University of Fort Hare

Together in Excellence

A Data Governance Maturity Evaluation Model to enhance Data Management in Eastern Cape Government Departments

by

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Abstract

The governance of data assets has become a topical issue in the public sector. Government departments are faced with increasingly complex data and information arising from multiple projects, different departments, divisions and several stakeholders seeking data for divergent end uses. However, an exploratory study of the literature regarding data governance in government departments of the Eastern Cape province of South Africa suggest that there are no clear data governance processes in place within the departments. The research question **"How can a data governance maturity evaluation model enhance data governance processes in the Eastern Cape government departments"** was derived as a result of a perceived need for government departments of the province to manage their critical data assets in a manner which promotes accurate, verifiable and relevant fiscal and strategic planning. Following the review of current literature in the data governance domain, a conceptual data governance evaluation maturity model was developed and produced. The conceptual model was influenced by the IBM data governance maturity model (2007) and it was aimed at addressing the gaps in the reference model to suit the context of the Eastern Cape government departments and the governance of their data assets.

A qualitative phase of empirical data collection was conducted to test the components of the conceptual model. A quantitative instrument, derived from the findings of the qualitative study, as well as the components of the refined model was administered to 50 participants in the same departments where qualitative data was collected, with additional participants being drawn from three other departments. Pragmatism was the guiding philosophy for the research. The Contingency and Institutional theories form the theoretical grounding for the study. Design Science guidelines by Hevner et al (2004), Peffers et al's (2008) Six Steps in Design Science and Drechsler & Hevner's (2016) Fourth Cycle of Design Science were employed to construct, improve, validate and evaluate the final artefact. Findings confirmed the literature that data governance is lacking in government departments. It is asserted that the implementation of this model will improve the way data assets are recorded, used, archived and disposed in government departments of the Eastern Cape. The outcome of this research was the development and production of a data governance maturity evaluation model as well as a process document which gives a roadmap of how to move from one maturity level to another.

Keywords: DGMEM; Data Governance; Maturity models; Pragmatism; Mixed Methods

Declaration

I, Olutoyin Olaitan, Student number 201013856 hereby declare that:

- I am fully aware of the University of Fort Hare's policy on plagiarism and I have taken every precaution to comply with the regulations.
- The work in this dissertation is my own work.
- All sources used or referred to have been documented and recognised.
- This dissertation has not previously been submitted in full or partial fulfilment of the requirements for an equivalent or higher qualification.
- I am fully aware of the University of Fort Hare's policy on research ethics and I have taken every precaution to comply with the regulations. This thesis received ethical approval (HER061SOLA01) from the University of Fort Hare's Research Ethics Committee (UREC).
- My supervisor is Prof. M. Herselman and her Co-supervisor, Dr N. Wayi

_____

Olutoyin Olaitan

_____01/12/2017_____

Date

Publications

Journal Publications relevant to this thesis

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Conferences relevant to this thesis

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Olaitan O, Herselman M. & Wayi N. (2016): A Data Governance Maturity Evaluation Model to enhance Data Management in Eastern Cape Government Departments. (Presented at the South African Institute of Computer Scientists and Information Technologists on the 26th of September 2016).

Journal articles on other research interests

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Dedication

This thesis is dedicated to **God**, for the gift of life and health, my parents, who taught me life lessons that have seen me through all the seasons of life so far, and to my siblings, without their support, this thesis could not have been completed.

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The saying "If you walk alone, you will walk fast but if you walk with others, you will walk far" has never held more meaning for me than during the journey of completing this thesis. The process of compiling this work was made possible with the assistance and input of a number of people. It is therefore important to acknowledge their help and contribution towards the success of the thesis.

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Acronymns

BYOD	Bring-Your-Own-Device
CGICT	Corporate Governance of Information and Communication Technology Policy Framework
CMM	Capability Maturity Model
COBIT	Control Objectives for Information and Related Technology
COSA-DLC	Comprehensive Scenario Agnostic Data Lifecycle
DGMEM	Data Governance Maturity Evaluation Model
DGO	Data Governance Office
DHMIS	District Health Management Information Systems
DLC	Data Lifecycle
DPSA	Department of Public Service Administration
DSRM	Design Science Research Method
EA:	Enterprise Architecture
EIM	Enterprise Information Management
ETL	Extract-Transform-Load
GCIS	Government Communication and Information Systems
GITO	Government IT Officer
GoCoMM	Governance and Compliance Maturity Model
HR	Human Resources
IBM	International Business Machines
ICT	Information and Communication Technology
IEC	International Electrotechnical Commission
IoD	Institute of Directors
IoT	Internet of Things
IS	Information Systems
ISO	International Organisation for Standardisation
IT	Information Technology
ITGI	IT Governance Institute
ITIL	IT Infrastructure Library
KMMM:	Knowledge Management Maturity Model
KPIs	Key Performance Indicators
MDM	Master Data Management

MPAT	Management Performance Assesment Tool
NDP	National Development Plan
NRI	Networked Readiness Index
NHISSA	National Health Information Systems committee of South Africa
OECD	Organisation for Economic Cooperation and Development
OPM	Office of Personnel Management
PAIA	The Promotion of Access to Information Act
PIFI	Personally Identifiable Financial Information
PII	Personally Identifiable Information
PMMM	Project Management Maturity Model
RDBMS	Relational Database Management Systems
SEI	Software Engineering Institute
SLAs	Service Level Agreements
SOP	Standard Operating Procedure
SPSS	Statistical Package for the Social Sciences
StatsSA	Statistics South Africa
TE	Transition Economies
TEDC	Transition economies and developing countries
USA	United States of America
VAC	Verifiable, Accurate and Complete

Chapter 1
Introduction

Chapter 2

Methodology

Chapter 3
Relationship between Corporate Governance, IT Governance and Data Governance

Chapter 4

An analysis of current Data Governance Practices in the Eastern Cape Government Departments

Chapter 5

A discussion of Five Maturity models relevant to this Study

Chapter 6

A Conceptual Data Governance Maturity Evaluation Model

Chapter 7

Presentation of Findings from the Qualitative Data

Chapter 8

Implications of Findings from the Qualitative Data

Chapter 9

Presentation of Findings and Implications of the Quantitative Data

Chapter 10

A Data Governance Maturity Evaluation Model for Government Departments of the Eastern Cape

Chapter 1: Introduction

1.1 Introduction and Background to the study
1.2 Statement of the Problem
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1. Introductory Chapter

1.1 Introduction and Background to the Problem

Data serves diverse needs of different stakeholders in an organisation. These needs include reporting and decision-making; ensuring data quality; data access across organisational divisions; ability to analyse, sort and filter data; ability to share sensitive and non-sensitive data in a secure environment, and the capacity to meet legal, compliance and risk management requirements (Soares, 2016; Thomas, 2015; Seiner, 2014; Dismute, 2010; Khatri & Brown, 2010; Kushner & Villar, 2008). Due to easy accessibility and availability of computing devices, there has been a distinct increase in the number of people with the capability to alter the structure, storage and accessibility of data (Thomas, 2015). Soares (2015), Dismute (2010) and Kushner and Villar (2008) assert that the danger of this ease of access is that data may be compromised, reduced or expanded to the detriment of the organisation. Furthermore, there has been a tremendous increase in the amount of data being processed within organisations in recent years. The dearth of trustworthy information due to inconsistencies, redundancy and variances in the process of data collection, data processing and data archiving has added significant risk and poor managerial decisions to organisational business (Korhonen, Melleri, Hiekkanen, & Helenius, 2013).

Additionally, organisations have increased in size and enterprise data has become more complex, with multiple data streams on different devices, personal workstations and bring-your-own-device (BYOD) becoming conventional in the workplace (Alles & Piechocki, 2012). To this end, most organisations are seeking effective and usable data governance policies, programs or frameworks that can be implemented to make sense of all the data at their disposal and to use it for strategic advantage (Alles & Piechocki, 2012).

In spite of this awareness of the strategic importance of data governance and the attempts by management to correct and address the challenges, most organisations have found that there is very little clarity concerning the governance and management of data processes (Korhonen, et al., 2013). There is confusion about the roles and responsibilities regarding decision rights for data and other related issues. Data governance alludes to high-level planning and control over data management (Crowston & Qin, 2012). Research has shown that most organisations have some form of data governance processes, whether formal or informal (Eckerson, 2014; Dismute, 2010; Morsley, 2008). Eckerson (2014) attests to the importance of an effective data governance framework for government departments. The Eastern Cape Government

Departments, which is the context of this study, currently have in place a number of policies which allude to the importance of data governance (DPSA, 2013). Some of these policies are the Record Management Policy (NARS, 2006) and the Minimum Information Security Standards (South Africa Government, 2008). However, a cursory look at the operations of these departments does not reveal an implementation of data governance processes as outlined in well-known data governance frameworks (DPSA, 2013). The study aims to fill this gap by developing and producing a data governance maturity evaluation model (DGMEM) which the departments can employ to gauge their compliance level in comparison with known, tested and established data governance frameworks. This will assist the departments to measure their current level of maturity with regards to data governance; thus prompting the required action for them to move to the desired maturity level of implementing data governance processes that are repeatable and auditable (Poppelbub & Roglinger, 2011).

1.2 Statement of the Problem

Government departments are faced with increasingly complex data and information arising from multiple projects, different departments, divisions and several stakeholders seeking data for divergent end use (Seiner, 2014; Alles & Piechocki, 2012). Data governance is pivotal to ensuring that data stored on different IT systems and managed by different units are regulated in their entirety throughout government departments (Marco, 2006). Furthermore, issues of data authentication, access control and levels of decision rights are critical and require governance in ensuring data is treated and managed as an asset within an organisation (Soares, 2015). Data also needs to be effectively controlled to avert any risks that may arise due to data mishandling or manipulation (Khatri & Brown, 2010). The existing information on data governance policies within the departments does not outline the critical processes required to ensure successful implementation of data governance. This dearth of repeatable and verifiable processes for data governance, therefore, informed the main research question stated below.

Main Research Question:

How can a data governance maturity evaluation model enhance data governance processes in the Eastern Cape Government Departments?

1.3 Objective of the Study

The main objective of the study is to develop and produce a Data Governance Maturity Evaluation Model for measuring the maturity level of data governance in the Eastern Cape Government Departments. The model proposes a clearly outlined process-based approach to data governance which will assist the departments in moving from one maturity level to an improved level. The implementation of this process-based approach will help in ensuring the accuracy, validity and completeness of data within the departments.The study answers the primary research question by addressing the following sub-questions:

Research Sub-questions

1. What is the importance of maturity models in evaluating available data governance policies in the Eastern Cape Government Departments?
2. What are the components of an effective data governance framework required to support data management in the Eastern Cape Government Departments?
3. How do existing current data governance practices in the Eastern Cape Government Departments align with international best practice frameworks such as COBIT and ISO/IEC 38500?
4. How will data governance components within the maturity evaluation model assist the departments in ensuring better governance of their data assets?

1.4 Significance of the Study

Data forms the basis of information, which is the central, most important factor employed by government in fiscal and developmental planning. Also, national decision-making on one hand, and government budgetary projections on the other are heavily dependent on the availability of information which comes from data collected across a broad spectrum of government departments. It, therefore, is of utmost importance that the data on which such information is based is accurate, valid and complete. For data governance to achieve the desired purposes stated above, there needs to be unambiguous processes and guidelines in place to direct the departments regarding data handling, management and archiving. The study proposes a Data Governance Maturity Evaluation Model (DGMEM) to evaluate the maturity level of Eastern Cape Province Government Departments. Although there are existing policy documents alluding to the importance of data governance within these departments, they do not clearly

outline the processes required to implement the governance elements that will insulate the departments against the risk of ungoverned data.

Maturity models outline a descriptive 'as is' assessment of the entities or organisations under investigation (Poppelbub & Roglinger, 2011). They also provide a prescriptive, clearly articulated set of processes of how to achieve desired improvements in order to get to the desired maturity level from a current level (Poppelbub & Roglinger, 2011). There is presently no model in place to measure compliance, implementation and maturity of data governance principles within these departments. The DGMEM is expected to fill this gap by providing a structured methodology for assessing the maturity level of these departments with regards to data governance. The model prescribes definitive steps of process improvement for data governance within the Eastern Cape Government Departments (Hamel , Herz, Uebernickel, & Brenner, 2013; Huner, Ofner, & Otto, 2009). The study also provides a roadmap for enhancing data governance processes of these departments based on the assessment of their maturity stage. A maturity model for the Eastern Cape Government Departments will significantly enhance their ability to measure their effectiveness in managing data, thereby ensuring the quality of data employed in information management, fiscal and strategic planning is reliable and trustworthy.

1.5 Literature Review

The Data Governance Institute (2015) defines governance as a "*system of decision rights and accountabilities for information-related processes, executed according to agreed upon models which describe who can take what action with what information, when, under what circumstances, using what methods*" (Data Governance Institute, 2015, p.1). Seiner (2014) describes data governance as the correct implementation and enforcement of authority regarding the management of data and data related assets. In agreement, Korhonen et al., (2013) define data governance as an organisational approach for managing data which outlines a set of formal policies and procedures to cover the full lifecycle of data, from acquisition to use and disposal. In the same vein, Kushner and Villar (2008), describe data governance as a management program which treats data as a crucial asset to organisations, having within it a collection of corporate policies, standards, people, processes and technology.

Based on all the definitions above, the researcher posits that data governance is **"a homogeneous set of processes which assures formal management of data assets in an**

enterprise". The fundamental aim of data governance is to ensure that data is trustworthy, managed by the right human resources, and follows a standardised process. Data governance also ensures that decisions based on available data do not place the enterprise at risk due to low quality, falsification of data, or use of obsolete data (Soares, 2015; Eckerson, 2014). Effective enterprise-wide data governance forestalls the occurrence of errors in decision-making and enhances the efficiency of its operations.

There are various policies and guidelines for IT governance, both national and provincial, which are ostensibly in place for the management and control of IT processes, including data governance and management. Some publicly accessible documents detailing how information should be managed in government departments are the Public Service Corporate Governance of Information and Communication Technology Policy Framework (CGICT) (DPSA, 2013), Minimum Information Security Standards (South Africa Government, 2008), and the Record Management Policy (NARS, 2006). There is also a detailed policy guideline regarding data handling, management and storage from the National Archives and Storage Organisation (NARS, 2006). However, a comprehensive analysis of these documents reveals that an ad hoc approach to data stewardship and management seems to be in place, rather than adherence to a set of processes for data governance. This study proposes the DGMEM to address this gap. The study makes use of thematic content analysis of secondary literature to inform the conceptual model. Content analysis refers to a method for systematically exploring textual data to identify the patterns and structures in it, with the intention of identifying the important features of a given construct (Billore, Billore, & Yamaji, 2013).

1.5.1 Theories for the study

The Institutional and Contingency theories form the theoretical basis for this study. The Institutional theory was originally proposed by Meyer and Rowan (1977) and later employed in significant IS governance research by Jacobson (2009). The theory stipulates that the evolution of IT governance necessitates a focus on:

- how IT governance processes are actualised,
- the link between IT governance and performance and
- constantly changing requirements within an organisation.

All of these factors are critical in order to align IT governance to the needs of the organisation (Jacobson, 2009). The DGMEM aims to specify a set of processes which answers the question of how effective data governance can be achieved in government departments; the theory is,

therefore, relevant to the study. The Contingency Theory states that there is no best or universally accepted way of organising a corporation, leading it, or making decisions (Weber, Otto, & Osterle, 2009). The theory specifies that the best course of action in a given context is dependent upon its prevalent internal and external situation. The goal of the study is to develop and produce a maturity evaluation model for the Eastern Cape Government Departments. The application of this theory to the research problem will be based on the government's strategic goals for provincial departments, which planning is anchored on the provision of valid, accurate and complete data for information processing. The evaluation will adapt Steinhart's Data Governance Evaluation Process Areas as depicted on Table 1.1 below.

Table 1.1: Data Governance Evaluation Process Areas (Adapted from Steinhart, 2010)

Process Area	Relevance to this study
User Needs Assessment	The divergent needs for data access, processing and documenting in the departments of the Eastern Cape.
Data Management Planning	The control and management of all data access point in the departments.
Technology Management	The choice of technology for managing data access, and the decision rights and access levels for personnel in charge of the technology supporting the data assets of the Eastern Cape Government Departments.
Workflow Management	The current practices around data workflow management and repeatable processes regarding data assets in the departments.
Metadata Management	The control, documentation and storage of metadata in the departments as it relates to metadata retrieval, risk management and legal compliance issues that may arise.
Documentation Management	The decision rights, processes, controls and access rights for data assets and documents of the Eastern Cape Government Departments.
Performance Assessment	The processes, methodologies and documented standards of assessing the performance of individuals and departmental stakeholders with regards to data handling, management and archiving within the departments.

1.6 The Significance of a Data Governance Maturity Evaluation Model

A maturity model is described as a structured collection of components that define certain aspects of maturity in an organisation (Eshlaghy & Pourebrahimi, 2011). Well- governed data enhances the delivery of better information for improved decision-making within government departments (Seiner, 2015). It also enables a standardised set of requirements for commonly defined, managed data within multiple user domains (Khatri & Brown, 2010). However, extant

literature reveals that many organisations do not have a formalised data governance policy, framework or process in place (Seiner, 2015; Marco, 2006). Seiner (2015) and Thomas (2015) assert that the failure of organisations in not fully embracing data governance stems from the challenge of quantifying its inherent value like other physical, financial and technology assets.

The Capability Maturity Model (CMM) is considered as the foremost maturity model. Originating in the 1990s, the Capability Maturity Model (CMM) was originally designed for Software Development but has since become popular for diverse fields of technological advancements (Crowston & Qin, 2012). The CMM enables organisations to use this framework to measure their current state and determine short- and long term goals for improvement. The CMM also proposes the best practices that can move organisations to the next maturity level, while enabling them to assess their progress at any point in the process (Hamel et al., 2013; Huner et al., 2009). CMM comprises a set of process areas which groups requirements into five levels of organisational capability maturity. The processes become more refined and standardised as they increase from 0 - 5, with 0 being non-existent and 5 being the optimised maturity level (Huner et al., 2009). Data governance maturity evaluation models are based on the principles of the CMM.

The benefits of a Maturity Evaluation Model which serves to highlight the strategic and tactical importance of data governance in the Eastern Cape Government Departments are:

1. The departments will have an organised method of evaluating existing data governance frameworks and policies in a measurable, scientific manner. A maturity evaluation model is a practical, analytical tool for assessing and classifying data governance processes. The model will assist in identifying the gaps, critical skill sets and procedures required to accomplish the data management goals of the departments.
2. Based on the findings of the evaluation, the Data Governance Maturity Evaluation Model (DGMEM) will systematically outline the processes involved in implementing international data governance best practices and measuring the success of the implementation on a well-articulated and clearly defined set of metrics.
3. One of the ultimate benefits of a data governance maturity evaluation model is the ability to use the results as a catalyst for building a convincing business case for securing executive sponsorship to support data governance investment and resources for the departments. The model will create an awareness of data goverance processes,

importance and negative implications of ungoverned data within government departments.

1.6.1 Current Maturity Evaluation Frameworks to Be Employed as Benchmark Models for this Study

As the success of maturity models are premised on their ability to measure the critical processes which will ensure the improvement of the domain area in which the maturity is being measured, it is important that this study has a benchwork framework that will inform the underlying processes of the DGMEM. The Control Objectives for Information and Related Technology (COBIT) and the ISO/IEC 38500 framework for Information and Communication Technology were chosen as benchwork frameworks for this study as they represent the most relevant to data governance in the context of government departments.

1.6.1.1 Control Objectives for Information and Related Technology (COBIT)

COBIT is a framework for Information Technology Governance created by the Information Systems Audit and Control Association (ISACA) and the IT Governance Institute (ITGI). COBIT outlines a detailed set of measures, processes, indicators and best practices for IT managers and other stakeholders in managing IT and related functions. The objective of COBIT is to assist managers in maximising the benefits derived through the use of Information Technology and to develop suitable IT governance and control in an organisation (COBIT, 2007). COBIT maturity modelling is based on a method of evaluating the organisations' processes so it can be rated from maturity level non-existent (0) to optimised (5). The COBIT framework has been chosen for this study as it is internationally acclaimed. Furthermore, policy documents accessible in the Eastern Cape Government Departments specify COBIT as a framework adapted for IT Governance and control within the departments. However, there is no empirical evidence to show that these departments are using COBIT correctly. This study aims to develop and produce a model that will highlight the processes involved in using such a framework as COBIT to manage data. This will be done by benchmarking the process document of the Data Governance Maturity Evaluation Model (DGMEM) against the data governance processes specified by COBIT 5 in DS 11: Manage Data.

1.6.1.2 ISO/IEC 38500

The ISO/IEC 38500 is an International Standard published in 2008 for the corporate governance of Information and Communication Technology (ISO/IEC, 2008). The framework was jointly developed by the International Organisation for Standardisation (ISO) and International Electrotechnical Commission (IEC). The objectives of ISO/IEC 38500 include: (a) ensuring stakeholders have confidence in the overall IT and related governance activities of the organisation which follow the standard; (b) acting as functional guidance to organisation directors on IT governance activities, and (c) providing a basis for the objective evaluation of IT governance activities (ISO/IEC, 2008). The ISO/IEC 38500 outlines six principles of good IT governance: Responsibility, Strategy, Acquisition, Performance, Conformance and Human behaviour. The standard also assigns three main IT governance tasks for directors: evaluation, directing, and monitoring.

The choice of the framework for this study is based on the criticality of these six principles to the implementation of a sound data governance framework in government departments. Extant literature on data governance has shown that most directors regard data management issues as IT business and fail to see the importance of data as an 'asset' in their organisations (Soares, 2015). This is a misnomer which the ISO/IEC addresses by placing the responsibility for these three main areas at the highest levels of authority in the organisation. The standard is also relevant as it does not replace frameworks such as COBIT and ITIL which have detailed processes for governing data; however, it is a principle-based standard which further highlights the significance of instituting data governance practices in line with well-established international standards.

1.7 Research Design and Methodology

Research methodology gives an unequivocal, easily tested depiction or roadmap of how the researcher derived his conclusion (Hofstee, 2006). An accurate depiction of the research design in any study serves to enlighten the reader on the application of the methodology used for the study (Teddlie & Tashakkori, 2009). This section outlines the plan for conducting the research. The philosophical stance, research paradigm, research methods and data collection and analysis techniques are discussed in this section.

