ANALYSIS OF DATA GOVERNANCE IN HIGHER EDUCATION INSTITUTIONS: CASE OF A UNIVERSITY OF TECHNOLOGY IN SOUTH AFRICA

By

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DECLARATION

I, Thandi Charmaine Mlangeni, declare that "Analysis of Data Governance in higher education institutions: Case of a University of Technology in South Africa" is my own work, and it has not been submitted before for any degree or assessment in any other university. All the sources I have used or quoted have been acknowledged by means of references.

Signature: _____   Date: _____

ACKNOWLEDGEMENTS

DEDICATIONS

I dedicate this thesis to my late grandmother, M. V. 'gogo' Mlangeni, my uncle, C. J. 'ndoda' Mlangeni, my aunt, B. E. 'Tuza' Mlangeni and my mother, T. M. Mokoena. I always wanted to make them proud and thinking of them has made me not to give up until today. I also dedicate it to my father, S. S. Mlangeni, my aunts, E. M.'Mamkhulu' Makhubo and N. P. 'Gcins' Mlangeni, my uncles, N. V. 'Dondo' Mlangeni and S. D. 'Stone' Mlangeni, and lastly, all my precious cousins.

ABSTRACT

Organisations now invest in ICT solutions to drive business activities and provide the agility sought for competitive advantage. These may include government departments, higher-education institutions (universities) and commercial entities amongst other things. The challenges with regards to ICT and data management are equally applicable in universities as they do in business organisations.

Universities have a growing ICT infrastructure used in everyday activities and online functionality, making them prone to data problems. This emerges from data that is used across various business processes which are dispersed among departments. In turn, a level of inefficiency finds its way with potential to generate inaccurate, missing, misinterpreted and poorly defined information.

Higher education institutions are service providers and it is imperative to have reliable, timely and organised data to maintain the performance of the institution. They often experience data management challenges that ultimately affect the institution's efficiency. These data management challenges arise from institutions not thoroughly dealing with data content, records management, quality, stewardship, governance and research data management.

This study explored how data can be managed in higher education institutions using properly defined principles of data governance (DG) which will assist the institutions recognise and treat data as an organisational asset.

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GLOSSARY

BI	Business Intelligence
CIO	Chief Information Officer
COBIT	Control Objectives for Information and Related Technology
CPUT	Cape Peninsula University of Technology
CTS	Computer and Telecommunications Department
DG	Data Governance
DQC	Data Quality Committee
DQM	Data Quality Management
DVC	Deputy Vice Chancellor
HE	Higher Education
HEI	Higher Education Institution
HOD	Head of Department
ICT	Information and Communication Technology
IT	Information Technology
ITIL	Information Technology Infrastructure Library
ITS	Integrated Tertiary Software
MDM	Master Data Management
SMSE	Small to Medium-Sized Enterprises
M & A	Mergers and Acquisitions
POPI	Protection of Personal Information Act

CHAPTER 1

INTRODUCTION

1.1 Introduction

Information and Communications Technology (ICT) is a critical business tool of the 21st century. The major purpose of ICT is generation and dissemination of data/information. Organisations now invest in ICT solutions to drive business activities and provide the agility sought for competitive advantage. The critical components in business are people, processes and technology. However, all these are rendered inert without data. Godfrey, Hodgson, Holmes and Kam (1997), portrays information as an asset with economic value in their book. This infers that looking after data has the potential to bring efficiency in the running of the organisation.

Organisations have a common goal which underpins their existence as entities. Sometimes, they are referred to as enterprises. Organisations include government departments, higher-education institutions and commercial entities, amongst other things. In the case of higher-education institutions the primary goal is to educate. A higher education institution is sometimes referred to as university, university of technology or college. The challenges with regard to ICT and data management are equally applicable to universities as they are to business organisations. Students, similar to customers in commercial entities, are now given online self-services capabilities. All these depend on the data flows within the organisation and the inherent ICT systems.

Data management continues to be a pain point for organisations to the extent that there is considerable development surrounding data management in general. There have been quite a number of terminologies and concepts that concentrate on data welfare. These include data governance (DG), big data, data quality management (DQM), master data management (MDM) and Business Intelligence (BI), amongst others. Of particular interest is DG, because it embraces a majority of the terms due to its emphasis on governance. DG is an executive-level of board, committee or other organisational structure that creates and enforces policies and procedures for business use and technical management of data across the entire organisation (Russom, 2008:5). According to Poor (2011:109), higher education institutions can benefit from improved data governance.

1.2 Background to the research problem

Universities have a growing ICT infrastructure used in everyday activities and online functionality, making them prone to data problems. Just like business organisations, universities are concerned about brand perceptions, business processes and human presence in the IT ecosystems (people, process and technology). Data repeatedly used across various business processes in universities mostly originate from these entities: students, classes, faculty, campus, facilities, location and employees. This data is often dispersed among units, departments or divisions (Drucker, 2005:102) and, therefore, a level of inefficiency finds its way with potential to generate inaccurate, missing, misinterpreted and poorly defined information (Redman, 2005:1). According to Yanosky (2009:1-2), institutional data management challenges can be understood through reflection of three broad domains of data impact: 1) the difficulties higher education institutions face when attempting to retrieve, manipulate and analyse aggregate data for metrics and planning, 2) difficulties to manage unstructured data, and 3) research data which exists in massive quantities.

1.3 Statement of research problem

Higher education institutions often experience data management challenges on their information systems, resulting in inaccuracy and inconsistency of information that ultimately affects the institutions' efficiency. These data management challenges arise from institutions not thoroughly dealing with data content, records management, quality, stewardship, governance and research data management (Albrecht & Pirani, 2009:3).

1.4 Aim of the study

The aim of this study is to explore how electronic data can be managed in higher education institutions using properly defined principles of data governance that will assist the institutions recognise and treat data as an organisational asset.

1.5 Objectives of the study

The study's main objective is to analyse how data governance can have an impact on institutional data. The sub-objectives are:

- To investigate the data challenges that affect the institution's performance.
- To identify developments and processes that are currently implemented to manage and standardise data
- To test a chosen data governance model that can be explored to manage data at CPUT.

- To develop a data governance model that can be used as a guideline for higher education institutions.

1.6 Research question

The main question to be addressed within the scope of this research study is the following:

How does data governance impact the management of data in higher education institutions?

1.6.1   Research sub-questions

1. What are the data-related challenges that higher education institutions are facing?
2. What developments and processes are currently employed to manage data in higher education institutions?
3. What data governance components can be explored to manage and maintain data on information systems in HEIs?
4. Which data governance framework can be adopted for a HEI?

1.7 Significance of the study

Higher education institutions are service providers and it is imperative to have reliable, timely and organised data to maintain the performance of the institutions. The study identified data challenges and explored ways in which data governance can be implemented in the institution to improve its performance. This study will help the CPUT evaluate the processes used to manage data. It will also serve as a guideline to HEIs that want to implement a DG strategy with the aim of treating data as an asset.

1.8 Delineation of the research

This study used Cape Peninsula University of Technology in Cape Town, South Africa, as a case to analyse how DG can assist management of data in higher education institutions. The researcher also sought to understand the lived experiences within CPUT regarding data management and challenges on information systems.

1.9 Ethical considerations

The researcher ensured that instructions of the research ethics committee of the university were followed. The participants were informed about the study and processes to be used to collect data. The research was conducted for academic purposes and no part of it will be made available without permission from CPUT.

1.10 Thesis Structure

CHAPTER 1: Introduction

The first chapter focuses on the overview of the study. It includes the introduction, background, problem statement, research question and sub questions of the study. The objectives, aims, significance, delineation and ethical considerations of the study are also elaborated.

CHAPTER 2: Literature Review

The second chapter review the literature at length; it begins with discussing higher education and higher education institutions (HEIs) in South Africa. This is followed by an in-depth discussion on governance, which includes the concept of corporate governance, corporate governance in HEI and IT governance. It also looks at the relationship between corporate governance, IT governance and data governance, and further discusses the role of data in HEI.

The chapter discusses data governance and elaborates the purpose of its strategy, who should be included in the committee, challenges that might lead organisations to consider implementing it, data-driven business initiatives that require data governance, relationship between corporate governance, IT governance and data governance. And it further discusses the chosen DG model used for this study which is transferred from IT governance.

The chapter lastly focuses on few theories that have been employed pertaining data governance implementation

CHAPTER 3: Research Design and Methodology

The third chapter focuses on defining the proposed methods adopted for conducting the research. It starts by explaining the research design, followed by research philosophy, the approaches to research, the research strategy, data collection methods used, techniques of data analysis and case description of this study.

CHAPTER 4: Data collection and data findings

The fourth chapter analyses data collected from a questionnaire and structured/semi-structured interviews. It is organised in two sections. The first section discusses data collection process and how participants were selected. While the next section covers data analysis from questionnaires and interviews using the thematic analysis approach.

CHAPTER 5: Discussion of Data Findings

The fifth chapter discusses the findings of this study and answers the following main research question; how can data governance influence the management of data in higher education institutions? This question is answered through answering the sub-questions: What are the data related challenges that Cape Peninsula University of Technology (CPUT) is facing as a result of poor data management? What strategies and processes are currently employed to maintain and standardise data from the information systems? What data governance components can be explored to manage and maintain data from the information systems?

CHAPTER 6: Conclusion

The last chapter presents a summary of the research findings and highlights main findings drawn from the study. Furthermore, it discusses limitations, future research opportunities and provides recommendations.

1.11   Conclusion

This chapter served to introduce the problem to be addressed; it highlights the background, objectives and aim of the study. Further it discusses the delineation and ethical considerations of the study and presents the research questions and significance of the study. The following chapter focuses on understanding and analysing previous research to develop a context for this study.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature at length; it begins with discussing higher education and HEIs in South Africa. It is followed by an in-depth look at governance, which includes discussing the concept of corporate governance, corporate governance in HEI and IT governance. It also looks at the relationship between corporate governance, IT governance and data governance and further discusses the role of data in HEIs.

The chapter discusses data governance as a discipline that focuses on data. It then elaborates on the purpose of data governance strategy, composition of the data governance committee, challenges that might lead organisations to consider implementing data governance, data-driven business initiatives that require data governance, relationship between corporate governance, IT governance and data governance and further discusses the chosen DG model used for this study, which is transferred from IT governance. Lastly, it focuses on theories that have been employed in previous data governance research.

2.2 Higher education landscape

Higher education (HE) is primarily concerned with the transmission and development of knowledge at the most advanced levels of learning and research (Power, 2015:163). HEIs still see themselves as fountains of knowledge and reason for a better world (Power, 2015:163), because they prepare most of the professionals who develop, lead, manage, teach, work in and influence society's institutions (Cortese, 2003:17). Lozano, Lukman, Lozano, Huisingh and Lambrechts (2013:10) proposes that for HEIs to become sustainability leaders and change drivers, they must ensure that the needs of present and future generations are better understood and built upon, so that professionals who are well versed in sustainable development can effectively educate students of 'all ages'. According to Cortese (2003:17), HEIs are made up of teaching, research, operations and relations with local communities (Figure 2.1) and, these activities should not be treated separately and differently because they are all critical to achieving a transformative change that can only occur by connecting the head, heart and hand.
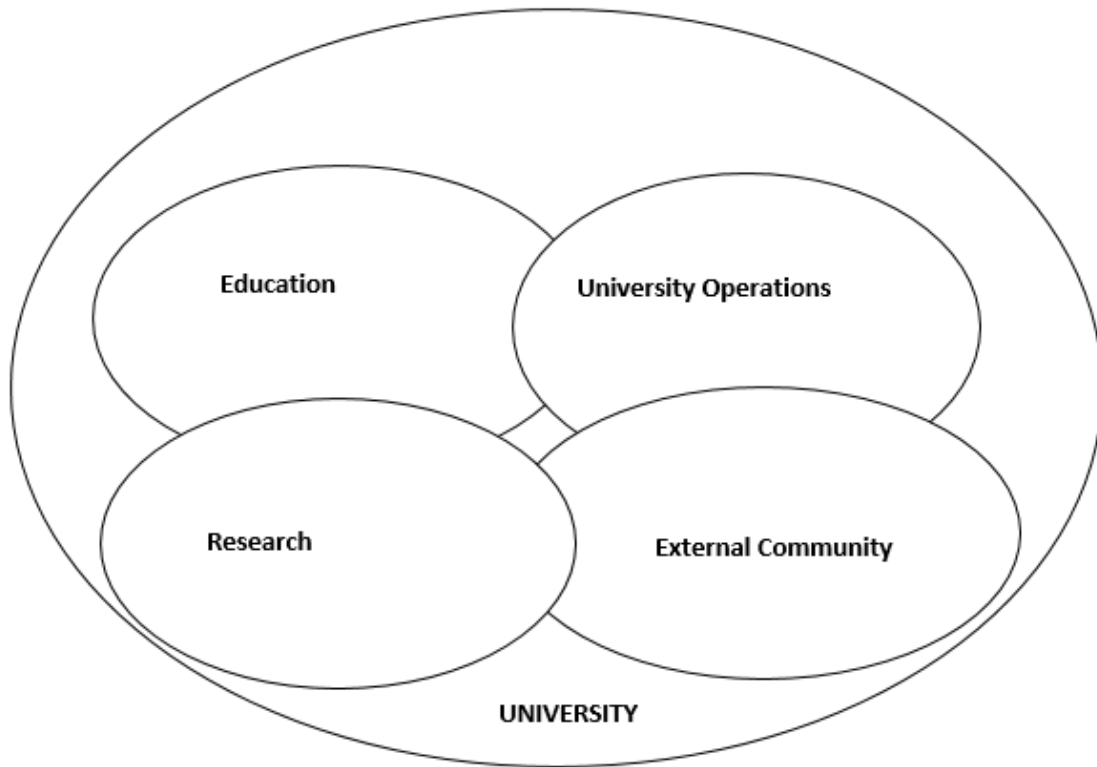
Figure 2.1: Higher education modelling sustainability as a fully integrated system

Source: Cortese (2003:17)

2.2.1 Higher education institutions (HEIs) in South Africa

In the early 1980s in South Africa, the historical white universities began to admit a small number of black students as a result of relaxed state apartheid policies (Boughey, 2010:4). It did not end there. A decade came to an end during 1990s, political change signalled by the release of Nelson Mandela from prison led to considerable reform pressures on all sectors of society, higher education included (Cloete, Fehnel, Maassen, Moja, Perold & Gibbon, 2004:7). This was when the report of the National Commission on Higher Education (NCHE) in 1996 suggested restructuring of the education system, which was then later legislated by the White Paper and Higher Education Act 1997 (Hall, Symes & Luescher, 2004:91).

Policy documents were produced to transform the complex system of apartheid and the National Education Policy Investigation (NEPI) document was produced with the aim of promoting equality in HE and increasing access for black students to institutions which still remained unequal in terms of resources and capacity (Boughey, 2010:9). Through understanding the structural inefficiencies and inequalities caused by apartheid, the then Minister of Education, Professor Kader Asmal, established the National Working Group (NWG) in 2002 to advise on restructuring the institutional landscape of higher education

through the development of new institutions, institutional mergers and collaboration (Ministry of Education, 2002:7). The NWG was guided by the following principles and goals:

- Equity and Redress.
- Democratisation.
- Development.
- Quality.
- Effectiveness and Efficiency.
- Academic Freedom.
- Institutional Autonomy.
- Public Accountability.

Universities in South Africa are divided into three broad categories, namely:

1. Universities of Technology that focus on vocationally-oriented education;
2. Comprehensive universities that offer a combination of academic and vocational diplomas and degrees;
3. Traditional universities offering theoretically oriented university degrees.

Jansen and Taylor (2003:2) assert that the establishment of new institutions as a result of merging of existing institutions was a very significant achievement of the new government. However, Gillard, Saunders, Terblanche and Sukel (2012:25), point out that even though the mergers were intended to improve HE provision across the country, all institutions that went through mergers had to deal with issues such as institutional culture, which includes management styles, race, governance and multi-campus integration. To address that issue the Higher Education Act (1997) introduced the Institutional Forum for each institution in the spirit of South Africa's negotiated democratic settlement. This forum is a higher education governance structure which was compromises students, support staff, management, academic staff, Senate, Council stakeholders and, may sometimes include external stakeholders as well. It has a key role to play in advising Council on issues related to the transformation of higher education and those affecting the institution. These issues lead to the implementation of national policy, the selection of senior management candidates and race and gender equity policies (Hall et al., 2004:93). In a nutshell, governance played a significant role in guiding the restructuring of education system in South Africa.

2.3 Governance overview

Biermann, Stevens, Bernstein, Gupta, Kabiri, Kanie, Levy, Nilsson, Pintér, Scobie and Young (2014) defines governance as a purposeful and authoritative steering of social processes. Research practitioners identify the need to define good governance as a process for making and implementing decisions (Municipal Association of Victoria, Victorian Local Governance Association, Local Government Victoria & Local Government Professionals, 2012:95). According to research practitioners, this process is not about making correct decisions, but choosing the best possible process for making those decisions. It also involves selecting, monitoring and replacing authorities (Kaufmann, 2005:41) that will carry out the wishes of principals (Fukuyama, 2013:4). These definitions highlight that governance is a process where decisions/tasks are made and assigned to authorities who will be accountable for them to ensure the organisation is managed effectively. Governance is usually confused with management. According to Dayton (2001:6), confusing governance with management responsibilities will hamper the mission of the organisation. In their efforts to clarify the difference between governance and management, Khatri and Brown (2010:148) explain that governance refers to what decisions must be made to ensure effective management and who will make those decisions, while management involves making and implementing those decisions.

2.3.1 The concept of corporate governance

Corporate governance can be defined as "*a set of relationships between a company's management, its board, its shareholders and other stakeholders that provide a structure for determining organisational objectives and monitoring performance, thereby ensuring that corporate objectives are attained*" (Khatri & Brown, 2010:148). According to Zingales (2010:37), corporate governance serves as first-line treatment for preventing financial crisis. Love (2010:5) contends that corporate governance can have an impact on several different aspects of firm performance including the following:

1. Operating performance - profitability often measured as ROA (return on assets) or ROI (return on investments).
2. Market value - market capitalisation relative to book value.
3. Stock returns: relative change in stock price over time, measured by return on investment.

Acharya and Volpin (2008:3) state that organisations can implement their own governance in accordance with the regulatory standard or markets, but they argue that even if they commit to governance standards, they may choose inefficiently low levels of governance standards because they do not internalise the benefit that their own choice of governance has on competitors. For instance, if an organisation is competing for managerial talent with other companies, the choice of governance in one organisation is affected by the governance quality of its competitors because competitors may decide to change their governance practices with the aim of acquiring candidates which, in turn, will force the organisation to change its governance practices. Corporate governance practices can either be on country-level or firm-level mechanism. A country-level mechanism includes a country's laws and the institutions that enforce the laws, its culture and norms and the various formal and informal monitors of corporations (Aggarwal, Erel, Stulz and Williamson, 2007:2). Firm-level mechanisms are the mechanisms that operate within the firm and it is where corporations adopt governance features voluntarily (Love, 2010:3).

In 1992, the Institute of Directors in South Africa (IoD, 2009:4) established the King committee with the aim of researching and making recommendations on corporate governance in South Africa. The committee published the first King report on corporate governance (KING I) in 1994, which was recognised internationally as the most comprehensive publication on the subject embracing the inclusive approach to corporate governance (IoD, 2009:55). King I focused on recognising that companies do not act independently from society (Hendricks & Wyngaard, 2010:105). The committee made amendments on King I report and launched the King II corporate governance report in 2002. This report was more focused on introducing the idea of corporate citizenship. In September 2009, the committee further formally introduced King III, which came into effect on the 1st of March 2010. King III was necessitated by the new Company Act no 71, 2008 that regulates the establishment of entities in South Africa. It uses the 'apply or explain' principle and, therefore, supports the principle-based approach to organisational governance, which is currently unique in the Netherlands and now in South Africa (IoD, 2009:6). However, Hendricks and Wyngaard (2010:105) argue that King III is not legislation and the fact that it suggests organisations should 'apply or explain' why they are not applying creates the illusion that it has the same authority as legislation.

According to Hendricks and Wyngaard (2010:104), the King I and King II corporate governance reports were more concerned with commercial entities, but King III report applies to all entities regardless of the manner and form of incorporation or establishment and whether in public, private or non-profit sectors. The principles contained within King III report have been drafted in a way that every entity can apply them and, in doing so, good governance can be achieved. These principles are of equal importance and together they form a holistic approach

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to governance (PricewaterhouseCoopers, 2009:2). In Table 2.1 Wilkinson (2014:228) explain how each principle would inspire organisations to reach the highest level of maturity for governance.

