavioral skills, are required to provide and perform processes, organisational roles, etc. The goals for the people include appropriate levels of availability.	Section **4.3.7** in this study shows that the respondents of the study are equal to the task since they identified the following skills: Information technology skills, communication, strategic management, knowledge management, project management, generic management, problem and analytical management skills when asked on what skills and competencies people required to complete successful BI activities.
Based on: Brown W.C. (2014:6). "The failed Vasa: COBIT 5 Governance and the Seven Enablers (Part 3)"		

Furthermore, the South African government has issued the compulsory capacity development training for senior managers (see Table 5.6). It is also evident from the results as presented in section 4.3.7 of the study that training to close competency gaps is bearing fruits. It was also noted in section 2.4.2 that knowledge management

gives better insights on business operation. According to Becerra-Fernandez and Sabherwal (2010:194), knowledge can be synthesised tacitly across individuals during joint activities. The knowledge management process becomes a building block that leads to BI.

Table 5-6: Core and process competencies

Core competencies	Process competencies
Strategic capability and leadership	Knowledge management
People management and empowerment	Service delivery innovation
Programme and project management	Problem solving and analysis
Financial management	Client orientation
Change management	Communication
Source: Directive on compulsory capacity development, mandatory training and minimum entry requirements for SMS (RSA, 2014:5)	

It should be noted that no respondent had indicated change management as one of the competencies to have. RSA (2014:7) indicates that change management expertise is required to implement turn-around strategies for the acceleration of transformation and the improvement of the lives of the population by making effective decisions. It is on this note that Jalaldeen, Karim and Mohamed (2009:128) emphasises change management as indicated in section 2.5.1 that an understanding that introducing any change in any organisation is difficult and, therefore, leaders are encouraged to assess the readiness of their organisation to adopt those changes in advance. Du Plessis and Mabunda (2016:55) emphasise that communication and strong leadership are requirements for enabling change instead of barriers to it.

5.7 Summary

This chapter provided details on the relationships and information flow that exist between CSD, Logis, Persal and BAS when supplier master and bank details are synchronised to all other systems. The dependencies between and impact on the systems were also discussed. COBIT 5 enablers highlighted the following based on the evidence collected from the respondents in relation to the theoretical framework chosen for the study:

- The organisation’s principles, policies and goals are supporting the policy mandate of the DoT as indicated in section 1.1.1, to improve the levels of service and cost in a fashion that supports government strategies for economic and social development while being economically and environmentally sustainable.
- The current infrastructure does not support all the needs and plans that should be implemented to accommodate changing requirements. Section 5.4.1 indicated that some integration challenges are currently being experienced.
- Stakeholders are still encountering challenges because the process goals are not aligned.
- Information flow from the top and the stakeholders must align with good practices for culture, ethics and behaviours for successful MIS integration for effective decision-making.
- It showed that respondents to the research had adequate knowledge and skills to execute BI activities as this was one of the challenges identified in section 2.6, that having skills will assist in economic growth of the country.

The next chapter provides the conclusions, summaries and recommendations on how the DoT can adopt best practices for MIS to be integrated to obtain BI for effective decision-making.

CHAPTER SIX

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The purpose of this chapter is to discuss and elaborate on the meaning and implications of the data analysis, interpretation and research results in chapters four and five, respectively. A conclusion is also drawn on the whole study. Leedy and Ormrod (2015:37) indicate that a conclusion is regarded as the use of specific instances or occurrences of a sample to draw conclusions about a larger population from which the sample has been taken. In another words, the conclusion should be linked to the research objectives on the study. Pickard (2013:314) advises that findings should be directly associated with the objectives so as not to surprise the readers. In this chapter, the findings of the study are summarised and recommendations are presented. The chapter gives suggestions on the future research as per the opportunities that were identified in the study.

6.2 Summary of findings

The results indicate that decision-making has a significant positive relationship with organisational ethos. Secondly, the MIS usage has a significantly positive relationship with decision-making. Integration of MIS can mediate the effect of BI use on effective decision-making. The only component where MIS was found to be integrated, was in the financial business units (Supply Chain Management, Finance and Budgeting). Core business units use off-the-shelf systems in some cases, custom-made applications that do not integrate with any other system. This silo mentality is rife in the public sector and it negatively affects integration activities later. While the PRC report has identified these issues, little progress has been made 20 years before and to date.