1.7.1 Research Paradigm

The study adopts Pragmatism, a paradigm which states that the research question drives what 'works' (Creswell, 2014; Teddlie & Tashakorrie, 2009). Pragmatism contends that a researcher may work with conflicting assumptions and variants of the way knowledge is produced (Saunders, Lewis, & Thornhill, 2012). Pragmatism is considered appropriate for this study as it enables the researcher to explore a variety of methods for the purpose of solving the research problem (Creswell, 2014). The artefact to be produced at the end of the study is a Data Governance Maturity Evaluation Model for the purpose of measuring the maturity of data governance in Eastern Cape Government Departments, and thereafter propose a roadmap for effective data governance. Thus, it is important that a pragmatic approach to finding out what works is used in solving the research problem.

1.7.2 Research Method

The research methodology for this study is Design Science. Although there have been divergent arguments for its appropriateness as a paradigm or methodology, Design Science is increasingly being employed in IS research for creating artefacts to solve 'real life' problems (Peffers, Tuunanen, Rothenberger, & Chartterjee, 2008). Peffers et al. (2008) and Pries-Heje and Baskerville (2008) are some of the notable works in IS research where Design Science was considered as a methodology. Design Science is perceived as the most suitable for investigating all facets of the research problem and proffering a solution that 'works' in enhancing data governance processes in government departments of the Eastern Cape.

Design Science organises secondary data in an iterative manner. The purpose of this is to innovate a model, framework or artefact by way of primary research that will solve a known problem in a more efficient and effective way (Hevner, March, Park, & Ram, 2004). In Design Science, the relationship between people, practice and problems are explored from several viewpoints with the aim of creating an artefact for solving life issues (Johannesson & Perjons, 2012). Furthermore, Design Science aims to produce and communicate knowledge that is generalisable across a broad spectrum of related real life problems in the area under investigation (Gregor & Hevner, 2013). The most important and final objective of a Design Science research method is to produce a 'mental mode' of the research output (Peffers et al., 2008). A mental mode is described as a small scale model of reality which reviewers, consumers and any target audience of a research output can relate with and adapt to solve real life problems. Hevner et al. (2004) outline seven guidelines for a research to follow in order to

be considered as following a Design Science methodology. The seven guidelines are discussed in relevance to this particular study in section 2.4.1 and Table 2.3, Chapter 2 in order to further elucidate the reasons for the choice of Design Science.

It is argued that the relevance of Information Systems research must stem from its applicability to solving real-life problems, failing which IS research would lose its influence in the field of Technology, Science and Engineering (Peffers et al., 2008). The purpose of the research design in this study is to develop and produce a Data Governance Maturity Evaluation Model for the government departments of the Eastern Cape. The Design Science Process model developed by Peffers et al. (2008) will be followed in the development, design and demonstration and evaluation and communication of the Data Governance framework. This process as it applies to the study is discussed extensively in Chapter 2.

1.7.3 Data Collection and Analysis

Data collection and analysis for the purpose of this study was conducted via a mixed method. Greene (2008) describes mixed methods research as an approach to investigating the social world which comprises of more than a singular methodology, with the aim of gaining a better understanding of the phenomenon being investigated. Six mixed methods research designs are outlined in Creswell (2014) and Creswell and Clark (2011). These are the convergent parallel design, explanatory sequential design, exploratory sequential design, transformative design, the multiphase design and the embedded design. This study employed the exploratory sequential design in the development and validation of the DGMEM through the process of empirical data collection and analysis. The exploratory sequential design is useful for an iterative process of designing an artefact that can be tested within a larger population (Creswell, 2014). The conceptual model was tested for relevance, validity and usability with the aid of qualitative and quantitative questions; these were drawn from the secondary literature used in deriving the conceptual model. Details of the data collection and analysis are discussed in Section 2.7, Chapter 2.

1.8 Delimitation of the Study

The context of this research was the government departments of the Eastern Cape. The aim of the research was the development and production of a Data Governance Maturity Evaluation Model for the departments to measure the level of maturity of their data governance practices and processes. The study also produced a process-based checklist to assist the departments in

making changes and moving upwards on the maturity spectrum where needed. The study did not examine, study, or discuss any other IT governance issues within the departments.

1.9 Ethical Considerations

The research context of the thesis was the government departments of the Eastern Cape. The researcher is and was aware of the stringent privacy rules binding the staff of these departments. To this end, certain ethical considerations were relevant and binding on the researcher in the course of carrying out her investigation of the problem and proffering a solution:

Ethical clearance: The researcher obtained an ethical clearance certificate from the University of Fort Hare's Ethics Committee (HER061SOLA01). The ethical clearance certificate detailed the ethical boundaries of the researcher and assured participants of the authenticity of the research process(Appendix A).

Confidentiality: The focus of the study was data governance. The researcher will not divulge any part of a policy/process/ framework to which she has been given access in the course of the study. The output from the findings on current data processes, which will be published in a journal or conference proceedings, will not include the names of particular persons or departments. The identity of all participants in the study are confidential. The questionnaires also outline the rights of the participants to refrain from answering any question they may consider as an infringement on their privacy. No participants under the age of 18 participated in the study.

Data Accuracy: The researcher has ensured, to the degree to which it rests upon her, that the integrity of data collected during focus group discussions and through the web-based questionnaires are maintained in the analysis stage of the research. Utmost care was taken to avoid misrepresentation and/or ballooning of data.

1.10 Outline of Chapters

The introduction forms **Chapter 1** of this study. The chapter gives a detailed description of what the researcher intends to do and the roadmap to achieving the aims and objectives of the study. A brief background to the problem is given and the problem stated in the form of a research question. Thereafter, secondary objectives that will help the researcher answer the main research question are proposed. **Chapter 1** also discusses the significance of the study and its expected contribution to the existing body of knowledge in the subject area.

Chapter 2 discusses the research methodology and design. This includes the research paradigm, data collection methods, and data analysis procedures. In **Chapters 3, 4** and **5,** a critique of existing literature on the research topic is carried out. This critique is done with targeted focus on the research problem and subproblems. **Chapter 3** reviews extant literature on the relationship between corporate governance, data governance, global practices, international best standards, and emerging trends in data governance. **Chapter 3** also focuses on the components of a successful data governance framework. A thorough investigation of the components required for the departments to have an effective data governance programme is carried out. **Chapter 4** discusses the factors currently affecting effective implementation of sound data governance practices in the Eastern Cape, benchmarking existing processes against international best practices already discussed in **Chapter 1,** identifying the gaps and proposing a conceptual Data Governance Maturity Evaluation Model to address the gaps between current practice and ideal data governance processes. A survey to determine the level and type of data governance components critical to successful management of data assets in order to achieve the strategic objectives of these departments is also carried out. **Chapter 5** discusses several maturity models in the context of their relevance to the study. The components of maturity models considered relevant to the final output of this study are identified in the literature. The three literature review chapters constitute phase one of this study.

In **Chapter 6**, a conceptual data governance maturity evaluation model is proposed. The components of data governance and maturity models found in the literature form the theoretical basis for the model. The conceptual model, its constructs and placement in data governance are discussed in detail. The model is thereafter tested by way of empirical data collection which serves as an assessment of the relevance and usability of the artefact in a real world setting according to the design science process outlined in Peffers et al., 2008.

Chapter 7 of the study presents the findings of the empirical data collection. The implications of results of the initial qualitative data are discussed in depth in **Chapter 8**. **Chapter 9** discusses the results of the quantitative data which was analysed using the SPSS software version 24 package (IBM Corp, 2016). Triangualtion of multiple sources of empirical data is converged in order to ensure rigour and enhance confidence in the findings from the data. Further refinement of the model based on the findings is also presented in this chapter. **Chapter 10** presents the final data governance maturity evaluation model. **Chapter 10** presents an overview of the entire study, conclusions, reflections, limitations of the research and recommendations for future research in the domain.

1.11 Summary

Chapter 1 has laid the foundation for the study. An outline of the entire research has been presented. The problem domain has been discussed and the methodology whereby the solution to the research problem will be answered has also been discussed in the chapter. Issues of ethics and the limitations of the study have been discussed, followed by a concise outline of all the chapters in the study. Chapter 2, next, discusses the methodology in depth for the entire study.

Chapter 1
Introduction

Chapter 2

Methodology

Chapter 3
Relationship between Corporate Governance, IT Governance and Data Governance

Chapter 4

An analysis of current Data Governance Practices in the Eastern Cape Government Departments

Chapter 5

A discussion of Five Maturity Models relevant to this Study

Chapter 6

A Conceptual Data Governance Maturity Evaluation Model

Chapter 7

Presentation of Findings from the Qualitative Data

Chapter 8

Implications of Findings from the Qualitative Data

Chapter 9

Presentation of Findings and Implications of the Quantitative Data

Chapter 10

A Data Governance Maturity Evaluation Model for Government Departments of the Eastern Cape

Chapter 2: Methodology

2.1 Introduction

2.2 Research Design

2.3 Philosophy

2.4 Design Science Process Models

2.5 Approach to Theory Development

2.6 Evaluation of Secondary Data

2.7 Data Analysis

2.8 Research Strategy

2.9 Validation and Evaluation

2.10 Ethical Consideration

2.11 Summary

2. Methodology Chapter

2.1 Introduction

As outlined in chapter 1 (section 1.3), the main objective of the study is to develop and produce a Data Governance Maturity Evaluation Model for measuring the maturity level of data governance in the Eastern Cape Government Departments. The model proposes a clearly outlined process -based approach to data governance which will assist the departments in moving from one maturity level to an improved level. The main research question for the study is framed thus: **How can a data governance maturity evaluation model enhance data governance processes in the Eastern Cape Government Departments?** Chapter 1 set the context for, and outlined the secondary objectives of the study. Chapter 2 discusses the methodology by which the artefact for this thesis is constructed, demonstrated and validated.

Research methodology is the general approach chosen by the researcher in carrying out the research project (Leedy & Ormrod, 2014). The purpose of research methodology is to give an unequivocal and easily-tested depiction or roadmap of how the researcher derived a conclusion (Hofstee, 2013). Johnson and Christensen (2014, p.6) define research as *"a process of investigation that is systematic, controlled and empirical"*. Research involves observation and argumentation and establishes a relationship between newly discovered and existing knowledge in a field of inquiry (Amrollahi, Ghapanchi, & Talaei-Khoei, 2014; Saunders, Lewis, & Thornhill, 2012). Research can thus be described as the scientific method by which new knowledge is sought, discovered and expanded in any field of inquiry.

This chapter details the process that was followed throughout the different stages of compiling this study. A comprehensive discussion of the philosophical paradigms informing the research methodology is presented in this chapter. The chapter highlights the philosophical stance underlying the study and discusses the research paradigm, research method, research strategy and data collection techniques used in the study. Motivation is made for the chosen research methodology and its suitability in finding a solution to the research problem under investigation.

2.2 Research Design

Research design is "the blueprint of the research that describes the methods used for the collection, measurement and analysis of data" (Upadhyaya, 2013, p. 6). There are different

definitions for research design: Saunders et al. (2012) contend that a research design comprises of a research philosophy which represents the philosophical worldviews, the research approach, research strategy, research choices and research methods used to find a solution to the research problem at hand. However, this study adopts an amalgamation of research design definitions by Bertram and Christiansen (2015) and Creswell (2014) which describes research design as procedures of inquiry and research methods of data collection, analysis and interpretation for a particular study. The research design for this study follows Design Science guidelines by Hevner, March, Park and Ram (2004). The next section discusses several research philosophies, motivates the choice of Pragmatism as the chosen paradigm and thereafter discusses the Design Science methodology employed for this study.

2.3 Philosophy

In an academic study, there must be a philosophy upon which certain assumptions are based (Denzin & Lincoln, 2011). These assumptions lend credence to the framework which constitutes the guidelines for conducting the research. Philosophies demonstrate the process by which knowledge is developed with regards to a specific phenomenon (Denzin & Lincoln, 2011). There are a myriad philosophies upon which researchers base their respective scientific investigations (Saunders, et al., 2012). These include objectivism, pragmatism, subjectivism, positivism, realism, interpretivism, radical humanism and functionalism.

A researcher chooses a research paradigm based on his own viewpoint of the world and the purpose he wants to achieve with the research (Teddlie & Tashakkori, 2009). Also, the nature of the research, in other words, whether it is qualitative or quantitative, determines the research philosophy. The assumptions guiding qualitative research are based on the philosophies of interpretive research, postmodern research or critical studies (Creswell & Clark, 2011). On the other hand, the assumptions guiding quantitative research are philosophies such as post-positivism, objectivism, positivism and empirical research (Denzin & Lincoln, 2011). This chapter discusses five of these paradigms. The next section also chronicles the emergence of Design Science as a research paradigm in IS studies.

2.3.1 Research Paradigms

The researcher's objective in this study is to discover new knowledge in the chosen field of inquiry by using a systematic and organised strategy with the aim of enriching the existing body of knowledge with a new or novel contribution (Saunders, et al., 2012). To this end, the research journey started with careful deliberation of the choice of a topic, the domain of the research and a research paradigm (Johnson & Christensen, 2014; Saunders, 2009). Following from this, a research paradigm facilitates the ability of the researcher to choose an appropriate research strategy for gathering, analysing data in such a way that it scientifically provides an answer to the research question.

Paradigms are defined as "*sets of beliefs and practices, shared by communities of researchers, which regulate inquiry within disciplines. The various paradigms are characterised by ontological, epistemological and methodological differences in their approaches to conceptualising and conducting research, and in their contribution towards disciplinary knowledge construction* (Bunniss & Kelly, 2010, p. 360). Oates (2006, p. 282) defines a paradigm as "*a set of shared assumptions or ways of thinking about some aspects of the world*". In agreement, Nieuwenhuis and Maree (2007) state that words (concepts, terms and symbols) are the only tools available for communicating meaning, therefore, paradigms can be described as lenses through which reality is interpreted. Guba and Lincoln (1994), describe paradigms as basic belief systems based on ontological, epistemological and methodological assumptions. Four of these assumptions are discussed below in order to give a meaningful context to different paradigms employed by researchers.

Ontology is concerned with the nature of reality (Creswell & Clark, 2011). It is concerned with finding answers to questions such as "what assumptions are being made about reality" (Creswell & Clark, 2011). The philosophy behind ontology is describing whether reality is existent because of natural laws (objectivism) or a construction of the human mind and experience (constructivism) (Krauss, 2005). In this study, the researcher, by means of questionnaires, investigates the perspective of employees of government departments in the Eastern Cape Province to decipher their understanding, procedural knowledge and routine practices regarding data governance.

Epistemology is the philosophy of how the knowledge of reality is derived (Saunders et al., 2012). The authors describe this as a philosophy of what constitutes acceptable knowledge in a given field of inquiry. Epistemology takes into account the sources of knowledge, methods

of inquiry, and the limits of what can be known (Easterby-Smith, Crossman, & Nicolini, 2008). This research study employs information systems tools such as web-based questionnaires as well as the traditional data collection method of focus group activities to interact with the context of the research in order to decipher what can be known in the data governance domain within Eastern Cape government departments.

Axiology is the philosophy of how values influence the perception and interpretation of realities (Saunders, et al., 2012). This study examines and discusses some of the relevant existing biases and interpretations regarding data governance particularly in public enterprises.

Methodology is concerned with the various tools that are used to collect and analyse data in the attempt to find answers to the research question (Cooper & Schindler, 2010). These tools must be systematically engaged before any generalisation can be made from the research results. The next section of this chapter discusses research paradigms and the choice of the Pragmatist paradigm for this study. There are four widely acknowledged research paradigms in literature (Cooper & Schindler, 2010; Bunniss & Kelly, 2010). These are namely; positivism, realism, interpretivism and pragmatism. The four paradigms are discussed below:

(1) Positivism

Positivism is the epistemological position of the natural scientists (Upadhyaya, 2013). The paradigm is principally associated with the philosophical ideas of French philosopher, Auguste Comte (Upadhyaya, 2013). Comte contends that knowledge is defined by empirically verifiable and measurable observation. The positivist paradigm relies on the ability to form hypotheses, test them on the current social order and thereafter predict events based on existing patterns and relationships. According to Saunders et al. (2012), the main advantage of positivistic research is that the researcher does not in any way influence the research as the measurement and analysis are devoid of his 'feelings' thus ensuring or emphasising the credibility of the results. This epistemological stance is mostly popular in the natural science and engineering fields. The quantitative method of enquiry is more employed in positivism than the qualitative approach.

(2) Interpretivism

Interpretivism, also referred to as social constructionism, stems from the viewpoint that our knowledge of reality and the domain of human action is socially constructed by human actors

(Walsham, 2006). The goal of an interpretive researcher is to understand human behaviour in a social context. The positivist, on the other hand, seeks a rational explanation for situations. The purpose of interpretivism in Information Systems is to understand the social context of an Information System and how the social processes by which its development, construction and use are influenced by people and its social setting (Easterby-Smith, Crossman, & Nicolini, 2008; Oates, 2006). Interpretivism strives to find meaning and understanding in human behaviour. The interpretivist approach is often (although not exclusively) associated with qualitative research techniques, whereas the positivist approach is usually (again, not exclusively) aligned with quantitative techniques (Bryman, 2008). Collis and Hussey (2009) opine that interpretivism requires a qualitative approach because it refers back to `**how**' and `**what**' research questions. According to Saunders et al. (2012), the researcher aims to understand and interpret the feelings and opinions of the research subject for the purpose of deciphering meanings on his/her internal reality of subjective experience. Table 2.1 below details the main features of Positivism and Interpretivism.

Table 2.1: Features of Positivism and Interpretivism (Collins & Hussey, 2009)

Positivism	Interpretivism
Uses large samples	Uses small samples
Has an artificial location	Has a natural location
Is concerned with hypotheses testing	Is concerned with generating theories
Produces precise, objective, quantitative data	Produces rich, subjective, qualitative data
Produces result with high reliability, but low validity	Produces result with high validity, but low reliability
Enables results to be generalised from the sample to population	Enables findings to be generalised from one setting to another similar setting
Uses methodologies such as surveys, experimental studies and cross-sectional studies.	Uses methodologies such as case studies, grounded theory and action research.

(3) Realism

This paradigm essentially states that what our sense shows us as reality represents the truth of the situation (Saunders et al., 2012). In realism, the object has an independent existence outside the human mind. Additionally, in this paradigm, reality is both pre-interpreted and equally a positivistic approach. The paradigm further states that scientific study is both empirical and objective (Saunders et al., 2012).

(4) Pragmatism

Pragmatism as a worldview arose as a result of a concern with the practical application of what works best in a situation (Creswell & Clark, 2011). Pragmatism offers effective and applicable solutions to problems (Patton, 1990, cited in Creswell, 2014, p.10). The paradigm asserts that it is possible to work with contradictory assumptions regarding the nature of reality in order to find the best way of resolving the research problem. Pragmatism also states that a researcher may employ different methods in the way knowledge is best produced (Saunders et al., 2009, p. 109). Pragmatic researchers place emphasis on the research problem and use all approaches available to understand and resolve the problem (Creswell & Clark, 2011). According to Tashakkori and Teddlie (2010), pragmatism holds its value in focusing attention on the research problem and then using pluralistic approaches to derive knowledge about the problem. The philosophical basis of Pragmatism as a research paradigm is chronicled below:

- Pragmatism is not committed to any one system of philosophy and reality. In pragmatic research, the researcher is at liberty to utilise both qualitative and qualitative assumptions in engaging and dissecting the research problem.
- Researchers are free to choose the methods, techniques and procedures of research that best help in forging a well-rounded solution to the research problem.
- Pragmatists do not see the world as an absolute unity. Pragmatism is employed in mixed methods where the researcher needs to draw inferences from both the quantitative and the qualitative data in a single study (Cameron, 2011). Similarly, researchers engaged in mixed methods research use many different approaches for data analysis and collection, rather than focusing on a singular method i.e. quantitative or qualitative.
- Pragmatism states that truth is what works at the time. In mixed methods' research, which has a strong leaning amongst researchers employing the pragmatist paradigm, both quantitative and qualitative data are used as means of investigation as it is believed

they work to provide the best understanding of a research problem; Pragmatic researchers work on ***what*** and ***how*** to research based on the intended consequence. However, mixed methods' researchers need to establish a rationale of why quantitative and qualitative data need to be mixed in the first place; and

- Pragmatism opens the door to multiple methods, different worldviews, and different assumptions, as well as different forms of data collection and analysis. The pragmatist philosophy asserts that there is no single best 'scientific' method that can lead the way to indisputable knowledge (Creswell, 2014; Bunniss & Kelly, 2010; Guba & Lincoln, 1994).

Drawing inferences from the above, this study aligns itself with the Pragmatic paradigm. The study adopts Pragmatism which states that the research question drives what 'works' (Creswell, 2014; Teddlie & Tashakorrie, 2009). The justification for the choice of the pragmatic paradigm is based on the objective of the study, the sequential exploratory mixed method data collection and analysis, and the validation of the final artefact to be produced at the end of the study. The study proposes a data governance maturity evaluation model for the Eastern Cape Government Departments. To achieve this objective, the knowledge regarding what currently obtains in terms of data governance has to be co-constructed. Additionally, pragmatism is aligned to both the Contingency Theory and the Institutional Theory, both of which are the theories for this study. The Contingency Theory stipulates that there is no best or universally accepted way of organising a corporation, leading it, or making decisions (Weber, Otto, & Osterle, 2009). It stipulates that the best course of action in a given setting is dependent upon the prevalent internal and external situation of the context. To this end, as pragmatism seeks to unveil what parameters would work in the quest for building a useful and usable artefact for measuring data governance maturity in government departments, the contingency theory also justified the stated objective of the study as it advocates that finding the solution to the research problem needs a pragmatic approach which takes into consideration the prevalent environment of, in this instance, the Eastern Cape Government Departments. The Institutional Theory for IS, on the other hand, stipulates that the evolution of IT governance necessitates a focus on:

- how IT governance processes are actualised,
- the link between IT governance and performance and
- constantly changing requirements within an organisation.

All of these factors are crucial in order to align IT governance to the needs of the organisation (Jacobson, 2009). The data governance maturity evaluation model encapsulates all three focus areas of the theory mentioned in the first bullet; the model outlines a process-based approach to managing data assets and defines the steps involved in moving from one level of maturity to the next level; in relation to the second bullet, it provides the essential link between the use of technology to manage data and the reality of human resources as the drivers of such technological artefact; in terms of the third bullet, the model makes adequate provision for the dynamism in organisations, allowing for the alignment of constantly changing requirements with agility of design and an ability to respond to upcoming, unforeseen and unintended triggers of the design process. Pragmatism also aligns with the mixed method employed for data collection and analysis in the study. To this end, Pragmatism speaks to the Design Science methodology for solving the research problem with the construction of an artefact, which in this instance is the data governance maturity evaluation model through an iterative process. The sequential exploratory mixed method was used to gather qualitative and quantitative data in order to have a well-rounded understanding of the problem. The next section discusses the Design Science methodology employed for building the model which is the final artefact of this study.