Table 2.1.*Principles and guidance contained in King III corporate governance*

Principle	Guidance
Ethical leadership and corporate citizenship.	Effective leadership is based on an ethical foundation where the board is responsible for implementing an effective ethics management process as well as for ensuring that the organisation is seen as a responsible corporate citizen.
Board and directors	An effective board (consisting of responsible directors), adhering to all responsibilities as indicated in King III, is in place.
Audit committees	An effective audit committee, adhering to all responsibilities as indicated in King III, is in place.
The governance of risk	An effective risk committee is in place. An organisation-wide risk management framework and process is implemented, applied and monitored.
The governance of IT	An IT governance framework supporting the effective governance of IT, is implemented, applied and reported on.
Compliance with laws, codes, rules and standards	An effective compliance, with associated processes, is implemented, applied and reported on.
Internal audit	An effective internal audit activity, adhering to the definition of internal auditing as well as fulfilling the requirements for an effective risk-based internal audit, as indicated in King III, is in place.
Governing stakeholder relationship	Effective stakeholder relationship management is in place. Stakeholders are identified and engaged with and relationships are monitored.
Integrated reporting and disclosure	Integrated reporting, supported by values of transparency and accountability, to all relevant stakeholders.

Source: Wilkinson (2014:228)

It is, however, important to note that while King III report is currently in use at the time of this research, a revision of it, King IV draft report has already been launched for public comment. According to IoD (2016), King IV is designed to incorporate local and global developments on all matters relating to governance. An important feature about King IV is that it is a co-created product because the drafting process included the input of all entities and organisations. Figure 2.2 shows the developmental phrases of King IV report. The setup phase lays the project foundation by establishing required infrastructure, research phase is for gathering and analysing information and data, followed by the initial content development phase, which leads to public consultation and comment phase after which the phase of incorporating public comments (close out phase) is executed before the launch of the report. As aforementioned, all organizations in South Africa are required to adhere to King corporate governance, and that includes higher education institutions.

Phase 0 - Setup

Setup governance structures

Working groups · Task team · King committee

Finalise project plan

Finalise pillars and themes for content development

ACCOUNTABILITY CORPORATE CITIZENSHIP
PERFORMANCE LEADERSHIP AND CULTURE
CONFORMANCE OVERSIGHT
STRATEGY STAKEHOLDER ENGAGEMENT

More info

Phase 1 - Research

Conduct initial research

=

Interviews and comments from stakeholders from different sectors

+

Comparison with international codes and other developments

Phase 3 - Public consultation and comment

Phase 2 - Initial content development

FAIRNESS
RESPONSIBILITY
TRANSPARENCY
ACCOUNTABILITY

Phase 4 - Close-out

Launch

Figure 2.2: King IV Report Development Phrases

Source: IoD (2016)

2.3.1.1. Corporate governance in HEI

Santiago, Tremblay, Basri and Arnal (2008) defined corporate governance in a context of higher education (HE) governance. HE governance encompasses the structures, relationships, characteristics of the institutions and how they relate to the whole system. It includes defining how money is allocated to the institutions and how people should be accountable for the way they spend it, and lastly, it also involves identifying processes that require the development of policies in the institutions that will be implemented and reviewed. According to a study of corporate governance in HEI, Restrepo-abondano, Trujillo and Guzmán (2013) assert that because of the impact higher education has on economic development, efficient governance structures in HEI is relevant not only for the stakeholders of these organisations but for society as a whole.

Hall et al. (2004:93-106) did a study on the culture of governance in South African HE. They selected 12 institutions as case studies, while deriving benchmarks for the desired quality of governance from the White Paper 1997 (Policy framework for higher education in SA). They matched four types of institutional governance by rating each of them against the three parameters consisting of representatives; organisational effectiveness and implementation capacity (see Figure 2.3). Type A institutions were those with self-referential governance combined with shallow delegation. Type B institutions were those that focused on effective management as a key objective. Type C institutions had broad participation in governance coupled with weakly developed system of delegation. And Type D institutions had a combination of representative governance and well-developed delegation.
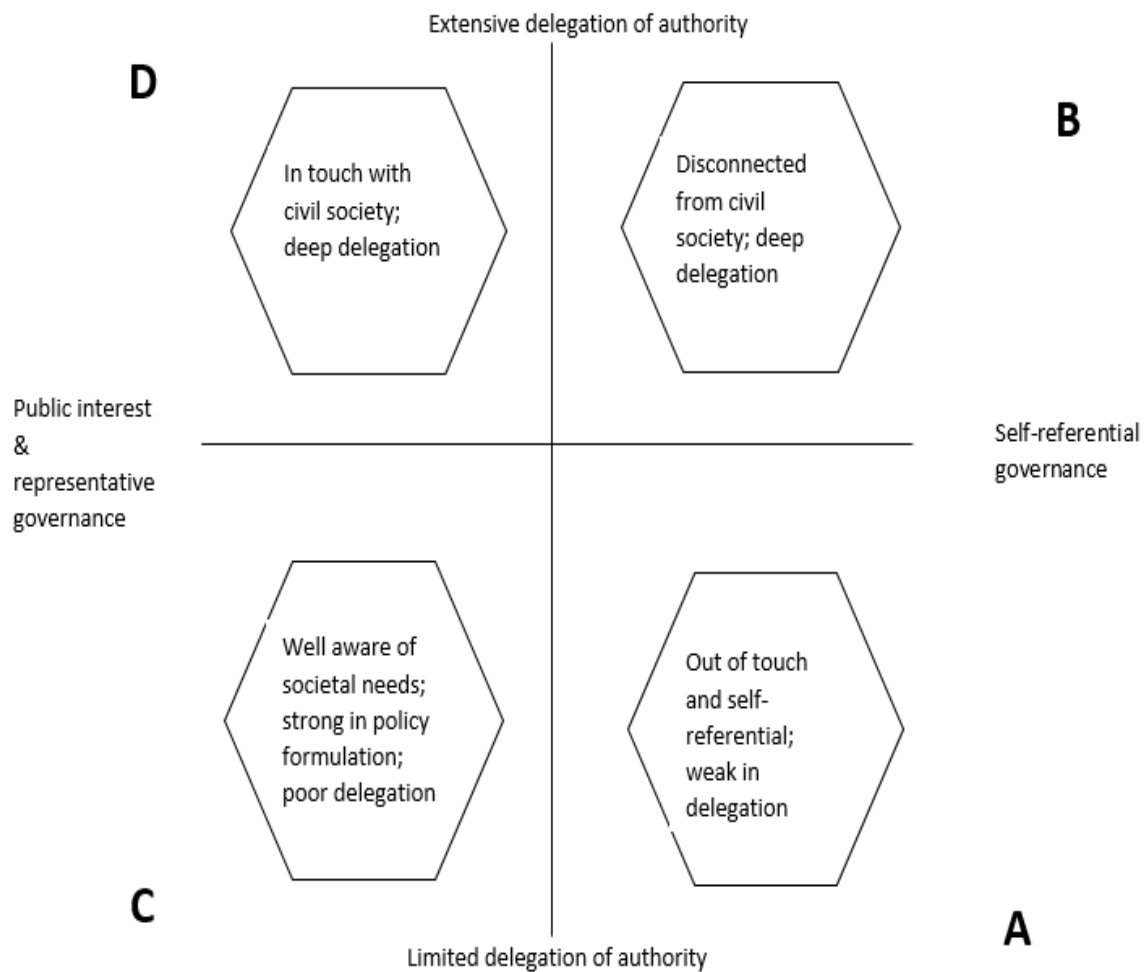
Figure 2.3: *Governance Conditions*

Source: Hall et al. (2004:94)

Based on their findings, problems in governance which emerged in the case studies can be attributed to a lack of institutional capacity and an outcome of uneven apartheid-era resourcing and investment. The study also showed that governance is more than a set of technical arrangements that can be changed through amendments to the Higher Education Act. According to them, South African public HEIs carry a heavy burden of past inequities.

Public HEIs in South Africa have a model of reporting which is rightly captured in Government Gazette No30132 of August 2007:

> *Public higher education institutions (HEIs) in South Africa enjoy considerable statutory autonomy. This autonomy makes it important that the structures of governance and management of these institutions should account to both internal and external stakeholders in a consistent and prescribed manner [own emphasis]... [they]... are required to provide such account to the state through the Minister of Education and,*

according to accepted practice, to report to other stakeholders, which would normally include staff and students of the institution, its donors and alumni and members in which it is located. (Government Gazette No 30132 1, August 2007).

In their audit reports, HEIs are expected to report on matters of governance as articulated in King III Report. It is reported by PricewaterhouseCoopers that "*The King Committee on Governance released the third King Report on Governance (King III). Our review of the corporate governance reports of the 23 public universities found that 13 universities refer to King III*" (PricewaterhouseCoopers, 2014:15).

2.3.2 The concept of Information Technology Governance

In most organisations, IT has become crucial for support, sustainability and growth of the organisation (Van Grembergen, De Haes & Guldentops, 2004:1). The pervasive use of IT in organisations mandate IT governance as a corporate imperative (IoD, 2009:14). This is also supported by King III corporate governance report as earlier mentioned, it recognises IT governance as one of the principles that are of strategic importance and require governance to facilitate the achievement of the organisation's strategic objectives. According to De Haes & Van Grembergen (2005:2), IT governance focuses on the link between business and IT, this is based on the following definitions the author identified: *"IT Governance is an integral part of corporate governance and consists of the leadership, organisational structures and processes that ensure that the organisation's IT sustains and extends the organisation's strategy and objectives". "IT Governance is the organisational capacity exercised by the board, executive management and IT management to control the formulation and implementation of IT strategy and in this way ensure the fusion of business and IT".* The author further asserts that IT governance describes the distribution of IT decision-making right and responsibilities among stakeholders in the organisation and that is illustrated in Figure 2.4.
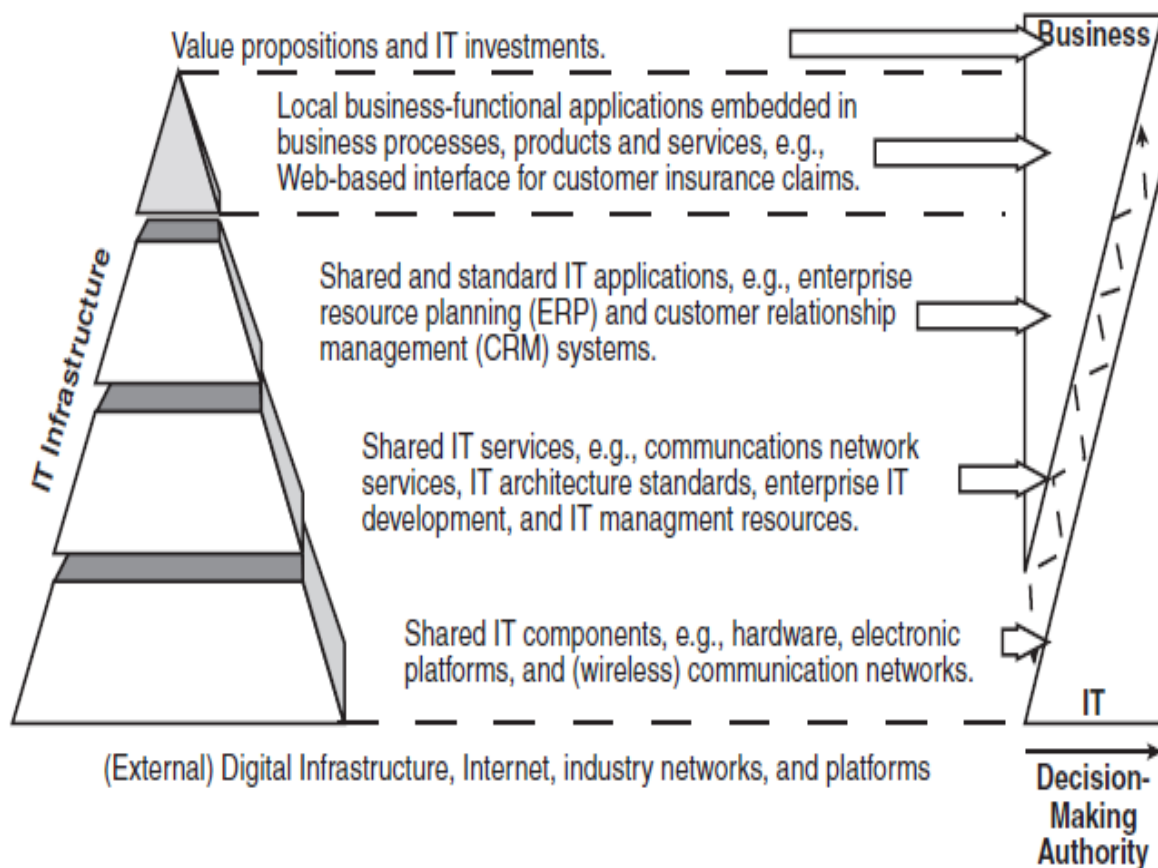
Figure 2.4: *Allocation of IT Decision-Making Authority across Business and IT Management functions*

Source: Peterson (2004:9)

Organisations with effective IT governance ensure alignment between IT and business goals, while organisations with ineffective IT governance will suffer due to poor performance of IT resources (Ali & Green, 2012:179). A set of mechanisms need to be employed in order for organisations to implement IT governance effectively. These include;

1) Active involvement of IT steering committee
2) Involvement of senior management in IT
3) Corporate performance measurement systems
4) Shared understanding of business and IT objectives
5) And a balance of business and IT representatives in IT decisions (Ali & Green, 2012:180-181).

Bowen, May, Decca and Fiona (2007), assert that these mechanisms give a good insight into the phenomenon of effective IT governance. However, Ali and Green (2012:181) argue that its results are limited to the context of one organisation. The effective implementation of IT governance cannot be addressed by legislation alone, hence the development of international IT governance frameworks such as COBIT, Information Technology Infrastructure Library (ITIL) and Val IT frameworks (IoD, 2009:15). COBIT 5 framework is designed to be applied by organisations of all sizes in any sector and, thus, regarded as one of the most comprehensive frameworks available (Wilkinson, 2014:145). However, Botha (2012:26) argues that it lacks impact on IT governance and management in the education sector worldwide. ITIL is a framework that enables managers to document, audit and improve their IT service management processes (Cater-Steel, Toleman & Tan, 2006). It is a well-known alternative framework for IT service quality delivery in education institutions (Botha, 2012:28). However, Botha (2012:28) point out that full implementation of all ITIL processes is rare and might take institutions three to seven years to complete.

Organisations are urged to amalgamate COBIT and ITIL guidelines for a wider control of governance framework (Cater-Steel et.al, 2006). This is supported by Symons (2005:10) when he asserts that these two frameworks are more complimentary than competitive. COBIT takes the perspective of audit and control, while ITIL focuses on service management and combining the two can be beneficial. According to Dahlberg and Kivijarvi (2006:1), there are instances where both COBIT and ITIL could not suit the organisation's requirements, hence authors, consultants and research practitioners developed several new frameworks and tools for IT governance. These frameworks can be used as a guideline to audit the governance of data (IoD, 2009:15).

2.3.2.1 IT Governance in HEIs in South Africa

King III Report recognises the use and reporting of information technology matters in corporate governance. The governance of information technology is a standalone chapter in which the following were emphasised on IT governance:

- Strategic alignment with performance and sustainability objectives of the company;
- Development and implementation of an IT governance framework;
- Value delivery: concentrating on optimising expenditure and proving the value of IT;
- Risk management: addressing the safeguarding of IT assets, disaster recovery and continuity of operations; and
- The protection and management of information.

The association of South African university directors of information technology (ASAUDIT) is a body that:

> *promote and advance the use and support of computing and information technology at South African universities … strives to promote professional skills and conduct in university ICT management and to serve as unitary voice for the South African higher education IT profession and to provide mutual support mechanisms to its members by encouraging development and application of standards and best practices through the sharing of expertise among members and colleagues in organising informative events.* (ASAUDIT, 2014).

Individual universities report to their respective councils the responsibilities for IT governance as per King III Report. These include IT controls and risk mitigation, IT performance and role of IT as it relates to sound financial reporting.

2.4 The role of data in HEI

Tolley and Shulruf (2009:1201) designed a structure that show data in higher education institutions occur in many forms, that is, student's records including demographic, achievement, behaviour and attendance information; curricula material including subject and lesson plans information; programme information; administrative records; financial records; human resources and so forth (Figure 2.5). These are stored in various locations using different storage methods, for example, excel spread sheet, word documents or paper trail. The structure show that different roles such as administrators, HOD/Dean, senior management, lecturers and students use that data. And, in turn, institutional databases are created with the aim to store and manage that data from different departments effectively. On a study of Institutional data management in higher education conducted by Yanosky (2009:4), the fastest growing types of data came from learning management systems, which included data and content, email systems, and research data were found to be the slowest growing.

According to Tolley and Shulruf (2009:1199), education institutions across the world collect data, but few institutions can effectively use their data to improve the quality of education they deliver. This is caused by a rapid growth of IT that provides decision makers with large amounts of data that require processing and analysis (Hartley & Almuhaidib, 2007:268), which, in turn, can be problematic as the field of data management has not been explored enough (Diekema, Wesolek & Walters, 2014:322). The administration of educational systems is complex and that it is caused by complexities of large-scale data management. According to Hartley and Almuhaidib (2007:269), this could mean educational administrators in their policy

and decision making have to rely on technical staff for assistance, which can make the process cumbersome.

Lack of attention to data may have a negative impact on the brand perception of an institution. This view is supported by Redman (2004:12), he points out that an organisation with the best data wins' wars, crafts the best strategies, makes the best decisions and knows most about consumers. Zornes (2013) further asserts that leveraging data properly can result in operational and IT cost savings which, in turn, drive business growth. However, Fisher (2009) argues that a belief that better data brings better decisions leading to better business is easier said than done because most organisations fail to implement data management programmes. According to Fisher (2009), corporate leaders are still being harmed by poorly-managed data that lead to operational problems, poor decision-making and reporting compliance issues. A study done by Tolley and Shulruf (2009:1204) revealed that quality of data management in higher education institutions is affected mostly by the data collection methods and analytical capacity within the institution and, according to the participants of their study; although resources are a factor, staff skills and the nature of data analysis has most influence on quality of knowledge created.

Administrative		
Administrators	Excel sheets	Detailed administrative & financial data
	Work documents	
	Paper trail	

Human Resources

Finance

Student Records: Demographic; grades

Educational (Curricular)	Educational (Students)
HOD/Dean	Excel sheets
	Work documents
	Paper trail

Major student's records events e.g. curricular material, Assessment material

Strategic

Senior Management	Excel sheets	Major administrative & financial data, Institutional reports, Guides a& instructions from government agencies
	Work documents	
	Paper trail	

Educational (teaching)

Lecturer	Excel sheets	Student assessment records; teaching materials, detailed records of student's events behavior
	Work documents	
	Paper trail	

Institutional databases	Roles	Types of decisions	Non-institutional data repositories

2.4.1 Impact of data quality

Most organisations deal with data quality problems emerging from both systematic and structural perspective. In seeking for solutions they develop new systems to replace old ones and, as a result, neglect to address the issue inherited from the old systems (Lee, Pipino, Funk & Wang, 2006). Some authors agree that if organisations have poor data quality that is inappropriately integrated, business operations will continue to be afflicted with data deficiencies that will make it hard to use data (Fisher, 2009; Lee et al., 2006). According to Olson (2003), poor data management is said to cost worldwide business $ 1.4 billion each year and a large portion of that cost is due to data quality inaccuracies. Redman (2001:45) suggests that 10% of organisations revenue is impacted by poor data quality, while Olson (2003) claims that it is from 15-25%. Both authors recognise the impact data quality can have on the organisation's profit.

According to Redman (2008:41), data quality issues experienced by most organisations include the following; 1) People cannot find the data they need, 2) Incorrect data, 3) Poor data definition, 4) Data privacy/data security, 5) Data inconsistency across sources, 6) Too much data and, lastly, 7) Organisational confusion. It is important institutions know whether they have data quality issues so that they can create solutions. Redman (2004:13) suggests basic questions that organisations should ask to check if they have data quality problems:

- How much data does the organisation have, how fast is it creating new data and how many redundant copies are there?
- Which data are most important?
- Are there policies that define who are accountable for these important data?
- Are the data of high quality?
- Are sufficient precautions in place to ensure that data are kept secure, held private and cannot be manipulated?

If the answer is no to any of the questions, organisations should come up with ways to ease the situation. It is also highlighted by Redman (2001) in his book that to improve data quality you must find and fix the root problem, examine and implement ways to prevent poor data quality. With that said, it is clear that data governance is a discipline that can address data quality issues (Korhonen, Mellen, Hiekkanen & Helenius, 2013:11).

2.5 Data governance

Organisations seek to break down the silos of data that result in poor quality of information which, in turn, lead to organisational costs, risks and wrong decisions (Korhonen et al., 2013:11). Most of them realise that their strategic initiatives depend on the quality of data and their ability to manage fast-growing volume of information. Bryant (2014) asserts that this can be achieved through data governance. Data governance can be defined as an organisational approach to data management that formalises a set of policies and procedures to encompass the full life cycle of data (Korhonen et. al., 2013:11). It transforms an organisation's data, its management technology, who owns it and how it should be used (Russom, 2008:4).