SITA has not taken the lead in being the prime IT solutions integrator as envisaged in the SITA Act and state departments end up buying costly solutions. On a positive note, the National Treasury has issued a moratorium prohibiting state organs from purchasing software solutions while other integration initiatives are in progress.

6.3 Conclusions about research objectives

The conclusions of the research are based on the objectives of the study:

- To determine the business intelligence strategies (principles, policies and frameworks) implemented in the Department of Transport.
- To identify MIS (services, infrastructure and applications) implemented in the Department of Transport.
- To assess how the processes for integration of MIS can effectively enhance decision-making.
- To assess the culture, ethics behaviour and organisational structures as key success factors in decision-making activities in the Department of Transport.
- To identify people, skills and competencies required for the successful completion of BI activities for making the correct decisions.

6.3.1 Conclusions on "To determine the business intelligence strategies (principles, policies and frameworks) implemented in the Department of Transport"

The current integrated and partially integrated systems were implemented when there were no IT governance standards for systems integration. The constraints are experienced due to ageing legacy systems which are now reaching obsolescence. A government-wide policy on the integration of MIS must be implemented as per the Presidential Review Report as indicated in Chapter One. New MIS that would be operationalised must supply information for strategic planning and policy decision-making.

It was recommended in the National Land Transport Strategic Framework developed by RSA (2017:97) that it is critical for transport planners and policy to improve the integration between various sectors by enhancing economic development, regional economic competitiveness, efficiency in transport operation and upgrading and maintenance of transport infrastructure that would enable an effective decision-making.

6.3.2 Conclusion on "To identify MIS (services, infrastructure and applications) implemented in the Department of Transport"

Building blocks and common architecture already developed must be implemented and have inclusion of the following technical elements:

- Governance standards
- Database standards
- Open standards
- Documentation and version standards

Technical standards enable any system to share data and interoperability with any other system and to ensure greater interoperability of different applications.

6.3.3 Conclusion on "To assess how the processes for integration of MIS can effectively enhance decision-making"

The technological systems that have been used in the public sector are for transactional and control purposes. Policy oriented (core) systems are not integrated due to incompatible platforms, networks and applications. The pace of technology change has accelerated the supply of new products and innovation, which are too quick for government processes.

The integration of MIS is not fully realised due to organisations operating in silos and the variety of data required by the different business units. The opportunity to integrate data would be to have an architectural approach as it addresses the requirements for decision makers to identify the data source they need to be able to bring into the decision-making environment.

6.3.4 Conclusion on "To assess the culture, ethics behaviour and organisational structures as key success factors in decision-making activities in the Department of Transport"

The current culture at DoT is dictated by the strategy of the organisation. Training and development programmes can be used to drive communication of the new culture of

the organisation as opposed to speeches and newsletters. Cultural change can have the following characteristics:

- The DoT's mission and vision should be communicated to everybody in the organisation and identified for improvement. The measured and monitored results be communicated to the staff.
- Current performance of the DoT can be benchmarked with other governments departments.

The organisational structure operates on a top-down command approach where decisions are made at the top and implemented to cascade downwards and in the process has stifled innovation. Mosweu et al., Mutshewa and Bwalya (2014:246) provide a suggestion that system functionalities should be simple and easy to understand in order to remove any complexities for adoption of MIS.

6.3.5 Conclusion on "To identify people, skills and competencies required for the successful completion of BI activities for making the correct decisions"

To overcome the skills shortage by absorbing those doing internship and by the facilitation of continuous improvement in technology and human resources. The management must find the right mix of qualified people to put a strategy in place to realise effective decision-making. The organisation would achieve a sustained competitive advantage due to the high number of respondents that are being mentored and trained and that are adapting to changes in external trends and events and internal capabilities, competencies and resources. It is also emphasised that growing own talent and developing the infrastructure necessary can help with high performance and can obtain competitive advantage (Wheelen & Hunger, 2012:322).

6.4 Recommendations

The following recommendations are made for the integration of MIS to enhance BI for effective decision-making:

6.4.1 The business intelligence strategies (principles, policies and frameworks) implemented in the Department of Transport

The DoT uses transversal systems (Supply Chain Management: CSD and Logis; Human Resource Management – Persal; Financial Management BAS and SafetyNet; Business Intelligence - Vulindlela). Many of these financial systems are based on aging technologies. Furthermore, these systems are not fully integrated and there are duplicated functionalities across systems. The DoT would wait for the policy direction as issued by the National Treasury for the development of the integrated financial management system as adopted by the South African Parliament to replace these transversal systems with an integrated financial management system (RSA, 2016:1).