2.3.2 Design Science as a Paradigm

Design Science is evolving as an accepted and widely used paradigm for Information Systems research (Peffers, Tuunanen, Rothenberger, & Chartterjee, 2008). As a paradigm, it provides a foundation for analysing design artefacts for the purpose of improving on the design aspects in such a way that the final artefact is fit for solving real life problems (Peffers et al., 2008). Design Science was first used in architecture and engineering literature by Buckminster Fuller who described it as a systematic form of designing (Krauss & Lichtenstein, 1999). It was later introduced to the Information Systems field by Herbert Simon as a "*logical search for satisfactory criteria that fulfils a specific goal*" (Huppatz, 2015, p. 116). In his widely acclaimed book, The Sciences of the Artificial, Simon (1996) states that in contrast to the natural sciences, that is, physics, chemistry and biology, there is a substantial source of knowledge that can be attributed from the human-constructed world of the artificial. Simon (1996) contends that the main difference between the natural sciences and the artificial sciences is that the former is concerned with truth and veracity while the latter is concerned with usefulness and contingency. According to Huppatz (2015), the influence of Simon in arguing

for Design Science as a problem-solving paradigm has expanded its use as a paradigm in Information Systems. The advocacy for Design Science to be recognised and acknowledged as a scientific method to artefact building has since gained wide acceptance, followership and continuous enhancement amongst IS researchers (Drechsler & Hevner, 2016; Huppatz, 2015; Peffers et al., 2008; Hevner et al., 2004). The reason is that the field seeks to create relevant and usable artefacts to solve real life problems. Table 2.2 below details some of the notable works which have used Design Science as a paradigm.

Table 2.2: Design Science as a Paradigm (Amrollahi, Ghapanchi & Talaei- Khoei, 2014)

Main contribution	Output focus	Design Science position	Reference
Defines "meta-artefacts" as way to enhance IS research	Research	Paradigm	Livari (2003)
DSR framework / seven guidelines for DSR / five evaluation methods	Artefact	Paradigm	Hevner et al. (2004)
Eight components of design theories	Theory	Paradigm	Gregor and Jones (2007)
Study of DSR in terms of ontology, epistemology, methodology and ethics	Research	Paradigm	Livari (2007)
Complimentary to DSR framework.	Artefact	Paradigm	Hevner (2007)
Methodology for DSR with six steps	Artefact	Method	Peffers et al. (2008)
General design cycle of DSR	Theory	Paradigm	Kuechler and Vaishnavi (2008)
Set of constructs and methods named design theory nexus for addressing ill-structured or wicked problems	Artefact	Method	Pries-Heje and Baskelville (2008)
Design-relevant explanatory / predictive theory for theory development	Theory	Paradigm	Kuechler and Vaishnavi (2012)

In spite of the interest in Design Science as a useful paradigm in IS studies, Amrollahi et al. (2014) opine that top academic journals only publish a few Design Science-based paradigm papers and argue that there is a need for the paradigm to become expansively more applicable to other scenarios, rather than to the context of the artefact for which it was designed. Hevner et al. (2004) contend that the design and evaluation of IT artefacts impact upon people,

processes and existing knowledge in the investigative domain. The authors, therefore, proposed the seven guidelines for Design Science which encompass a justification for the research and conclude with research communication. The next section discusses this study's adoption of the Pragmatic paradigm and the adoption of Design Science methodology in the design and validation of the final model for the study.

2.3.3 Justification of Design Science as the Research Methodology for this Study

Design Science is employed as the research design method for this study as it provides a comprehensive and well-rounded set of guidelines for the design, justification and evaluation of the proposed maturity model which is the final artefact for this study. Design Science is employed in IS research to solve real life and wicked problems by building artefacts that are directly applicable to the problem context (Venable, Pries-Heje & Baskerville, 2016; Johannesson & Perjons, 2012; Peffers et al., 2008; Pries-Heje & Baskerville, 2008). The Design Science method in IS research is prefaced on the formation of useful, usable and evaluative artefacts for the purpose of solving research problems (Peffers et al., 2008; Hevner et al., 2004). An artefact is something that is "artificial, man-made, as opposed to something that occurs naturally" (Simon, 1996). Artefacts are also described as "constructs (vocabulary and symbols), models (abstractions and representations), methods (algorithms and practices) and instantiations (implemented and prototype systems)" (Hevner et al., 2004). March and Smith (1995) describe constructs as vocabulary and conceptualisations which enable a researcher to communicate the description of the problem, the constraints in the problem domain, the components of the solution and present the objectives of the solution to its stakeholder audience. Models are thereafter used to represent the problem and its designed solution. The literature review has been used to communicate the problem of unstructured data governance activities in government departments of the Eastern Cape, the data governance maturity evaluation model has been proposed as a solution to the problem domain, with the relevant components and process checklist to ensure the model has a measurable path to better data governance.

From the definitions and arguments in favour of Design Science as a methodology for IS research, it is stated that the uniqueness of Design Science is that it addresses the **relevancy** gap in academic research, with particular focus on management and information systems research domains. The seven guidelines proposed by Hevner et al. (2004); six steps proposed

by Peffers et al. (2008); the three cycle depicted in Hevner's (2007) Design Science Research Design article; the FEDS process of Venable et al. (2016) for evaluating Design Science Research and the recently proposed four cycle model for IS research (Dreschler & Hevner, 2016) all attest to the emphasis on the relevancy and usability of artefacts in real life contexts. According to Vaishnavi and Kuechler (2015) and Zhang et al. (2011), Design Science forms a creative, novel and practical way of introducing innovative, unconventional but still scientific solutions to wicked organisational problems. The dynamic nature of improvements made to the Design Science methodology also testifies to the relevancy attribute of the method, as it continually responds to the changing nature of problems and knowledge areas in ensuring that researchers maximise the available guidelines in the construction and evaluation of artefacts. It can also be asserted that the steps undertaken by a researcher in building an artefact according to the Design Science Research Method (DSRM) ensure that they satisfy the criteria for scientific knowledge as they are informed by appropriate theories that explain or predict human behaviour. The key difference in Design Science is that the steps in the DSRM process ties back to the need, relevance and proven ability of the artefact to bring about a positive change to an existing problem by the application of the artefact that is produced via the design science methodology.

This justification also aligns with the Institutional Theory chosen for this study. According to Meyer and Rowan (1977), and extended by Jacobson (2009), the Institutional Theory for IS stipulates that the evolution of IT governance necessitates a focus on:

- how IT governance processes are actualised,
- the link between IT governance and performance and
- constantly changing requirements within an organisation.

All of these factors are crucial in order to align IT governance to the needs of the organisation (Jacobson, 2009). One of the ways to ensure the alignment of IT governance goals to the needs of the organisation is by delivering quality data which serves the information needs of the managers and enables them to make quality decisions. All of the three elements outlined in the Institutional theory are in tandem with the features of the Pragmatic paradigm.

Design Science is regarded as the 'best fit' methodology for this study. The methodology encompasses a rigorous process which involves the design of artefacts for the purpose of solving real life problems, thereby making a valuable contribution to the problem area and

communicating the results to the appropriate audience (Peffers et al., 2008). Research by Peffers et al. (2008); Johannesson and Perjons (2012) and Ahmad et al. (2011) are some of the works which outline detailed steps in the design and implementation of Design Science studies. The DGMEM is the novel contribution of this thesis to the body of knowledge in the data governance and information governance domain. The researcher's aim is the creation of a maturity model for data governance which can measurably improve data governance processes in government departments. To this end, it is important to ensure the rigour of scientific research is painstakingly adhered to throughout the entire process. To achieve this, an amalgamation of literature in the Design Science Process Models field was adapted for the purpose of this study. These and their application to this study are discussed in the next section.

2.4 Design Science Process Models

There are various academic papers offering perspectives on DSRMs (Gregor & Hevner, 2013; Peffers et al., 2008; Hevner et al., 2004; March & Smith, 1995). As different authors build upon the framework proposed by March and Smith (1995), the consistent themes that have emerged in the Design Science domain are:

- Artefacts could be in the form of constructs, models, methods and instantiations;
- Artefact research activities include: theorise, build, evaluate and justify.

According to March and Smith (1995), the building and evaluating process depicts Design Science intent while the theorising and validating part depicts the Natural Sciences. The seven guidelines proposed by Hevner et al. (2004) as an Information Systems Research Framework (ISRF) encapsulate these activities and are now presented below.

2.4.1 Hevner et al. (2004) Design Science Guidelines

The seven guidelines of Design Science attributed to Hevner et al. (2004) were considered pertinent in crafting the process of development and validation of the artefact. The seven guidelines of a Design Science research project and its applicability to this study are summarised in Table 2.3 below.

Table 2.3: Design Science Guidelines and Application to this Study (Informed by Hevner et al., 2004)

	Guideline	Description	Application
1.0	Design as an Artefact	Design Science research must produce a viable artefact in the form of a construct, a model, a method, or an instantiation.	The objective of the study is to produce a Data governance maturity evaluation model for the Eastern Cape Government Departments.
2.0	Problem Relevance	The objective of Design Science research is to develop technology-based solutions to important and relevant business problems.	Extant literature in this area of study has shown that effective data governance enables an organisation to maximise the values derivable from accurate, verifiable and current data in their fiscal, operational and performance planning. Critical decision-making and strategic planning are also dependent on correct information, which is derived from accurate data.
3.0	Design Evaluation	The utility, quality and efficacy of a design artefact must be rigorously demonstrated via well-executed evaluation methods.	The model is based on an iterative process whereby relevant data is gathered, processed and the quantitative strands of data collection was used to validate the model.
4.0	Research Contribution	Effective Design Science research must provide clear and verifiable contributions in the areas of the design artefact, design foundation, and/or design methodologies.	The contribution of this study is the Data Governance Maturity Evaluation Model; this will add value to the existing body of knowledge in the area of data governance within public enterprises and government departments.
5.0	Research Rigour	Design Science research relies upon the application of rigorous methods in both the construction and evaluation of the design artefact.	The research employed ethical and validated methods for data collection and analysis. The instrument of data collection were questionnaires and focus group discussions.
6.0	Design as a Search Process	The search for an effective artefact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.	Questionnaires/Focus group discussions were used to gather primary data for the study. Research findings were validated through a triangulation of all data sources.

	Guideline	Description	Application
7.0	Communication of Research	Design Science research must be presented effectively both to technology-oriented as well as management-oriented audiences.	Research outcomes are being communicated to the Stakeholder community, Data Governance practitioners and academia via conferences, workshops and journal publications.

According to Hevner et al. (2004), researchers must use their creative skills and judgement to determine the best and most practical way of applying the guidelines in a specific study. Design Science Guidelines outlined by Hevner et al. (2004) are now discussed as they apply to this study.

Guideline 1: Design artefact

An IT artefact is defined as "*an entity/ object, or a bundle thereof, intentionally engineered to benefit certain people with certain purposes in certain contexts. It is developed, introduced, adopted, operated, modified, adapted, discarded and researched within contexts and with various perspectives*" (Zhang et al., 2011 p.3). This study has embarked on an in-depth review of extant literature in the area of data governance maturity evaluation models. The principles of IT Governance in COBIT 5, ISO/IEC 38500 and the Contingency and Institutional theories were applied to the literature in order to come up with a conceptual data governance maturity evaluation model for the Eastern Cape Government Departments. The final artefact and output of this research is thus a well iterated, tested and validated model capable of solving the real problems presented by the lack of data governance in government departments in the Eastern Cape Province, South Africa.

Guideline 2- Problem Relevance

This guideline speaks to the specific research problem being investigated and seeks to justify the value of the solution to the subject or domain area. The purpose of Information Systems research is to address the problems and opportunities arising from the interaction between people, information technology and organisations. The need for data governance in government departments has been made apparent in chapters 3, 4 and 5 of the study.

Guideline 3- Design Evaluation

The purpose of design evaluation is to compare the objectives of the solution to the research problem with the observed results from the demonstration of the artefact (Peffers, 2008). The efficacy, quality and relevance of the artefact has to be rigorously tested in the evaluation phase through a scientific and approved scientific method. The conceptual DGMEM was developed from secondary literature, and refined through several iterations involving questionnaires, and focus groups amongst stakeholders in government departments of the Eastern Cape. The final artefact was thereafter presented in Chapter 10.

Guideline 4- Research Contribution

The main objective of the study is to produce a Data Governance Maturity Evaluation Model for measuring the maturity level of data governance in the Eastern Cape Government Departments. The model proposes a clearly outlined process-based approach to data governance which will assist the departments in moving from one maturity level to an improved level. The implementation of this process-based approach will help in ensuring the accuracy, validity and completeness of data within the departments, thereby ensuring accuracy of information which is based on these data sets.

Guideline 5- Research Rigour

Design Science advocates the application of rigorous research methods to the application and evaluation of the artefact (Hevner 2004). To this end, Johannesson & Perjons, (2012) and Peffers et al. (2008), declare that the Design Science researcher must employ diverse means of formulating, and subsequently, testing the artefact. They advocate that this starts from the research methodology. For this study, a content analysis of secondary data was carried out in chapters 2 to 5. This was done in the search for a conceptual data governance maturity evaluation model. The research methodology for the study included questionnaires, focus groups and triangulation of the three data sources to validate the model. The data collection was done by a mixed methods approach and triangulation was used to rigorously analyse the results of both the qualitative and quantitative data.

Guideline 6- Design as a Search Process

The artefact in a Design Science project goes through several iterations (Gregor & Hevner, 2013; Hevner et al., 2004). The purpose of these iterations is to ensure that an optimal and

usable solution that solves real-life problems is achieved by the final artefact. At the centre of a Design Science study is the discovery of an effective solution to the research problem. In this study, the model was refined iteratively based on findings from the analysis of empirical data collected from the departments.

Guideline 7- Research Communication

Hevner et al. (2004) assert that research outcomes must be published and communicated in journals, workshops and conferences in order that the community of practitioners in the domain, as well as other researchers in the field, can take advantage of the solution offered by the final artefact. Also, it is important that the outcome is published in order to allow for scientific reviews which may offer new insights that would develop the original contribution further. A conference paper has already been published from the research. The results of the final artefact have been submitted to an academic journal for publication. A copy of the thesis will be made available at the Fort Hare University library and online at the university's digital repository. The steps described in the 7 step guidelines are diagrammed in Figure 2.1 below.

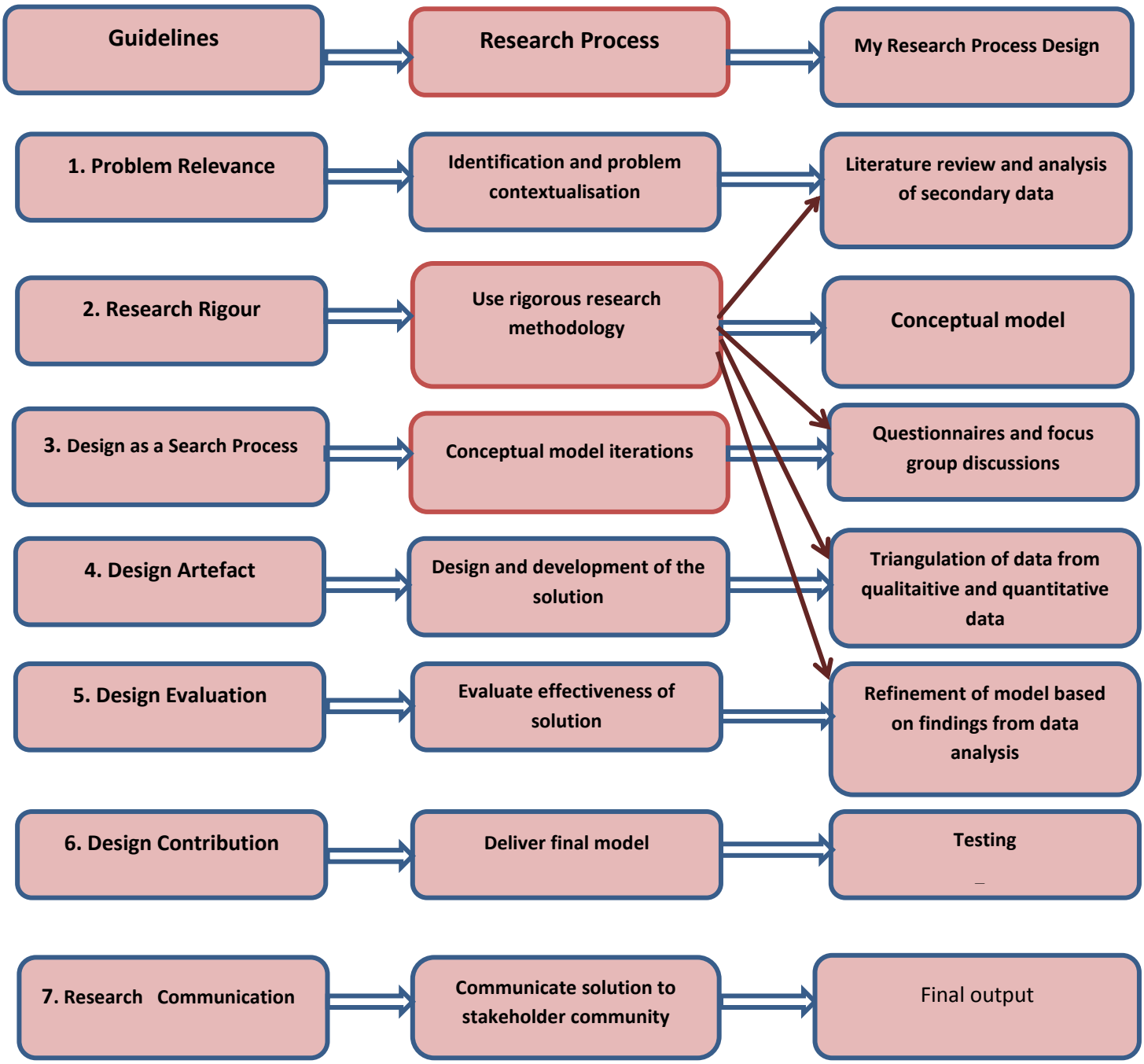

Figure 2.1: Application of Design Science to this Study (Informed by Hevner et al., 2004)

To further strengthen the argument for the dynamism, relevance and usability of a Design Science artefact, the four cycle view of Design Science research was proposed by Drechsler and Hevner (2016). This is discussed below as it relates to this study.

2.4.2 The Four Cycle View of Design Science Research

The four cycle view of Design Science Research builds upon the established three-cycle view postulated by Hevner (2007). The three cycles comprise the rigour cycle, the relevance cycle and the design cycle. The relevance cycle is a clear indication of the research problem, the requirements for a solution and the criteria for the artefact's credibility or utility value. The rigour cycle speaks to the grounding of the artefact in known theories and extant literature, experience and practicality of what works and what does not, in the context of the artefact. At the centre of the relevance and rigour cycles is the design cycle, which encompasses the building and evaluation of the artefact. The three cycle view is depicted in Figure 2.2 below.

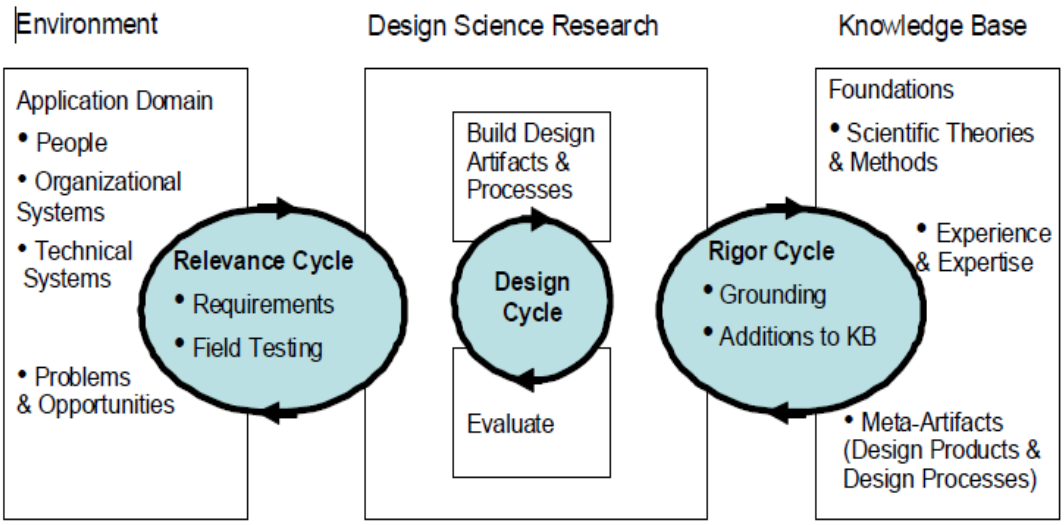

Figure 2.2: Design Science Research Cycles (Hevner, 2007)

As a result of more recent literature which highlights the dynamic and increasingly complex nature of IS research and necessitates an agile approach to the design process, Drechsler & Hevner (2016) presented a fourth cycle to the initial three cycle view of Design Science research process. The additional cycle, categorised as the change and impact cycle (CI) is diagrammed in Figure 2.3 below.