According to Russom (2012), a well-designed data governance programme should consist of both business and IT people. They must ensure information strategy and business strategy are aligned with the organisation's overall mission and strategy (Korhonen et al., 2013:14). Figure 2.6 illustrates how business and IT collaborate in data governance by combining business processes with IT systems. It is where business should ask the following question; "*How do we leverage data to improve business processes and performance?*" while IT asks, "*How do we ensure optimal reuse, quality and operational efficiencies?*" (Dyche & Levy, 2006).
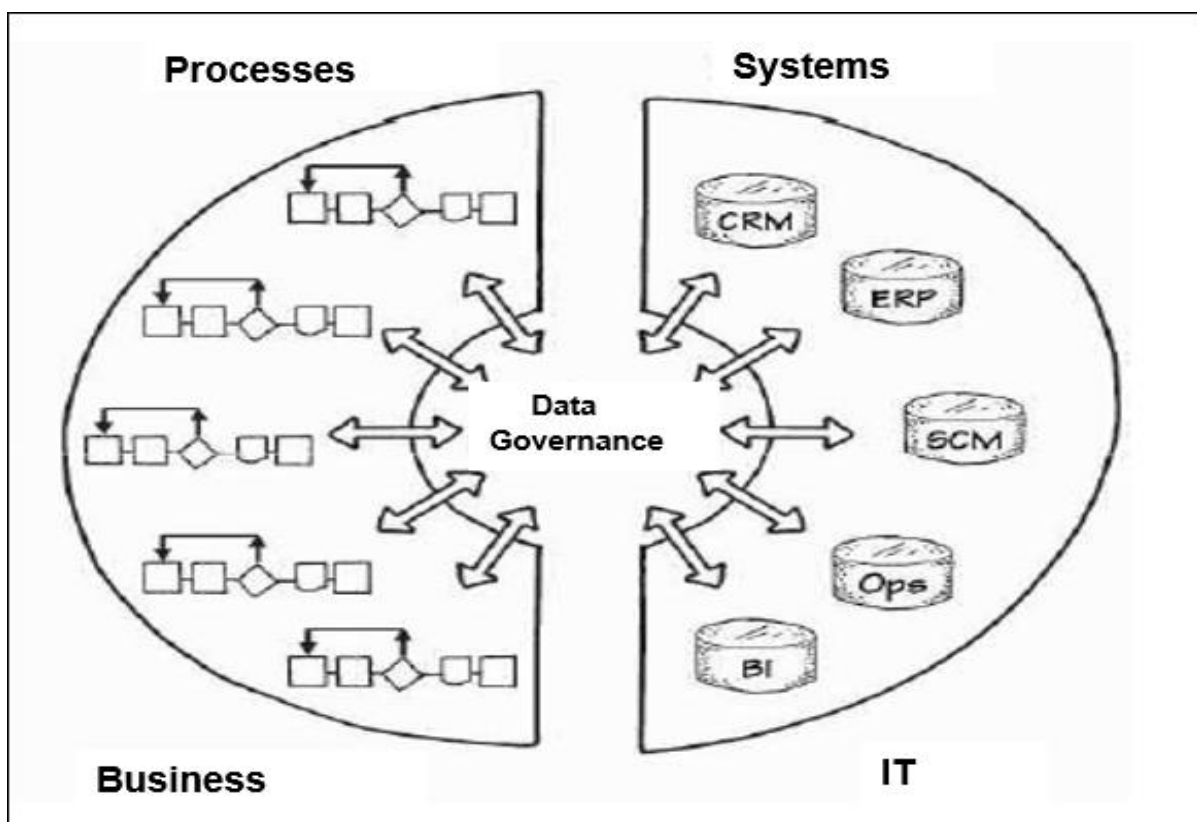
 Figure 2.6: *Collaboration of business and IT in data governance*

Source: Dyche and Levy (2006)

Since organisations are different they also have distinct definitions of what falls into their DG definition, but they are all related and aim at addressing the protection of data, proper use of data and the management of data as an organisational asset (Chalker, 2014:3). Figure 2.7 shows various data-driven business initiatives that may require DG implementation. According to Russom (2008:11), the intersection between DG and data-driven business initiatives is mainly the focus on data. Van der Merwe (2010) has identified the following challenges that might also lead to DG consideration:

1) Multiple versions of truth (for example, Customer, Bookings)

2) Limited time for data analysis and time wasted on data gathering

3) Project-driven approach resulting in disparate data definitions

4) Uncontrolled data redundancy

5) Unclear data ownership rules

6) Inconsistent and incomplete information (poor quality)

7) Inflexible custom code and "work-around" from early implementations

8) No widely adopted standard reporting tools

9) Re-writing history for realignments and errors

10) Development focus on providing detail data, and

11) High IT maintenance and development costs.

Data Warehousing/Business Intelligence	Master Data Management
Risk Management	Data Security
Organizational Integration	Policies and Procedures
Business Process Management	IT and Architecture Management
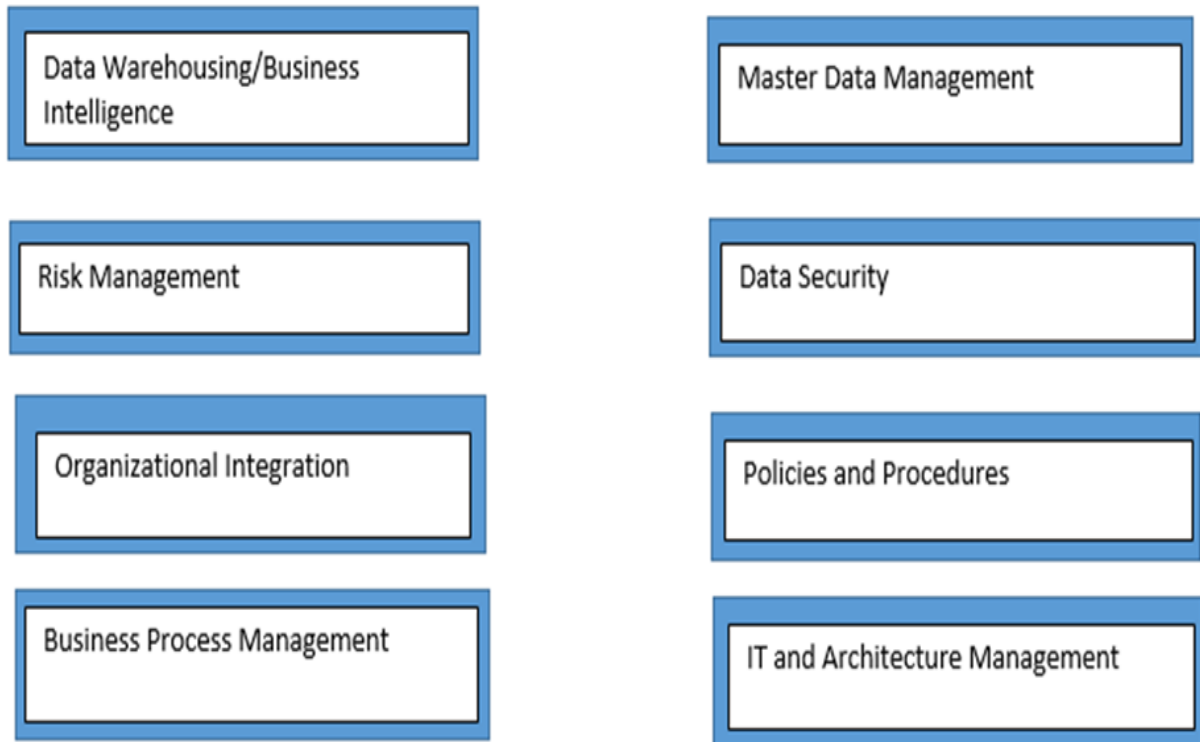
Figure 2.7: *Initiatives that calls for DG implementation*

Source: Chalker (2014:3)

Russom (2008:4) asserts that data governance is best coordinated with IT governance and corporate governance. This is because IT governance reflects broader principles of corporate governance (Weill & Ross, 2004:1). However, Chin, Brown and Hu (2004), and Wende (2007) argue that IT governance has to follow corporate governance principles, and that factors identified to have significant impact on corporate governance will have effect on IT governance. Most data governance research has been transferred from IT governance. However, Wende (2007) points out that it does not make data governance a full subset of IT governance and further argues that IT governance and data governance are coequals. Cheong and Chang (2007:1006) explain in their study that there is a relationship between corporate governance, IT governance and data governance. The authors further elaborate that IT governance and data governance committees should work collaboratively and report to the members of corporate governance council as shown in Figure 2.8.
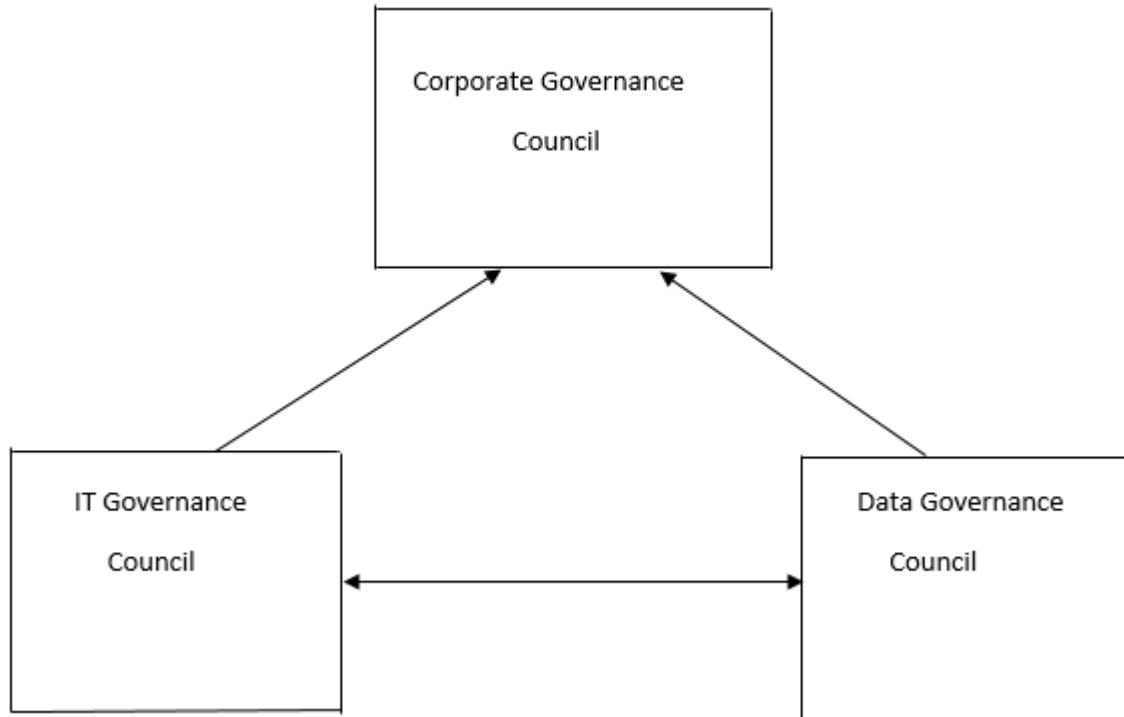
Figure 2.8: *Relationship between corporate, IT and data governance*

Source: Cheong and Chang (2007:1006)

2.5.1 Data Governance model based on IT Governance

According to Khatri and Brown (2010:149), IT governance and data governance refer to who holds decision rights and is held accountable for the organisation's decision-making process on its IT assets and data assets. That is why some data governance research (Wende, 2007; Khatri and Brown, 2010:149) is translated from IT governance research. Weill and Ross (2004:3-4) propose the following decision domains in their IT governance framework:

- IT principles – high-level decisions about the strategic role of IT in the business.
- IT architecture – an integrated set of technical choices to guide the organisation in satisfying business needs.
- IT infrastructure – central coordinated, shared IT services providing the foundation for the enterprise's IT capability and typically created before precise usage needs are known.
- Business application needs – business requirements for purchasing or internally developed IT applications,
- Prioritisation and investment – decisions about how much and where to invest in IT, including project approval and justification.

Khatri and Brown (2010:150) used IT governance decision domains to structure their data governance decision domains, which can also be referred as DG components (Figure 2.9). They identified the following DG components:

- Data Principles – establish the linkage with the business, by describing the business uses of data and ensuring data is treated as an enterprise wide asset.
- Data Quality – involves ensuring accuracy and integrity data that is always available for an enterprise.
- Metadata – describes what the data is about and provides a mechanism for a concise and consistent description of the representation of data.
- Data Access/Data authorisation – involves data security and explaining variety of ways in which a dataset can be accessed.
- Data life cycle – involves understanding how data is used, and how long it must be retained to minimise the total cost of storing over its life cycle.
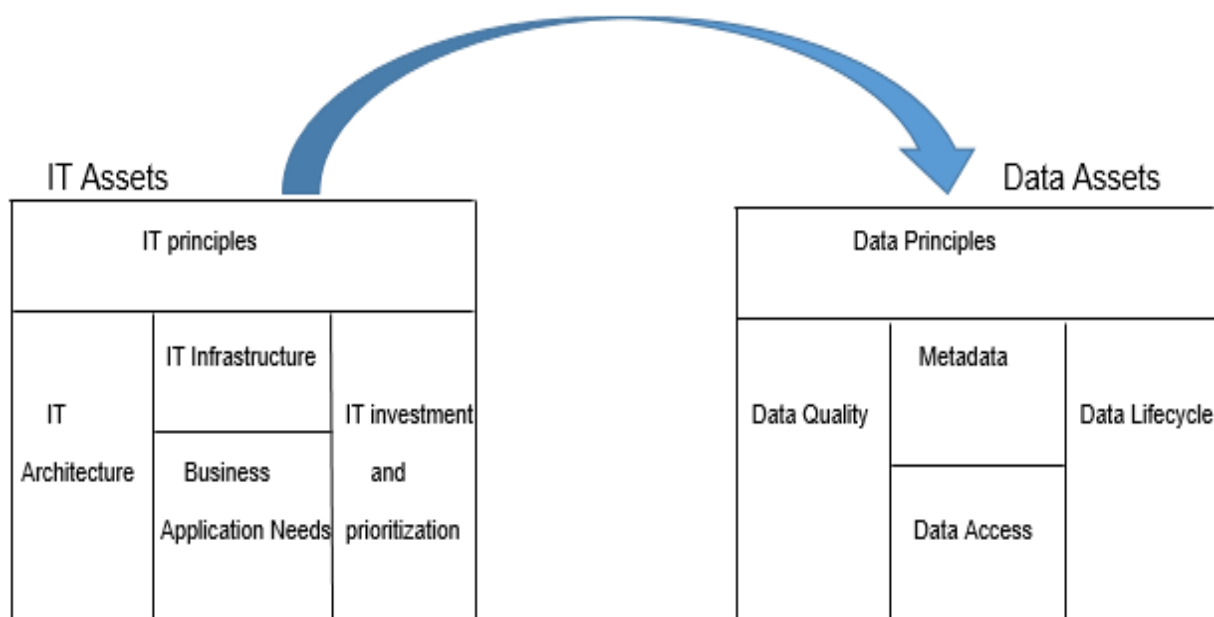
Figure 2.9: *IT governance framework transferred to Data governance framework*

Source: Khatri and Brown (2010:150)

These components need to be assigned to roles that will be accountable for them, also referred as locus of accountability. According to Wende (2007), IT governance research is more advanced now, and has more flexible approach for assignment of accountabilities. The author further states that there are two IT governance models for assignment of accountabilities that can be used for data governance namely: centralised and decentralised models. The centralised model indicates that all decision domains in IT/Data governance are

centralised within the IT department. With the decentralised model, various business units of the organisation are accountable for the decision domains on IT/Data governance depending on the structure of the organisation.

Khatri and Brown (2010:151) designed a data governance matrix (Table 2.2), which portrays an overview of how responsibilities will be assigned based on the locus of accountability for each decision domain. Begg and Caira (2012) used this data governance framework in their study, to check the impact of DG in small-to medium-sized enterprise (SMSE) organisations. They find that the framework is simple and non-technical and also adoptable and scalable, but not for SMSEs. This study also chose to use this DG framework to analyse the impact of DG in higher education because it is simple and adoptable, which can be advantageous for HEI that would like to implement DG strategy.

Table 2.2.*Data governance matrix table example*

Decision Domain / Locus of accountability	Data Principles	Data Quality	Metadata	Data Access	Data Lifecycle
Centralized	✓				
				✓	✓
			✓		
		✓			
Decentralized					

Source: Khatri & Brown (2010:151)

28

2.6 Underpinning theory

Theory explains how some human behaviour is organised and how to bring change about those behaviours (McCallister & Osborne, 1996). It is a tool that enables us to identify a problem and plan a way of altering the situation. It can also help us understand what we do not know and serve as the only guide to research. According to Gilbert (1993), theories must be capable of being tested or falsified, while McCallister and Osborne (1996) assert that it enhances the growth of a body of language of theories from both within and outside the area of distance learning.

Data governance framework can be implemented following various theories as guidelines, however the study discussed just a few - namely: big bang, morphology, incremental and contingency.

2.6.1 Big bang theory

A big bang theory is used by scientists to explain what happened at or soon after the beginning of the universe. According to Pasachoff (2004), a big bang theory proposes that the universe was created by a quick cosmic explosion called the big bang, which occurred about 10 billion to 20 billion years ago and the universe has been expanding since. That simply means nothing existed before the big bag. However, Pasachoff (2004:1) argues that there is no way at present to detect the origin of the universe because big bang theory does not explain what existed before big bang. Ball (2003:5) asserts that the theory is incomplete and does not explain all details of the universe history. Despite the theory's arguments, some people still think that DG can be achieved with the big bang approach.

A big bang approach says that a DG solution can be created all at once and quickly. This leads to a lot of complexities due to lack of time and planning. Joseph (2013) point out that one of the biggest challenges faced today in Data Governance is the big bang theory, "*the idea that we can get everything from nothing very quickly*". Numerous authors and practitioners agree that implementing Data Governance following a big bang theory rarely works (Knifton, 2014; Addagada, 2015; O'Neal, 2013; Noah Consulting, 2015) mainly because it is difficult to execute a data program all at once (O'Neal, 2013), and it takes time to find and educate all the relevant key people in one's company and to answer all the questions that will be asked (Joseph, 2013). Noah Consulting (2015) state that the "one size fits all" organisational model of the big bang theory cannot work because company culture and maturity must be considered. This theory is dismissed for this study because proper planning

needs to be in place so that a suitable DG that fits the institution's culture and meets the needs of the institution can be developed.

2.6.2 Morphology theory

According to Otto (2011), a morphology theory follows the principles of analytic theory because it is concerned with the structure and arrangements of parts of an object. Otto (2011) carried out a study on *morphology of the organisation of data governance*, where he used six mini case studies to evaluate morphology by means of empirical data using a deductive approach. He developed a model that consists of data governance goals and structure (Figure 2.10).
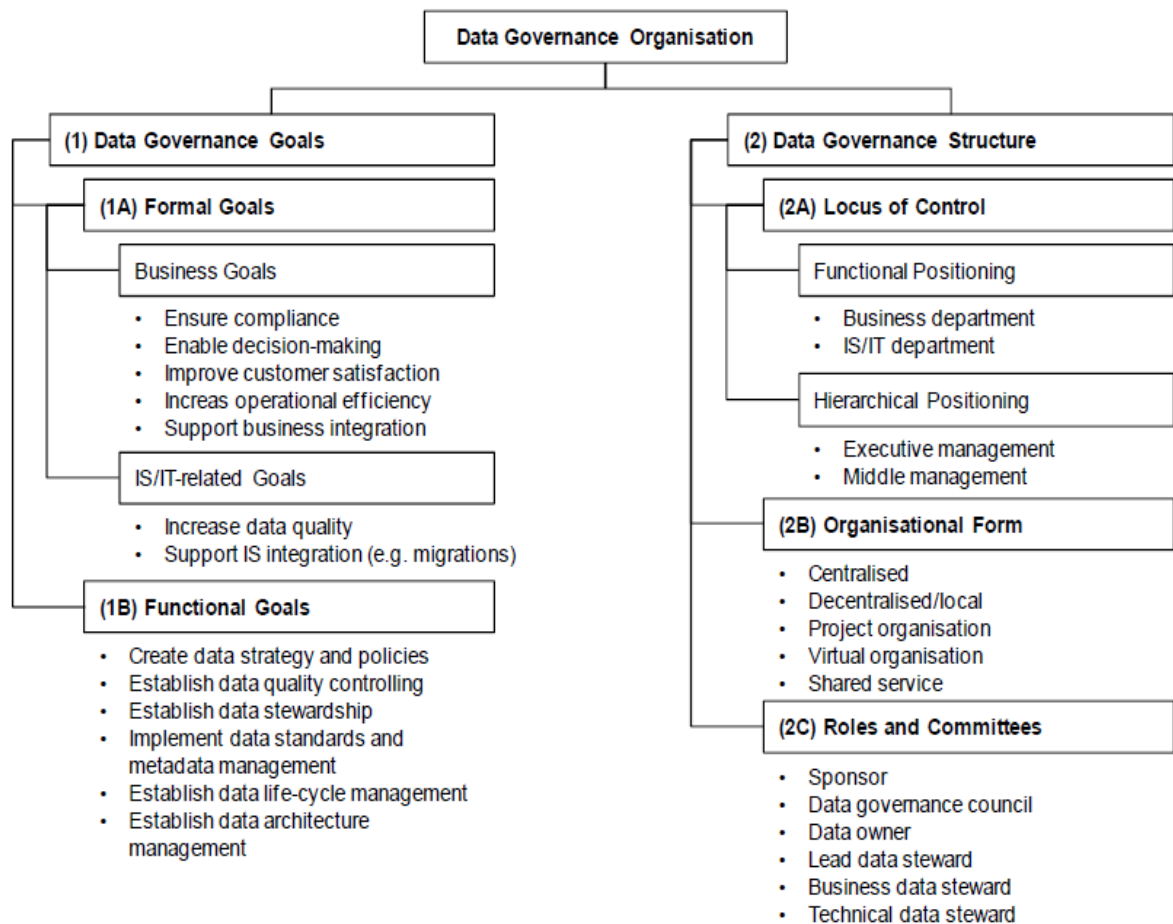
Figure 2.10: *A Morphology of Data Governance organisation*

Source: Otto (2011)

Based on the findings of Otto (2011), morphology allowed him to identify and evaluate "archetypes" of data governance and a detailed analysis of contingency factors. He further proposed that this model can be used as a guideline or checklist for implementing DG, but mentioned that limitations lie in the nature of analytic theory. Analytic theories form only a starting point of future research, meaning that the study cannot be enhanced/changed but evaluated. Niemi (2013) and Hallikas (2015) conducted data governance studies using Otto's (2011) morphology framework. The main limitation of Niemi's (2013) paper is that it only introduced the research topic and did not include any empirical evidence or theory development. Hallikas (2015:82) findings show that the two aspects of data governance which include goals and structure can only be found in the expectations of the selected members of the case company. In turn, that can also be a limitation. With the mentioned limitations, morphology theory won't allow flexibility for this research in terms of developing a data governance framework that can be enhanced/changed for future studies that for focus on DG in higher education institutions (HEIs).