The following must be realised in the replacement of the current technology with a modern system and must be in compliance with the below frameworks:

- Financial accountability framework – directing the way government finances are to be governed, controlled and managed
- Budgeting framework – directing the way government activity is to be resourced
- Appropriation framework – authorising expenditure from the consolidated revenue fund
- Cash management framework – controlling and managing the funding required to enable government business to operate
- Financial reporting framework – reporting on financial results
- Performance reporting framework – evaluating performance
- Human resource management framework – regulating how human resources in the public service are managed

Planning for the DoT needs to be inclusive of the budgetary process at the National Treasury in order to prioritise where the impact can be felt by the citizens.

6.4.2 The Management Information System implemented in the Department of Transport

Below are the recommendations for MIS integration:

- Replacing aging technologies and developing integrated-ready technologies with application programming interface (API), which is a particular set of rules and specifications that software programs can follow to communicate with each other.
- Alignment with the supporting implementation of legislation such as the Public Finance Management Act and the Public Service Act since most of the systems are used government-wide.
- Improving service delivery by automating and standardising processes to maintain data integrity.
- Achieving interoperability, security, economies of scale and eliminating duplicated IT systems through SITA as the primary systems integrator.
- Improving quality of data and ease of access thereof within a secure environment and sharing of data within government and in compliance with POPI act as indicated in section 2.4.2.

6.4.3 The processes for integration of MIS can effectively enhance decision-making

Due to the complexity of government processes, an architectural framework such as COBIT 5 must be adopted to create alignment of systems requirements. A hybrid solution architecture consisting of bespoke system modules developed by SITA and department-specific Commercial off-the-shelf (COTS) systems that would be integrated through Application Programming Interface (API) as indicated below:

- Bespoke modules include financial management, payroll and supplier verification and procurement management.
- COTS / in-house developed modules include auditing and transport licensing application systems, and other systems that the organisation might require in future.
- Free open source software (FOSS) should be used and skills that should be developed to support that applications due to licensing costs that can prove unsustainable going forward. FOSS was adopted as South African government policy in 2007 and advised that there is migration from proprietary software FOSS wherever a comparable software (Webb, 2007:8).

That became impractical in practice as Ngoepe (2015:196) states that there were government departments that had migrated to FOSS and costs were considered to surpass those of proprietary software.

The decision makers of the DoT need to make it a priority that systems that are implemented should be information driven to enhance decision-making. The decision-making tools must be designed to predict the needs of the state. The adoption of the new business process and re-engineered techniques to ensure that there are correspondences between the business objectives of the DoT and the MIS that are used to meet these objectives.

6.4.4 The culture, ethics behaviour and organisational structures as key success factors in decision-making activities in the Department of Transport

It was demonstrated through literature in section 2.5 that the DoT has adopted a vision and mission and other guiding principles for the organisation's operations. The DoT needs to adopt clear strategic direction as encapsulated by the vision and mission statements as outlined by Louw and Venter (2014:118), as these will assist the organisation to:

- provide guidance to human behaviour and define working relationships
- help in building employee relationships and also relationships with external stakeholders
- lead to better performance by assisting with strategy formulation and implementation
- serve as a benchmark for resource allocation
- create confidence that the intended strategies will not compromise the interests of the various stakeholder groups in the organisation
- inspire employees throughout the organisation and remind them of the purpose of the organisation and each individual's role in achieving its goals.

Furthermore, Kotter (2014:9) formulated an enhanced 8-step process that gives organisations additional capabilities to lead change for the effective running of operations that would be beneficial to the DoT as stated in the following sub-sections:

6.4.4.1 Create a sense of urgency

Organisational management must describe opportunities that would appeal to individuals' heads and hearts and use those statements to raise an army of interested volunteers to the organisational cause. Once an opportunity is identified, relevant supporting information must be available to make decisions on how to articulate and communicate it.

6.4.4.2 Build a guiding coalition

Doing real collaboration by stepping out of traditional institutional structures to focus on the results for the DoT. Engagement with organisational formalised network to take on innovative initiatives. BI activities must be seen as "have to" by the employees. A communication and engagement plan must be developed to remove bottlenecks.