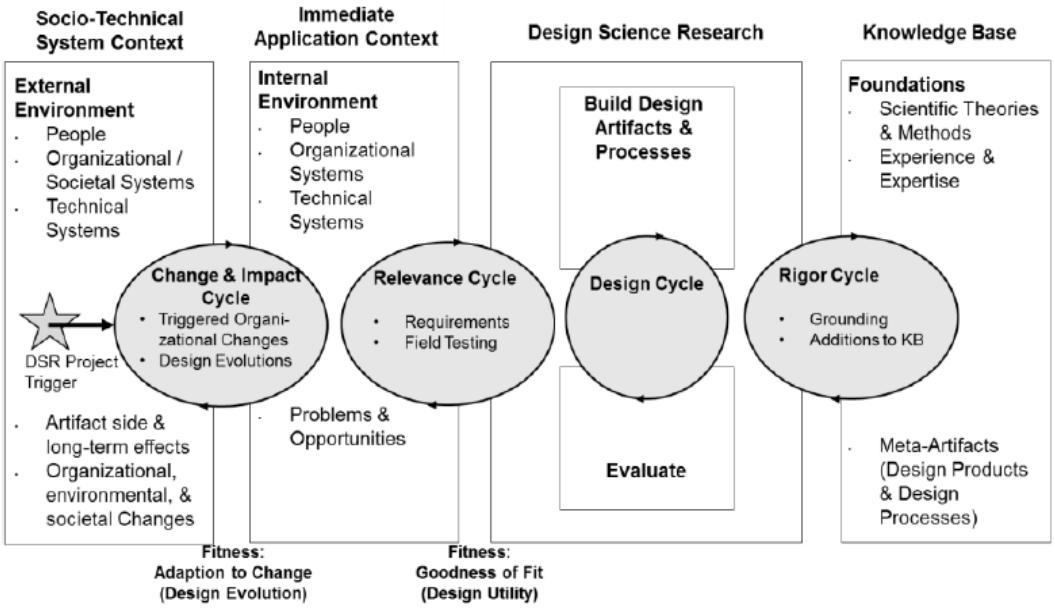

Figure 2.3: A Four Cycle view of Design Science Research (Drechsler & Hevner, 2016)

From the diagram, it is asserted by Drechsler & Hevner (2016) that the current state of IS research requires the researcher to consider the secondary impact of the artefact on the external, wider organisational context beyond the sphere of its immediate application. The implication of the fourth cycle is that the researcher has to distinguish the immediate application context from the wider impact it can possibly have on the socio-technical environment where it is applied. It is also important to consider how the artefact can serve as a trigger for a business, government or enterprise process chain. This fourth cycle is directly relevant to this study as it is believed that the successful creation, testing and implementation of the DGMEM will be a trigger for effective data governance, not only in the Eastern Cape, but throughout the government departments of the Republic of South Africa. This assertion is based on the emergent information from the IT governance literature available in the Eastern Cape Provincial Government Departments (DPSA, 2015; OTP, 2015). Both of these government policies were discussed extensively in chapter 4 of this study. The narrative from national and provincial governments is the desire to effectively manage IT resources, information governance and information security through COBIT. The policy documents accessed by the researcher further confirm this desire (DPSA, 2015; OTP, 2015). In spite of this stated aspiration, not much is being done to actualise the implementation of the required processes towards achieving this aim as the government does not seem equipped with the manpower, knowledge capabilities and resources necessary to achieve this. This study has consistently argued for the criticality of data governance at the base of any information governance in order

for the government to have an accurate, valid and complete foundation for fiscal planning. It, therefore, becomes crucial that the artefact is able to respond to the need in government departments for accurate and verifiable data processes in order to maintain its relevance. In the same vein, the Auditor General's report on Eastern Cape departments, in particular has been consistently negative (APP, 2014). One of the reasons for this low scoring is the lack of evidence-based data governance in the departments. The absence of a process-based approach to data governance has led to the challenge of presenting the Auditor General's team with valid and verifiable information for audit purposes. It is opined that one of the effects of a successful data governance maturity evaluation model in this environment is the capacitating and equipping of government workers on different levels to recognise and manage data as a critical organisational asset. To this end, one of the vital attributes of the artefact must be simplicity of use. The data governance maturity checklist aligns with the ease-of-use attribute, as the applicability to a wider socio-technical audience will include its use by the lower-skilled staff of government departments who may not be familiar with the technicalities of IT governance and related artefacts. The design of the model also ensures that it is generalisable and able to meet real world demands, process improvement and organisational change within the ambit of its subject domain. The next section discusses the application of the DSRM process of Peffers et al. (2008) to this study.

2.4.3 Peffer et al.'s DSRM Process and its application to this research

Although the seven guidelines for Design Science research have already been adapted for this research, it is pertinent to discuss the fit of the artefact for solving the research problem in accordance with the process of evaluating the artefact. The process of evaluation and validation is important for an instantiated artefact in IS research as it helps to testify to the efficacy, relevance and usability of IS artefacts in the context of the "real world" (Prestopnik, 2013). Design Science deals with how a problem-solution domain can be modelled and evaluated through the creation of artefacts (Vaishnavi & Kuechler, 2015). Peffers et al. (2008) opine that the final objective of a DSRM process is the provision of a "mental mode" of the characteristics of a research output. The authors describe a mental mode as a small scale model of reality that can be constructed from "*perception, imagination, the comprehension of discourse and are akin to architects' models or physicists' diagrams in the sense that their structure is analogous to the structure of the situation they represent, unlike the structure of logical forms used in formal rule theories*" (Peffers, et al., 2008, p.10). It is also important to evaluate the practical

value and contribution of Design Science research. Thus, problem identification and motivation of the artefact is the relevant entry point at which Peffers et al. (2008) are employed for the purpose of this study. The DSRM process and the relevant entry point for this research are diagrammed below.

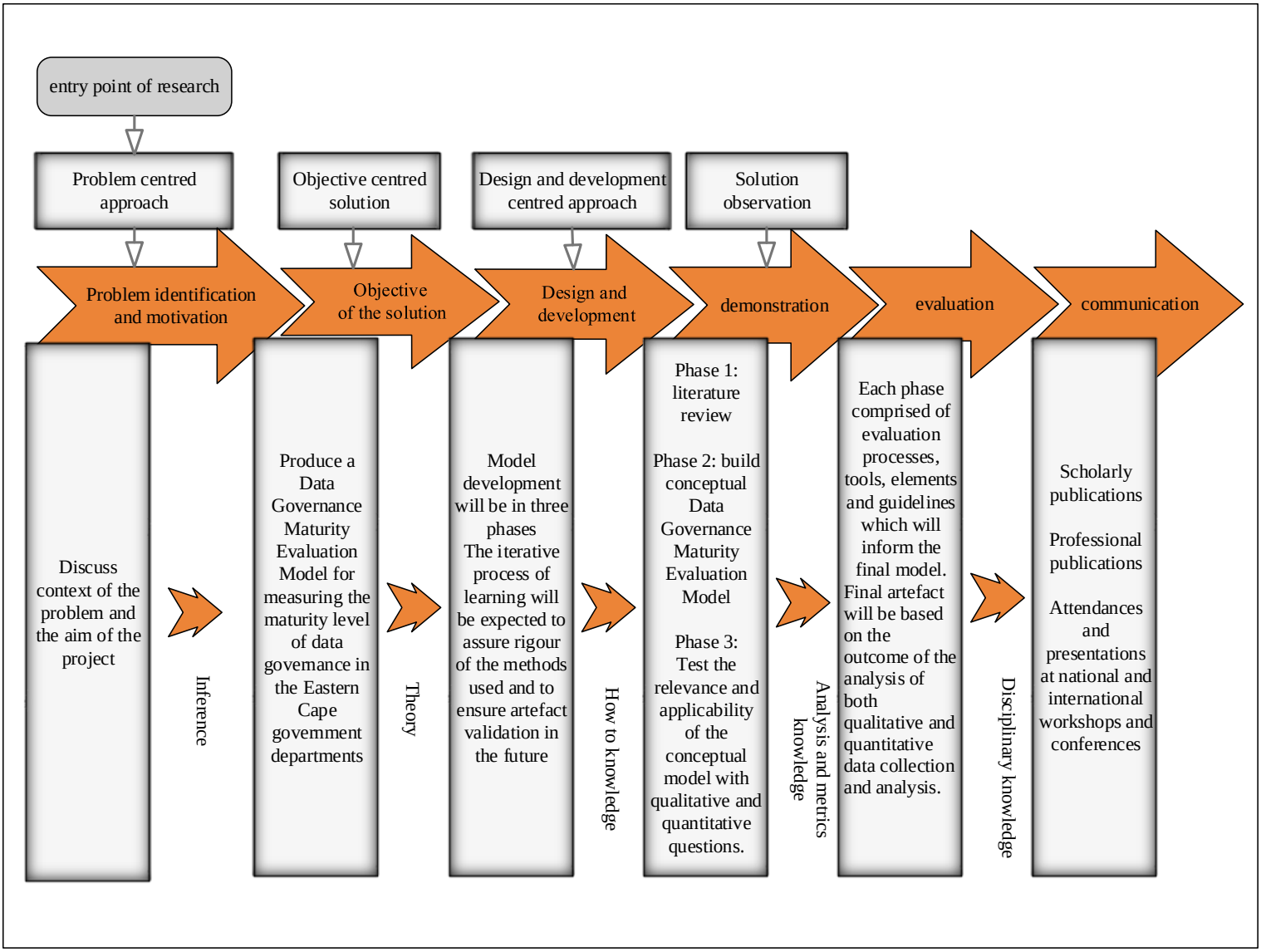

Figure 2.4: Application of Peffers et al.'s DSRM Process to this study (Peffers et al., 2008)

From Figure 2.4 above, this researcher depicts the problem identification and motivation process as the entry point at which Peffers et al.'s (2008) research process was employed for the study. As stated in chapter 1 of the study, the data governance maturity evaluation model is the output of this research. Hevner et al.'s (2004) seven guidelines have been used to highlight the entire design process for the artefact. Chapter 4 engaged in an in-depth discussion of the problem context and motivated the need for a solution with the aid of secondary literature and the needs analysis data. The remaining five processes of Peffers et al. will be subsequently

applied to the entire research. However, emphasis is placed on Step 4 and Step 5 of the process for this research (Figure 2.4) as they further strengthen and enhance the credibility, relevance and applicability of the model. Step 4 is the demonstration of the artefact. This was achieved by making the conceptual model and its process document available to 50 participants to test its relevance at the quantitative data collection phase of the study. These participants were drawn from seven Eastern Cape Government Departments. The components of the artefact were tested against the work processes relating to data capture, data usage and data archiving in the these departments.The final model is based on the feedback from the analysis of data. The evaluation criteria were based on the ease of use, relevance and applicability of the artefact in solving the problem of data governance within government departments of the Eastern Cape. The questionnaire required an evaluation of the artefact with regard to its contingency and pragmatism for the chosen context; thereafter, requisite changes were made to improve the model and ensure its relevance in offering real life solutions to data issues in the departments. Chapter 10 discusses the evaluation in greater detail. The next section describes the study's approach to theory development.

2.5 Approach to theory development

Saunders et al. (2016) state that the process of research entails two possible approaches, namely, induction and deduction. Induction is defined as "*the formation of a generalisation derived from the examination of a set of particulars, while deduction is the identification of an unknown particular, drawn from its resemblance to a set of known facts"* (Khalid et al., 2012, p. 4).

In the inductive approach, the researcher moves from a specific observed viewpoint to broader, general ideas or theories where patterns and themes are identified from the phenomena and utilised to formulate a set of hypotheses. These are thereafter tested, leading to the development of theories and conclusions (Troachim, 2006). In the deductive approach, propositions and theories are generated in advance of the research process, these are then adjusted or changed in accordance with the results of the empirical research conducted to falsify or validate them (Troachim, 2006). The characteristics of the two approaches are depicted in Table 2.4 below.

Table 2.4: Characteristics of Inductive and Deductive Approaches

Characteristics of Inductive and Deductive Approaches	
Deductive approach	**Inductive approach**
Quantitative in nature	Uses qualitative approaches
Uses a top-down approach	Uses a bottom-up approach
Based on post-positivism	Based on interpretive and critical systems
Tests theory against data	Generates theory from data
Moves from general to specific	Moves from specific to general
Allows generalization	Analyses meanings that participants encounter through experience
Works with variables	Research context is investigated
Works on hypotheses to test data	Less concerned with need to generalise

[Informed by: Hasse-Biber and Leavy (2011); Saunders et al., (2012)]

For the purpose of crafting a data governance evaluation maturity model for the departments of the Eastern Cape, this study chose an inductive approach. A conceptual model was developed from extant literature and refined through an exploratory sequential mixed methods data collection and analysis process. The components of the conceptual model were thereafter tested by means of known research methods.

2.5.1 Methodological choice for Data collection

Researchers made use of different data collection instruments for the purpose of gathering information to address the research question. The process by which secondary data was collected for this study is discussed below:

2.5.2 Secondary Data Collection: Literature Review

Literature review refers to the analysis of existing documents which contain information about the research problem and the subject domain. Secondary data is information that has been previously gathered about the topic, but not for the specific study at hand (Wild & Diginnes, 2013). The purpose of the literature review is to provide insight into possible ways of answering the research question (Olivier, 2009). Literature review is categorised into secondary and primary, these are described as follows:

Primary literature: This is also referred to as grey literature. These include sources such as position papers, white papers, reports, industry policies and minutes of congregational meetings on the subject area.

Secondary literature: refers to formal writings about the subject matter. These include conference papers, academic journals, books and newspapers among others (Saunders et al., 2012).

For this study, the four steps specified by Kumar (2014) in conducting a literature review were followed. The steps are stated below:

1. Searching for extant literature in the area of data governance and maturity models.
2. Selection of relevant, scientific and frequently cited literature in the area of data governance and maturity models.
3. A review of the literature selected from Step 2 above and the development of a theoretical maturity model based on the review of current and relevant literature.
4. Developing a conceptual data governance maturity evaluation model through a series of activities already outlined in Chapter 1 of the study (Kumar, 2014; Okoli & Schabram, 2010). The PRISMA statement is used to highlight the methodological process by which the literature study was conducted. The next section discusses the PRISMA statement and its application to this study.

2.6 Evaluation of Secondary Data

In the context of a scientific study of this nature, the information obtained from different secondary sources must be evaluated in terms of quality, content, usability, presentation and cost (Wild & Diginnes, 2013). Due to the fact that secondary data is not collected specifically to solve a particular problem, a researcher has to use a certain level of judgement and logic to evaluate the suitability of secondary data for the study at hand (Wild & Diginnes, 2013). The researcher must critique the various sources, seek expert opinion, and determine the instances of citations and references to the key documents before the choice of secondary data for a study. This is important as the findings and final results of the study would be impacted by the materials used to generate a conceptual model. The process of evaluating the secondary data and the choice of articles, white papers, conference proceedings and reports to include in the final texts selected for the study are detailed in the PRISMA statement.

2.6.1 Application of the PRISMA Statement to the Literature review for this study

The PRISMA statement is used to contextualise and detail the approach by which authors chose the contents that were relevant for a study and how these were employed in order to reach a scientific conclusion. The PRISMA statement was originally developed for the reporting and writing of medical reviews in the United Kingdom (Moher, Liberati, Tetzalaff, Altman, & Prisma Group, 2009). It was considered essential that a researcher should have a set of processes or procedures that were followed in undergoing a systematic review which can be verified or validated scientifically. It is asserted that the conduct and successful outcome of a systematic review depend, to a large extent, on the scope and quality of the literature included in the study.

The relevance of the PRISMA statement to this study (Figure 2.5) is that it serves to underpin the steps taken by the researcher to undergo a systematic review of the literature. This thereafter sets the rationale for the conceptual DGMEM. A content analysis of data governance articles and maturity models was done using the recommended steps in the PRISMA statement (Moher, Liberati, Tetzalaff, Altman, & Prisma Group, 2009). This was considered expedient in order to expound a scientific foundation for the study. A content analysis of recent and relevant literature was carried out, with the aim of determining the components of an effective data governance programme and elucidating the determinant steps for each of the maturity levels. The task was made possible by the comparison of seasoned, frequently cited literature on maturity models and data governance processes which are known and practised internationally. Among these were frameworks such as COBIT 5, ISO/IEC 38500, the Data Governance Institute maturity model, the IBM maturity model and a number of authors considered as experts in the data governance domain. The essence of this exercise was to ensure that the conceptual model had the relevant elements required for a successful data governance programme and used the right measurement and parlance for measuring the department's maturity levels. This methodology ensured that the conceptual model had a scientific foundation and made it easy to ask the right questions at the stage of crafting both the qualitative questionnaire and the final quantitative questions for the purpose of validating the model.The PRISMA process for this study is diagrammed below:

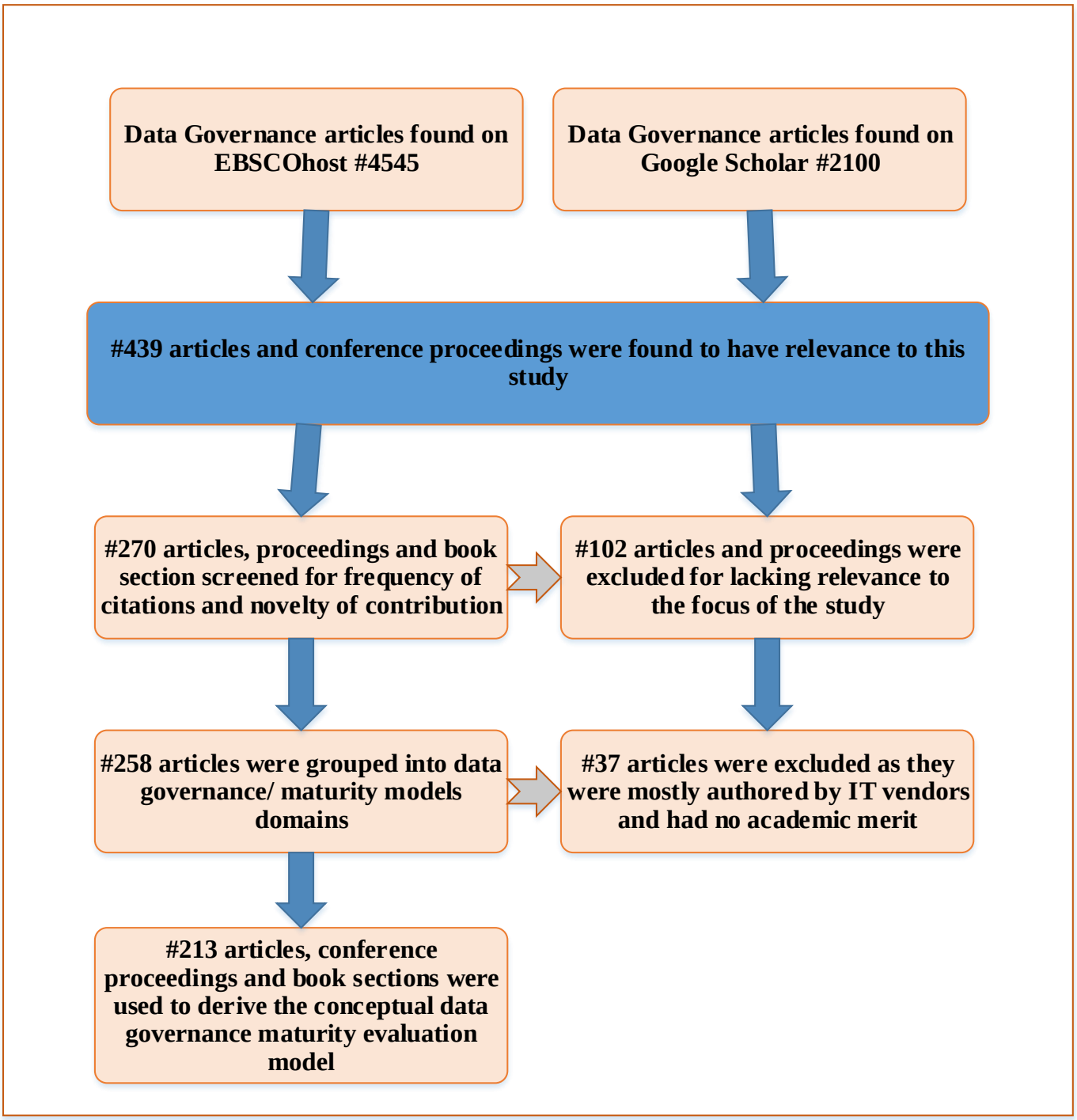

Figure 2.5: Application of the PRISMA Statement to this Study

2.6.2 Primary Data Collection method for this study

Due to the nature of the study, which is to develop and produce a model which can be used to measure data governance maturity in EC government departments, the study conducted an extensive collection of data in the set context. This was considered critical as the peculiarities of this context must be taken into account in the process of building the research artefact, in this case the DGMEM. Data collection, analysis and presentation were in four phases of the study. The phases are explained in this section and diagrammed on Table 2.5, Section 2.7.1.1 of this chapter.

The first phase of primary data collection was by means of a quantitative questionnaire for the purpose of conducting a Needs analysis for the study, the justification for this is provided in Section 4.4, Chapter 4. The questionnaire instrument consisted of seven pivotal questions on the awareness of data governance in the department (appendix B). The questions were informed by the literature review and derived from Stanford University's (2015) data governance awareness questionnaire instrument. The second phase was the administration of a qualitative questionnaire to participants in four departments in the EC (appendix C). This was done after a conceptual model had been constructed from the literature (Figure 6.2, Chapter 6). The purpose of the questionnaire was to test the relevance of the constructs in the model to the context of the study. The questionnaire also assisted in confirming the required components of a data governance programme and established a checklist of features which can determine the various maturity levels and how this can be scientifically evaluated. An online questionnaire hosted on Google Forms was distributed to 45 participants mostly CIOs, directors, data handlers and strategic managers in the EC government departments. The rationale for this choice is that governance is a strategic matter. A 55.5% response rate was achieved. The initial set of questions for the qualitative questionnaire were piloted to fifteen participants from two departments and colleagues at the Information Systems department of the University of Fort Hare. The pilot study is further discussed in Section 2.6.4. Focus group discussions were subsequently held in three departments to further collect rich data for the qualitative stage of the study (appendix D). This is part of Phase 2 as the data collection at this stage was also qualitative and complementary to the qualitative questionnaire hosted on Google Forms.

The third phase of data collection was by means of a quantitative questionnaire instrument (Appendix E). This phase involved participants in the four departments where the first qualitative questionnaire was administered, as the participants were already familiar with the study and could give meaningful inputs regarding the model. Additional participants from three

other departments were also contacted and taken through the rationale for the DGMEM and its process document. An online quantitative questionnaire was distributed to 64 participants; 50 participants (76.5%) completed the questionnaire. The phases of data collection and other relevant details are depicted on Table 2.5, Section 2.7.1.1.

2.6.3 Survey instrument for this study: Questionnaire

A survey instrument is a method of "*collecting opinions, attitudes or previous experiences from a group of people by asking questions and tabulating their answers*" (Leedy & Ormrod, 2013, p. 183). A survey acquires information from a sample of a given population in order to be able to generalise about that population (Leedy & Ormrod, 2014). The questionnaire is considered as more economical and efficient to serve the purpose of generating rich knowledge in this context, hence its use for this study (Blumberg, Cooper, & Schindler, 2008, p. 278).

2.6.4 Design of the Survey Instrument

The questionnaire instrument was designed based on the components of data governance programme identified in the literature (Olivier, 2009; Blumberg et al., 2008). These were extensively discussed and reviewed in chapters 3, 4 and 5 of this study. Careful consideration was also given to the advice from Funchall (2011) and Olivier (2009) on the features of an ideal survey instrument. The suggested features are listed below:

1. Questions must be clear and unambiguous. Participants must be able to easily understand the questions and interpret them as intended by the researcher.
2. Questions must be short, with related concepts grouped together.
3. There must be no clutter or repetition in the questions in order to prevent confusion on the part of the participants.

The questionnaires were tested for compliance with these recommended features through the aid of a pilot study. This is discussed in the next section.