2.6.3 Incremental theory

Implementing data governance using an incremental approach implies that a certain set of "evangelists" within an organisation have previously attempted data management policies and procedures (Pilch, 2010). This means DG policies, procedure, and data management standards have to be created upon the actions of these "evangelists", and they must be used as a starting point while being incrementally added to the "evangelists" processes to form an overall DG program. This approach takes time and patience (Dyche & Nevala, n.d.). However, Lam (2011) asserts that it is a practical, proven strategy that any size organisation can implement to suit their immediate and long-term needs. The authors further propose the following seven steps of developing effective Data Governance following an incremental approach:

> **Step 1**: Prioritising areas for improvement
>
> **Step 2**: Maximise information availability
>
> **Step 3**: Create roles, responsibilities and rules
>
> **Step 4**: Ensure information integrity
>
> **Step 5**: Establish an accountability infrastructure
>
> **Step 6**: Convert to a master data-based culture

Step 7: Develop a feedback mechanism for process improvement

Dyche and Nevala (n.d.) stated that even though these steps can unite business objectives, technology initiatives, and information policy without starting a daunting and expensive DG project, their incremental approach does not properly explain how the decision-making structure and accountabilities will be addressed within the DG program. This research used a DG framework from a study that transferred research from IT governance to DG. According to Weber, Otto and Österle (2009), research on IT governance indicates that the distribution of accountabilities for IT management differs between organisations based on contingencies. The authors mentioned that since DG comprises parts of IT governance, there are contingencies that affect decision-making and company-specific configuration of a DG model. This study followed a contingency theory that is discussed in the next section.

2.6.4 Underpinning theory for this study

Contingency theory is a well-known part of behavioural research that describes the relationship between organisational factors such as structure and environment (Opitz, Krup & Kolbe, 2014). It encompasses the idea that there is no best way of organising while highlighting that organisation value is contingent/dependent on the organisational factors (Devos & Van de Ginste, 2015). Gu and Ray (2008:6) define contingency theory on IT governance as an alignment between IT governance configurations, organisational capabilities and business strategies. This definition arises from prior IT governance studies that proposed a contingency theory, mainly because there is no single IT governance type that fits for all forms of organisations (Optiz et al., 2014) and the decision rights IT management differ between companies depending on contingency factors (Schmidt & Kolbe, 2011). Wende and Otto (2007) mention that this theory says the relationship between some characteristics of an organisation and the organisation's effectiveness is determined by contingency factors.

There are multiple identified contingency factors that influence IT governance configurations. Schmidt and Kolbe (2011) list these contingency factors: competitive strategy, diversification breadth, firm size, organisation structure, performance strategy, IT infusion and IT diffusion, and line IT knowledge. The authors assert that they are affected by the forces such as corporate governance, economies of scope and absorptive capabilities. Table 2.3 shows the category of forces that can affect characteristics of contingency factors which, in turn, have an influence on the locus of IT decision rights (Sambamurthy & Zmud, 1999).

Table 2.3. *Contingency factors that influence the accountability of authority in IT decision-making*

Category of forces	Contingency factor	Locus of decision rights	
		Corporate IS	Division
Corporate Governance	Overall governance mode	Centralized	Decentralized
	Firm size	Small	Large
Economies of scope	Diversification mode	Internal growth	Acquisition growth
	Diversification breadth	Related markets	Unrelated markets
	Exploitation strategy	Enterprise-wide consolidation of assets	Enterprise-wide line/IS partnerships
Absorptive capacities	Line IT knowledge	Low	High

Source: Sambamurphy & Zmud (1999)

Gordon (2014) studied data governance, stimulated by the findings of Weill and Ross (2004) IT governance study. According to the findings of IT governance, structure comes in two forms; IT Governance Institutes and IT archetype models. IT governance Institutes model defines the following:

- Strategic alignment between business and IT
- Value generation from IT to business,
- Management of the IT-resources,
- Management of risk, security and rules, and
- Performance monitoring of IT.

On the other hand, IT archetypes model includes:

- IT principles,
- IT architecture,
- IT infrastructure,
- Business Application needs, and
- IT investment prioritisation.

These are the archetypes Weill and Ross (2004:3-4) used in their proposed IT governance models as decision domains (see section 2.5 Literature Review). The same archetypes were used by Wende and Otto (2007) to guide them on the decision domains for DG. Gordon (2014) further states that IT governance archetypes indicate that there are three elements that

constitute an IT governance model: roles, major-decisions and assignment of accountabilities and that approach can be used for a DG model.

As mentioned earlier, most IT governance studies have been used as a reference discipline for data governance because both studies aim at answering the same question: How does Data/IT governance enable data quality and IT services to deliver enterprise value (Wende, 2007). Prior research on DG have been following a universal approach where they describe accountabilities as one best way to organise. According to Wende (2007), contingencies affect DG similar to IT governance as each organisation needs a specific DG configuration dependent on a set of influencing factors or contingencies. However, Wende (2007) argues that contingencies have an impact on the outline of the DG model because organisations that know the contingencies that impact their model are only provided with indications on how to structure their DG model, but not the contents within the model.

Weber et al. (2009) and Schmidt and Kolbe (2011) depict a model that illustrates the two main ideas of the contingency theory (Figure. 2.11). Schmidt and Kolbe (2011) explain the ideas on his IT governance study, the first being the characteristics of an organisation, for example, the allocation of decision rights and the impact of the organisation's success. Second, the ideal organisation is determined by specific contingency factors. In a nutshell, this model can guide organisations to develop IT governance and Data Governance designs that suit the specific organisation's needs as they have distinct contingency factors. Weber et al. (2009) also state that companies require specific data governance configurations that fit a set of specific contingencies. As such this model is recommended (Figure 2.11).
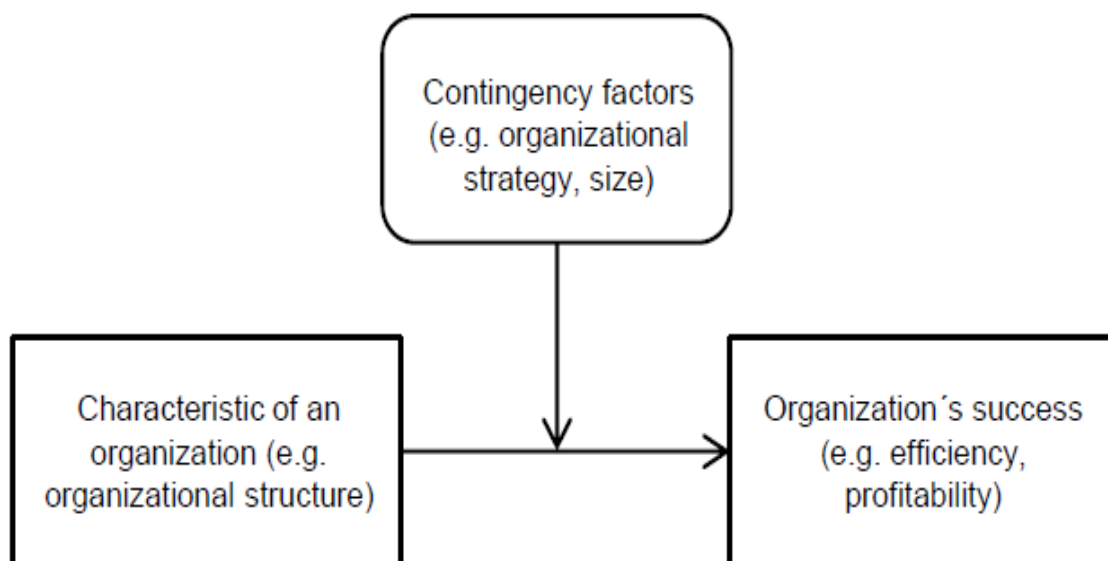
Figure 2.11: *Contingency moderation model*

Source: Weber et al. (2009); Schmidt and Kolbe (2011)

Wende and Otto (2007) conducted a study where they translated IT governance research that used a contingency approach into a Data Governance research. The aim of the study was to develop a flexible DG model comprising data quality roles, decisions areas and responsibilities, using a contingency approach instead of universal approach of prior research. They outlined a contingency model (Figure 2.12) based on two parameters – organisational placement and coordination mechanisms. According to authors, these two design parameters affect the configuration of data governance model as their value influences the assignment of responsibilities.

Organisational placement parameter ranges between two opposed pairs of centralised/decentralised models. With centralised model, decision-making authority is in a central IT department, even though Buytendijk (2011) asserts that this model offers a unique approach and can work, Chalker (2014:15) state that the initial cost due to resource allocation to provide the organisation knowledge is a potential risk in using this model. The decentralised model, all decision-making authority is allocated to distinct organisation units/divisions. This model has proven to be difficult as it leads to dispersed data with many version of the truth that can be analysed with a limited scope (Buytendijk, 2011). According to Bailey (2010), combining these two models, also referred to a hybrid model, can uniquely accommodate diversified lines of business and their different business processes while allowing for a collaborative process. Bailey (2010) further defined a decentralised model in a hybrid mode, that is, all data management activities remain in the individual line of business and the data steward and members of the committee who are accountable for data management tasks remain in their respective units while approving policies and processes approved by the centralised DG council.

Coordination parameter ranges between hierarchical/cooperative models. In the hierarchical model, coordination is achieved through superiors such as CIO or IT governance board to communicate, control and manage subordinates, while with cooperative model direct control is replaced with cooperative behaviour to clarify differences and solve problems among individuals. This study used Wende and Otto's (2007) proposed contingency model to develop a DG model because their model focuses on the accountabilities aspects of DG and enables the development of a specific and flexible DG configuration that fits a set of contingencies of the institution.
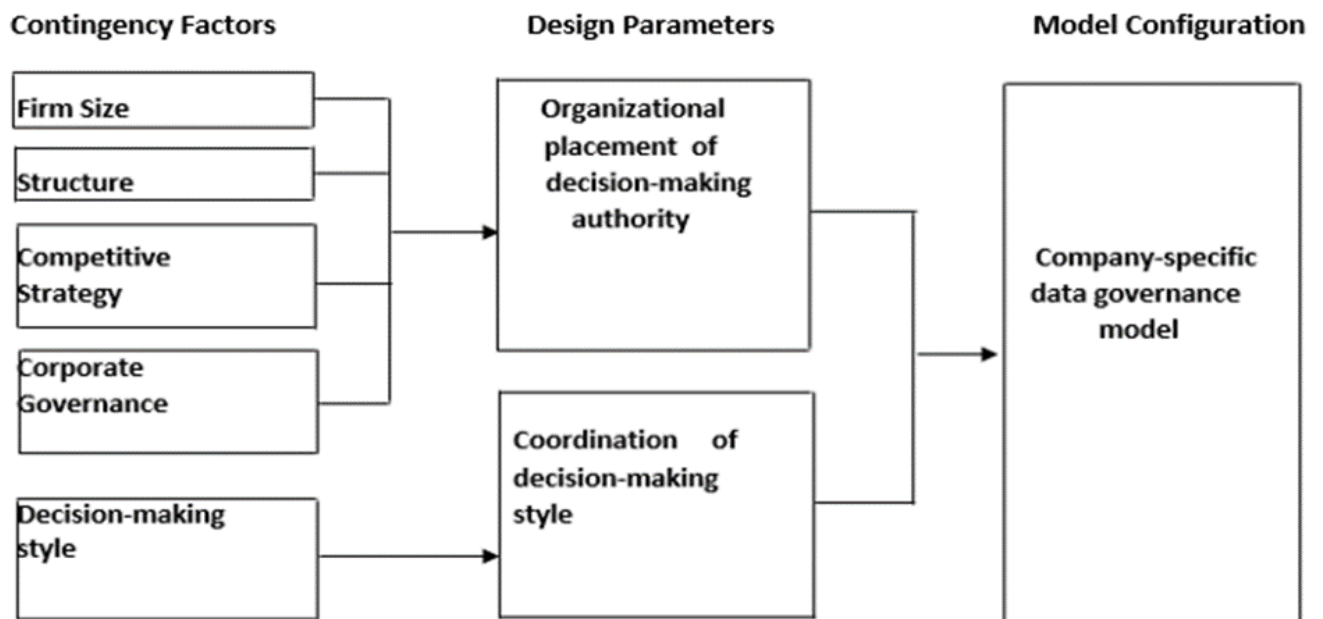
Figure 2.12: *Contingency model for Data Governance*

Source: Wende and Otto (2007)

2.8 Conclusion

This chapter reviewed literature at length by discussing higher education and HEIs in South Africa, governance, which includes the concept of corporate governance, corporate governance in HEI and IT governance. It also looked at the relationship between corporate, IT and data governance and further discussed the role of data in HEIs. It elaborated on data governance as a discipline that focuses on data and discussed the chosen DG model used for this study. Lastly, it focuses on theories that have been employed pertaining to data governance implementation, and further discussed why contingency theory was chosen to guide development of the data governance model for HEI.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter focuses on defining the proposed methods adopted for conducting the research for this project. It starts by explaining the research design, followed by research philosophy, the approaches to research, the research strategy, data collection methods used, techniques of data analysis and case description of this study.

3.2 Research design

A research design is a plan to which research participants or objects are obtained to collect information with a view for reaching conclusions about the research problem (Welman & Kruger, 2001). It is a process operating through every stage of the research to ensure that the initial question is answered. This involves the activities of collecting and analysing data, developing and modifying theory, elaborating research questions and identifying valid threats that might be implemented simultaneously, and in turn each influencing the others (Maxwel, 2013).

3.3 Research philosophy

This is an IT study that focuses on analysing the impact of data governance on information systems in HEIs. March and Smith (1995) assert that IT has attracted scientific attention because of its potential for impacting organisational effectiveness. They further assert that scientific research can improve IT practice. Science involves subjective or objective philosophical approaches to research (Holden & Lynch, 2004, citing Hussey and Hussey, 1997).

In subjective philosophy, the focus is on human beings acting on the world through sense making and, in that, way modifying the context they live in (Huizing, 2007). In objective philosophy 'people other than the researcher should agree on what is being observed' (Welman & Kruger, 2001). According to Holden and Lynch (2004), subjectivists underline the truth, understanding and meaning come from ongoing interaction with the physical environment and with other people while objectivists claim that objects exist in an object reality independently of human will and thought. The aim of this study is to understand the

environment and the lived experiences within CPUT from a perspective of selected individuals regarding data management in challenges on information systems. The study further analyses how data governance framework can be explored to manage data on the information systems. Therefore, the study falls under the subjective philosophy approaches with interpretive paradigm procedures. According to Grant and Perren (2002), interpretive paradigm focuses on explanations of how society is regulated and it holds that reality is constructed in the mind of the individual, rather than an external singular entity (Ponterotto, 2005; citing Hansen, 2004).

3.4 Research approach

A research approach is a strategy that is implemented to collect evidence/data through methods. Creswell (2003) lists three approaches that can be followed by researchers: qualitative approach, quantitative approach and mixed (qualitative and quantitative) approach.

Qualitative research was originally developed in the social sciences to enable researchers to study social and cultural phenomena. It is designed to help researchers understand people in the social and cultural contexts within which they live, while using data collection methods such as interviews, documents, and observing participants to understand and explain the phenomena (Myers, 1997). According to Creswel (2003), a researcher collects emerging data with the primary intent of developing themes from the data.

Quantitative research was developed in the natural sciences to study natural phenomena; it includes methods that are now well acceptable for social science such as survey, laboratory experiments, formal methods and numeric methods (Myers, 1997). Caswell (2003) asserts that this approach employs strategies of inquiry to collect data on predetermined instruments that yield statistical data Creswell (2003).

Newman and Benz (1998) state out that qualitative and quantitative research can be combined. However, Sale, Lohfeld and Brazil (2002) argue that mixing these research methods often diminishes the value of both methods. According to Radwan (2009:2), the difference between qualitative and quantitative research is a methodological use, the decision to choose a suitable methodology that will help in answering the initial research question. Both qualitative and quantitative methods are invoked using distinct methods (see comparison in Table 3.4).

To analyse whether data governance framework can have an impact on the institution's data while understanding the data management challenges, this study used an approach that enabled the researcher to understand and explain the cultural context within which the institution's participants live and apply appropriate methods. Thus, qualitative method was selected and used for this study. In a nutshell, the study employed a qualitative, interpretive research method, which was implemented using a deductive approach.

Table 3.4. *Comparison of quantitative and qualitative research*

	Quantitative	Qualitative
General framework	• Seek to confirm hypotheses about phenomena • Instruments use more rigid style of eliciting and categorising responses to questions • Use highly structured methods such as questionnaires, surveys and structured observation	• Seek to explore phenomena • Instruments use more flexible, iterative style of eliciting and categorising responses to questions • Use semi-structured methods such as in-depth interviews, focus groups and participant observation
Analytical object	• To quantify variation • To predict casual relationships • To describe characteristics of a population	• To describe variation • To describe and explain relationships • To describe individual experiences • To describe group norms
Question format	• Closed - ended	• Open – ended
Data format	• Numerical (obtained by assigning numerical values to response)	• Textual (obtained from audiotapes, videotapes and field notes)
Flexibility in study design	• Study design is stable from beginning to end • Participant responses do not influence or determine how and which questions researchers ask next • Study design is subject to statistical assumptions and conditions	• Some aspects of the study are flexible (for example, the addition, exclusion or wording of particular interviews questions) • Participants responses affect how and which questions researchers ask next • Study design is iterative, that is, data collection and research questions are adjusted according to what is learned

Source: Mack, Woodsong, MacQueen, Guest and Namey (2005:3)

3.4.1 Deductive approach

As aforementioned, this research followed a deductive approach which is theory-driven. This is because empirical data was tested against an existing theory of DG framework to check if DG can be applied to HEI. Elo and Kayngas (2007) state that a deductive approach "*is useful if the general aim was to test a previous theory in a different situation*". Figure 3.13 indicates that researchers begin their research activity with a theory about the nature of the world. They put the theory to empirical test by deriving hypotheses about particular observations and that process follows principles of deductive logic.
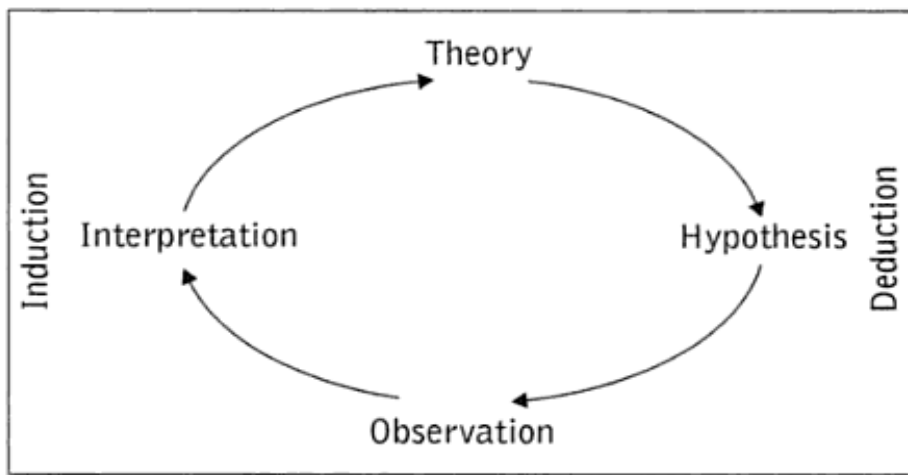
Figure 3.13: *The hypothetic-deductive model*

Source: Blanche, Blanche, Durrheim and Painter (2006)

3.5 Research strategy

Since this research is qualitative in nature, a case study research strategy was adopted and it is a commonly known IS research strategy (Ives, Hamilton & Davies, 1980), which is used to document and analyse implementation processes (Yin, 2012). A case study is defined as an "empirical *enquiry that investigates a contemporary phenomenon within its real-life context especially when the boundaries between phenomenon and context are not clearly evident*" (Yin, 2003). Benbasat, Goldstein and Mead (1987) summarise three reasons a case study is a viable IS research strategy:

1. Firstly, researchers can study information systems in a natural setting, learn about the state of the art, and generate theories from practice.
2. Secondly, the case method allows the researcher to answer the 'how' and 'why' questions, that help understand the nature of the processes followed.