6.4.4.3 Form a strategic vision and initiatives

The DoT's strategic initiatives must be targeted, coordinated and executed fast enough to make an organisational vision a reality. The employees in the organisation should be aligned around a single idea, which should speak to the goals in the same way with the same priority.

6.4.4.4 Enlist a volunteer army

Employees must be invited and encouraged to help with the implementation of BI strategies. The must be kept engaged through progress meetings or informed of developments.

6.4.4.5 Enable action by removing barriers

Employees within the DoT need to know where its organisation's barriers are. The answers may lie in the past initiatives that failed and that have prevented the organisation's initiatives from succeeding.

6.4.4.6 Generate short-term quick wins

Successes from organisational initiatives must be shared and celebrated, no matter how small they may seem. While the organisation's employees are working hard over longer periods and no results may seem forthcoming and quick win may energise the volunteers to drive BI change.

6.4.4.7 Sustain acceleration

The employees must adapt quickly to changes in order to maintain their speed to stay on course towards the organisational vision of making effective decisions. That would involve talent sourcing or the removal of misaligned processes.

6.4.4.8 Institute change

The organisation needs to ensure that new behaviours are repeated over the long term.

6.4.5 The people, skills and competencies required for successful completion of BI activities for making the correct decisions

In the position paper on skills development by New Partnership for Africa's Development (NEPAD), the following practical ways were forwarded to improve skills (NEPAD, 2016:7):

- Enhancement of technical and vocational education
- Closing of the gap between skills and business needs
- Adaptation of training and mechanisms to local context
- Establishment of connections between research-training organisations
- Improve coordination around training needs

Louw and Venter (2014:115) contend that an organisation such as the DoT needs to ensure that the following primary activities are carried out to support better decision-making:

- Procurement – Purchasing of inputs to facilitate and support all other decision-making activities.

- Technology development – Activities associated with BI technology improvements, including research, information sourcing, processing and data presentation.
- Human resources management – Management of personnel throughout the organisation, including recruitment, selection, training, development and compensation.
- Organisation's infrastructure – Support of the whole value chain, including setting up of governance structures, management, planning, finance, legal.

6.5 Recommendations for future research

The study has dealt with one of the key issues that concerns the use of MIS to enhance BI for effective decision-making. The following possible studies from the main findings from this research are the following:

- The use of a larger sample size across government departments to evaluate whether the results from the current study can be extended to other settings. This will assist on the application of the constructs and measurement scales used in this research, of which would confirm the measurement instrument reliability.
- Future studies can expand the research to African countries to test and examine the structural relationships across countries, and if the differences in organisational cultures may influence the perceptions on the relationships among BI system usage, processes for a system of integration, organisational ethos and the skills.
- Future studies can conduct a longitudinal study to test and account for the time-lag effects on organisational ethos and decision-making after MIS usage. There would be a need to examine further the impact of BI use on organisational ethos, processes system of integration and decision-making.
- A further study on a framework to integrate MIS at the DoT or elsewhere is also recommended.

6.6 Implications on theory and practice

The current study adds to the body of knowledge as it was outlined in the published PRC report and the CGICT policy framework about decision-making on all important

ICT decision that would have to come from the political and managerial leadership with no delegation to technology specialists (RSA, 2012:3). Roles and responsibilities should be defined and implemented to ensure that ICT resources (MIS) are in alignment to ensure that they enable organisational processes in support of decision-making.

The processes for integration of MIS needed a holistic picture by having governance architecture such as the COBIT 5 framework as a guidance to enhance effective decision-making. Policy certainty and planning would bring different cultures, ethical behaviour and organisational structures that are aligned to bring success in decision-making activities in the DoT. Finally, the study indicates to recruiters the types of skills that the DoT can source in future that they may need to develop or have developed in order to be able provide services for the enhancement of BI through the use of MIS for effective decision-making.

6.7 Final conclusion

The study was arranged into six chapters. Chapter one gave a brief overview of the study to be undertaken. Chapter two was an overview of the literature on the business intelligence strategies, management information system, system integration; skills, competencies and people. The research methodology was presented in Chapter Three. Chapter Four presented the results of the study that were collected through an online survey and analysed using both statistical and thematical methods. The discussion and interpretation of the findings from the study were given in Chapter Five. Chapter Six presented the conclusions of all the objectives as stated in Chapter One and to show that all objectives of the study have been responded to satisfactorily.