2.6.4.1 Pilot study

A pilot study was conducted to test the validity and trustworthiness of the questionnaire instrument in adequately addressing the research objectives. The pilot study was conducted between the 22nd February and 2nd of March 2017. Ten participants from two government departments and five participants from the academic community participated in the exercise. The motivation for using participants from government departments in the Eastern Cape is due

to the context of the study; it was important to ensure that the questions were relatable to this group of people as the actual questionnaire is primarily addressed to them. Participants were asked to determine whether the questions were simple, unambiguous and logical to their work context. The pilot study yielded the required results as the input of departmental participants and those in academia assisted in further refining the research instrument. A number of participants believed some of the questions regarding certain aspects of the conceptual model were too technical and may be difficult to understand for some departmental staff. The questions were thus further modified to enhance easy understanding without losing the intended meaning of the particular component. The final questionnaire was thereafter published on Google Forms on the 3rd of March 2017.

Thereafter, a quantitative questionnaire was used to test the relevance of the model (Appendix E). The purpose of this phase of data collection was to test the validity, usability and effectiveness of the model in the establishment of a data governance maturity evaluation model in a real life setting. In line with recommendations by Funchall (2011), a checklist of requirements to confirm each maturity level was also provided for the participants to review before completing the questionnaire (Table 6.1, Chapter 6). The quantitative instrument and results are discussed in Chapter 9 of this study. The next section discusses the focus group activities.

2.6.5 Focus Group Discussions

This study employed an exploratory sequential mixed methods approach for the data collection and analysis phase of the data governance maturity evaluation model. (Creswell, 2014; Nieuwenhuis, 2014; Wild & Diginnes, 2013). Based on the results of the qualitative questionnaire, it was decided that focus group discussions would further serve to enrich the data as some of the participants did not expantiate on their answers. Focus groups are a form of group interviews which are anchored on active communication between research participants in order to generate data about the phenomenon being investigated (Morgan , 2013). Although group interviews are often used simply as a quick and convenient way to collect data from several people simultaneously, with focus groups, the interaction between participants is part of the inherent benefits of the explicitly use group interaction as part of the method. Information sharing, even dissent of opinions which happens in focus groups, all serve to impact the depth of information collected for each activity (Acocella, 2011). The method is particularly useful for exploring people's knowledge and experiences and can be used to

examine not only what people think about the current phenomenon, but also typically generates data about how the phenomenon is perceived and what can be done to save the day. Details of participants in the focus group discussions for this study are presented in Section 7.1, Chapter 7.

2.7 Data Analysis

In qualitative data analysis, the overall inferences and meaning of data are considered to be more important than the meaning of its parts (Creswell, 2014). Quantitative data, on the other hand, is analysed using statistical and mathematical techniques in order to observe specific variables in a data set (Mouton, 1996, p. 169). The thematic analysis of qualitative data was carried out using the Nvivo software version 11 (NVivo, 2015). The choice of Nvivo was based on its ability to generate evidential and scientific themes from the data in such a way that associations and cross-conceptual relationships can be identified. Furthermore, there is an increased call in academia for qualitative data to show more scientific and auditable analysis of data (Broeder & Donze, 2010). The findings are presented in Chapter 7 and the implications in Chapter 8 of the study. The nodes generated from the Nvivo analysis are on the attached CD.

The data analysis for the quantitative phase of the questionnaire was conducted using the SPSS version 24 (IBM Corp, 2016). The data analysis consisted of both descriptive and inferential statistics (Cronbach's alpha and t-tests). The coefficient alpha was developed by Cronbach (1951). It is the most commonly used index for estimating the reliability of measurement instruments such as scales, multiple item tests, questionnaires, or inventories (Raykov, 2010). The test is widely used in the fields of psychology, education, statistics, sociology, medicine, counselling, nursing, political science, and economics (Cortina, 1993). Although there has been numerous debates regarding the sample size in quantitative studies, it has been established by Javali, Gudaganavar, & Raj, (2011) that a good quantity of internal consistency estimates is observed in survey samples of 50 or more participants. The researchers claim that for calculating the coefficient of internal consistency for five points scale or any, the sample size should be at least 50. This study thus qualifies to test the internal consistency of the questions through the Cronbach alpha.

The One Sample t Test is a parametric test which determines whether the sample mean is statistically different from a known or hypothesized population mean (Kim, 2015). As a parametric procedure, the one sample t-test makes several assumptions. Although t-tests are

quite robust, standard practice is to evaluate the degree of deviation from these assumptions in order to assess the quality of the results. The t-test makes four main assumptions: i.e. (1) the dependent variables are all continuous (interval/ratio), (2) the observations are independent of one another as it is assumed the data collection process was random. (3) all the dependent variables were approximately normally distributed as the Q-Q plots showed that the points were diagonal and (4) with the aid of boxplots, the dependent variables contained no significant outliers. Since one sample t test assumes normality which usually requires sample sizes >=30 (as a rule of thumb only), and the dataset for this study had 50 participants, it was used for inferential analysis in the data. Research affirms that using extremely small samples sizes for the one sample t test has no negative effect on the results (de Winter, 2013). Descriptive tests were thereafter done to derive meaning from the data collected. The results are presented in graphs and tables (Section 9.7, Chapter 9).

2.7.1 Data Triangulation

Triangulation of both the qualitative and quantitative data will be used to establish reliability and validity of the components of the model. Triangulation is done to ensure that the research design is strengthened and also to increase the ability to interpret the findings. Using more than one data method allows the finding from one method to be corroborated or questioned by comparison with data from another method. If consistency is shown in findings across methods, it creates a sense of increased confidence in the findings. Figure 2.6 below details the use of triangulation within this study. The process as applied in this study is discussed in Section 9.10, Chapter 9.

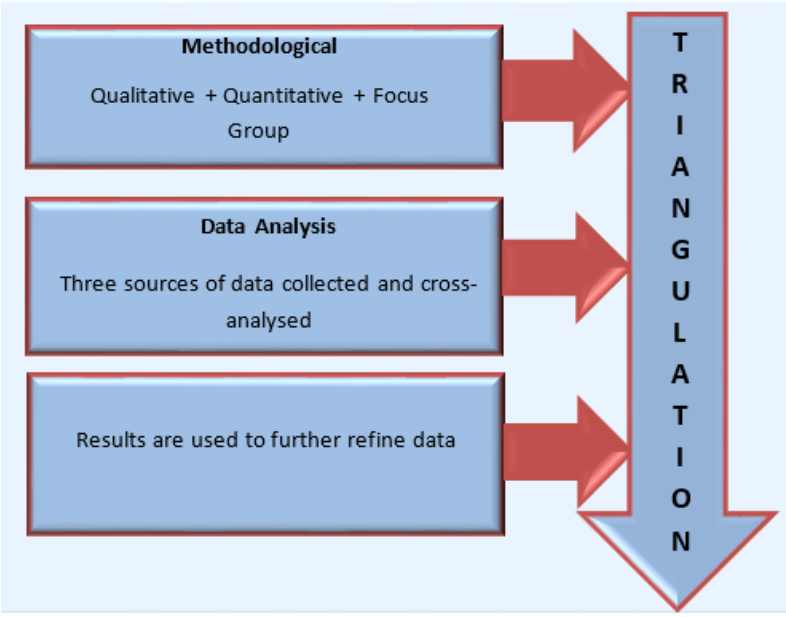

Figure 2.6: Forms of Triangulation Used in this Study

2.7.1 Sampling

Marshall & Rossman, (2008) describes population as the object for study which consists of events, individuals, institutions, groups of people, human products and the conditions to which they are exposed. For this study, the population comprises employees from seven departments in the Eastern Cape Province which may not be named for confidentiality's sake. These personnel are involved in data governance or management in one capacity or the other. Since it is difficult and impractical to engage with the entire population, a sample size was drawn to reflect the relevant sample of the department engaged in data governance and management. The following section examines the sampling procedure used in this study.

2.7.1.1 Sampling procedure

Sampling is the process of selecting a subset of the population to include in the study (Mpofu, 2013)**.** The sampling procedure is important in this study as it saves time, effort and money, while at the same time providing useful, reliable and valid results (Mpofu, 2013). According to Marshal and Rossman (2008), the preparation must include a careful review of the purpose of the study, the available resources, the nature of the population, research design considerations as well as ethical considerations. The sampling procedure employed in this study involved different phases, with each stage dependent on the projected outcome of the stage of inquiry. Table 2.5 below details the sampling procedure for all phases of data collection.

Data Collection Phase	Location in the thesis	Designation of participants	Relevance to Research question	Response rate	Mode of Distribution	Method of analysis	Evidence of data collection
Needs analysis	Section 4.4, Chapter 4	• CIOS • Directors • Strategic managers • Functional managers • Data capturers • Administrators	Due to the dearth of literature on data governance in government departments, this exercise was conducted to reinforce the need for this study	25/ 45= 55.5%.	Email and hard copies on request	Excel was used to generate Pie charts based on the responses	Needs analysis questionnaire instrument, appendix B
Pilot Study for qualitative questionnaire	Section 7.3, Chapter 7	• Staff of two government departments. • Colleagues at the Information Systems Dept, UFH.	The pilot test is a standard test conducted to test the understand ability and clarity of the research instrument.	15/15= 100%	E mail and hard copies	Careful consideration of the comments of participants and refinement of actual and final questions	No evidence as it was a test of the quantitative questionnaire's first draft.
Qualitative Questionnaire	7.6, Chapter 7	• Directors • Deputy Directors • Strategic managers • Senior managers • Data capturers • Administrators • Data was collected across four government departments	The test was conducted to establish the current data governance practices in the department. The components of the conceptual DGMEM, which was built from literature were used as themes in the questions	25/45= 55.5%	Web based questionnaire domiciled on Google Forms	Nvivo Version 11 was employed to find the themes and sub-themes, which were then explained thematically.	• Questionnaire instrument as appendix C • Excel spreadsheet showing raw data on CD(Appemdox E). Nvivo analysis depicting themes on CD(Appemdox E).
Focus Group Discussions	Section 7.7, Chapter 7	• Directors • Deputy Directors • Strategic managers • Functional managers • Data capturers • Administrators	This phase was conducted to further gather rich data about current data governance practices in the departments	Eleven participants from three departments	Appendix 3, facilitated by the researcher as an informal discussion.	Results were analysed thematically as presented on Table 7.3	• List of questions (appendix D)

Data Collection Phase	Location in the thesis	Designation of participants	Relevance to Research question	Response rate	Mode of Distribution	Method of analysis	Evidence of data collection
		Data was collected from 11 participants across three departments.					
Quantitative Questionnaire	Section 9.2. Chapter 9	• Directors • Deputy Directors • Strategic managers • Senior managers • Data capturers • Administrators Data was collected across seven departments of the Eastern Cape Province	This phase was conducted to confirm or disprove the applicability of the DGMEM, and to test the dependability of what had been found in the qualitative data.	50/64= 76.5%	Web based questionnaire on Google Forms	SPSS version 24 was used mostly to obtain descriptive statistics of the phenomenon under investigation.	• Questionnaire instrument (Aappendix D) • Excel spreadsheet showing responses to questionnaire on CD(Appendix E). • Presentation of SPSS results in tables and graphs (Section 9.2, Chapter 9)

Table 2.5: Details of Data Collection and analysis Phases (Source:Self)

The questionnaire for the needs analysis was distributed via e-mail and some hard copies were printed. The survey instrument for the both the qualitative and quantitative questions presented in Chapter 7 and Chapter 9 respectively were web-based questionnaires hosted on Google Forms. No Participant indicated a preference for hard copies hence no printed version of the questionnaire was required. The research strategy is discussed in the next section of this chapter.

2.8 Research strategy

A mixed methods approach of data collection was employed in this study. Qualitative research is defined as "the collection, analysis and interpretation of data that cannot be meaningfully quantified" (Wild & Diginnes, 2013, p. 87). Qualitative research emphasises meanings and inferences which cannot be measured or experienced experimentally in terms of quantity, amount, intensity or frequency (Denzin & Lincoln, 2011). Quantitative research, on the other hand, is defined as the use of mathematical models, statistical tables, and graphs in representing data. In quantitative research, objective theories and hypotheses are tested by the analysis of the relationship among variables (Creswell, 2014). These variables are measurable modes of data which are typically analysed using statistical processes.

Qualitative data (through open-ended questions and focus group discussions) and quantitative data (through close-ended questions) were utilised in data collection. A qualitative instrument was adapted to test the conceptual model developed from the literature. Thereafter, a quantitative instrument was developed to validate the usability and relevance of the data governance maturity evaluation model. The method of combining these two approaches is what qualifies the data collection phase of the research as multi methods. The following section discusses mixed methods and justifies its choice for this study.

2.8.1 Methodological Choice for Data collection and analysis: Mixed Methods

Mixed methods constitute the use of both the qualitative and quantitative research methods in a singular study (Creswell & Clark, 2011). This view is also supported by Saunders et al. (2016). In this study, this combination was employed to gather and analyse data. Integration of the two forms of data provided a more robust understanding of the research problem than a singular approach would have done (Creswell, 2014). Out of the six types of mixed methods designs observed by Creswell (2014), this study used the sequential exploratory design.

A mixed method consisting of both qualitative and quantitative techniques was used to identify factors that can assist the Eastern Cape Government Departments to measure their current level of maturity with regards to data governance in a scientific manner. This approach is increasingly popular in the field of IS as it addresses the interaction between humans and computers to achieve business goals. This is is a result of the complexities of human emotion, nuances and opinions regarding the IS tools used that cannot be quantified without due consideration of the context (Myers, 2013). To this end, an effective and representative investigation of the research problem for the study was done through a mixed method analysis of the findings of the study. This process is depicted in Figure 2.7 below.

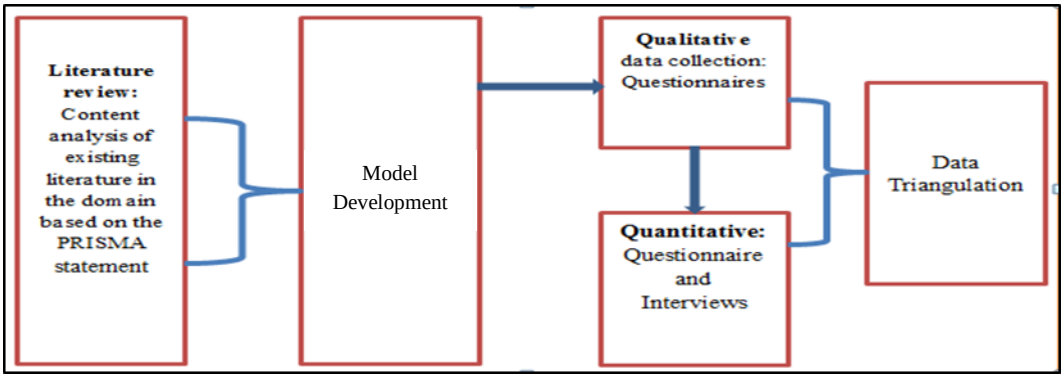

Figure 2.7: Exploratory Sequential Mixed Method Design for Model Development

2.9 Validation and Evaluation

The quality of a research can be evaluated by a number of criteria. These include objectivity, reliability, internal validity and external validity as suggested by Babbie (2008) and Oates (2006).

Objectivity: Although it is virtually impossible to totally eliminate bias on the part of the researcher due to his or her own experience, conceptualisation and worldview, it is important that an awareness of bias and influence be maintained throughout the study. For this study, the researcher ensured this awareness was kept in mind throughout the process of collecting and analysing data from the selected government departments of the Eastern Cape. This helped to maintain an objective viewpoint in writing up the research findings. Due care needed to be taken in this regard as the researcher interpreted the qualitative data, and the numerical nature of the quantitative study further ensured the objectivity of the research findings.

Reliability: Reliability refers to the repeatability of the study. The research method for this study has been carefully outlined in this chapter. The researcher committed to ensuring that

these outlined scientific and rigorously tested research methods were followed at every stage of the study. Additionally, the 7-step guidelines of Design Science, which is the research design for the model, enablds an independent researcher to easily replicate and test the validity of the study in order to verify if the same or similar results would be obtained.

Internal and External Validity: This is the extent to which the research findings are free from error and the measurements accurate. The careful deliberation of the choice of data collection instrument, the process of data collection and analysis all lend credence to the internal validity of a study. External validity refers to generalisability of findings: this is dependent on how representative the selected research samples are. The sampling procedure for this study was informed by Marshall and Rossman (2008), the designation of the representative participants assured both the internal and external validity of the study. The measurable validation and verification of the entire research is discussed in greater depth in chapter 7, 8 and 9 of this study. These chapters provide reasonable descriptions, explanations and interpretations, supported by the evidence of the data generated.

2.10 Ethical Considerations

"Ethics are norms or standards of behaviour that guide moral choices about our behaviour and our relationship with others" (Blumberg et al., 2008, p.179). Ethics serve to direct the action of the researcher throughout the process of conducting the study. Ethics also ensures the researcher goes about the study in a manner that is not harmful to the participants and that participants are fully aware of the rationale for the study (Blumberg et al., 2008). An ethical clearance form was obtained from the Ethics Committee of the University before the commencement of data collection. The principles of full disclosure, privacy of participants' demographic data and freedom to decline to answer any of the questions were upheld throughout the data collection process. An informed consent form was also provided for participants along with the data collection instrument. A robust discussion of ethical consideration guidelines followed in this study has been carried out in Section 1.9, Chapter 1.

2.11 Summary

This chapter laid out the research design and the research methodology. The choice of Pragmatism as the research paradigm was justified. This was followed by a discussion of Design Science, which was chosen as the research design for the conceptualisation, construction and validation of the data governance maturity evaluation model, which is the

output of this research. This was followed by a discussion of the method employed for the collection of both primary and secondary data, with an elucidation of the PRISMA statement as a means of ensuring the academic propriety and currency of reviewed secondary literature. Mixed method as the methodological choice of data collection and analysis for primary literature was discussed; followed by a discussion of the choice of questionnaires and interviews for data collection. Thereafter, the chapter touched on the importance of reliability and validity of the research methodology and the techniques used. It focused on the importance of data trustworthiness when dealing with mixed methods study. The chapter concluded with a discussion of the ethical issues that were considered pertinent to this study. The next chapter discusses the concept of governance, the importance of data governance and the components of an effective data governance programme.

Chapter 1
Introduction

Chapter 2

Methodology

Chapter 3
Relationship between Corporate Governance, IT Governance and Data Governance

Chapter 4

An analysis of current Data Governance Practices in the Eastern Cape Government Departments

Chapter 5

A discussion of Five Maturity Models relevant to this Study

Chapter 6

A Conceptual Data Governance Maturity Evaluation Model

Chapter 7

Presentation of Findings from the Qualitative Data

Chapter 8

Implications of Findings from the Qualitative Data

Chapter 9

Presentation of Findings and Implications of the Quantitative Data

Chapter 10

A Data Governance Maturity Evaluation Model for Government Departments of the Eastern Cape

Chapter 3: Relationship between Corporate Governance, IT Governance and Data Governance

3.1 Introduction

3.2 The Significance of a Literature Review

3.3 The Concept of Governance

3.4 Importance of Data Governance within Corporate Governance and IT Governance

3.5 Dichotomy/ Overlap between Information Governance and Data Governance

3.6 Emerging Global Trends in Data Governance Practices

3.7 Components of an Effective Data Governance Model/ Framework

3.8 Summary

3. Chapter 3: Relationship between Corporate Governance, IT Governance and Data Governance

3.1 Introduction

This chapter sets the context, rationale and importance of the review of extant literature in the data governance domain conducted in the next three chapters of this study. The primary objective of this chapter is to discuss the relationship between corporate governance, IT governance and data governance. The various regulatory and compliance frameworks which bind organisations to report a single version of the truth, have auditable and repeatable processes to govern the data which forms the basis of their information and these processes are discussed. The context for data governance as an essential component of today's organisational architecture is examined in this chapter. Furthermore, the current global atmosphere where stakeholders are more aware, have far-reaching rights and input on how the organisation is governed; and the continual risk of litigation and financial loss due to data theft or mishandling has compelled a scientific handling of "data as an asset" (Kushner & Villar, 2008). The dichotomy between information governance and data governance, emerging trends in data governance and the components of an effective data governance framework are also discussed in the chapter.

3.2 The significance of Literature Review

Review of secondary literature is an important component of any research work. The literature review establishes or contextualises fellow academics' findings and writings that have been documented regarding the study at hand (Okoli & Schabram, 2010). The following three chapters of the study are crafted to discuss in great depth and to a degree of critical appraisal, relevant and cited literature on data governance, and data governance maturity evaluation models and processes, both globally and in the South African context. The synthesis of the literature is expected to culminate in deciphering the relevance of such a model for government departments in the Eastern Cape as well as identifying the knowledge gaps which exist in the context of the existing literature and the unique positioning of this study (Thornhill & Van Dijk, 2010). The literature review will also form the basis and foundation of the conceptual maturity model. This process has been discussed in Section 2.5.2, Chapter 2).

In addition, a literature review for a doctoral thesis must reflect the critical thought process expected of an original research (Okoli & Schabram, 2010). The literature review should not consist of a regurgitation of what other researchers have said about the subject matter, but a critical analysis of available literature as it relates to the subject under investigation. An underlining guiding concept defines the direction of a literature review and dictates the critical areas the review has to address. In the case of a doctoral thesis, the researcher has an obligation to relate the literature review directly to the research question being investigated.

The purposes of a literature review for a doctoral thesis are thus summarised below:

- The literature review forms an anchor whereby the study is given a scientifically sound context.
- The theoretical framework and its components are identified and formulated from the literature.
- The justification for the domain or area of inquisition where the unique contribution of the study is made is explicated (Okoli & Schabram, 2010; Thornhill & Van Dijk, 2010).

For this study, the four steps specified by Kumar (2005) in conducting a literature review were followed. The steps for this literature review are stated below:

1. Searching for extant literature in the area of data governance and maturity models.
2. Selection of relevant, scientific and frequently cited literature in the area of data governance maturity evaluation models.
3. A review of the literature selected from Step 2 above.
4. Development of a theoretical maturity model based on the review of current and relevant literature.
5. Developing a conceptual Maturity model through a series of activities already outlined in Chapter 1 of the study (Okoli & Schabram, 2010; Kumar, 2005).

The steps outlined above are considered adequate and sufficient to provide a sound theoretical base for the study. In the context of this study, the purpose of a literature review is primarily to gain an all-encompassing understanding of existing positions, current research, philosophical standpoints, themes and components of maturity models especially for public enterprises regarding data governance. The secondary objectives of a literature review are to pinpoint a strong benchmark position from which to test the conceptual model (Pickering & Byrne, 2014). Furthermore, a maturity model is expected to present a set of processes which direct the

measurement of what is required for an organisation to move from one maturity level to another (Johannesson & Perjons, 2012). The ability to decide on which components to include or exclude for the Eastern Cape Government Departments before the actual testing of the model and processes through primary data collection are made possible by review of extant literature (Okoli & Schabram, 2010). To this end, it is opined that a literature review empowers the researcher to find scientific and verifiable ground for the development of a maturity model for data collection and validation. The remaining sections of this chapter lay the foundation for the model by examining some of the key concepts which underscore the need for, and the importance of, data governance.