3. And lastly, the case method is an appropriate way to research an area in which few previous studies have been carried out.

According to Bitektine (2008), inductive research, which focuses on developing theory/hypotheses while describing phenomena, is often associated with qualitative methods like case study, and deductive research with quantitative methods. However, the author argues that deductive research can only be coupled with quantitative methods because he believes qualitative methods (such as case study) are the greatest for deductive research "*in the areas where few or no quantitative measurements exist, or where substantial leap of faith is required to connect the existing quantitative operational measures with the postulated theoretical constructs*". With that said, this study followed a deductive case study.

3.5.1 Deductive case study

Barratt, Choi and Li (2011) notes that often studies employ inductive logic to deductive studies because of limited guidelines published using case studies for deductive research. The authors propose a methodological model that can be used for conducting qualitative case studies for deductive theory-testing purposes (Figure 3.14). They are of the view that in clear absence of research protocols, a study can adopt inductive logic for deductive purposes. Meaning data can be compiled inductively and then used for deductive means to claim support. The study used this model (Figure 3.14) as a guideline for conducting a qualitative deductive case study. The research question for this study emerged from a problem statement and in-depth literature. Since this study is about DG, which involves business and IT people, unit of analysis was identified based on that principle. The reason this study followed a case study deductive approach was that the aim of the study was to analyse or test the impact of DG in HEIs at the selected institution in South Africa using an existing DG model/theory.
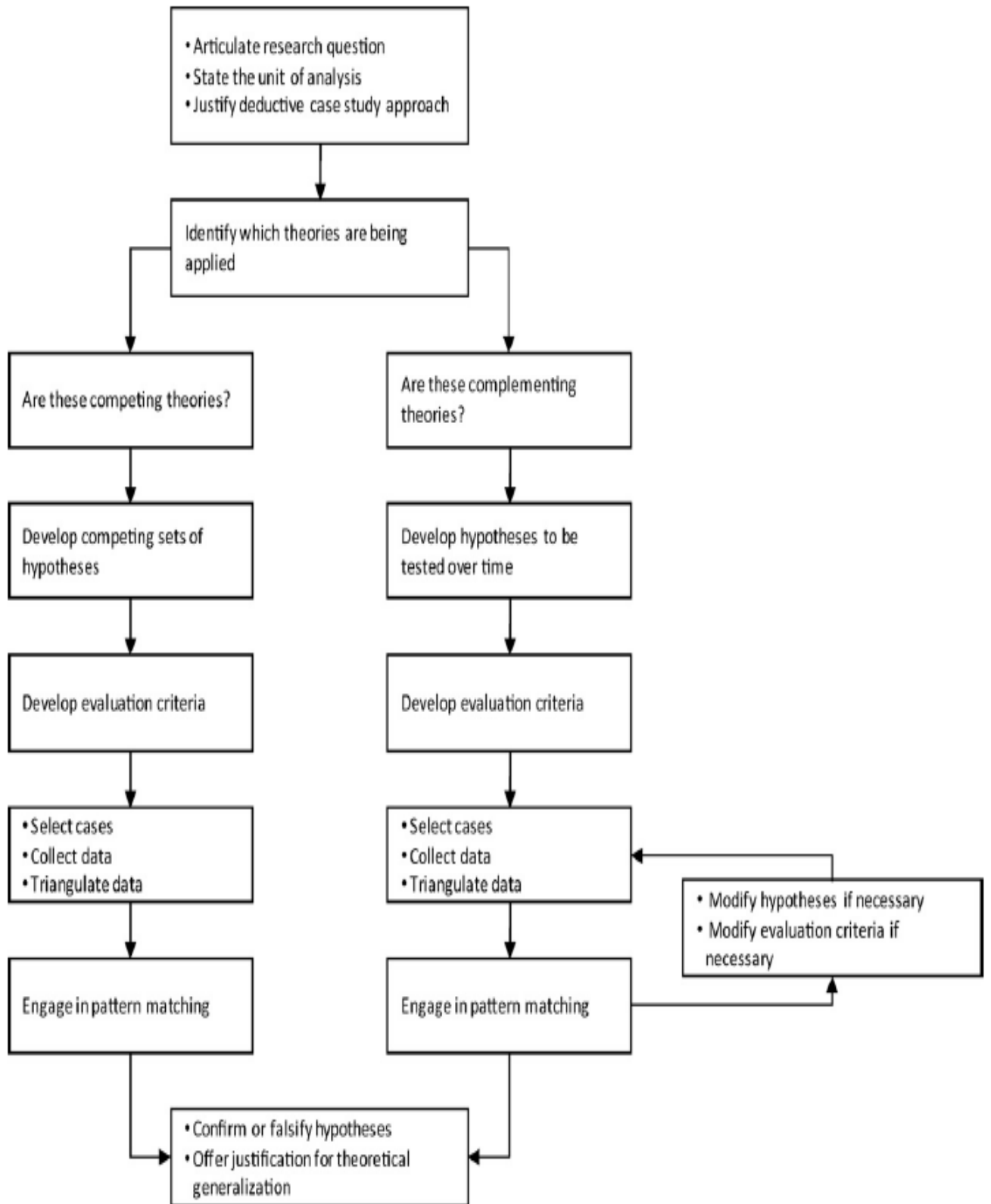
Figure 3.14: *Proposed methodological model for conducting deductive case studies*

Source: Barratt et al. (2011)

3.6 Sampling

DG is the main focus of this study and it is a concept that should involve IT and Business people to describe how data should be used, managed and accessed. Business people are referred to as individuals who carry out strategic objectives of the entire organisation. Since this study was about assessing the impact of DG in HEIs, business people in this context include executive-level board members (for example, Vice Chancellors, Deputy Vice Chancellors and others). The following explain selected participants or unit of analysis for this study. Participants chosen to represent executive-level members included:

1. Deputy Vice Chancellor of knowledge and information services: this individual was selected because he oversees the whole ICT function in the entire institution.
2. Registrar: this individual was selected because he is liable for student data and he is a custodian for the institution policies.

Participants chosen to represent IT included:

1. IT manager: this individual is responsible for the integration of systems,

2. IT Risk and Compliance officer: is responsible for the development and compliant of policies in the IT department, and lastly,

3. IT coordinator: this individual focus more on IT projects involving student data. These are the participants that were used as unit of analysis.

This research employed purposive non-probability sampling to select the sample. As mentioned before DG is about IT and Business people, so the researcher already had a specific plan in mind of who will provide relevant empirical data for the study. Trochim (2006) asserts that purposive sampling is useful for situations where one needs to reach a target sample quickly. Also, the probability that any element will be included in a non-probability sample cannot be specified. With purposive non-probability sampling, researchers rely on their experience, ingenuity and/or previous research findings to deliberately obtain unit of analysis in such a manner that the sample they obtain may be regarded as being representative of the relevant population (Welman & Kruger, 2001).

3.7 Data collection methods

This study followed a deductive approach, which is theory-driven, and a DG framework proposed by Khatri and Brown (2010:150) was used as a guideline to test empirical data with the aim of analysing the impact of DG in the HEI. A questionnaire was used to collect data. It was structured using DG components within the DG model of Khatri and Brown (2010). The researcher investigated issues and aspects concerning each DG component and developed questions that would help acquire more information and understand the current state of the institution from the participant's perspective. Data collected from the questionnaire allowed the researcher to determine and understand the impact of DG in the HEI, in this case, CPUT as an institution. Structured and semi-structured interviews were also conducted to get perspectives from the participants. These interviews allowed the participants to express their opinions on experiences and challenges related to data, and their understanding of the concept of DG, policies, governance structures and data integration in the institution. According to Esterberg (2002), the goal of semi-structured interviews is to explore a topic more openly and to allow interviewees to express their opinions and ideas in their own words.

The institution is governed by a specific structure that consists of: 1) Council, 2) Executive Management, 3) Management Committee, 4) Senate, 5) Institutional Forum and, 6) Deans of Faculties. The Council is the governing body of the university that is constituted by members appointed by the Minister of Education and the following bodies report to it. The Executive Management is the body that guides, monitors and evaluates the implementation of strategic planning to ensure that the institution's vision and mission are attained. The Management Committee is the body responsible for decision-making in respect of staffing matters, procedures that support Council approved policies, changes and amendments to organisational structure, matters outside the delegated authority of line managers as well as the evaluation of performance management reports. The Senate is accountable to the council for regulating all teaching, learning, research and academic functions of the University and all other functions delegated or assigned to it by Council. The Institutional Forum (IF) is a statutory body, established in terms of the Higher Education Act of 1997 and Section 40 of the CPUT Statute. The Dean of faculties are accountable for overseeing all faculty responsibilities (Cape Peninsula University of Technology, 2014: **Online**). This is the structure that guided the selection of participants, in terms of who would be in a position to provide valuable information for the study.

Data collection took place in June, July and August 2015. The participants were chosen based on their roles to fit the principle of DG, which stipulates that the committee should consists of IT and business/executive people. Five participants were interviewed and given the

questionnaire. Table 3.5 defines each participant's role, responsibilities and their positions in the institution. Two participants (Deputy Vice Chancellor and Registrar) represent the executive level of the institution and the other three (IT manager, IT Risk and Compliance officer, and the IT coordinator) represent IT management and operational level in the institution.

Table 3.5. *Definition of participants and their roles in the institution*

Role	Description	Institutional Position
Deputy Vice Chancellor (Knowledge and Information Services)	Responsible for knowledge and information management services within the institution including software applications related to it. These are the key elements that this role focus on; 1) ICT infrastructure managed by the IT department (referred as CTS), 2)Knowledge management from the library site, 3) E-learning (student system), 4) Management information that is part of the institutional planning office, 5) Business Intelligence (BI) which is used for decision-making, and 6)Web development/Mobile development/ICT innovation	Executive level
Registrar	Responsible for regulatory compliance, institutional governance, and maintenance of university records.	Executive level
IT Risk and compliance officer	The portfolio looks after IT Risks and Compliance, It covers; 1) Internal audits, 2) External financial audits, 3) Policies, 4) Risk management, 5) Disaster recovery, and 6) Introducing IT Governance COBIT 5 framework.	Middle management level
IT manager (Integration services and facilities)	This role focus on three areas; 1) Integration of various systems, 2) Facilities that include a team that supports all core ICT infrastructure services from various campuses, and 3) Printing department	Middle management level
IT coordinator	This role is within the academic administration department that forms part of the registrar's office. It is highly involved in any IT related projects within that department.	Operational level

3.8 Data analysis

This study used thematic analysis to analyse both questionnaire and interviews data because it followed an interpretive approach. Thematic analysis is used to analyse classifications and present themes that are related to data and further illustrates data in great detail, while dealing with diverse subjects via interpretations (Alhojailan, 2012; Boyatzis, 1998). It provides description and understanding of answers through discovering patterns and developing themes. Themes come from both data itself (an inductive approach) and from the investigator's prior theoretical understanding of the phenomenon under study (Ruhode, 2016). In this case, themes from the questionnaire emerged from the components within the DG framework (as discussed in section 2.6) used for this study. Burnard, Gill, Stewart, Treasure and Chadwick (2008) highlight that in deductive thematic analysis, a predetermined framework is used to analyse data. According to the authors, this approach is useful when one has specific research questions that already identify the main themes. Interview themes emerged from the data itself and the actual data was used to derive the structure of analysis. The six stages of thematic analysis identified by Braun and Clarke (2006) guided the analysis of interview data:

> **Step 1:** Familiarising with the data -reading and rereading of the data, noting down initial ideas.
>
> **Step 2:** Generating initial codes -coding interesting features of the data
>
> **Step 3:** Searching for themes - Collating codes into potential themes, gathering all data relevant to each potential theme.
>
> **Step 4:** Reviewing themes - checking in the themes work in relation to the coded extracts (level 1) and the entire data set (level 2).
>
> **Step 5:** Defining and naming themes - On-going analysis to refine the specifics of each theme and overall story the analysis tells; generating clear definitions and names for each theme. The researcher went through each category (themes) to identify sub categories and this was done until it was not possible to subcategorise or to group themes anymore.
>
> **Step 6:** Producing the report - Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature.

3.9 Case description

This study used Cape Peninsula University of Technology (CPUT) as a case study. The institution was established from a merger of Cape Technikon and Peninsula Technikon in January 2005. This merger was part of a national transformation process that changed the higher education landscape in South Africa. CPUT is the largest university in the Western Cape region, boasting more than 30 000 students, several campuses and service points and more than 70 programmes (Cape Peninsula University of Technology, 2014: Online).

The university's IT support systems are managed by the IT department, referred to as Computer and Telecommunications (CTS) department. According to CTS, CPUT uses two systems for managing the entire institution: 1) Blackboard for academic purposes, and 2) Integrated Tertiary System (ITS), which is an ERP system that acts as a main business application. The ITS system is responsible for managing students, programmes, employees, residential and campus data. Considering the growth of this institution and the number of students that increase per year, managing that data has a potential to present challenges.

CHAPTER 4

FINDINGS AND DATA ANALYSIS

4.1 Introduction

This chapter focuses on analysing data that was collected from a questionnaire and structured/semi-structured interviews. It is organised in two main sections: the first section discusses data collection process and how participants were selected, while the next section covers data analysis from questionnaires and interviews using the thematic analysis approach.

4.2 Thematic analysis of the questionnaires

This section consists of data analysed from the questionnaire using a thematic analysis approach. As aforementioned, the questionnaire was designed using a theoretical DG framework proposed by Khatri and Brown (2010). The following are the themes that emerged from the DG theoretical framework: Data Principles, Data Quality, Metadata, Data Access and Data Lifecycle. The researcher investigated issues and aspects concerning each DG component and developed questions that would help acquire more information and understand the current state of the institution from the participant's perspective. Table 4.6 shows the DG components that were identified as themes and outlines the findings.

Table 4.6. *Questionnaire research themes and findings*

Themes	Description	Findings
Data Principles	Establish the linkage with the business, by describing the business uses of data and ensuring data is treated as an enterprise wide asset.	Participants were asked what is considered as key assets of Cape Peninsula University of Technology institution. They all identified IT and data as an asset. The responses show that data concept is understood and it is regarded as an asset by the executive management of the institution. Three participants agreed that data has an impact on the brand perception, while two participants think it brings value in managing the operations of the

		institution. Based on the findings it is identified that the institution has a standardised process that emphasise ownership of data assets, and these assets are owned by individuals (business users) in their respective units. The responses indicate that these individuals are responsible for ensuring that their data is of good quality and access is given to authorised users, while IT is responsible for effecting the decisions that are made by business who are data owners. This was also explained by Khatri and Otto (2010:150) that data principles define desirable behaviour between IT professionals and business users, which implies that business users have an important role in managing data quality, data access and its lifecycle, while IT play the role of stewardship using IT tools to make sure that they effect the changes made by business users. Also according to the findings, most business users don not take ownership of their data because they believe IT is responsible for it.
Data Quality	Involves ensuring accuracy and integrity data that is always available for an enterprise.	Four participants agreed that there seems to be data quality issues that are not handled appropriately in the institution, data is not 100% correct, there are inconsistencies, duplications and missing data experienced on the systems. Participants also experience application data errors when accessing and retrieving data. Two participants agreed that poor data quality affects the strategic

		and operational levels of the institution. According to a participant, the implications of carrying poor quality data on strategic level leads to faults in managerial decision-making, and on operational level it results in inefficient decision-making process. All participants thought the implications of carrying poor quality data in the institution leads to negative effects on the institution's culture and on operational level it results in low performance. One participant asserted that poor quality data affects only the operational level of the institution, because it increases operational cost in IT.
Metadata	Describes what the data is about and provides a mechanism for a concise and consistent description of the representation of data.	All participants agree that based on their interaction with the applications they understand the meaning of data and they document most of it. The meaning of data is passed on to new employees through documentation, according to a portion of participants there are mechanisms that provide a clear description of data representation, they have access to information about descriptions of who created or modified data, descriptions of the application data for individual units, and lastly they have access to authorize or audit information related to data.

Data Access	Involves data security and explaining variety of ways in which a dataset can be accessed.	Two participants pointed out that Data Access and Security need improvement in the institution. According to two participants, data access is not secured, data is not always available, standards that track who can have access or modify data on what are not fully implemented, and appropriate data security measures are also not implemented. The findings reveal that the institution has an office called IT Risk and Compliance that is responsible for ensuring there is data security in information systems in the institution. According to the IT Risk and Compliance Officer, even though there are policies the institution is being assessed upon, and formal processes that guard data security and access, there are still issues that the institution needs to improve and mostly they involve people not adhering to policies or not following formal processes.
Data Lifecycle	Involves understanding how data is used, and how long it must be retained to minimise the total cost of storing over its life cycle.	The findings show that the institution does not have data lifecycle processes in place for electronic data, and data is stored longer than required. There are no policies and procedures that focus on how long data can be used, retained and archived. But one participant thought that there are policies in place that define how long data should be retained for paper-based data and that is handled through an established department called Records and Archives, which focuses on data lifecycle.

4.3 Thematic analysis of Interviews

As mentioned in section 3.9, thematic analysis of interview data was guided by the proposed steps of Braun and Clarke (2006). This information was used to answer the research sub-questions of study. Table 4.7 shows themes and sub-themes that were generated from data.

*Table 4.7.*Themes generated for interview data analysis

Themes	Categories	Sub-categories
Governance in the university	Governance in the university	Governance within departments Governance in the IT department
Perception of IT assets in the institution	Value of IT assets	Alignment of IT and business assets Challenges pertaining IT in the institution
The use of the main application (ERP)	Information systems	Restrictions of the main system Data flow between ERP system and sub-systems
Causes of data inaccuracy	Perception of data assets in the institution	Data Flow Data Capturing Data Quality
Accountability of IT and data responsibility	Business Involvement IT involvement Assignment of responsibilities	
Activities that focus on the data welfare space	New developments pertaining data Current processes for managing data Future initiatives that focus on data	Challenges on the current processes
Policies in the institution	Role of policies	Reviewing policies Issues regarding

4.3.1 Governance in the university

Based on the findings, the Cape Peninsula University of Technology has been adhering to the Higher Education Act in terms of governance. This legislation is the governing act that promotes co-operative governance for public educational institutions. The findings suggest that this Act provides a comprehensive guideline to every public centre for higher education and some privately-funded universities. When asked if the Higher Education Act is the only legislation the institution adheres for governance, it was mentioned that given the fact that entities in South Africa, whether in the public, private or non-profit sector, are expected to adhere to the KING III corporate governance legislation, the institution has also adopted that legislation. As highlighted in the literature (Chapter 2 in section 2.2), IT governance is one of the seven principles within the KING III corporate governance legislation, which promotes the use of IT as a platform for the full functioning of an organisation. The findings show that KING III legislation, with its emphasis on IT governance, was the ultimate driver for the adoption of IT governance in CPUT. It said in order to achieve that the institution first had to appoint an executive member in the institution to take ownership of and be accountable for IT governance. The findings reveal that in 2014, a Chief Information Officer (CIO) equivalent role was appointed at a Deputy Vice Chancellor level to oversee the whole ICT function in the institution. According to some participants, the appointment of a CIO equivalent role was a key element in meeting the KING III requirements. However, in response to a question asked in the interview whether the institution had planned to implement IT governance, it was revealed that IT governance was not in the institution's immediate plan. The implementation of IT governance was a result of the KING III legislation. Below is how one participant elaborated.