It was established in the study that having properly integrated MIS plays a significant role in effective decision-making by having information at fingertips. To expand this to core MIS systems would need to include the basic building blocks, which include standards that are agreed upon to facilitate future data exchange and interoperability. Governance structures from all affected stakeholders need to be set up to deal with a more holistic business, information, systems and technology architecture for the Department of Transport and the public sector. All these initiatives must be driven through management buy-in in order to enforce compliance with the MIS decision-

making requirements. Failure to transform this pattern would lead to service delivery protests persisting due to a lack of access to reliable information by decision makers.

In conclusion, the study proposed the desired future works such as: using a larger sample size across government departments to evaluate whether the results from the current study can be extended to other settings; expansion of the research to African countries to test and examine the structural relationships across countries; conducting a longitudinal study to test and account for the time-lag effects on organisational ethos and decision-making after MIS usage; and a further study of a framework to integrate MIS at the DoT or elsewhere.

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ANNEXURE A: QUESTIONNAIRE

Section A- General Information

1. **Gender: ***
   Female O
   Male O

2. **Level of Management ***
   Middle manager O
   Senior Manager O

3. **Age ***
   20-29 O
   30-39 O
   40-49 O
   50 and above O

4. **Branch ***

Administration	**O**
Civil Aviation	**O**
Integrated Transport Planning	**O**
Maritime Transport	**O**
Public Transport	**O**
Rail Transport	**O**
Road Transport	**O**

Section B - Research Questionnaire

This evaluation model will help Department of Transport to evaluate if the Integration of information management systems is enhancing business intelligence for effective decision making***. For each survey item in the following tables, a 7-point Likert scale is used. Please evaluate each attribute on the basis of this scale and choose the appropriate number on the following tables.***

1. **What business intelligence strategies have been implemented in your section/branch?**

   1.1 ***Are there any policies/information gathering strategies implemented within your section/branch?*** **[Yes/No] ***

1.1(A). If yes, what are those strategies implemented within your section/branch? [If Yes, please answer all questions in Section 1, except 1.1(B)]

1.1(B) If no, why are they not there? [If No, please answer 1.1(B) and proceed to section 2]

1.2 ***Business Intelligence Strategies***

For each survey item in the following table, a 7-point Likert scale is used

	BI Strategies	Ep	Vp	P	Av	G	Vg	Ex
1	This system is easy to change for supporting your business strategies.	1	2	3	4	5	6	7
2	This system helps you improve reliability of decision processes or outcomes	1	2	3	4	5	6	7
3	This system helps you use more sources of information in decision making.	1	2	3	4	5	6	7
4	This system provides you with accurate content to make decisions	1	2	3	4	5	6	7
5	The information this system provides is easily comprehends for users	1	2	3	4	5	6	7

2 What are the MIS (services, infrastructure and applications) implemented to enhance BI within your section/branch?

2.1 ***Do you have IT systems in your organisation?*** **[Yes/No] * [If no IT systems are used, please move to question 2.8, if Yes, answer question 2.2 – 2.7]**

2.2 ***Which IT system(s) (MIS) has been implemented in your section/Branch/organisation?*** **(Check any that apply)**

	Basic Accounting System (BAS)		**Barnowl**
	Persal		**NTF portal**
	Logis		**SAS**
	Email		**eNaTIS**
	NLTIS		**Paradox**
	SafetyNet		**Intranet**
	Libwin		**ACL**
	Spreadsheet		**Road Asset Man. System**
	Vulindlela		**Central Supplier Database**
	Pastel		**Other: (Please specify)**

2.3 ***System characteristics?***

For each survey item in the following table, a 7-point Likert scale is used.

		Ep	Vp	P	Av	G	Vg	Ex
1	This system is easy to change for user's requirements.	1	2	3	4	5	6	7
2	This system supports your needs completely	1	2	3	4	5	6	7
3	This system is reliable	1	2	3	4	5	6	7
4	This system is error-free	1	2	3	4	5	6	7
5	This system displays information in time whenever you do a search	1	2	3	4	5	6	7

2.4 **How long have you used the system(s)?**

O < 6 months **O 6 months ~< 1 year**

O 1 year ~< 2 years **O 2 years ~< 3 years**

O 3years ~< 4 years **O 4 years and more**

2.5 **What other system(s) are integrated with the one you are using?**

2.6 **Did you encounter any problems with Information system operations? (Check any that apply)**