3.3 The Concept of Governance

The concept of governance has become familiar within most organisations in recent decades (Ammann, Oesch, & Schmid, 2011). The failure and bankruptcy of businesses, such as Enron and other big corporations, served to highlight the threat faced by organisations where there were no adequate or measurable governance processes in place (Redman, 2008; Sarsfield, 2009). Furthermore, the economic meltdown and subsequent financial crisis experienced by most developed and developing economies forced governments across the globe to pay close attention to the underlying issues that constitute good governance for both public and private enterprises (Bahrman, 2011). Some of the factors driving the importance of governance within organisations are; (1) the ongoing global economic downturn, (2) the increased awareness of organisational stakeholders of their right to information and transparency, (3) greater value placed on organisational integrity by shareholders and clients, (4) the pressure to meet various legal and compliance requirements (OECD, 2015; IoD, 2015; Ammann, et al., 2011).

Studies by Ammann et al. (2011) and Bahrman (2011) indicate a very strong and positive link between corporate governance and the real and perceived value placed on an organisation. The studies show that leaders both in public and private enterprises are motivated to install and institutionalise a governance methodology which is measurable and can be graduated progressively in aid of sustainable business success and assurance of ethical practices for all stakeholders' sakes. In line with the foregoing, Soares (2016), Seiner (2014) and Khatri and Brown (2010) contend that the effectiveness of data governance is, to a great degree, dependent on sound governance principles or frameworks in an organisation. Since IT governance is a

subset of corporate governance, the next section of this study examines the importance of corporate governance within organisations.

3.3.1 Corporate Governance

Due to successive corporate failures and financial scandals, research into corporate governance has been at a frenzied pace in recent years (Rossouw & van Vuuren, 2013). Corporate governance is a broad, somewhat abstract concept, with different interpretations by different parties. The Organisation for Economic Cooperation and Development (OECD) defines it as "*a set of relationships between a company's management, its board, its shareholders and other stakeholders".* Corporate governance provides the structure through which the company's objectives are set, and the means of attaining those objectives and monitoring performance. The OECD stated in the 2015 updated version of the Principles of Corporate Governance that "Users of financial information and market participants need information on reasonably foreseeable material risks that may include: risks that are specific to the industry or the geographical areas in which the company operates; dependence on commodities; financial market risks including interest rate or currency risk; risk related to derivatives and off-balance sheet transactions;business conduct risks; and risks related to the environment" (OECD, 2015, p. 46).

In the South African context, the most prominent source of guidance with regards to effective corporate governance for organisations is the King Code. The Institute of Directors (IoD) describes corporate governance as the structure through which organisations are *'directed, controlled and held accountable'* (IoD, 2015). The first King Code on Corporate Governance was published in 1994 and received international acclaim as the most comprehensive code of corporate governance to be released. The code was reviewed in 2002, with the King Code II adopting a "comply or explain" stance regarding corporate governance. The King III Report, which was released in September 2009, and came into effect on the 1st of March 2010, details the expectations and responsibilities of business leaders across all corporate bodies in South Africa. The framework of rights, responsibilities, procedures and relationships amongst stakeholders within an organisation is defined by its corporate governance structure. The IoDSA submits that good governance is essentially about effective leadership. Leaders have a fiduciary duty to define strategy and to provide the direction for the ethics and values that guide business practices in a positively sustainable way (IoDSA, 2009). However, for the purpose of this study, corporate governance is defined as "*the set of responsibilities and practices*

exercised by the board and executive management in providing strategic direction, ensuring that objectives are achieved, ascertaining that risks are properly managed and verifying that the enterprise's resources are used responsibly" (IT Governance Institute, 2005, p. 23). This definition is chosen for this study as it aligns with the objective of the study; to produce a data governance maturity evaluation model which details the processes required to assure the correctness and validity of data; enable government departments to measure their maturity level with regards to the governance of data; thereby mitigating the risks associated with ungoverned data within the Eastern Cape government departments.

The principles of corporate governance can be summarised thus;

1. Good leadership, that shows integrity and structured direction in every strategic and operational area of running a company (IoDSA, 2009).
2. Ethical values of accountability, responsibility, fairness, transparency are as important as the financial health of an organisation (Rossouw & van Vuuren, 2013 Bahrman, 2011).

Internationally, the Sarbanes-Oxley Act of 2002 (USA) commonly referred to as SOX, focuses on internal control, requiring companies to follow a set of rigorous and legally binding processes when storing or processing sensitive financial and related data (Sarbanes-Oxley, 2016). The Act requires the board of directors to ensure compliance with laid down rules and regulations, and they are held accountable for the consequences of non-compliance.

Unlike the Sarbanes-Oxley Act which is rules-based, the King Code is principles-based (Deloitte, 2009). However, it is argued that the rules-based approach cannot be justified as more effective as the existence of SOX did not prevent the global crisis that was triggered off by the bankruptcy of such big firms as Enron and WorldCom (Ammann et al., 2011). The publication of the first King Report was the catalyst for the promulgation of the Public Finance Management Act (PFMA) (South Africa, 1999). The PFMA drives public sector governance in South Africa. Also, the Companies Act (South Africa Government, 2008), serves to reinforce the importance of corporate governance in the country. The Companies Act makes it mandatory for companies to appoint audit committees, a key component in the implementation of sound governance principles. The next section of this chapter examines the relevance of IT governance within corporate entities.

3.3.2 The importance of IT Governance in Organisations

Several definitions have been offered for IT governance. According to the IT governance Institute, IT governance is "*set of responsibilities and practices exercised by the board and executive management with the goal of providing strategic direction, ensuring that objectives are achieved, ascertaining that risks are managed appropriately and verifying that the enterprise's resources are used responsibly*." (IT Governance Institute, 2005 p.23). This long definition is summarised by Gartner (2016), who describes IT governance as the processes that ensure the effective and efficient use of IT for enabling organisations to meet their business goals (Gartner, 2016). Also, the King III Report defines IT governance as "*a framework that supports effective and efficient management of IT resources to facilitate the achievement of a company's strategic objective"* (IoDSA, 2009, p. 52). All the definitions examined have alluded to the crucial role played by the board and executive management of organisations in ensuring that IT assets are protected, risks are minimised and resources of the organisations are put to effective and efficient use through the governance of IT.

Governance is central to the achievement of goals and the correct implementation of the plans and strategies for achieving these goals in an organisation (Albayrak & Gadatsch, 2012). Cocca and Alberti (2012) affirm this further by stating that the principles of effective IT governance serve to improve day-to-day efficiency in the technologically enabled processes within an organisation. Information Technology (IT) plays a central role in the crafting and introduction of new product offerings and serves as a guide in the implementation of strategic decision-making in organisations (Albayrak & Gadatsch, 2012; Montazemi, 2006). Information Technology is also critical in upgrading or improvement of existing business operational processes. The increasing interconnectivity of the world has made it imperative for organisations, both large and small, to rely on IT systems for achieving their objectives (Devos et al., 2009; Van Grembergen, 2008). The critical role played by IT in enterprises, therefore, necessitates that a framework is put in place to ensure its governance (Cocca & Alberti, 2010).

IT governance consists of rules and practices that determine the way enterprises manage their IT processes to achieve corporate goals (Albayrak & Gadatsch, 2012). The domain of IT governance relates to the systemic optimisation of the IT portfolio and related enterprise investment to ensure it delivers maximum value and manages the risks that may arise from those investments (Gartner, 2016; IoDSA, 2009). All the aforementioned descriptions of the IT governance domain place emphasis on the structures and processes that ensure that an

enterprise's IT infrastructure generates the business value that justifies its investment and mitigates the risks posed by its use. This is aligned to the objective of this study, as the domain of data governance is to ensure that data becomes, and remains, a key business asset whose value is justified by the quality of information processed and produced by the organisation. In addition, IT governance encompasses the leadership, organisational structures and processes that can ensure that an organisation has an IT strategy which is in tandem with its overall strategy and objectives (ITGI, 2007). The way an organisation manages its data is influenced by the underlying governance principles adopted for IT in the enterprise.

There are two important components of IT governance: the IT governance structure and the operational governance processes. The IT governance structure refers to the enterprise's IT strategic plan which is based on its financial capabilities, business needs and risk appetite. Thus, IT governance is the framework that governs IT within the business. The second important component of IT governance is an effective, well-laid-out and unambiguous process for implementing the IT governance framework.

This study aims to develop and produce a data governance maturity evaluation model for the government departments of the Eastern Cape. The principle and purpose of an effective data governance methodology for government departments are domiciled in its importance as a subset of IT governance. There is, therefore, a need to establish the strong link between IT governance roles and responsibilities and the strategic aim of data governance. The dependency of organisations on sound and accurate information has become more poignant, with organisations being unable to achieve their strategic goals effectively without access to the IT which enables them to achieve efficiency (Tokhid, Abdul Rashid, & Abdu Roni, 2012). Information Technology is used to input, process and store data which becomes the information used for planning purposes in an organisation. Information Technology, which serves as an enabling tool for the data processes mentioned above, consequently needs to be governed in order to achieve the goals of the organisation.

The 'critical dependency' on IT dictates that every organisation must put in place a sound IT Governance policy/ strategy (De Haes & Van Grenbergen, 2015). The IT Governance Institute reinforces this by stating that every organisation must institute controls, processes and procedures for the management of all its IT related matters (IT Governance Institute, 2005). It, therefore, behoves CIOs and CTOs in public enterprises to ensure that their IT policies reflect a sound and critically appraised process which safeguards the entirety of data assets in the

organisation. The next section of this study discusses the relationship between corporate governance and IT governance.

3.3.3 The Relationship between Corporate Governance and IT Governance

The role of Information Technology has become an integral part of both private and corporate life in the current world order. Information Technology is now considered as a strategic business tool which must be leveraged maximally to achieve the goals and objectives of the organisation (Van Grembergen, 2008). The accessibility of the Internet to millions of people worldwide has also introduced new business models and a more inclusive role for shareholders and stakeholders in an organisation (Eckerson, 2014). Unfortunately, this ease of access has also introduced enormous IT risks such as data theft, hacking, loss of critical information and loss of critical output hours caused by the failure of IT artefacts (Hardy, 2006).

The King III Report states that the board and executive management cannot abdicate their responsibilities if they do not apply the necessary rules for the greater good in their organisation. The 'apply or explain' principle places organisational responsibility on the shoulders of the board in the case of eventualities (IoDSA, 2009). The governance of IT is aligned to the goals of the business; it, consequently, forms part of the responsibility of the board to ensure components of IT that drive the business are governed effectively. To this end, it is expected that there is cohesion in the way the two elements of the business are carried out (Van Grembergen, 2008; IoDSA, 2009). This position is very relevant to the context of this study as it encapsulates the impact that a lack of effective IT governance can have on the data assets of an organisation. Data forms the basis of information, which ultimately becomes the platform for the strategic and operational plans of the organisation (Sarsfield, 2009). The risks associated with a lack of governance of data assets include the risk of unsecured data, falsified information, data obsolesce and data theft (Hardy, 2006). The enabling processing and storage of data assets are all dependent on IT, thus the significance of a sound IT governance protocol in any organisation. The effective management of IT is a crucial element in the success and sustainability of any implemented data governance framework. The focus of this thesis is the production of a maturity evaluation model to measure whether or not the essential elements of a data governance program according to international standards are in place within Eastern Cape Government Departments; the entire process for the composition, testing and validation of the model will be facilitated by IT infrastructure and processes.

3.4 Importance of Data Governance within Corporate Governance and IT Governance

Data governance has been defined as *"a system of decision rights and accountabilities for information-related processes, executed according to agreed-upon models which describe who can take what action with what information, and when, under what circumstances, using what methods"* (Data Governance Institute, 2015, p.1). In light of this definition, and the current business climate which outlines and imposes stringent regulatory and compliance reportorial laws on corporations, it has become essential for business managers to ensure that data is scientifically managed to protect the firm. As IT becomes progressively critical to business operations, and data volumes and sources continue to grow exponentially, the mismanagement of data due to lack of governance or process failures exposes organisations to greater risks (Soares, 2015; Lipunstov, 2014). Furthermore, organisations are beginning to realise the importance of trusted data for leveraging information effectively in order to gain better insight into consumer needs, design innovative solutions and meet strict compliance regulations (Alles & Piechocki, 2012;Weber, Otto, & Osterle, 2009). One of the significant outcomes of corporate governance regulations such as the Companies Act (South Africa) and the Sarbanes-Oakes Act (USA) is the audit requirements which organisations are expected to fulfil. All of these compliance reports involve several layers of data which must be consistent and accurate (Salido, 2010). The domain of IT governance encompasses the use of technology for driving compliance processes in the organisation. Within this domain is the field of data governance and its attendant processes which should ensure that an organisation reports a single version of the "truth" (Sarsfield, 2009). Soares (2015) and Seiner (2014) both allude to this by stating that data governance is the enabler of the arm of corporate governance which mitigates the risk a company would incur in case of unstructured data. The renewed argument for the criticality of data to be treated as an asset relates to the traditional attitude of business managers in treating data accuracy and uniformity as a technology matter rather than an issue of governance such as financial, human resources and physical assets (Thomas, 2015). There are now more reasons for companies to consider a single entry point for data assets, with a common representative language and a system of continuously monitoring data assets from entry point to storage and disposal in order to ensure compliance and maintain data integrity (Salido, 2010). Data governance taxonomy, therefore, becomes an ingrained part of both corporate governance and IT governance. The diagram below serves to illustrate this relationship further.

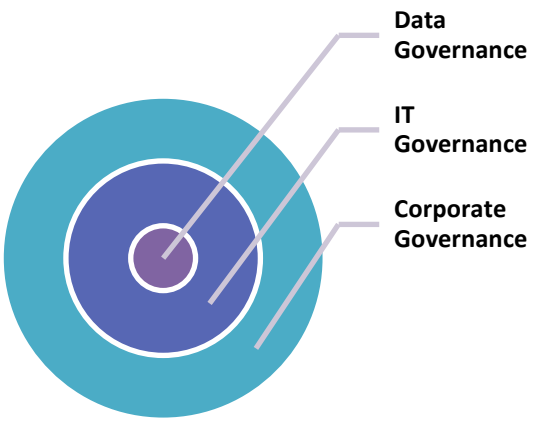

Figure 3.1: Data Governance Placement in Corporate and IT Governance (Source: Informed by Soares, 2015; Thomas, 2015)

Based on the diagram above, it is deduced that data governance is a subsection of IT governance which is enabled by corporate governance principles and processes for the purpose of achieving business objectives and delivering value. COBIT 5 framework clearly outlines the data governance steps in the framework, a detailed discussion of this is carried out in Chapter 5 of this study. In the light of this, it is opined that the buy-in and cooperation of top management in implementing data governance processes is the best way to assure the security, accuracy and sanctity of data in organisations (ISACA, 2013). Furthering the argument, Saetang and Haider (2012) state that in the corporate world where there is fierce competition, IT governance has the capability, tools and processes to support business strategy in practical, applicable ways. One of the strong tools for this is the management and governance of data assets through technologically enabled processes and practices (Alles & Piechocki, 2012). Figure 3.2 below illustrates this in more detail.

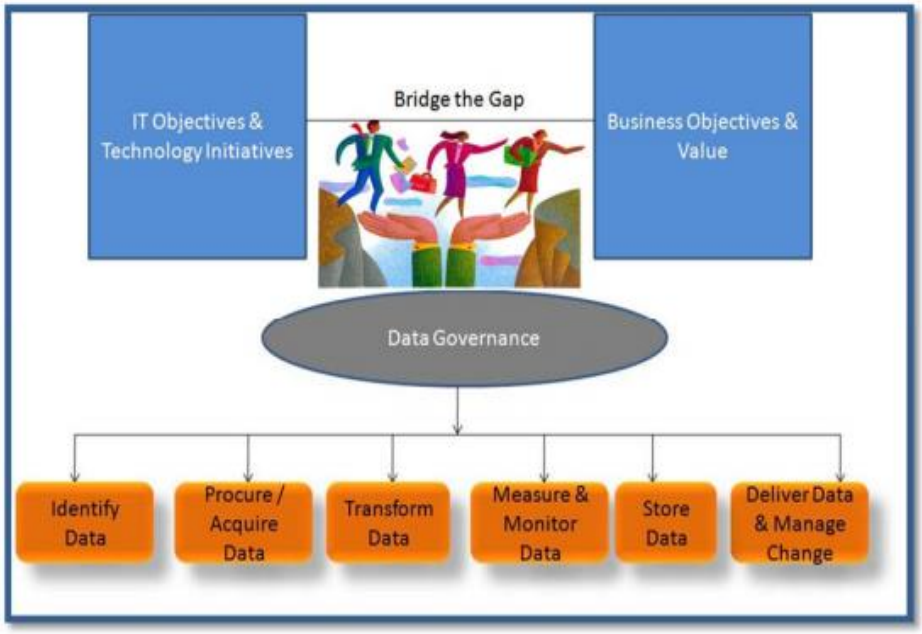

Figure 3.2: Data Governance as a subset of IT governance (Inforsys, 2015)

The diagram illustrates the particular areas covered by data governance. The over-arching control for all the identified processes in the diagram is guided by IT, which is geared towards achieving the goals of the business. As already outlined in section 3.3 of this chapter, corporate governance is an all-encompassing concept that covers every aspect of an organisation. In light of this reality, the IoD entrenched IT governance as an integral part of the King III Code in the 2009 edition. The three principles outlined in the ISO/IEC 38500, which forms one of the benchmarks for the proposed maturity model of the study become relevant in showcasing or dissecting the importance of data governance within the corporate governance and IT governance context. The ISO/IEC 38500 outlines guidelines for IT corporate governance. The framework recommends three main tasks for directors in the guiding of corporate IT governance; evaluation, directing and monitoring (ISO/IEC, 2008). The three techniques recommended for directors to follow by ISO/IEC 38500 for the purpose of governing IT are:

1. Evaluate the current and future use of IT;
2. Direct preparation and implementation of plans and policies to ensure that IT use meets business objectives;
3. Monitor conformance to policies, and performance against plans.

The IT governance model is presented in Figure 3.3 below:

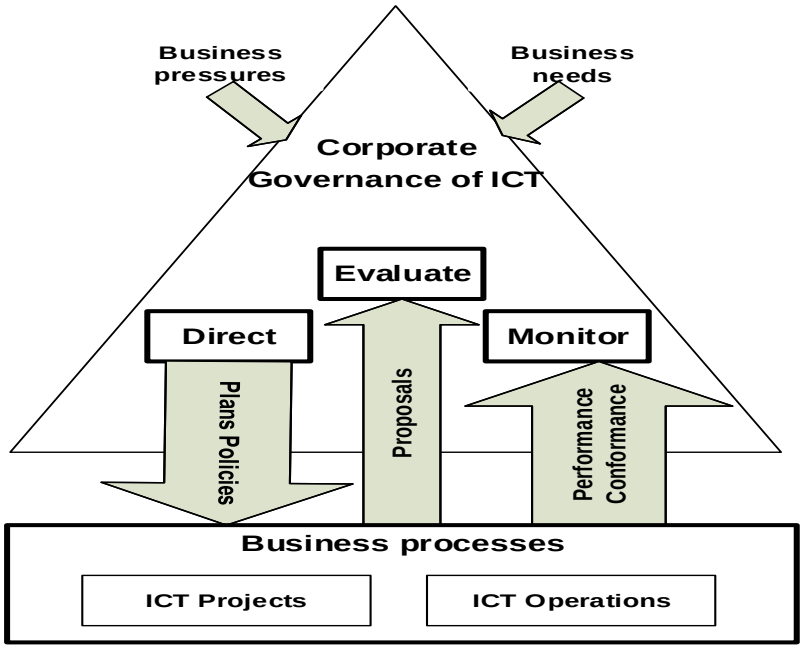

Figure 3.3: Model for corporate governace of IT (ISO/IEC, 2008)

From Figure 3.3 above, the ISO/IEC 38500 framework for the corporate governance of ICT explicitly states that directors have a responsibility to direct plans and policies regarding ICT projects and operations, evaluate all business proposals relating to such and, after due processes have been followed in the approval and implementation of such business processes, management has a duty to monitor performance and conformance to agreed processes and principles on the implementation of the operations (ISO/IEC, 2008). According to the King III Code of governance (2009), the board has the mandate to provide strategic direction in the way organisations must act. Executives also have a duty of care whenever the organisation has to answer for compliance and legal reasons. These are the drivers that make it possible for directors to be effective in IT and related functionalities. Compliance with regulatory authorities and laid down governance requirements such as the King Code (South Africa) and Sarbanes-Oakes (USA) have become major drivers for data governance. These government regulations mandate strict and auditable data integrity since the post-Enron debacle which was the catalyst for the 2008 financial markets meltdown.

Additionally, in the past, organisations governed data primarily to meet regulatory demands and ensure compliance (Korhonen et al., 2013). However, with a barrage of data such as big data; reference data; internet of things; the need for correct reporting of a single version of the

truth for qualities such as corporate integrity, compliance purposes, risk aversion and accurate fiscal and financial planning became essential data governance drivers (De Haes & Van Grenbergen, 2015; Ammannn et al., 2011; IoDSA, 2009). Corporate governance is now responsible for an expansive list of issues across the organisation, more than was the case in past decades (OECD, 2015). International standards like ISO/IEC, COBIT and ITIL all refer to the responsibility of ensuring risk being contained and managed by the highest level of authority in the organisation (ISACA, 2013; ITIL, 2011; ISO/IEC, 2008). Due to the easy access of information via the web, clients, customers and several stakeholders currently interact with businesses more directly than they used to do. Organisations, as a result, need to ensure they manage data in a manner that is consistent with the values and missions they profess to their stakeholders. The current era of tweets, newsfeed and all associated social media has forced management of organisations to entrench a culture of care in the way data and the information are managed and processed (Huner, Ofner, & Otto, 2009). Additionally, the sheer volume of data processed by organisations has made it imperative for government agencies to reconsider the way data is handled. This factor also becomes important in light of the guidelines of the companies Act, the King Code and the legalistic and judicial implications of the fallout of any data management crisis (Khatri & Brown, 2010; Bahrman, 2011). As noted by Marco (2006), "*Most enterprises carefully manage other assets (financial, physical and human) but overlook the immense value inherent in their data*" (p.28). The next section examines the dichotomy and areas where overlaps exist in the information governance and data governance domains.