> "*IT governance wasn't a bottom up but a top down approach, in fact it was an external driver (legislation) forcing us to adhere*"

The findings reveal that the institution is currently implementing IT governance using the COBIT 5 framework. There is a committee established and trained at a foundation level. However, the implementation, awareness and training on IT governance are still in their infant phase. With regard to responses to the question: what are the plans for IT governance implementation on interviews? respondent 1, who is driving the implementation of IT governance in the institution, stated that raising awareness among senior staff within the IT department should be a priority. This is because most of the senior staff make up the IT governing committee hence, the importance of, especially, senior team members to understand the vision and goals of implementing IT governance, reported respondent 1.

4.3.2 Perception of IT assets in the institution

The participants were asked how they view IT in the institution. Based on the findings it is clear that the implementation of IT governance has shown how the institution introduced IT from ground level up to the council level, while highlighting the importance and value it brings into strategic plans of the institution. One participant said that IT was and still is treated as an asset. He further articulated that even though the implementation of IT governance was driven by a national legislation, the institution already had an IT department looking after the ICT function throughout the entire institution. This shows IT was regarded as an asset and given the necessary attention. The findings show that before the implementation of IT governance the CPUT, the IT department was and still is divided into five sections:

- Integration and facilities – responsible for building links and integration on various systems. This section consists of a team that supports all core infrastructure areas that include hardware and other computing technology environment;
- Networks – this section involves all people dealing with network related aspects;
- End-user computing – involves people who are dealing with PC's (personal computers) and labs;
- Business Administration Services – responsible for the whole Enterprise Resource Planning (ERP) system, which is the main system in the institution; and
- Strategic Administration Services – this section includes people who are dealing with service desk and project management areas.

The Registrar said that running university business processes through IT as a platform is highly dependent on the institution's strategic plan. It is in the institution's strategic placement of finances to foster a transition from the traditional manual route to investing in the latest technology. According to him, this institution acknowledges the benefits embedded in following an IT-based platform. For example, with technology one lecturer can conduct a class on two campuses through video conferencing, one lecturer who has two or more students in a master's programme based in different locations can connect the whole class through Skype or teleconferencing. These are some of the examples that show how the university is using technology effectively to ensure that objectives and goals of the institution are achieved.

Although IT has received considerable attention from the institution, the findings show that there are still issues. One of the challenges is not having an executive member taking ownership of IT in the institution. The IT department reported to the operations area before the appointment of a CIO-equivalent executive role. The participants agreed that it made it difficult to convey anything IT to the institution's management committee because the person

the IT department reported to did not have any IT background. Therefore, conversing in IT language with the Vice Chancellor (VC) and personnel on that level was a difficult task. Again, the appointment of the IT executive member was not only about addressing IT governance, but also ensuring that the IT department aligns its strategy with the university's strategy.

4.3.3 The use of the main application (ERP)

The university bought an enterprise resource planning (ERP) application called ITS and it is the main system for the whole institution. ERP integrates all business units within the university, that is, HR, finance, student system and general data. A team within the university's IT department (CTS) that consists of a manager, database administrators, programmers and trainers support the use of the system. According to a participant, there is a need for universities to have a main application, ERP type that integrates all business units because if that is not done all the various departments/units will need to purchase their own systems. For instance, HR will acquire its own system and finance might decide to procure PASTEL, which is not likely to be integrated with any other system. In a nutshell, the institution may end up with 25 plus systems that cannot talk to each other. The aim is having a single main application that is integrated with bought or developed sub-systems that are flexible and user-friendly to meet the needs of the institution.

4.3.3.1 Restrictions of the main application

Participant 1 pointed out that there is generally no ERP system that is a one-size-fits-all, but it is customisable. Unfortunately, even the customised fit cannot meet all the business's needs. Therefore, the university bought and developed in-house sub-systems that meet business needs and integrated them with the ERP system. Four out of Five participants agreed that there are benefits of using sub-systems. The ERP is known to be slightly cumbersome. As such, most people prefer using the sub-systems. Using sub-systems is particularly preferred because they are user-friendly and easier to upgrade given they are open-source. Unlike using the ERP system, which is oracle-based, the more power or features are added onto the application, the costlier it becomes as one needs to pay more for licences. The costs are likely to be carried by the IT department. As explained by participant 3, the ERP system is designed for possibly 300 maximum personnel who perform the core business functions. However, if there are 450 lecturers in the institution and each one is a potential user to extract class lists and perform various other tasks, it may be a huge challenge to accommodate all the 450

personnel on the system. Further comments from participants regarding ERP limitations are shown in Table 4.8.

Table 4.8. *Interview responses from participants to question why is the institution using ERP and sub-systems at CPUT*

	Response
Participant 1	*The ERP system has restrictions because it is still in the old format of fixed reports hence people prefer using a Business Intelligent (BI) sub-system where reports can be pull around and you can drag and drop as you want with flexibility*
Participant 2	*ERP does not give us all the information we need. There is a limitation of what is available; if it is available, it is only in certain formats. And also it is not a system that you can easily change*
Participant 3	*The ERP system came with a certain set of standards for usernames and passwords to connect to data and they could not be changed. So to get into the ERP one uses the same username and password which has not changed probably for 15 years. We had to change it because of audit demands. It is then that the IT and Risk Compliance portfolio came with a new process to control access to systems by creating separate users that has read permission to data. And that is one of the things that have been implemented successfully*
Participant 4	*There are things that we would have liked to do but the current version of the ITS system is old. Example of one of the issues; when you are sending bulk messages to 2700 students who are applying now for 2016, the system does not allow one to automate sms's to students you have to sit on the sms system and send individual sms's*
Participant 5	*The main system is not properly integrated with the sub-systems and that is mostly caused by the lack of automation which leads to data inaccuracy, so data flow is the root cause of the problem*

4.3.3.2 Data flow between ERP system and the sub-systems

The IT manager, responsible for the integration of systems in the institution, explained how data is shared amongst the sub-systems and the ERP system. Firstly, scripts that handle the data flow are developed and, in most cases, the flow is one-way from the ERP main system to the sub-systems. However, there are instances where data flows in both directions. For example, with a sub-system called MASS that is used for capturing marks, lecturers can extract information from the ERP system via MASS and further make the required changes or upload marks and transfer the information back to the ERP system. That is a typical example of how most sub-systems function in the institution.

It was highlighted that even though sub-systems have benefits there are challenges that come with developing or purchasing of sub-systems such as keeping track of information (metadata) and data synchronisation issues caused by data flow. According to participant 2, losing track of information happens when one starts developing sub-systems and exchanging data from outside the ERP system. Participant 2 explained that it leads to losing control over the ERP system. The ERP is developed in such a way that certain controls take place within the system. For example, the system is designed to capture personal information of the person updating or changing information on the system; the log sheet is saved with the date. These controls, however, are not available on sub-systems making them difficult to track information that can be used for security reasons or for audit purposes.

Participants 1 and 5 asserted that data flow is the root cause of the problem regarding data not being synchronised. This is caused by lack of automation when there are updates or changes on a system. Changes made on the ERP system need to be manually updated on the related sub-systems or vice versa and, in most cases, it is not done. There is no process that checks the changes made on a system to automatically update the other system(s) that share the same information. This, in turn, leads to data inaccuracy, a result of the ERP system not being properly integrated with the sub-systems. A participant who is responsible for student data within the academic and administration department explained a situation that can also contribute to data flow challenge. He said that students at CPUT first need to be registered on ITS (ERP system), then the e-learning system, which is a sub-system, takes data from ITS and pulls it through to the learning management system. Lecturers are then assigned course codes in which students can be identified as the course code is linked to the name of a lecturer. If this information is not properly linked, the lecturer is most likely to pull wrong information from the ITS to the e-learning sub-system, leading to incorrect student lists on the learning management system. According to this participant, it is possible that lecturers are linked to the

wrong course codes deliberately. Some users argue that they add any name because they are not informed in time of the course schedules and their associated lecturers. The participant said that it is the spirit of laziness among the system users because even when such mistakes are realised the system is hardly updated to capture recent details or rectify mistakes.

4.3.4 Causes of data inaccuracy

Keeping information synchronised through various systems is still a major issue; there is still a significant portion of data that is not 100% clean, as articulated by participant 4. From the participant's responses the following comments surmise the possible examples that may also contribute to data inaccuracy.

Participant 1:

"Staff members may move between campuses, but their information remains unchanged on the system e.g. lecturers that have moved from the Bellville to the Cape Town campus more than three to five years ago but that information is still not reflecting. We try to make a data owner for instance in HR to be responsible for HR data but people have been complaining that although they have been sending their information it does not somehow gets updated on the system."

Participant 2:

"*The problem is where data is captured. Even if you speak to the people who are responsible for the ERP system, they will tell you that everything is up-to-date, we can give each student a personalized calendar. But if that head of department (HOD) does not key in all relevant classes and courses then the data is incorrect. People like taking short-cuts, for example with the e-learning management system, "Oh yes, I do not know who is going to teach the subject, so let me put HOD into all the spaces"."*

Based on the responses from the participants, there seems to be an issue of garbage-in-garbage-out in the institution, which means the information that is on the main system, regardless of its accuracy is the same information one will view on the sub-systems. As one participant said that one cannot prevent human error or honest mistakes when capturing data from the point, but there should be proper management of where the data comes in. The question should be: is there an independent person to verify accuracy of data that has been captured by the data capture? The challenge in ensuring proper segregation of duties is to have people as resources. There is a need to have separate individuals' independent for those functions. The participant further asserted that you will never get away from incorrect data

being captured and also it is the manner it is captured, for example if you have a student applying and capturing data themselves for online registration or admission process, chances of that data being accurate are greater than when another person in the admission office capturing that information.

Updating information also seems to be an issue because it is done manually. Even though it is a very tedious process prone to human error, data capturers also do not take full responsibility for their actions. They are well aware of their duties with full access to facilities and resources, but choose not to use them. Both participants' responses highlight human error as a major factor that could be avoided if people take responsibility. Users simply do not take ownership of their data and accept no responsibility for the quality of data. The IT manager stated that the IT department tried to intervene by offering assistance in carrying out some of the processes but, ultimately, it required that staff put in the hours and have the job done. Lack of automation is also a major factor that contributes to the problem, because if most of the processes could be automatically updated between systems that could eliminate the manual process that is causing the issues.

4.3.5 Perception of data assets in the institution

The institution seems to have realised the value of data following the resolution to form a committee called Data Quality and Records Management five years ago. Participant 3 said that even though committee has been functioning for a while there are still difficulties in delivering on its objectives. This committee was re-initiated in 2014 by the executive portfolio that focuses on IT (Deputy Vice Chancellor of Knowledge and Information Services) and it meets four times a year to discuss all data issues and initiatives regarding data in the institution. Based on how participants described it, this committee puts a huge emphasis on the importance of data and data quality in the university.

As articulated by a participant the institution does take data serious. However, but in terms of new trends, there is still a gap in ensuring that data is treated as an asset. It was revealed that the disadvantages of not using new trends for data is that funding from government is reducing and the only way to qualify for more money is when the institution's data is accurate and treated as an asset. Participant elaborated using the following example, if a programme takes three years to complete the university needs to make sure that registered students complete it in record time, but as soon as the student start doing a three-year programme in four years the university starts losing money. For example, let's say the government is giving R10.000 per year for a student to do a three year course and that sum it to R30.000 amount the university is going to get in three years, but if the student spent 4-5 years the university will

still get R30.000 for those years and in that case the university loses money. The findings reveal that the benefits of data analytics are recognized in the institution, as a participant further pointed that the institution need to use more of data analytics that can warn them, and they can develop a system that gives them information about the students that are not completing their courses in record time. According to him that will help the institution find solutions on how to assist the students or deal with them. Another example that is related to funding as stipulated by the Registrar:

"*I am accountable for student data and it is my responsibility to give the department of education an accurate total number of students for funding purposes. If I say that the total number is 33 000 for example, the university will be funded based on those students. But if now the department of education comes back and find that I've got 29 000 students, then I will be penalized two years down the line because of the data that I have provide which is also audited.*"

The findings suggest that the importance of data goes far beyond the examples that are mentioned above. The Registrar further made an example comparing two circumstances: if students want a 0% fee increase and workers also want 50% salary increase, the student data is very key and important to convince workers that what they are asking for is not sustainable. According to the Registrar, if the university tries to meet the demands of both structures (students and workers) the university will not be sustainable. To avoid that, the workers can be provided with information that shows the financial position of the institution. And then again, if that data is corrupt it will project a totally different image and the institution will have to make a decision based on the data that will lead the university to a major issue.

There is a realisation of data being an important asset that needs to be given more attention because of the impact it has on the entire university. The findings show not only does data affect the daily business processes but it can also cause major financial issues that could put the university in trouble. The findings also show management is aware that in order for the university to achieve its goals they need to make decisions on the basis of accurate information. In a nutshell, the institution does treat data as an asset to certain extent because of issues that need improvement.

4.3.6 Accountability of IT and Data responsibilities

IT and Data are perceived as different assets in the institution and it is understood that the IT department (CTS) owns IT infrastructure, but not data. A participant pointed that the IT

department only effects the changes but does not make decisions related to data. The following is how the participant explained:

"*We work in a system where we have data owners and data managers, for instance IT does not make the decision of who has access to the system or not, that is done by various business owners and there is a formal process for it".*

According to the IT manager, this process consists of three participants: data owner, data manager and the requestor. A data owner is potentially a director of a department (for example, HR director) and he does not normally use the system on day-to-day basis, but is responsible for the data. Data manager can be anyone in that department who operates that system and works closely with people. The department can have only one data owner who has multiple data managers for various systems. For example, in Finance you can get a finance director who is a data owner with various data managers for multiple systems such as, assets, finance, and procurement. The requestor is someone who needs access to the system. A participant who is a data owner for a student system explained the process as follows:

"*When people from faculties want access to our system, user request a form and gets it completed where the HOD from that faculty and data manager need to sign off indicating the rights of the particular user based on the function. That form once all the signatures are there and authorization is given, that comes through our business and administration system section within the IT department and they will grant that particular access to the user. On the form the requestor specify which access they require, is it for update or just view. If update permission is requested, I also as a data manager needs to double check because you cannot just give update to anyone without checking their roles and what is it needed for."*

Based on the findings this process is responsible for ensuring that business people realise that it is their data and they should be accountable for it, not the IT department. There seem to be awareness and understanding that there is a process in place However, some participants think that even though this process is efficient it is very tedious and needs improvement. One of the challenges mentioned was delegation of ownership. For instance, you could have an executive member who is a data owner, but not necessarily understand the complexities involved in granting access to the system. In such a case do you allow for that role to be delegated to someone at the senior level from directory level to take proxy ownership of the data or not? One participant highlighted the following example of an issue regarding the process: if people want access and a data manager is not available for days these forms will wait till the data manager comes back which can be inconvenient for users who need access to carry on business processes.

Another participant said that because of the controls they need to have in place for IT and data assets for auditing purposes as they are being assessed in terms of financial audits and external audits, it explains why she thinks IT and data are regarded as different assets and treated differently in terms of accountability in the institution.

4.3.7 Activities that focus on the data welfare space

The findings reveal that there have been few initiatives and plans that focus on the data space of the institution. According to the Deputy Vice Chancellor (DVC) who is accountable for the ICT function in the institution, Big data is a new trend that the institution is starting to implement because it can help predict the future 99% accurately based on the data of all previous performances. The DVC highlighted that the institution has started making use of learner analytics to analyse the state of the student data. In his words:

"We will in future say to you as a student we think you shouldn't take mathematics; you rather should take this. So we are busy implementing this feature in e-learning system. Additionally, in future we will also watch how much time you spend online, check your marks and we going to analyse all your social media streams and see your language use, what are your topics, interests and so forth."

Learner analytics seem to be significant in this institution. The IT manager supported this view by saying that the institution needs learner analytics to warn them if students are at risk of staying a year or two behind the course duration, so they can pick it up and provide intervention. For example, data analytics can warn them and they can develop systems can incorporate that information for decision purposes.

Managing data that comes in different forms is quite problematic in this institution. Consequently, the institution is moving towards having a paper-less environment. A document system is being implemented which will be integrated with the ERP system. A participant explained the purpose of the document system;

"*In future this is where we are going, when students apply online the document system is going to allow us to implement online application whereby you are going to the student enabler then click online and this document management system will allow the student to upload whatever supporting documents together with that online registration. So in that case we won't need to issue out a hard copy of application forms."*

The findings also reveal that another initiative the institution is currently busy with is POPI legislation which the Registrar is the champion for implementing it. A Protection of Personal

Information Act (POPI) committee has been established consisting of people from different departments who are dealing with institutional information such as, research information, staff information, student information, facilities and finance information. According to the Registrar, this legislation indicates that one can only use information for the purposes that one intends to. When asked what the purpose of the POPI legislation is, he highlighted that the institution has 33 000 students, more than 1000 staff members on a permanent basis and another 1000 staff on a temporary basis they keep information for. After information on an individual is accumulated, how it is used is key in terms of complying with POPI. The Registrar made the following examples involving POPI:

"*When the institution gets the student application form, the student would have indicated their address, telephone number, biography information and so forth, that information is only for my department that is responsible for student data to be able to send the results to the student, it is for when I as a data owner of student data have to contact a student to say there is information on blackboard (student system). A student cannot suddenly find their information with EDGARS (retail shop) or other parties, this is where POPI interfere, it says you got rights to enquire and ensure that the information you have given is not used for the purpose unintended for.*"

He further asserts that he could have sold that information to EDGARS, they can simply come and say they have a project that requires new customers so they need to distribute cards to students in exchange of an incentive. So this reveal that POPI is trying stop the misuse of information without the concern of the individual. However, there is an exceptional circumstance explained below by the Registrar;

 "*There is a very important element that does not say that information cannot be used to advance you without your concern, I can still use your information without your concern to advance you, for instance here comes a company that says Mr. Registrar can you give us top 3 students we are going to give them a bursary of R100 000 per year, that's reasonable. I do not even have to check around because I know it is going to benefit the student. Now I give that company and let you know later that this was done.*"

The findings show that POPI is not a cutting stone that you cannot provide information, you just need to justify where it is justifiable. Below is another example where the POPI committee have tried to implement the legislation on, explained by the Registrar;

"*We were also looking at the application form what can and cannot include, is it still appropriate to ask what religion, and what is it going serve by asking but if we have a valid reason for that, for example if you are a Christian we may at some stage schedule classes during Easter*

holidays but if we find that the majority of our students are Christians then we do not need to do that because it affects many students"

In a nutshell, this institution is in the process of adhering to POPI legislation which will bring a lot of controls around personal information, how it is managed and presented, just the whole life cycle will be carefully considered and reviewed there.

4.3.8 Policies in the institution

Based on the findings, a policy is understood that it acts as a guide and legislate some processes or actions that are being carried out in the institution. In order to be fair, consistent and equitable, the institution needs to develop and apply policies constantly, as elaborated by a participant. However, Registrar asserted that if you do not have a policy then a practice is fine as long as that practice is consistent. According to the Registrar, a practice is based on what you have been doing, for instance if you have a problem and you find a solution (practice) which remains constant then that is fine, but once you decide to legislate the practice you should stick by it. It is either you regulate that practice and make it part of a policy or you do away with the practice and make a policy. He further asserted that if you decide to change a practice to a policy you are going to be evaluated and reviewed based on what is in the policy. If you do not have a policy, but a consistent practice that is working for you, then that is fine, because once you start implementing something totally different from the policy you will be held accountable. There is an understanding of the role played by policies in the institution.

The findings show that the custodian of all institutional policies in the university is the Registrar, who is responsible for ensuring that policies are recorded, reviewed and address the underlying issues. Various departmental managers develop their own policies that fit their business processes and bring them to the custodian who records, including noting the number of policies developed for the year and their review dates. Departments are responsible for their own policies, not the Registrar, and this is indicated in the policies.

When asked if the institution adheres to policies, participant 1 mentioned that a policy must be flexible because it does not legislate for everything, there are extraordinary circumstances that require flexible policies. According to the participant, a policy can be created today only to find out tomorrow that the implementation does not going to address the outcomes, making it necessary to be changed. This response indicate that the institution has the flexibility to change policies that do not address issues. It was further highlighted that the governance law says comply or explain: if the institution cannot comply it has an option to explain why. The Registrar mentioned the following examples where an exception can be made on a policy:

"If there is a policy that says we offer you one opportunity to write examination, then you find a person who was in labour and given a second chance to write an exam. The auditor will come back and ask how did the institution get to allows student to write while the policy is against it, the institution will have mentioned that we said under extraordinary circumstances, and this was one of them"

"Today we determine that we've got a travelling policy that say if you use your car, and you travel from Bellville to Cape Town campus we are going to pay you R3 per kilometre for instance, and now the treasury regulation do a study and find out that in terms of the petrol budget the amount should now be R3, 50, now you will need to go back and adjust or review your policy accordingly."

These examples highlight the reality that there are instances where policies are affected by either internal or external factors and this is when people go back and review their policies to accommodate the extraordinary circumstances that should be catered for. CPUT is aware of this.