- ☐ **Inadequate reporting capability**
- ☐ **Over-dependent on IT**
- ☐ **System Integration capability**
- ☐ **Incompatible information**
- ☐ **Incomplete information exist in different systems**
- ☐ **Poor software functionality**
- ☐ **Data quality**
- ☐ **Limited decision-making support capability**
- ☐ **Poor analysis capability to support decision making**
- ☐ **Inadequate training**
- ☐ **Others:**

2.7 **What does the system(s) help you with?**

2.8 **What are the implications of making decisions without using any system?**

3 What processes for integration of Management Information Systems (MIS) can effectively enhance decision making?

3.1 ***This evaluation will help your organisation to make a comprehensive assessment of current decision-making support from Management Information Systems (MIS). The evaluation model***

encompasses dimensions such as: Data quality, System quality, Decision-making process and Organisational Learning. For each survey item in the table following table, a 7-point Likert scale is used to measure the decision-making performance from Information System support

3.2 ***What are the challenges in integrating data from different systems/stakeholders?***

	Decision-Making process	**Ep**	**Vp**	**P**	**Av**	**G**	**Vg**	**Ex**
1	**This system helps you to identify potential problems.**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	**This system provides alternative solutions for you to make decisions.**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3	**This system can help you forecast the future consequences of using various alternatives.**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4	**Your system help you improve the reliability of decision processes or outcomes.**	**1**	**2**	**3**	**4**	**5**	**6**	**7**

4 How can culture, ethics, behaviour and organisational structures be key success factors in decision making activities in the Department of Transport?

4.1 Below are some elements of organisational ethos that may influence decision-making. To what extend do each element influence you in making a decision?

	Learning and growth	**Ep**	**Vp**	**P**	**Av**	**G**	**Vg**	**Ex**
1	**Improve your organisation's awareness of shared vision, objectives and values**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	**Increase communication across your section/branch by sharing of knowledge**	**1**	**2**	**3**	**4**	**5**	**6**	**7**

3	**Improve the capabilities of data analysis and interpretation**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4	**Improve availability of the information in you section/branch**	**1**	**2**	**3**	**4**	**5**	**6**	**7**

4.2 ***How do*** *you want things done when there are new changes in the organisation for example: restructuring****?***

	Organisational learning	**Ep**	**Vp**	**P**	**Av**	**G**	**Vg**	**Ex**
1	**This system increases the understanding of problem you face.**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2	**This system stimulates new ways of thinking about a problem or a decision context.**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3	**This system enhances decision maker's ability to process knowledge.**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4	**This system increases your confidence in making decisions.**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5	**This system changes your attitude in your job.**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
6	**This system speed up problem solving and improves decision quality.**	**1**	**2**	**3**	**4**	**5**	**6**	**7**

5 What are the skills, competencies and people required for successful completion of BI activities for correct making decisions?

5.1 ***What skills do you think are required to complete BI activities within your organisation?***

5.2 ***Were you trained to use the system(s)?***

5.3 ***How did you managed to operate the system?***

5.4 ***Who is updating the system to reflect latest information?***

5.5 ***Who is responsible/accountable (System owner) for managing the systems you are using?***

ANNEXURE B: ETHICAL CLEARANCE

UNISA university of south africa

DEPARTMENT OF INFORMATION SCIENCE RESEARCH ETHICS REVIEW COMMITTEE

Date: 26 June 2017

Ref #: 2017_TAChauke_38569043_001
Name of applicant: TA Chauke
Student #:X
Staff #:

Dear TA Chauke,

Decision: Ethics Approval

Name: Title and name of principle applicant, address, e-mail address, and phone number Mr TA Chauke, Unisa Information Science,38569043@mylife.unisa.ac.za; and 0732050974

Proposal: Integration of information management systems to enhance business intelligence for effective decision-making at the Department of Transport in South Africa.