3.5 Dichotomy/ Overlap between Information Governance and Data Governance

The first chapter of this study examined several definitions and scope of data governance. Numerous schools of thought, including the Data Governance Institute, have consistently used 'information-` and `data governance' interchangeably, connoting the understanding that the two terms mean the same thing. Furthermore, the policy documents available in the Eastern Cape Government Departments also consistently use the two terms interchangeably (DPSA, 2013; NARS, 2006). However, for the purpose of this study, it is argued that the two terms are different, the processes and drivers for each of the terms distinct (Deloitte, 2009). `Information governance' is defined as '*the specification of decision rights and an accountability framework to ensure appropriate behaviour in the valuation, creation, storage, use, archiving and deletion of information. It includes the processes, roles and policies, standards and metrics that ensure*

the effective and efficient use of information in enabling an organisation to achieve its goals" (Gartner, 2016, p. 1). Condensing this definition, Smallwood (2014) states that `information governance' is policy-based control of information to meet all legal, regulatory, risk, and business demands. Likewise, the Information Governance Initiative describes `information governance' as "the activities and technologies that organisations employ to maximise the value of their information while minimising associated risks and costs". It is noteworthy that these three definitions of `information governance' do not focus on data capture or data quality processes; rather on controlling and managing the processed information from data to maximise its value and minimise the risks organisations may face by the misuse, theft or loss of its information assets.

`Data governance', on the other hand, encompasses processes and controls to ensure that information at the data level, raw alphanumeric characters being captured and imputed into a database are true, accurate, auditable and not redundant (Smallwood, 2014). As discussed in chapter one of this study, some of the activities encompassing `data governance' include; data identification, data quality management, metadata management, data storage, data cleansing and data archiving (Berson & Dubov, 2011; Khatri & Brown, 2010; Huner et al., 2009). The focus of `data governance' is the quality of information from the root. Legal, compliance and regulatory requirements necessitate that data which forms the basis of information is clean, correct and trustworthy. `Data governance' is at the most rudimentary level of `information governance' as it seeks to ensure that formal management controls are in in place to govern critical data assets (Steinhart, 2010). The consequence of poor data is faulty information which ultimately results in inaccurate and erroneous plans and decisions. To extend this notion further, it can be said that information comprises of data that has been put in context.

In summary, we state that while` information governance' consists of the policies and processes to maximally leverage data, meet its legal and compliance obligations and minimise and mitigate the risks associated with information assets, `data governance' is the embodiment of the processes, methods, tools and techniques to ensure that the enterprise or organisation has data that is of high quality, reliable and auditable (Smallwood, 2014; Korhonen et al., 2013; Suer & Nolan, 2012; Redman, 2008; IT Governance Institute, 2005). Table 3.1 below summarises the key differences in the two terms.

Table 3.1: Dichotomy between Information Governance and Data Governance

Information Governance	**Data Governance**
Focus Area	Focus Area
Appropriate use of information: who should or should not use organisation's information	Data Quality: What rules can be strategically applied for the capturing, measurement and monitoring of data
Business Value is maximum value being derived from the intelligence or context generated from the data.	Data Transparency: Content, location and security of enterprise data
Information Lifecycle: The control, discovery, and retention of data while ensuring privacy and collaboration	Data Lineage and Management: System for recording various data sets, consistency in notational entries and common language for data
Information Ownership: Clear definition of process ownerships for the creation and maintenance of varying kinds of information.	Data Security/ Ownership: How to secure data in spite of whatever platform it is on, accountability rights for the maintenance and storage of data assets
Key Drivers	**Key Drivers**
Legal and compliance requirements	Maximising the income generation potential of data
Optimised discovery of the organisation's potential	Increasing consistency and confidence in corporate decision-making
Privacy and security	Improving data security and quality
Productivity and collaboration	Optimised staff effectiveness
Defensible disposition	Establish process performance baselines to enable data improvement efforts
Key Issues Addressed	**Key Issues Addressed**
Location of records, verification of accuracy, decisions on what record to keep and for what length of time	How to leverage the vast amount of data and other applications available in databases to make better decisions for the organisation.
Identification and management of the latest and most relevant version of documents (ISACA, 2013).	How to address the issue of duplicate data across different platforms and applications and ensure data integration.
Maximisation of employee productivity through collaboration across business units and minimising losses during employee turnover.	How to ensure the accuracy, completeness and validity of data.
Ways and means of controlling documents and electronic information in case of litigation	How to keep critical and financial data secure
Location of privacy information across all repositories and how to take control of the information.	The control and assurance of privacy data in between applications.

[Source: Informed by John Schmidt (2014), Smallwood (2014) and Soares (2015)]

In spite of the outlined differences in the two programs, it is pertinent to recognise that there are basic overlaps in some of the functions. Some of the areas of overlap in the two areas are mapped in Figure 3.4 below:

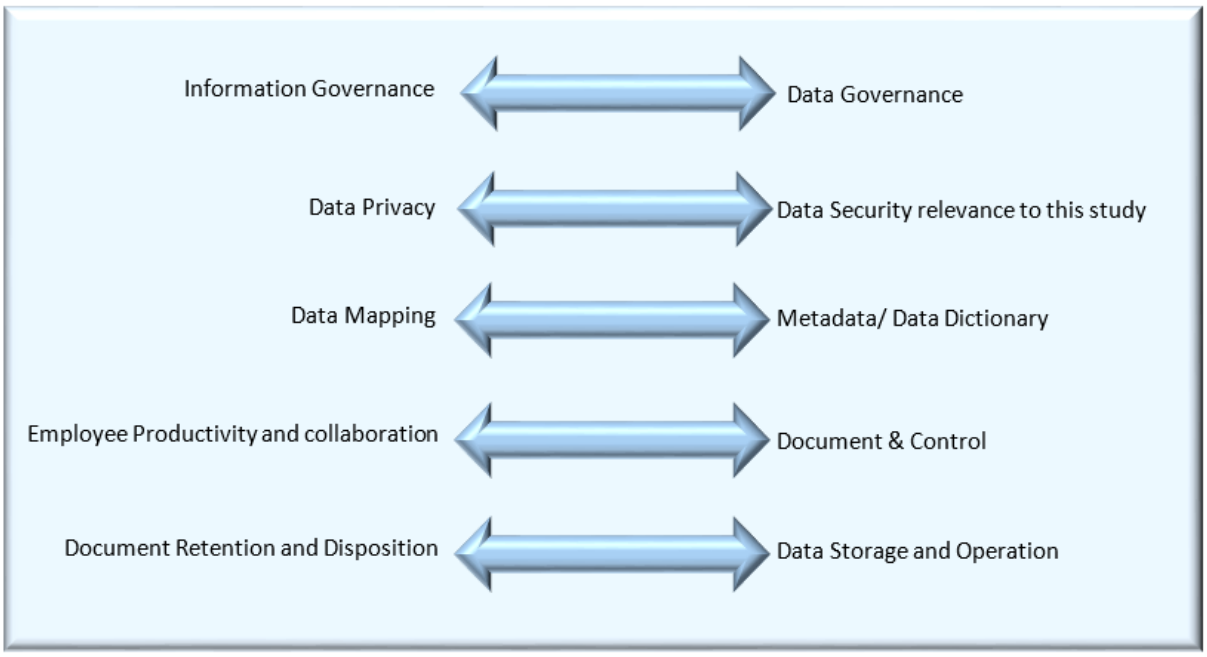

Figure 3.4: : Intersection between Information Governance and Data Governance.

[Source: Informed by Soares (2015), John Schmidt (2014), Smallwood (2014) and Thomas (2009)]

Figure 3.4 above depicts the core areas where Information Governance and Data Governance are closely interlinked or overlapping. According to Smallwood (2014), a well-articulated and clearly defined information governance policy will enhance an organisation's ability to implement an effective data governance programme. In this sense, it is argued that the successful outcome of an astute data governance programme is likely to be affected by the information governance policy in place at an organisation and vice versa.

3.6 Emerging Global Trends in Data Governance Practices

The use of technological devices for the purpose of collecting, processing and storing data in organisations has made data governance an integral part of the IT governance process (Eckerson, 2014). Consequently, it is imperative for this study to examine emerging data governance trends in practice around the globe. Data governance has been previously described as a process of managing all data related activities. It is important to distinguish data governance from data management; data governance is concerned with what decisions need to

be made, who needs to make the decisions and the provision of a structure to achieve specific tasks in order to ensure effective management (Fu, Wojak, Neagu, Ridley, & Travis, 2011). Data management, on the other hand, is focused on the decisions that an organisation has made concerning its data assets and involves the day-to-day implementation of such decisions (Fu et al., 2011). The decision and accountability rights pertaining to data management fall under the domain of data governance. To this end, data governance has become part of the vocabulary in many large corporations, government departments and private firms (Khatri & Brown, 2010). The most consistent emerging trend is the constitution of data governance councils within organisations (Thomas, 2015). The data governance council is composed of stakeholders from both IT department and business management of the organisation, with the highest executive being the sponsor and responsible for the strategic steering of the council (Korhonen et al., 2013). The council typically comprises of the CEO, CIO and senior IT managers and business process managers (Thomas, 2015). The rationale for having such high ranking members of staff in the council is to ensure that decision rights and accountability on data assets are in the hands of those who have a fiduciary duty to govern IT processes and can be held liable for any consequences thereby incurred (IoDSA, 2009). The goal of the data governance council is to align business with IT and ensure a common understanding and language for data related matters (Berson & Dubov, 2011; Kushner & Villar, 2008). The council is also tasked with developing standards for data management, data vocabulary, data quality management processes and the input, processing and storage of data assets. A very strong example of an organisation which employs and propagates the convening of a data council for the purpose of managing data is International Business Machines (IBM) (IBM, 2007). Data stewardships are another trend in the data governance domain. Data stewards are experts in the field of data handling and data management appointed from both IT and business (Korhonen et al., 2013). Data stewards are mandated to manage the data assets of the organisation, with due consideration for the strategic and operational goals of the company (Khatri & Brown, 2010). Business data stewards manage the tactical data issues from the business side, while technical data stewards manage such operational data issues such as data architecture and data integration (Korhonen et al., 2013). The members of the data council who undertake the day-to-day activities regarding data governance are data model administrators, database administrators, and data analysts. The diagram in Table 3.2 serves as a generic example of the roles described above.

Table 3.2: Design Artefact: Data Governance Instantiation (Korhonen et al., 2013)

Level	**Governance Roles**	
	Effectiveness	Efficiency
Strategic Steering	**Executive Sponsor**	
Strategic Implementation	**Data Governance Council, Chief Steward**	Data Stewardship Steering Committee(s), Coordinating Data Steward(s)
Tactical	Data Governance Office(DGO), Data Stewardship Facilitators	Data Stewardship team(s), **Business Data Stewards**
Operational	E.g. Architects(Data, Data Integration,	**Technical Data Stewards**
	Application, Technology	
Day-to-Day	E.g. Data Model Administrators, Database Administrators, Data Integration Specialists	E.g. Data Analysts, Data Modelers, Analytics Developers, Report Developers

In line with the principles of IT governance outlined in COBIT 5 and ISO/IEC 38500, the composition of a data council within an organisation does not change the fact that the executive is mandated to maintain an oversight function over the data assets of the organisation and is expected to answer for any data breaches that may occur (IoDSA, 2009; ISACA, 2013).

3.7 Components of an effective data governance model/ framework

The IBM Data Governance Council predicts that (a) data governance will become a regulatory requirement in developed countries (b) Risk calculations will become more pervasive and automated (c) the role of the CIO will include responsibility for data quality (IBM Data Governance Council, 2008). The three predictions highlighted by IBM have since come to pass, in varying degrees, across public and private enterprises since 2008 (Eckerson, 2014; Ammannn et al., 2011; IoDSA, 2009). There are many data governance frameworks proposed by diverse scholars and industry experts on the subject of data governance. Some of the most notably quoted frameworks include the Data Governance Institute framework (Thomas, 2014).

The framework discusses ten universal components of a data governance program under three headings. The ten components are hereby listed under the relevant headings:

1. **Rules and Rules of Engagement** - This consists of the mission and vision; goals, governance metrics and success measures as well as funding strategies. Other components of rules of engagement are data rules and definitions, decision rights, accountabilities and controls.
2. **People and Organisational Bodies** - This component is made up of data stakeholders, a data governance office and data stewards.
3. **Processes** - The components in this group speak to proactive, reactive and on-going data governance processes.

According to Thomas (2015), the first six components of the DGI framework describe the rules and rules of engagement to be employed by people and organisations for data governance, while the three components of the processes describe the methods to be used for the governing of data. The 10th process which pertains to a data governance office signifies a physical place where data governance is undertaken. The processes must be standardised, documented and repeatable. Information technology must also be able to support regulatory and compliance requirements for data management, privacy, security and access management.

Although this framework is comprehensive and touches on all aspects of an effective data governance framework, it is opined that it is high level and does not directly address the specifics of which components an organisation must include in a data governance framework in order to assure scientific management of its data assets. As the aim of this study is to produce a data governance maturity evaluation model for the Eastern Cape Government Departments, the study draws heavily on IBM's Data Council's depiction of the elements of effective data governance as outlined in Figure 3.6 below. The rationale for this is based on the comprehensive coverage of all data related matters and the buildup of the elements from the base to the highest level of governance.

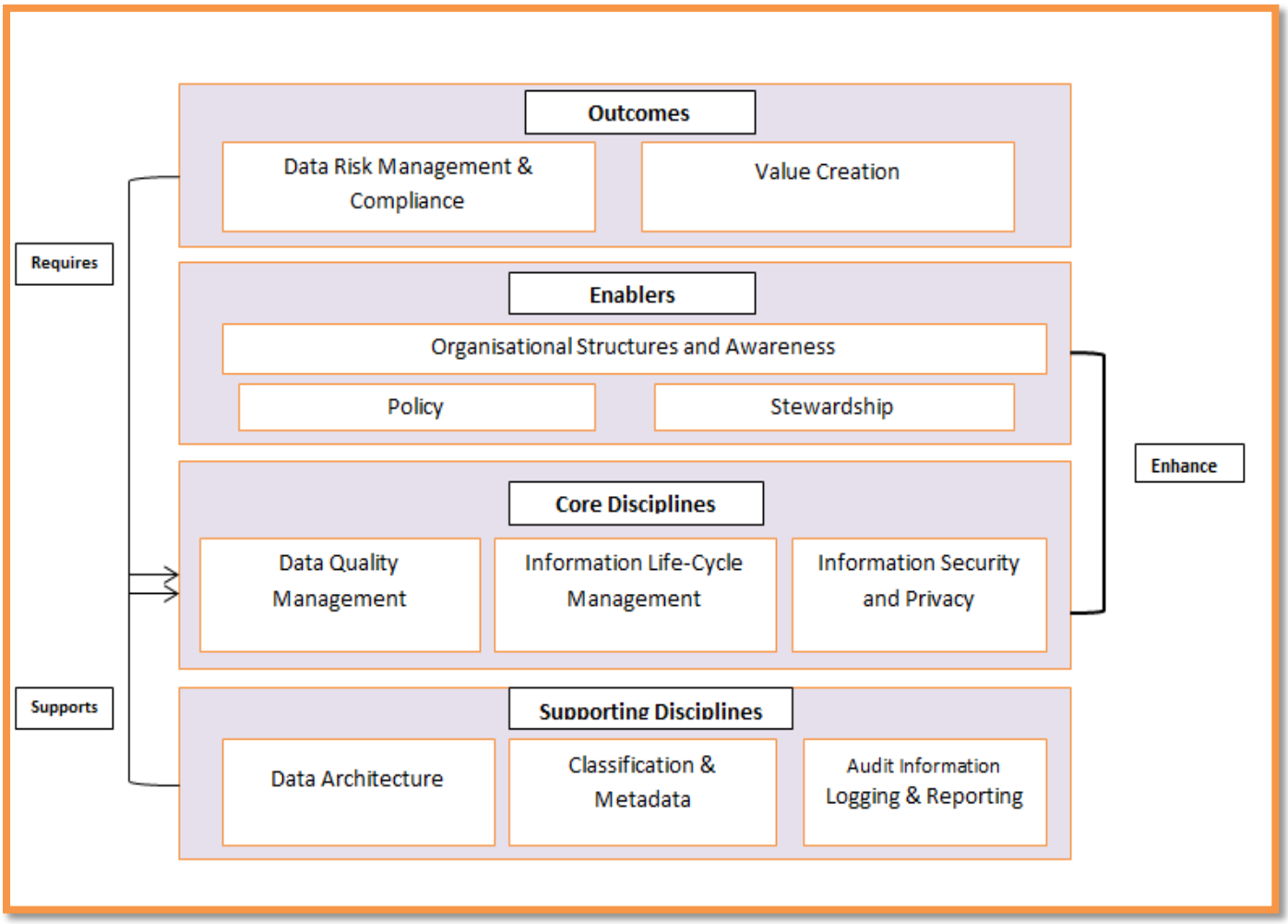

Figure 3.5: Elements of Effective Data Governance (IBM, 2007)

From Figure 3.5 above, it is deduced that the IBM data governance domain elements propose the building of the data architecture from the ground up. The ground level focuses on the basics of data classification, the development of a classic metadata and the standardisation of information reporting. This ground layer is a subset of the three-pronged disciplines of Data Quality Management, Information Life-Cycle Management and Information Security and Privacy. The enablers for the aforementioned components are data policy and stewardships. Effective implementation and management of these two components thereby produce the outcomes of effective risk management, regulatory compliance and ultimately results in the maximum creation of value from an organisation's data assets. This structure finds extensive support in widely quoted literature regarding data governance (Khatri & Brown, 2010; Steinhart, 2010; Fu et al., 2011). Chapter 5 of this study examines the components in the two frameworks in greater details and subsequently maps them to ISACA's COBIT 5 processes and the ISO/IEC 38500 relating to IT and data governance, respectively. The processes and features were also compared with the available policies of the national government and filtered down to the Eastern Cape policies on data-related matters.

3.8 Summary

This chapter emphasised the importance of corporate governance and IT governance to the successful realisation of an organisation's strategic and operational goals. The chapter surmised that the successful outcome of data governance is dependent on the executive support and the enabling IT infrastructure to implement repeatable and auditable processes. Furthermore, considering the regulatory and compliance requirements faced by organisations worldwide, stakeholders and shareholders expect executive management to judiciously and scrupulously exercise their fiduciary obligations in such a way that does not put the organisation, its stakeholders and assets at legislative or financial risk. To this end, data governance has become an essential component of the entire IT governance process and must be treated as an asset.

Chapter 3 examined the relationship between corporate governance, IT governance and data governance, concluding that data governance is a subset of IT governance domiciled within the ambit of corporate governance rules and responsibilities. The chapter made a distinction between information governance and data governance, acknowledging the common areas of overlaps in the two terms. Emerging global trends in data governance practices were discussed, with a caveat that executive management retain the burden of responsibility in spite of any data governance style or process adopted by the organisation. Finally, the chapter discussed the components of an effective data governance framework as outlined in the secondary literature. The components identified are now summarised in Table 3.3 below.

Table 3.3: Components of the Maturity Model identified in Chapter 3

Theoretical Component identified	Reference	Maturity model Category in IT/Data Governance
Rules and rules of engagement – Decision rights, Data rules and definitions, accountabilities and control	Gwen Thomas, 2015	Risk Policy and compliance
People and Organisational Bodies - Data Stakeholders, Data Governance Office, Data stewards	Gwen Thomas, 2015	Stewardship, Organisational structures
Processes-Proactive, reactive and on-going data governance processes	Gwen Thomas, 2015	Processes
Data Architecture – Data Quality Management	IBM, 2007	Value creation, Data alignment
Classification of Metadata - Information Life-cycle management	IBM, 2007	Data Risk and Compliance management
Audit Information logging and reporting - Information Security and Privacy	IBM, 2007	Compliance management

The next chapter of this study examines current data governance practices in the Eastern Cape Government Departments. The chapter establishes the needs of the departments for an effective data governance model by identifying current practices vis-a-vis the COBIT 5 IT governance framework and the ISO/IEC 38500 framework for the governance of IT. The chapter attempts to map current data governance practices in these departments to the principles and recommendations in COBIT 5 and ISO/IEC 38500. It is believed that the exercise will enable the researcher to identify critical areas of non-compliance, strength and weaknesses of the current practices and this will, in turn, form a basis for understanding the components to be included in the conceptual model to be produced through secondary literature.

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Introduction

Chapter 2

Methodology

Chapter 3
Relationship between Corporate Governance, IT Governance and Data Governance

Chapter 4

An Analysis of Current Data Governance Practices In the Eastern Cape Government Departments

Chapter 5

A Discussion of Five Maturity Models Relevant to this Study

Chapter 6

A Conceptual Data Governance Maturity Evaluation Model

Chapter 7

Presentation of Findings from the Qualitative Data

Chapter 8

Implications of Findings from the Qualitative Data

Chapter 9

Presentation of Findings and Implications of the Quantitative Data

Chapter 10

A Data Governance Maturity Evaluation Model for Government Departments of the Eastern Cape

Chapter 4: An analysis of current Data Governance practices in the Eastern Cape Government Departments

4.1 Introduction

4.2 Technology and Governance

4.3 Eastern Cape Government Departments and Alignment with COBIT 5 Recommended Processes

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4.5 Summary

4. Chapter 4: An analysis of current Data Governance practices in the Eastern Cape Government Departments

4.1 Introduction

Chapter 3 discussed the dependence of organisations on IT and the resultant importance of a governance structure to direct the role and processes of IT governance. The relationships between IT governance, corporate governance and data governance were also discussed. The study asserted that data has to be listed and treated as an asset in line with other corporate assets such as financials and human resources in order for information generated from it to be considered accurate and infallible. Several components of effective data governance were considered. The chapter was concluded with a table depicting the components of an effective data governance program identified in the literature.

The aim of this chapter is to give a sound theoretical base to the context of this study. A theoretical elaboration enables the researcher to argue for the relevance of the research problem within the subject domain (Funchall, 2011). According to the Design Science processes of Peffers et al. (2008), the six stages of the design science process (Figure 2.4) are a pathway to achieving an artefact which solves a real life problem in practical ways. This chapter seeks to reinforce the first step in the Peffers process, which is problem identification and motivation. Although sections two and three of Chapter 1 have discussed the problem and its context, in brief, this chapter examines the different elements of the problem and attempts to understand the complexities inherent in the problem. This process is important as it enables the researcher and its target audience to have the same understanding of the problem's complexities and unequivocally accept the solution based on the prior understanding of the problem and its relevance in context (McKillip, 1987).