4.3.8.1 Reviewing policies

In CPUT, policies are reviewed, at least, after three years, but according to the Registrar, that does not stop them from doing it on a yearly or monthly basis because a policy is a dynamic document. Some participants pointed that three years is the limit a policy can run without feedback. One participant said that when you implement a policy you need to have a feedback loop to indicate whether the implementation of the policy addresses the outcome you want to achieve. If it does not, that is when you need to review the policy. According to a participant who is in the IT Risk and Compliance portfolio, based on her experience in the IT department, policies are being reviewed, but people don not necessarily deliver at the given deadline. So there are flexible rules in place that allow people to review policies if they do not address the underlying issues and there are also rules that guide when a policy must be reviewed, but there seems to be an issue of people not delivering to the deadlines for reviewing policies.

4.3.8.2 Issues regarding policies

The findings show that besides the issue of people not meeting the deadlines in reviewing policies, there are challenges concerning policies. Information is not communicated well to external auditors regarding business processes that have changed which cause issues when the institution is being audited. For instance, it was said that the students have an option to

apply or register online. However, when the external auditors are auditing the registration system they still want to see application forms that are not available because some of the students applied online. They do not ask for an alternative proof to show that the student applied online. It was suggested that department managers responsible for policies need to properly communicate information constantly with external auditors in case they change platforms or business processes to make auditing easier.

Another issue revealed is that there seems to be no proper management process for policies. A participant from the IT department stated that it is caused by resource constraints. Below its how she explained it relating to the IT department:

"*The lack of a proper managed process for policies is caused by resource constraints, for example in an IT environment policies are almost seeing to be secondary to operations because people want to be fighting fires all day where else it should work the other way around. Policy should govern how the operation should be handled with proper procedures and standards in place*"

She further pointed that in certain areas this issue is dealt with very well and in others policies are not properly implemented or they are not aligned with the operations. So it is a resource-intense activity that needs to be dealt with.

4.3.9 Data Analysis using the contingency theoretical framework

A contingency moderation model (Figure. 11) that is explained in Chapter 3 was used for prior IT governance research (Schmidt & Kolbe, 2011). The same model was further used by Wende and Otto (2007), as a guideline to build a DG contingency model (Figure. 12) because the initial contingency moderation model did not provide an indication of how to build and fill in the matrix on a DG model. Wende and Otto (2007) enhanced the model by adding two parameters and assert that they affect the configuration of a DG model as their value influences the assignment of responsibility. This study makes use of those parameters, which are organisational placement and coordination parameters from the contingency model.

4.3.9.1 Organisational placement

This parameter has been analysed in IT governance research. It focuses on the organisational structuring of IT activities in large or multidivisional firms. Organisational placement distinguishes two patterns of decision-making authority which are: centralised and decentralised models (Wende & Otto, 2007). According to these authors, with a centralised

model decision-making authority is in a central IT department. A decentralised model has all decision-making authority allocated to distinct organisation units/divisions. An organisation can decide to combine the two models, which is referred as hybrid model.

The findings of this study indicate that institution is using a hybrid model. Decision-making related to ensuring data is accurate, is up-to-date and serves its purpose is allocated to individual business units, while decision-making related to the infrastructure that provides data on information systems and ensures it is secure and available is done by the institution's IT department. Business units are responsible for making decisions that are related to their data, which includes giving data access on information systems to the users (data ownership process is explained in the previous chapter). This process was created by the IT department, but decisions to give access are made by business. IT owns the infrastructure that helps effect the decisions that have been made by business. IT is also responsible for making decisions related to security measures, providing technology to make data available, creating options for disaster recovery in case something happens to data there should be a backup located somewhere, and developing policies that look after data. This model is working for this institution, but the business does not fully realise that data is their responsibility, hence a committee has been set up to address the problem. It is called business ICT committee.

4.3.9.2 Coordination

Coordination decision-making authority ranges between hierarchical and cooperative models. Hierarchical model is characterised by a pyramid-like structure with power at the top exercised by a person or a group such as CIO or IT governance board. With the cooperative model, direct control is replaced with collaboration and it integrates formal and informal coordination mechanisms across business units (Wende & Otto, 2007).

The findings suggest that institution has developed a statute that was taken from the Higher Education Act. In terms of that statute, the university consists of various bodies and the highest education body within the university is the Council. The Council body consists of members who are not employees or students, people who are external and not involved in the day-to-day activities of the university. The reason for this is that the university is publicly funded needs people from outside to ensure it delivers on its mandate. Council is looking at the governance role to check whether the university is properly managed and administered. Another body within the university is Management, the Vice Chancellor, who is supported by the executive management level. Since the major responsibility of this university is teaching, there is a body or structure called Senate that looks at the quality of programmes offered to students. After the Senate structure is the Institutional Forum, which consists of different stakeholders such

as; students, workers, employees and so forth. The purpose of this structure is to make sure that the accumulated interests of all stakeholders are taken into account in the best interest and sustainability of the university. These governance structures of the university work together to ensure there is cooperation. While people might have different interests, the overall interest should be sustaining the university.

The findings indicate that within departments in the university decision-making is exercised by a person or group at the top who delegates to subordinates and who, in turn, delegate to their direct subordinates. The IT department reports to an executive member, the Deputy Vice Chancellor for Knowledge and Information Services who, in turn, reports to the Vice Chancellor of the institution. Within the IT department there are various sections that report to specifically assigned directors who, in turn, report back to the Deputy Vice Chancellor for Knowledge and Information Services. Based on these findings, the university is using both hierarchical and cooperative models in the sense that there are instances where coordination is used and cases where direct control is implemented.

4.4 Conclusion

The chapter used DG framework to generate themes for the questionnaire. The following are the themes; Data Principle, Data Quality, Metadata, Data Access, and Data Lifecycle. Analysis of interview data was guided by the six thematic analysis steps of Braun and Clarke (2006).

This chapter further analysed data using the contingency theoretical framework and themes were also generated from the framework. It was found that the institution is using both centralised and decentralised models for decision-making, meaning some decisions are made by the IT department in terms of the infrastructure and other decisions related to data are made by business. The chapter also shows that the decision-making structure incorporates both hierarchical and cooperative models, which mean there are instances where people coordinate and work together to ensure that the university is sustainable and cases where direct control is used where subordinates report to their superiors.

CHAPTER 5

DISCUSSION OF FINDINGS

5.1 Introduction

This study aimed at exploring how data can be managed on the application systems using properly defined principles of data governance. The objectives were to understand the lived experiences within the institution regarding data management, while investigating the data challenges that impact the institution's efficiency and, lastly, identifying how DG can be explored to manage data on the information systems. The investigation was centred on a main question and sub-questions posed in Chapter 1 to guide the study, although the literature review answered some of the questions. Based on the findings of the contingency theory parameters (organisational placement and coordination) adopted for this study, this institution is using a hybrid model, which is a combination of centralised and decentralised models for decision-making and a combination of hierarchical and cooperative models for decision-making structures.

The following section discusses the findings of this study and answers the main research question; *how can data governance influence the management of data in higher education institutions?* This question is answered through the sub-questions: *What are the data related challenges that Cape Peninsula University of Technology (CPUT) is facing as a result of poor data management? What strategies and processes are currently employed to maintain and standardize data from the information systems? What data governance components can be explored to manage and maintain data from the information systems?*

5.2 Data challenges caused by poor data management

Higher education institutions often experience data management challenges which have a potential to generate inaccurate and poorly defined information. This has been discussed broadly in literature the review on the research problem statement in Chapter 1 (section 1.3). From the literature, it is clear that these challenges arise from the institution not thoroughly dealing with data content, records management, quality, stewardship, governance and research data management (Albrecht & Pirani, 2009:3). From the results of this study, data quality is a major issue in the institution. The findings reveal that the main system (ERP) is not properly integrated with the sub-systems, which leads to data flow challenges that cause unsynchronised data which, in turn, affects data quality. This is caused by lack of automation when changes or updates are made on a system. If there are changes on the ERP system,

they need to be manually updated on the related sub-systems that share the same information. It is a tedious process that is prone to error hence people sometimes fail to update information.

The findings also reveal that there is a spirit of laziness from the system users (business people), if they do not know who is going to lecturer a subject for the following year and do not have anyone to put on the ERP system, they sometimes decide to put the Head of Department (HoD) or anyone just to have someone linked on the system for that subject. When the year begins and there is a lecturer for that subject, they do not take the responsibility of going back and updating the system with the correct lecturer for that subject. The results of the findings indicate that this is caused by data owners who do not take full responsibility and ownership to ensure that data is accurate and updated which, in turn, leads to poor data quality. That said, even if the ERP system was properly integrated with the sub-systems and there were no data flow challenges, there would still be problems caused by users who do not take responsibility to ensure that the system has data that is correct and up-to-date.

The literature indicates that quality of data management in the HEI is affected mostly by data collection methods and analytical capacity (staff skills) within the institution (Trolley et al., 2009). The findings of this study support the findings of the literature analysis: the findings reveal that managing data that come in different forms is quite problematic and incorrect data capturing and the way data is received in the institution is an issue that contributes to data management challenges. Based on the results, there is challenge of ensuring a proper segregation of duties, which implies having people as resources.

5.3 Processes employed to manage or maintain data in the institution

The literature highlights that data is an important asset in organisations and managing it properly can result in operational and IT cost savings which, in turn, drive business growth (Zornes, 2013). Data management continues to be a challenge for organisations to the extent that, there have been developments and a number of terminologies that focus on data management. As mentioned earlier in Chapter 1 (section 1.1), these include: Big data, data quality management (DQM), master data management (MDM), business intelligence (BI) and data governance (DG), amongst others. The findings of the study identified the following processes and developments that are implemented for data management in the institution: data ownership, data analytics, paper-less practice, Data Quality committee, business intelligence and DG.

5.3.1 Data ownership

Based on the results of the study, there is a sense of data ownership in this institution that focuses on ensuring business realise data belong to them and they should be accountable for it. This concept is used to handle data access and ensure data accuracy on the information systems. The findings reveal that even though the data ownership process for data access is efficient, there are challenges regarding to data owners (business people) who do not understand the complexities involved in granting access to users and which, in turn, may lead to people having more access than they should. With regard to data ownership process for data accuracy, the findings indicate that business does not take full ownership for ensuring data is accurate and up-to-date.

5.3.2 Data analytics

The results of the study show that even though big data is not fully implemented the institution makes use of data analytics and plans to implement it more in the future. There is a realisation that it plays a significant role in assisting the university achieve its goals. The findings suggest that data analytics have been used to pull information such as the kind of students in the institution, check if programmes are full and also decide if more students can be admitted. This information is then used by the Department of Education to decide how much funding the institution will get, hence implementing data analytics is essential in the institution. The results of the study also indicate that data analytics can assist management with decision-making and predicting the future 99% accurately based on the data of previous performance.

5.3.3 Paper-less practice

Data from education institutions is collected in many forms and stored in different locations using a variety of storage methods. This is clearly depicted in Figure. 2.5 (section 2.4), as illustrated by Tolley and Shulruf (2009:1201). The findings of this study reveal that managing data collected in paper format is quite challenging. As such, the institution is moving towards a paper-less practice where most processes will be computerised.

Based on the findings, the institution has developed a document system that will be integrated with the main system to eliminate management of paper documents, for example, the supporting documents that are required when a student is registering. The aim of developing that document system is to organise all paper documents in an electronic central place to ensure that data is managed efficiently.

5.3.4 Data Quality Committee

The findings from responses to the interviews show it is common knowledge that there is a data quality committee that has been established with the aim of addressing data-related issues in the institution. The results show that the committee has not been delivering on what it should and was re-established on the arrival of an IT executive member. The findings also indicate that the institution plans to use this committee more effectively and to emphasise the importance of data and data quality, while introducing new trends to manage data in the institution.

Based on the findings, using new trends to manage data can have a positive impact in terms of getting funding from government because the only way the university can get more money is to make sure that data is accurate and treated as an asset. The study identified BI as one of the trends that is currently implemented in the institution which helps management with decision-making. However, the findings show that data in this institution is not clean and there is poor data quality. This means BI tools will not help management because decisions will be based on inaccurate and invalid data.

5.3.5 Data governance

As reported in the literature, governance refers to what decisions must be made to ensure effective management (Fu, Wojak, Neagu, Ridley and Travis, 2011), it is a process where decisions/tasks are developed by a governance board and assigned to authorities who will be accountable for them (Fukuyama, 2013).

The results of this study show that policies implemented to assist with the management of the institution. The findings reveal that various departments in the institution are responsible for their own policies that fit their business processes. The institution has appointed a Registrar to be responsible for ensuring that policies are recorded, reviewed and address the underlying issues. The findings also indicate that there is an understanding of the role of policies in the institution and how they should be handled but there are issues regarding people not delivering to deadlines in reviewing policies, external auditors not provided proper information related to change processes and lack of proper management of policies within departments.

The literature confirms that HEIs can benefit from improved data governance (Poor, 2011). The results of the study identified data security, data backups and POPI legislation as the components of data governance that are implemented in the institution. There are data security and data backup policies in place that focus on the processes used which in turn, they

are assessed and reviewed by external auditors. The findings suggest that the institution is in a process of implementing and complying with POPI legislation, which emphasises that information can only be used for what it is intended and brings a lot of controls around personal data, how it is managed and presented. There is a POPI committee that consists of members from different departments who are dealing with institutional information. The study identified POPI committee and Data Quality committee as the only structures within the university that focus on dealing with data-related issues.

5.4 Adopted DG components for this study

This study used components from a DG model proposed by Khatri and Brown (2010:150), which is an adoption of a previous published IT governance framework by Weill and Ross (2004). The DG framework has five interrelated data decision domains and it was claimed to be simple and non-technical. The purpose of each decision domain is to explore data-related matters along with identifying the locus of accountability for decision-making, which is largely explained in Chapter 2 (section 2.5). These data decision domains, which can be referred as DG components, include: Data Principles, Data Quality, Metadata, Data Access and Data Lifecycle.

5.4.1 Data Principles

According to Khatri and Brown (2010:150), Data Principles clarify the role of data as an asset and establish the linkage with the business, meaning organisational decision to standardise business processes implies that there should be a clearly defined business owner of data assets. The response from the questionnaire reveal that the institution recognises data as an asset and it is considered to have value at both strategic and operational levels in relation to analytics which, in turn, can help the institution with decision-making.

The findings of this study support the findings from literature analysis: The findings of the study indicate that business users have an important role in managing data quality, data access and its lifecycle. The results show that the institution uses a standardised process that emphasises ownership of data assets, which further defines business users as data owners for data in their respective departments. This process is used for data access, data quality and data lifecycle. The results also reveal that even though there is process in place, when it comes to data quality most business users do not take ownership of their data because they think IT is responsible for it, which results in poor data quality.

5.4.2 Data Quality

Khatri and Brown (2010:150) state that Data Quality involves ensuring accuracy and integrity of data that is always available for an enterprise. According to the authors, poor data quality can impact an enterprise at both operational and strategic levels. The findings reveal that data is not 100% correct and data reliability and integrity are the major issues.

Based on the results, findings reveal that poor data quality affects the strategic level which leads to fault, managerial decision-making and also affects the operational level, resulting in inefficient decision-making processes. The findings further reveal that the implications of carrying poor quality data in the institution leads to negative effects on the institution's culture and causes low performance and increased operational cost in IT. The results show that the institution perceives data quality as an essential element, as the Data Quality committee that aims at addressing data quality issues has been re-established.

5.4.3 Metadata

Metadata describes what the data is about and provides a mechanism for a concise and consistent description of the representation of data (Khatri & Brown, 2010:150). The findings suggest that there are mechanisms that provide clear description of data representation and authorised users have access to it. The findings also indicate that data is documented and passed on to new employees through documentation.

5.4.4 Data Access

According to Khatri and Brown (2010:151), Data Access involves data security and specifying access requirements of data. The authors assert that an organisation must have data security officers to identify the data needs of the organisation and ensure confidentiality, integrity and availability of data. This must be integrated with organisation's legal and regulatory compliance monitoring efforts.

The findings reveal that the institution does recognise the importance of data security and access. Even though the institution understands how to establish appropriate data security, the responses reveal that there is still room for improvement regarding to data security and data access. Further, the findings show that the institution has an office within the IT department called IT risk and Compliance that is responsible for data security and developing policies that guard data security and data access. The responses indicate that the IT risk and Compliance office does look at data security and access and ensures that users adhere to

policies that focus on data security, but they do not fully implement the processes and policies, this leaves a room for improvement.

5.4.5 Data Lifecycle

Data Lifecycle involves understanding how data is used and how long it must be retained to minimise the total cost of storing over its life cycle (Khatri & Brown, 2010:151). The findings reveal that electronic data is stored for longer than required and there are no policies that focus on how long data can be used, retained and archived. The findings also show that the lifecycle of paper-based data is actively and properly managed in the institution by an established Records and Archive department, which determines the use of data, how long it should be retained and its archival value.

5.5 Contribution of the study to the selected Data Governance model

This study argues for the need to modify or extend the existing Data Governance framework proposed by Khatri and Brown (2010) to higher education institutions. Even though the authors claim to have identified five important components that can be used to develop a DG strategy for managing data as an organisational asset, the results of the study suggest data integration to be identified as one of the essential data components that should be given attention in HEIs.

As stated in the literature, in early 2000 South Africa began a radical restructuring of the higher education landscape through the development of new institutions and institutional mergers and collaboration (Ministry of Education, 2002: 7). According to Baker and Niederman (2013:2), IT plays a critical role in the success of mergers and acquisition (M&A) because information systems are closely tied to support business processes and need to be accounted for when building a unified organisation. The authors further assert that management decision-making is largely based on complete, accurate and timely information. This mean effective integration of data can provide information needed for decision-making. Since this study used CPUT, which was established through a merger of Cape Technikon and Peninsula Technikons, the findings suggest that the merger could be the reason the institution is experiencing data integration challenges, and this could apply to other institutions with a similar background.

Another major issue that seems to be causing Data Integration issues in CPUT is lack of proper integration between the main system and the sub-systems. The reason for developing sub-systems is to ensure that they meet the business needs and cater for the shortcomings

of the main system. However, information is not synchronised through various systems which, in turn, leads to Data Quality issues that affect the purpose of Data Principles. An extension of Data Governance model was developed to explain the results of this study. Figure 5.15 shows the Data Governance model depicting results of this study.
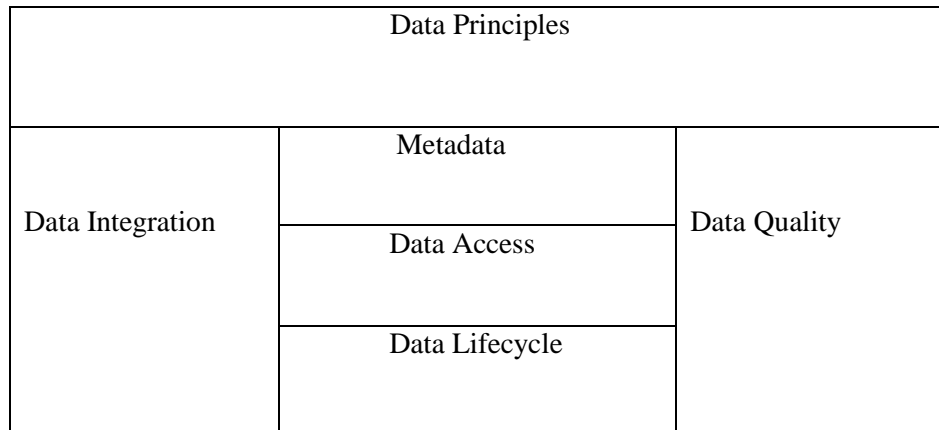
Data Principles		
Data Integration	Metadata	Data Quality
	Data Access	
	Data Lifecycle	

Figure 5.15: *Extended Data Governance model for Higher Education Institutions*

The interrelated data components shown in Figure 5.15 were found to be relevant and applicable in this data governance study. The extension of the DG model indicates that Data Principles in HEI establish the linkage with the business where the role of data as an asset and data responsibilities are understood. Once that has been established HEI need to focus on developing standards for Data Quality which, in turn, are the basis of how data is integrated (Data Integration), which will define how data is interpreted (Metadata) and accessed (Data Access). Lastly, what should involve the decisions to define the use, retention and retirement of data (Data Lifecycle)?

From the discussion of this chapter, the institution is not entirely aware that data integration challenges caused by the lack of properly integrating the main system with sub-systems or the merger of the previous institutions are the reasons it is currently experiencing data quality and data management challenges. This study found a need to identify and include Data Integration as a DG component because it contributes greatly to data quality in HEI. In the literature, Khatri and Brown (2010:149) explain each data decision domain and highlight the type of decisions to be made within each domain (Figure 2.9). The study further defined Data Integration decision domain with examples of questions to be asked within the domain and potential role players who could be accountable for each decision (Table 5.9). This was guided by the findings of the study.