Qualification: Masters in Information Science

Thank you for the application for research ethics clearance by the Department of Information Science Research Ethics Review Committee for the above mentioned research. Final approval is granted for *4 years.*

For full approval: *The application was reviewed in compliance with the Unisa Policy on Research Ethics by the Department of Information Science Research Ethics Review Committee on 8 June 2017.*

The proposed research may now commence with the proviso that:

1) *The researcher/s will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.*
2) *Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study, as well as changes in the methodology, should be communicated in writing to the Department of information Science Ethics Review Committee. An amended application could be requested if there are substantial changes from the existing proposal, especially if those changes affect any of the study-related risks for the research participants.*

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
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www.unisa.ac.za

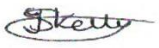
3) *The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study.*

Note:

The reference number 2017_TAChauke_38569043_001 *should be clearly indicated on all forms of communication [e.g. Webmail, E-mail messages, letters] with the intended research participants, as well as with the Department of Information Science RERC.*

Kind regards,

Signature



Dr Isabel Schellnack-Kelly
Department of Information Science
Research Ethics Review Committee

012 429 6936

ANNEXURE C: LETTER OF PERMISSION

transport
Department:
Transport
REPUBLIC OF SOUTH AFRICA

MEMORANDUM

TO: **MATHABATHA MOKONYAMA**
ACTING DIRECTOR-GENERAL

FROM: **THEMBA TENZA**
ACTING DDG: ITP

SUBJECT: REQUEST FOR PERMISSION TO CONDUCT SURVEY RESEARCH AT DEPARTMENT OF TRANSPORT

1. PURPOSE

To request the Acting Director-General to grant approval for Mr Tshepo Chauke, Acting Director: ICT Infrastructure to conduct a survey research at Department of Transport.

2. BACKGROUND

Mr Chauke is doing research towards Masters of Arts (MA) qualification at the University of South Africa under guidance of Mpho Ngoepe, a Professor, in the Department of Information Science. The topic for the study is entitled "*Integration of information management systems to enhance business intelligence for effective decision making at the Department of Transport in South Africa*".

3. DISCUSSION

3.1 The aim of the study is to investigate the integration of information systems at Department of Transport to enhance Business Intelligence for effective decision-making. To ensure that this

purpose is achievable, the following research objectives will be investigated:

- To determine the business intelligence strategies implemented in the Department of Transport.
- To assess how the processes for integration of Management Information Systems (MIS) can effectively enhance decision-making.
- To assess the culture, ethics behaviour and organizational structures as key success factors in decision-making activities in the Department of Transport.
- To identify MIS (services, infrastructure and applications) implemented in the Department of Transport.
- To identify people, skills and competencies required for successful completion of BI activities for correct making decisions.

3.2 Middle and senior managers will be selected in a stratified method random sampling as to ensure that the resulting sample gets distributed in the same way as the population being studied. Employees who are less than a year at DoT will not be included. A latest Human Resources employee list will be requested to prepare the selection of potential participants.

3.3 The study research proposal is also attached for ease of reference (**Annexure A**)

3.4 Ethical clearance certificate to proceed with the study has been received from UNISA (**Annexure B**).

4. CONSULTATION

Mr Bulelani Didiza – Chief Information Officer, DoT

Mr Mashaing Makhubedu – Acting Director: HRM, DoT

Dr Isabel Schellnack-Kelly – Research Ethics Review Committee, UNISA

Prof. Mpho Ngoepe – Study supervisor, UNISA

5. FINANCIAL IMPLICATIONS

None

6. COMMUNICATION IMPLICATIONS

The researcher will communicate directly with the selected participants through email to request their input on the questions prepared (**Annexure C**). Feedback procedure will entail research findings being shared with the department and a copy of the completed thesis will be donated to the department's library.

7. RECOMMENDATIONS

It is recommended that the Acting Director-General grants approval for Mr Tshepo Chauke, Acting Director: ICT Infrastructure to conduct a survey research at Department of Transport.

TSHEPO CHAUKE
ACTING DIRECTOR: ICT INFRASTRUCTURE
DATE: 12 July 2017

Recommendation supported / ~~not supported.~~.....

.....

.....

BULELANI DIDIZA
CHIEF INFORMATION OFFICER
DATE: 12/07/2017

7. RECOMMENDATIONS

It is recommended that the Acting Director-General grants approval for Mr Tshepo Chauke, Acting Director: ICT Infrastructure to conduct a survey research at Department of Transport.

Recommendation supported / ~~not supported~~ The researcher to obtain consent of the participants, ensure that the DOT information is protected and that the research is for academic purposes only.

MOSES MASWANGANYE
ACTING CD: HRM&D
DATE: 17/07/2017

Recommendation reviewed and supported / ~~not supported~~.
As per Act CD: HRM&D above.

THEMBA TENZA
ACTING DDG: ITP
DATE: 19/07/2017

	APPROVED / ~~NOT APPROVED~~ / COMMENTS
MATHABATHA MOKONYAMA **Acting Director-General** **Date:** 24/07/2017	