Table 5.9: *Data Integration decision domain that is included on DG framework*

Data Governance Domain	Domain Decisions	Potential Roles
Data-Integration Combining data from several sources into meaningful and valuable information.	- What are the processes and standards for addressing data inherited from the merger? - Which information is shared across systems in the entire institution? - What is the program for integrating new sub-systems with the main system? - What policies can be developed to address issues related to data integration? - How will data integration program be evaluated?	- Data Owner (business) - Data Quality Committee - IT manager and Solution Architecture - Enterprise Architecture - Business Analyst

Data Integration is a process that involves combining data from several disparate sources, which are stored in various technologies to provide a meaningful and unified view of information (Javlin Data Solutions, 2015). It is important in cases of merging systems of two companies or consolidating systems within one organisation to provide a unified view of the organisation's data asset. In the case of this institution, CPUT did not merge systems after the merger, but decided to buy a main system (ERP) that consolidated bought and developed sub-systems within the newly-established institution. The examples of decisions identified for data integration domain in Table 5.9 are guided by the results of this study. The potential role players that can be accountable for those decisions are also determined based on the results of the study. For example, determining processes and standards for data acquired from the merger could be decided by data owners who are business users. They can also decide on what data should be shared across various systems. The data quality committee could decide and develop policies that will guide data integration processes and standards, while also deciding how the data integration program will be evaluated. The IT manager, solution architecture and enterprise architecture should focus on assisting data owners identify

information that is shared across systems, identify the program for integrating the main system with sub-systems and, lastly, designing and implementing data integration of systems, while adhering to the policies developed by the Data Quality committee.

5.5.1 Suitable DG framework for higher education institutions

As discussed in Chapter 3, DG model can be implemented following various theories which are broadly explained. These theoretical frameworks include big bang, morphology, incremental and contingency. This study used the contingency theoretical framework and dismissed the others because contingency theory enables the development of a specific and flexible DG configuration that fits a set of contingencies of the institution. This will allow other HEIs to use this DG model as the basis of developing their own DG strategy. A contingency framework proposed by Wende and Otto (2007), which contains a DG model was used to develop a complete DG model for HEI (Figure. 12). The contingency model shows all factors that can affect the decision-making of the DG structure. The study used the suggested contingency model and plugged in the extended DG model (Figure 5.16) where it specified company-specific DG model. Factors that can affect decision-making of DG in HEIs are further discussed.
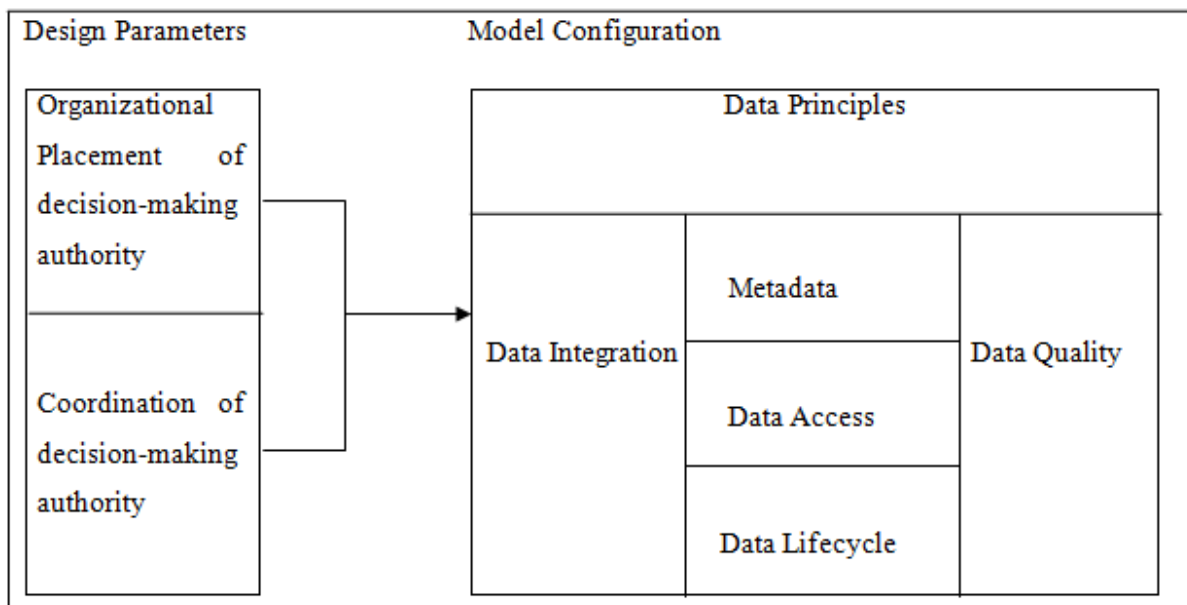

Figure 5.16: *Data Governance model for this study*

The contingency model indicates that organisational placement of decision-making authority and coordination of decision-making authority parameters facilitate the understanding of how contingencies affect the individual design of an organisation's data governance model. These

parameters are extensively explained in Chapter 3 and influenced by the contingency factors that may include: organisation size, structure, competitive strategy, corporate governance and decision-making style. This study identified background history as another contingency factor, for instance, if the institution is from a merger background.

The results of the study show that in relation to institutional placement of decision-making parameter, institutions can decide on whether to use a centralised, decentralised or a hybrid approach (combination of both centralised and decentralised) and that is determined by the identified contingency factors. In this study, CPUT can use a hybrid approach where some decisions are made by individual departments and others by the IT department. This was determined based on the size of the institution, current decision-making processes implemented in relation to data, how they currently delegate responsibilities and the policies that are in place (institutional governance). However, this also depends on the nature of the decision. For instance, if it is technical then IT will be accountable for it and if it involves strategic planning and affects the use of data then individual departments should be accountable for it because it is their data.

The results also show that with regard to institutional coordination of decision-making authority parameter, the institution can decide on whether decision-making authority should be a hierarchical or cooperative approach. This is also determined by specific contingencies like institutional size, structure, governance. For instance, based on the size and structure of the institution, decisions related to data could be made in cooperation or by superiors who then delegate to subordinates. And also it will depend on the background of the institution, if it had been involved in a merger, the institution must take into consideration how it should move forward with the aim of ensuring that data is recognised and treated as an institutional asset. In this study, CPUT could use both hierarchical and cooperative approaches. This was determined from the findings as the institution has a governance structure called Council that oversee governance of the entire institution, including IT governance. In this structure, decisions are made by the members in coordination, but when it comes to carrying out tasks subordinates report to their direct superiors. For instance, the IT manager reports to the IT director who, in turn, reports to the Vice Chancellor of the institution. This DG framework is proposed to be used as a guideline by HEIs that are planning to implement Data Governance strategy.

CHAPTER 6

CONCLUSION

6.1 Introduction

The study is concluded in this chapter, which presents a summary of the research findings and highlights main findings drawn from the study. Furthermore, it discusses limitations, future research opportunities, and makes recommendations.

6.2 Summary of the research findings

This study contributes to the management of data using DG in HEI, which has not been clearly elaborated by DG research so far. The study used a data governance framework proposed by Khatri and Brown (2010) due to its simplicity and non-technical format. The components within their DG model were found relevant and applicable for this study. However, the study argues for an extension of the DG model. Based on the outcome of the study, the results suggest Data integration to be identified and included as a component of the DG model. The study used a contingency theory to develop a specific and flexible DG model that fits a set of contingencies of the institution. The extended DG model was then plugged into the chosen contingency framework proposed by Wende and Otto (2007) to illustrate the complete DG model for HEI.

6.3 Limitation of the study

The major limitation of the research is that this study focused on a case study, and even though it claims to have extended a scalable and adoptable Data Governance model that can be adopted in HEI, the results may not be generalised for all HEI in South Africa. Another limitation is that the university does not have adequate technical roles to form complete and well-balanced data governance. The university showed lack of roles in the following aspects; roles that focus on architectural structure and roles that link business with IT (that is, business analysts). This can be a major setback which can affect the implementation of an effective DG. Lastly, since this study followed a qualitative approach, the number of respondents was small. Some participants did not have in-depth knowledge of some areas, which may have caused them to provide inappropriate responses which has impact on the validity of the results.

6.4 Future research

The findings show that data quality is a major issue in this institution caused, by poor data integration which results in poor data management. As highlighted, this is the result of the main system not being properly integrated with the sub-systems after the merger of the previous institutions. The study found the proposed DG components (Khatri & Brown, 2010) relevant and applicable for this research and argued for an extension of the DG model by adding data integration as a component. However, even though data integration was identified as a component, it was not fully explored. More practical research which will provide deeper insight into data governance and the implementation process should be provided. This will allow universities to test the efficiency of DG in HEI while giving a broader picture of DG.

6.5 Recommendations

There is a need for a greater understanding of the responsibility for data. People do not take full ownership of their data and do not realise the impact it has on the institution's strategy. The institution should start including data responsibilities as part of job descriptions for people who are responsible for data, so that case they will be held accountable for not taking ownership. The institution should also consider holding frequent workshops that focus on raising awareness on data and where issues pertaining data are discussed in collaboration. They should include representatives of areas affected by data (that is, students, department administrators, data owners, IT people and so forth). These workshops should also be part of raising awareness of data governance.

6.6 Conclusion

The primary purpose of this study was to analyse the impact of DG in higher education Institutions, using Cape Peninsula University of Technology institution as a case. Drawing upon existing literature, the study addressed the following research question: *how can data governance impact the management of data in HEI*? The research question was answered by determining data challenges experienced by CPUT and the current data management processes employed. The study further selected a simple and non-technical DG model proposed by Khatri and Brown (2010) to collect data.

This study identified data-related challenges in the institution that are the results of poor data management. Data quality was found to be the major issue. The findings reveal that this emerged from the ERP system not being properly integrated with the sub-systems, which led

to data flow challenges that cause unsynchronised data, which affects data quality. However, this is not caused by the systems only, but also people who do not take ownership of their data. There is a spirit of laziness from the system users, who do not take responsibility to ensure that the system has data that is correct and up-to-date.

There are various initiatives that focus on data management in this institution. The results reveal that the institution had a committee that focuses on data, which is called Data Quality forum. This committee was not delivering on what it should, and re-established on the arrival of the Deputy Vice Chancellor of Knowledge and Information Services. The Data Quality committee emphasises the importance of data and data quality while introducing new trends to manage data in the institution. The findings also show that the institution recognise data ownership and is aware of the role business should play in ensuring that data is treated as an organisational asset. Data access on the systems is granted through a process that involves data owners. Based on the findings, this seems to be the only legislated data process that involves the data ownership concept. The findings show that even though there is a data access process in place, there are still challenges that involve business not taking ownership of their data and data owners who do not understand the complexities and implications involved in granting access to users. The institution also makes use of data analytics which assists in decision-making and predicting future trends. The university realises the importance of data and the significant role it plays in assisting to meet its strategic goals. However, improvements are required pertaining use of data management processes.

This study set out to explore how data can be managed in HEI using properly defined principles of data governance. HEI can benefit from improved data governance (Poor, 2011) because it addresses data quality issues, while defining organisational approach to data management (Korhonen et al., 2013:11). This study used a DG model proposed by Khatri and Brown (2010) that is an adoption of a previous published IT governance framework by Weill and Ross (2004). The DG framework has five interrelated data decision domains and aims at exploring data-related matters along with identifying locus of accountability for decision-making. These data decision domains, which can be referred as DG components, include: Data Principles, Data Quality, Metadata, Data Access and Data Lifecycle. Based on the findings, the study argues for the need to modify or extend the existing Data Governance framework proposed by Khatri and Brown (2010) for HEIs. Data Integration was identified as one of the essential data components that should be given attention in higher education institutions. This study found a need to identify and include Data Integration as a DG component because it contributes greatly to Data Quality in HEIs.

Since this institution was established through a merger of Cape Technikon and Peninsula Technikon, the findings suggest that the merger could be the source of the institution experiencing data integration challenges and this could apply to other institutions with a similar background. Another major issue that seems to be causing data integration issues in the institution is the lack of proper integration between the main system (ERP) and the sub-systems, as aforementioned. This study developed a data governance model following the contingency theory, which says a DG model should be developed based on the organisational contingency factors. These contingency factors include: organisation size, structure, competitive strategy, corporate governance and decision-making style. This study identified background history as another contingency factor: whether the institution is of a merger background. The study used a suggested contingency model for data governance where the extended DG model was plugged in (Figure 5.16). This is the proposed DG model that can be used as a guideline for higher education institutions that want to treat data as an asset through data governance.

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APPENDICES

APPENDIX A: Questionnaire for CPUT employees

This questionnaire aims to investigate and analyse the impact of Data governance in CPUT institution. An existing data governance framework was chosen and used to gather relevant information that will assist with the analysis of data governance. This study will be guided by a contingency theory and data related to the theory will also be included.

The questionnaire is expected to take approximately 20 to 30 minutes. Please find attached a consent letter from the university that show permission have been granted.

M. Tech Research student	**Supervisor**
Thandi Charmaine Mlangeni	Dr Ephias Ruhode
Faculty of Informatics and Design	Faculty of Informatics and Design
Cape Peninsula University of Technology	Cape Peninsula University of Technology
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Section A

Data Governance Framework Questions: Data Principles

Question 1: What are the key assets of Cape Peninsula University of Technology institution? Please indicate your answer of choice by marking with an X in the relevant category

A. Human		B. Financial		C. Physical		D. IP	
E. IT		F. Data		G. Relationship		Other: Please specify …………………………	

Question 2: What is your perception about data in the institution in regards to points listed below? Please give _ONE_ answer per row according to the following scoring system: 1) Strongly agree; **2)** Agree; **3**) Disagree; **4**) do not know**.**

A. The data concept is clearly understood by the institution	
B. It is regarded as an asset by executive management of the institution	
C. It brings value in managing the operations of the institution	
D. It has impact on the brand perception of the institution	

Question 3: According to you what entities listed below consists of enterprisewide data? Please indicate your answer of choice by marking with in X in the relevant category:

A. Student		B. Classes		C. Employees		D. Campus	
E. Faculty		F. Facilities		G. Location		Other: Please specify……….. ……………………………………	

Data Governance Framework Questions: Data Quality

Question 4: Please rate the state of data based on your experience in this institution. Rank from 0 (extremely poor) – 5 (Extremely well)

Completeness   [_]

Accuracy   [_]

Credible   [_]

Consistent   [_]

Easy to access   [_]

Timeless   [_]

Question 5: How often do you experience errors when accessing data on applications? Rank from 0 (low) – 5 (high)

The information is inaccessible   [_]

The information is insecure   [_]

The information is hardly retrievable   [_]

The information is difficult to aggregate   [_]

Errors in the information transformation   [_]

The information is not based on fact   [_]

The information is of doubtful credibility   [_]

The information presents an impartial view   [_]

The information is irrelevant to the work   [_]

The information consists of inconsistent meanings [_]

The information is hard to manipulate   [_]

The information is hard to understand   [_]

Question 6: Please choose a level that is most likely to be affected by poor data quality in the institution. Indicate your answer of choice by marking with an X in the relevant category

A. Strategic level		B. Operational level		C. Both	

If your response in Question 6 above is A, respond <u>ONLY</u> to questions 7. If it is B, respond <u>ONLY</u> to question 8, and if it is C, respond both question 7 and 8.

Question 7: What are the implications of carrying data of poor quality on a strategic level of the institution? Please indicate your answer of choice by marking with an X in the relevant category

A. Faulty managerial decision-making		B. Negative effects on the organisation's culture	
C. Becomes difficult to trust the institution's data		Other: Please specify ……………………	

Question 8: What are the implications of carrying data of poor quality on an operational level of the institution? Please indicate your answer of choice by marking with an X in the relevant category

A. Increase operational cost in IT		B. Result to inefficient decision-making process	
C. Result to low performance		Other: Please specify ……………………………... …………………………………………………… .	

Data Governance Framework Questions: Metadata

Question 9: Based on your interaction with the applications, what is your experience in regards to data representation? Please indicate your answer of choice by marking with in X in the relevant category

You understand what the data is about   [_]

There is a mechanism that provides a clear description of data representation   [_]

You have access to information about descriptions of the data creator/modifier   [_]

You have access to descriptions of the application data for individual units   [_]

You have access to authorization or audit information related to data   [_]

Data Governance Framework Questions: Data Access

Question 10: What is your perception on data access and security in the institution in regards to points listed below? Please give _ONE_ answer per row according to the following scoring system: 1) Strongly agree; **2)** Agree; **3**) Disagree; **4**) do not know**.**

A. Data is protected and safe	
B. Data is always available	
C. Data access is secured	
D. Data access standards that tracks who can have access/modify data on what are implemented	
E. Appropriate data security measures are implemented	
E. Data access and security needs improvement	

Data Governance Framework Questions: Data Lifecycle

Question 11: What is your perception on data life cycle of the institution? Please indicate your answer of choice by marking with in X in the relevant category

A. Data is stored longer than required		B. Data lifecycle is monitored	
C. Policies and procedures that focus on how long data can be used, retained and archived are deployed		Other: Please specify …………………………………… ….	

Section B

Contingency Theory questions: Placement of decision-making authority

Question 1: What is the structure of IT decision-making in the institution? Please indicate your answer of choice by marking with an X in the relevant category

A. Decision-making authority is in a central IT department		B. Decision-making authority is allocated to individual units/departments	
C. Decision-making authority is allocated both in the IT department and other departments		Other: Please specify ……....................	

Question 2: Who do you think should be accountable for IT decisions regarding data in the institution? Please give _ONE_ answer per row according to the following scoring system: 1) IT department; **2)** Individual departments; **3**) Both.

A. Data access	
B. Data security	
C. Data ownership	
D. Data usability	
E. Data life cycle	
F. Data quality	

THANK YOU FOR YOUR COORPORATION!!!

APPENDIX B: Interview questions for CPUT employees

The interview questions are structure with the aim of answering research questions. Since this study is using structured/semi-structured interviews, some of the questions will be asked based on the response from the respondents to gather more relevant information. Section A includes interview questions for IT employees, and section B includes questions for executive-level members of the institution.

Section A:

1. What is your role in this institution?

2. What are the information systems that are used in the entire institution?

3. Who is responsible for the management of information systems?

4. Is IT governance implemented in the institution?

5. What is the role of data in the institution?

6. Are the IT assets and Data assets treated the same or differently?

7. What are the data challenges experienced in this institution?

8. What are the current processes or developments for managing data?

9. What are the data management challenges experienced by the IT department

10. Does business take responsibility for their data ownership?

11. What is the involvement of the Deputy Vice Chancellor of Knowledge and Information Services in the IT department?

12. Are there any regulations pertaining data in this institution?

13 Does this department adhere to the developed policies?

14. Are you happy with the current data state in this institution?

15. Do you think there are benefits of IT and business working together to implement a proper Data Governance strategy that will assist the institution in achieving its strategic goals?

Section B:

1. Please define your role in this institution?

2. What are the governance regulations adhered by the institution?

3. Are the governance committees within institution departments?

3. Is the implementation of IT governance influenced by the KING III corporate governance?

4. What is the role of policies in this institution?

5. What are challenges regarding policies?

6. Do various departments adhere to institutional polices?

7. What is your perspective in regards to data state in the university?

8. Do you think the IT department processes always make information available?

9. What is your take on governance consideration in regards to data?

10. Are the IT assets and Data assets treated the same or differently?

11. Do you think there are benefits of IT and business working together to implement a proper Data Governance strategy that will assist the institution in achieving its strategic goals?

APPENDIX C: CONSENT LETTERS

Cape Peninsula
University of Technology

Introductory letter for the collection of research data

Thandi Charmaine Mlangeni is registered for the M Tech (IT) degree at CPUT (214194752). The thesis is titled Effective implementation of data governance in mergers and acquisitions: In the case of Cape Peninsula University of Technology, and aims at identifying the data related challenges Cape Peninsula University of Technology (CPUT) is facing as a result of a merger that impacts the institutions efficiency, and getting insight on how data can be managed/maintained using properly defined principles of data governance. The supervisor for this research is:

Dr Ephias Ruhode

In order to meet the requirements of the university's Higher Degrees Committee (HDC) the student must get consent to collect data from organisations which they have identified as potential sources of data. In this case the student will use interviews, document analysis and literature review to gather data.

If you agree to this, you are requested to complete the attached form (an electronic version will be made available to you if you so desire) and print it on your organisation's letterhead.

For further clarification on this matter please contact either the supervisor(s) identified above, or the Faculty Research Ethics Committee secretary (Ms V Naidoo) at 021 469 1012 or naidoove@cput.ac.za.

Yours sincerely

Dr Ephias Ruhode

Cape Peninsula
University of Technology

I Professor Anthony Staak in my capacity as Deputy Vice-Chancellor at Cape Peninsula University of Technology give consent in principle to allow Thandi Charmaine Mlangeni, a student at the Cape Peninsula University of Technology, to collect data in this company as part of his/her M Tech (IT) research. The student has explained to me the nature of his/her research and the nature of the data to be collected.

This consent in no way commits any individual staff member to participate in the research, and it is expected that the student will get explicit consent from any participants. I reserve the right to withdraw this permission at some future time.

In addition, the company's name may or may not be used as indicated below. (Tick as appropriate)

	Thesis	Conference paper	Journal article	Research poster
Yes	✓	✓	✓	✓
No				

24/07/14

Professor Anthony Staak