To this end, the chapter discusses the current efforts of the South African National Government to incorporate IT governance, information governance and data governance into government processes. The positioning of IT within public enterprises and government departments in South Africa, its past and present efforts and the effectiveness of such attempts is examined. The COBIT 5 framework and ISO/IEC 38500, which are the benchmark frameworks for testing the existence of data governance processes in these departments, are discussed extensively, in comparison with existing policies and practices regarding data governance (DPSA, 2013). The discussion is followed by the results of a needs analysis questionnaire which was conducted to further reinforce the need for a data governance maturity evaluation model and the importance

of the solution within the Eastern Cape Government Departments. The needs analysis is also projected to identify the areas where there seems to be the most critical departure from sound international data governance practices as outlined in COBIT 5 and ISO/IEC 38500. The next section sets the context for this chapter with a discussion of the placement of technology within the ambit of public departments and their mandate to the people.

4.2 Technology and Governance

Information is knowledge, which transmits to power if used optimally and resourcefully (Matavire, Chigona, Roode, Sewchurran, Davids, Mukudu, & Boamah-Abu, 2010). Due to the information 'revolution' being witnessed by societies, there has been a shift in the mindset of citizens regarding the importance of industrialisation in comparison with a knowledge economy (Matavire, et al., 2010). Globalisation has made it important for governments to be accessible across global knowledge databases (Alexandru, Ianculescu, Parvan, & Jitaru, 2007). Dassah (2014), quoting Schick, (2003) defines a contemporary state as "*a state that continuously reads its environment and responds to new information".* The research problem in a contemporary state is finding the most efficient and cost effective way of using technology to govern the state (Dassah, 2014). It is important that a contemporary state continues to deploy technology in a way that ensures it remains globally relevant and is able to provide modern service delivery to its citizens. In order for this contemporary state to provide services, public administration involves large volumes of data processing (Moreno, Paez, Chaux, & Caceres, 2014). The state, therefore, stands as the biggest consumer of data and hence must invest in technology which facilitates the access, storage, communication and usage of such data in the most efficient way (Dassah, 2014).

Technology is projected to be the key driver of improved service delivery and should add immense value to governments in the future (PricewaterhouseCoopers, 2005). E-government is described as the use of Information and Communication Technology (ICT) to improve government by making services more accessible, effective and accountable (PricewaterhouseCoopers, 2005). Some of the routine strategic services provided by ICT are timeous and accurate information to citizens; better efficiency and transparency in the way government conducts its business; increased participation of the citizens; and the consistent delivery of quality government services (Dassah, 2014). Additionally, governments are seeking to promote greater accountability and responsible, fact-based fiscal plans for its citizens (Heeks

& Stanforth, 2015; Morena et al., 2014). There are many reasons for this, one being the global financial meltdown of 2008 which was mostly brought about by the effect of data falsification (Ammann, Oesch, & Schmid, 2011). This ultimately led to the current era of stringent regulatory and compliance laws and reports demanded by governments, effectively placing the responsibility for governance and accountability with the directors of an organisation; the heightened awareness by stakeholders of their rights and the keen interest in having an organisation which demonstrates transparency and integrity in the way it conducts business; and the ease of access to information by citizens (Rossouw & van Vuuren, 2013; Bahrman, 2011; IoDSA, 2009). In the USA, the Sarbanes-Oxley regulations demand clear-cut accountabilities, both for auditing and financial accounting purposes (Sarbanes-Oxley, 2016). In South Africa, the King Code of Governance specifies the expectations of stakeholders and other relevant structures on how directors should exercise their fiduciary duties. King III code also adopts an "apply or explain" principle which compels an entity or organisation's directors to account for negative incidents, even though they are not bound by legislation to do so (IoDSA, 2009). Although government departments mostly allude to the use of technology in the improvement of the quality of life of citizens, the real value added by information technology is difficult to quantify (Moreno, Paez, Chaux, & Caceres, 2014). The disarticulation or disconnection between information management and technology remains a huge barrier to the effective implementation of the technological processes that should be the drivers for better governance. Moreno et al. (2014) and Lipunstov, (2014) assert that there is a need to find irrefutable evidence of technological contributions which actually quantify the effect of technology artefacts on governance and government. There must be empirical evidence which shows how these improvements will support processes, bring greater transparency and efficiency to the implementation of projects, facilitate management and control of resources and establish timeous and structured decision-making at all levels of government (Lipunstov, 2014). It is thus important that governments do not just make statements regarding their readiness to govern better with technology; there must be a known methodology with which governments hope to achieve this aim (Accenture, 2012). The next section of this chapter examines South Africa and its e-readiness regarding ICT use in e-government.

4.2.1 E-readiness and ICT in the South African context

According to Bhattacharya and Ram (2016) and Dassah (2014), e-readiness is the extent to which a country or government is willing and ready to engage in electronic activities such as e-commerce and e-government. In the same vein, Ifinedo (2012), defines African economies as transition economies (TE), a term which refers to economies that are changing from centrally planned economies to market economies. The features of such economies are firstly, rapid economic liberalization; secondly, legal and institutionalised reforms; thirdly, privatisation and macroeconomic stabilisation (Ifinedo, 2012). Due to its infrastructural capacity and compliance with many international business practices and affiliations in terms of international trade, South Africa is considered a transition economy (Ifinedo, 2012). In spite of this, there is a high level of apathy in the country regarding how the government is deploying technology in meeting the service delivery demands of the citizens. According to Dassah (2014), this is mainly due to the high levels of illiteracy, which leads to the inability of most citizens to make a direct link from e- government to better services. Research also shows that literate people are mostly interested in using the Internet for social purposes and are not very curious about accessing government portals and websites for information about e-governance.

According to Heeks and Stanforth (2015), and affirmed by Pinheiro and Mehran (2014), ICT's ability to facilitate great opportunities for good governance is three-pronged:

(1) Accepting, storing and transmitting information much faster than a human could do.
(2) It supports the decision, decision communication and the implementation of those decisions by enabling the process by which the decisions communicated are being implemented by human agents.
(3) This process leads to automation, informatisation and transformation, which in turn leads to quicker turnaround times, the efficiency of services and the provision of better innovative governance (Heeks & Stanforth, 2015; Pinheiro & Mehran, 2014).

The automation made possible by ICT leads to an increase in the efficiency and productivity of business. This helps to improve the organisation of data and information in a manner that supports administration and management more efficiently, all these leading to greater policy development, decision-making and productivity (National Planning Commission , 2011).

According to Ifinedo (2012), the spread of technological innovations in a country is contingent upon the availability of supporting physical infrastructure. Countries with poor infrastructure,

low innovation capacity and resources to back their fiscal planning score low when assessed on their e-government maturity (Ifinedo, 2012; Srivastava & Teo, 2007). Supporting this claim, research has shown that countries lacking the aforementioned resources struggle to effectively use technological products for developmental and process improvement purposes (Bhattacharya & Ram, 2016; Achimugu, Oluwaranti, Oluwagbemi, & Afolabi, 2009; Srivastava & Teo, 2007). Ifinedo (2012) showed a positive correlation between high levels of technological progression and functional infrastructure in transition economies and developing countries (TEDC) such as South Africa. South Africa is the second largest economy on the African continent and is known as the most developed in terms of infrastructure and e-government initiatives (Dassah, 2014). In the context of this study, it is believed that the availability of the right resources and infrastructure coupled with a structured, process-based maturity model which shows the 'as is' state versus the desired state should culminate in the effective implementation of data governance processes within Eastern Cape Government Departments (Heeks & Stanforth, 2015).

Furthermore, South Africa is currently involved in charting a new course for the citizens through the National Development Plan (NDP) Vision 2030. One of the most significant mandates of the NDP is to ensure that governments have the ability to harness ICT for all aspects of national development, with special consideration for service delivery, health and technological advancement, all of which are pivotal issues in the South African environment (Gillward, Moyo, & Stork, 2012). According to Moodley (2007), the national government has focused on ICT as a way to fast-track social development and bridge the poverty and equality gap. However, it is important to recognise the fact that technology does not impact negatively or positively on society by itself. The interaction of human agents with technology determine the outcomes that a society obtains from the use of technological artefacts. In this regard, Gillward et al. (2012) stated that the South African government has maintained an over-enthusiastic view of technological capacity without due consideration for the importance of the human capital which facilitates the benefits being derived from it. Additionally, Moodley (2007) states that the belief of government that ICT can solve long-term socio-economic problems without proper planning for how this should happen is a failure on the part of the government. When good governance and supporting structures are in place, technological innovations thrive and reformative tools are used for the enhancement of government services to citizens; further strengthening the argument that there is a significant association between government efficiency and technological advancement (Searson & Johnson, 2010). Although

South Africa is ranked no 75 globally regarding e-readiness and third in Africa (after Seychelles and Mauritius) on the Networked Readiness Index (NRI), statistics reveal that the number of households in the population who are unable to access ICT information as compared to the population is unevenly high (World Economic Forum, 2015). It, therefore, stands to reason that the technological status of the country is not reflective in the lives of its citizenry (Moodley, 2007). Also, widespread illiteracy has made the digital divide a reality in the South African context. The government has rolled out a number of e-government initiatives and there are myriads of rich information on these technology portals, but the effectiveness of such portals in achieving the objectives for which they were set up have been debatable (Dassah, 2014; Matavire et al., 2010). Likewise, the dearth of skills remains an impediment to the successful roll out of e-government initiatives as the teeming population is not yet equipped to make use of the services enabled by technology without assistance from skilled personnel (Matavire, et al., 2010). Alongside the challenges of illiteracy, the lack of skills, internet connection, cost of computer hardware, the attendant high cost of connectivity in Africa and the dearth of resources to support public access of computer and associated machinery are some of the challenges faced by the majority of citizens, thus putting e-government services beyond their reach (Faul, 2014; Dassah, 2014; Matavire et al., 2010). However, despite all the aforementioned challenges, the country is regarded as one of the most structured and most advanced digital economies in Sub-Saharan Africa (Faul, 2014).

The Department of Public Administration has recognised this fact in the process of its strategic plans for the implementation of e- government and ICT usage. A communique from the office of the Director-General for Public Affairs stated that the Auditor General of South Africa (AGSA) conducted an Information Systems audit in the 2008 to 2010 financial years and reported a significant weakness in the governance of IT. The report stated that most of the Government IT officers (GITO) failed to fulfil their mandated strategic responsibilities (DPSA, 2013). The communique recognised the lack of a national government-wide IT governance framework and the non-adherence to laid down standards as a major impediment to the value that could be derived from IT. A government-wide ICT initiative to ensure compliance with and maximisation of ICT procured artefacts was, therefore, recommended. This framework was expected to institute the processes and controls required to ensure IT value and improved service delivery. The framework also proposed the implementation of a code of conduct for IT governance which would institute a culture of IT governance for all arms of government (DPSA, 2013). The white paper reiterated that the value of ICT as a business enabler would

not be realised without the structured incorporation of IT governance to the corporate governance regime in government departments (DPSA, 2013). To ensure that proper attention was paid to the institutionalisation of ICT projects, therefore, the government directive from the department of Public Service Administration (DPSA) required every department to report progress on its IT governance process on an annual basis to the DPSA. The report formed part of the Management Performance Assesment tool (MPAT) of the Department of Public Administration. All national and provincial government departments were expected to comply with the framework and report accordingly. Non-compliance attracted a penalty stipulated by relevant legislation. From the foregoing, it is deduced that the South African public service has had in place the requisite policy frameworks and infrastructure to enable ICT, but the implementation of these policies has remained a challenge (Pade-Khene, Mallison, & Sewry, 2011). The next section examines the South African public sector and ICT failures.

4.2.2 South African Public Sector and ICT Failures

The principles of Batho Pele (People first), which is a framework for equal access to public service delivery in South Africa, adopts ICT as a cornerstone of its success (DPSA, 2013). The South African Government has been focused on how to transform the nation into an information society which grows its economy, efficiencies and services through ICT (Matavire, et al., 2010). This enthusiasm and optimism are, however, dampened by the harsh reality of the economic, social and technical challenges faced by a developing economy such as South Africa whereby literacy levels are very low. Findings, from studies conducted by Ochara, Kandiri and Johnson (2014) and Matavire et al. (2010) indicate that the implementation of e-government as intended and outlined in frameworks by government are impeded by a lack of strong leadership, the fragmentation of multiple projects by government which leads to failure of many ICT projects, the lack of appreciation of the real and intrinsic value of IT, non-inclusion of citizens and conflicts regarding how the tasks which would facilitate ICT e-government are scheduled. The findings were based on an empirical study of e-government initiatives carried out in the Western Cape of the country, which is regarded as the most advanced in the public sector service delivery through technology in the South African context. It was thus contended that a system-thinking approach is required for the successful implementation of ICT governance in South Africa (Matavire, et al., 2010). This study focuses on the importance of data to knowledge management, and its objective of creating a data governance maturity evaluation model for Eastern Cape Government Departments. The objective is motivated by the impact that a well-organised set of data attributes within a data governance framework will

have on governance planning and resultant outcomes within the Eastern Cape Province (IBM, 2008). It is believed that a concise and well-outlined plan for data management processes will further serve to increase the positive impact that ICT can have on the delivery of efficient e-government service.

Technology enabled services have become the service delivery standard in most developed economies (PriceWaterHouseCoopers, 2005). Brynard, Cloete, and De Coning (2014) and Moodley (2007) assert that inappropriate use of technological artefacts has caused many e-government initiatives to fail in the South African public service. Some of the reasons for failure are the inability of government to identify and position the technical capabilities of staff assigned to oversee and implement projects (Ochara et al., 2014). The next section discusses data governance components entrenched in COBIT 5 and ISO/IEC 38500. The two frameworks have been discussed extensively in Sections 1.6.1.1 and 1.6.1.2 of Chapter 1 respectively. This discussion is important to the study as COBIT is a framework which the Department of Public Administration has adopted for all government departments and the ISO/IEC framework is recognised as one of the most tested frameworks for implementing a practical IT governance structure in organisations (Suer & Nolan, 2012) .

4.2.1 Data Governance Attributes in COBIT 5

In section 4. 2 above, it was indicated that COBIT 5 and its data governance attributes are critical to the implementation of a data governance process. This section focuses on these attributes and discusses their relevance to the study. COBIT 5 asserts that data governance requires four key elements; (1) clear information ownership; (2) timely, correct information; (3) clear enterprise architecture and efficiency; (4) compliance and security. The framework clearly outlines how this is achievable by means of concisely aligned structures, skills and processes to the goals and objectives of the enterprise. The purpose of this chapter is to map COBIT data governance processes to current data governance practices in the Eastern Cape government departments. To this end, the most relevant data governance principle from the five COBIT principles outlined in section 4.2 is principle 2; **covering the enterprise from end to end**. This is because the principle covers all the functions and processes that are required for the governance and management of enterprise information and related technologies, including data and all correlated data input and output issues. The governance objective of principle 2 is value creation for the entire enterprise. This is depicted in Figure 4.1 below:

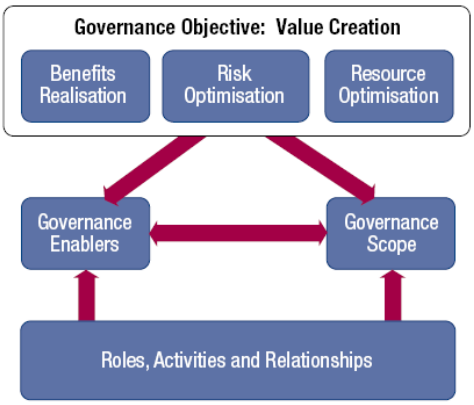

Figure 4.1: COBIT Governance Approach (ISACA, 2013)

Figure 4.1 above, indicates that the objective in Principle 2, is the creation of value for the enterprise. This is achieved by defining the governance enablers for Principle 2. Enablers consist of the organisational resources for governance such as frameworks, principles, processes and practices (Suer & Nolan, 2012). Enablers also include the organisation's enterprise resources such as service capabilities, IT infrastructure, people and information (Nogicevs, 2010). The lack of these resources may hamper the ability of an organisation to deliver value as expected. It is also expounded that although the scope of COBIT 5 is the entire enterprise, it has the capability to deal with any of the various perspectives or entities that make up the organisation, clearly defining the roles, relationships and activities regarding who is involved in governance, how they are involved and the interrelationships within the scope of a given governance system. It is important to note that the 3rd principle of COBIT (**applying a single integrated framework**) ensures that all COBIT processes are aligned with the latest standards and framework which provide a holistic approach to how the enablers and processes are integrated (Ataya, 2013). Figure 4.2 below depicts how the COBIT Information lifecycle recommends that enterprise data be managed.

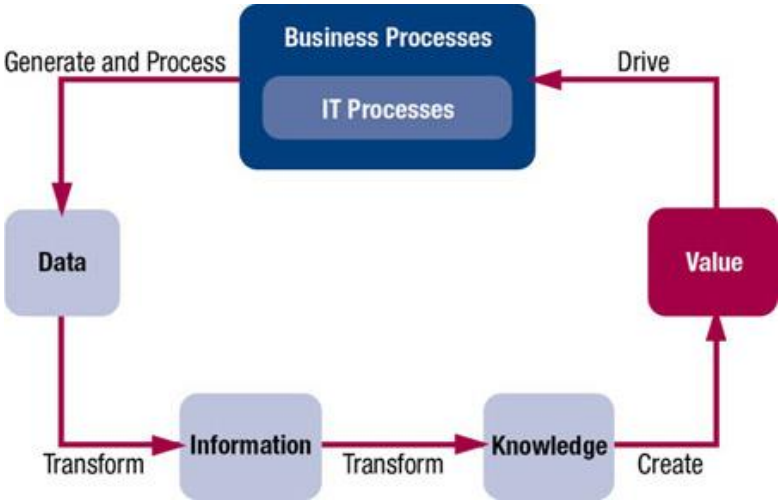

Figure 4.2: COBIT 5 Information Lifecycle (Suer & Nolan, 2012)

From Figure 4.2 above, the cyclical journey from data to value, which in turn drives business process, is depicted within a subset of IT processes. COBIT 5 recommends that organisations define their data systems, taking into consideration the peculiarities of the business and the stakeholders' needs. The CIO or a similar management position has to take charge of the data and determine where the accountabilities for each layer of data lies within the organisation. The rationale for this, according to COBIT 5, is that only the business understands the context in which its data is being used and which aspects require specific handling to meet its stipulated, financial or regulatory need. This aligns with the Contingency Theory adapted for this study. The theory stipulates that every organisation must develop a data governance programme which is contingent upon the purposes of data within the organisation's context. COBIT 5 further recommends that CIOs establish specific processes and technology around data management, define ownership, decisions and responsibilities regarding data assets. Data definition, classification, security control and data integrity are all components of the data governance process that must be considered by the CIO in an organisational context. These must align to the goal of ensuring the availability of reliable, accurate information which supports sound decision-making while keeping errors and inaccuracies to a minimum. All of these underpin the criticality of data as a major enabler of information management within the enterprise. To achieve this objective, both IT and business must establish the processes by which data is managed (Soares, 2016; Suer & Nolan, 2012). This entails that the organisation defines a common set of data requirements and puts in place enterprise architectures to manage the process. Furthermore, COBIT 5 outlines the Information Cycle whereby business processes (supported by IT Processes) produce data which needs to be processed to be transformed into

information which is analysed into knowledge which is used and applied to create wisdom (ISACA, 2013).

According to Soares (2016), organisations must standardise a data architecture which creates a unified integration layer among all its data sources. By doing this, organisations will be empowered to have repeatable data governance and management processes. They will also be empowered to put in place incremental improvements in order to keep in tune with increasing data sources and emergent new demands for the business (Schmidt, 2015). The organisation also has to be able to ensure the integrity of data. Research has shown that at least 20% of all raw data is corrupted in one way or the other (Krishnan, Wang, Wu, Franklin, & Goldberg, 2016). The absence of a sound data architecture further increases the chances of inaccuracy. Principle 2 of COBIT 5 recommends the clear differentiation in the roles, activities and relationships which hold both the primary and secondary enablers to the processes which would ensure data is managed as a critical asset.

The recommendations of COBIT 5 with regards to data compliance and information security specify that information systems security and controls should be the foremost agenda for an enterprise. COBIT defines procedures which must be implemented in order to secure the integrity of data stored in any format within the enterprise. Furthermore, to ensure that compliance and governance targets are achieved, all transactional data must have a nomenclature of where, how and duration of retention, with clear guidelines on how such data is disposed of or deleted. As earlier discussed in section 4.2, COBIT 5 places a great premium on the unique identification of users, their roles, and access levels in tandem with their business roles within the organisation. The same set of compliance guidelines must also be enforced within the ambits of the enterprise's contractors or consultants handling or appropriating data on behalf of the organisation outside its network or firewall settings. To manage the lifecycle of data, therefore, COBIT 5 identifies four phases: plan, design, build/acquire and use/operate (ISACA, 2013). The planning phase covers objectives' identification, architecture, definition of standards and conventions. The design phase speaks to the physical implementation of what was planned. The build/acquire phase covers the creation of data records, acquisition of data assets and data recovery from external sources, while the last stage of use/operate covers the storage, sharing and disposal of data according to agreed conventions (ISACA, 2013). Within these four phases, it is crucial that security and integrity of data be maintained such that in no phase is data exposed to undue risk or unauthorised access (Eckerson, 2014). In South Africa, most government departments have adopted the Controlled Objectives for Information and

Related technology (COBIT), ISO/IEC 38500 frameworks and the IT Infrastructure Library (ITIL) as guidelines for the governance of IT, as directed by the DPSA (DPSA, 2013).

4.2.2 Data Governance Components in COBIT/ISO/IEC 38500

This section examines the data governance components stated in COBIT 5 and ISO/IEC 38500. Information Technology risk is defined as business risk arising from or associated with the use, ownership, operation, involvement, influence and adoption of IT within the enterprise (Ataya, 2013). This definition is applicable in the context of data governance as data governance forms a subset of information governance, which is essentially in the information security domain. Furthermore, COBIT states that "***Governance*** *ensures that enterprise objectives are achieved by* ***evaluating*** *stakeholder needs, conditions and options; setting* ***direction*** *through prioritisation and decision-making ; and* ***monitoring*** *performance, compliance and progress against agreed-on direction and objectives* (ISACA, 2013, p. 4). The main thrust of COBIT 5 is the governance and management of information and related technology from an enterprise-wide, end-to-end perspective. This is designed to be achieved by five principles which are listed as:

- Meeting Stakeholder Needs;
- Covering the Enterprise end-to-end;
- Applying a Single Integrated Framework;
- Enabling a Holistic Approach and
- Separating Governance From Management (ISACA, 2013).

COBIT 5 outlines a set of enabling processes for enterprise architecture which comprise instituting a common understanding of the business context of the data. COBIT 5 stipulates that data input and output classification should be made in line with enterprise architecture, with issues of recovery, redundancies, backup and data integrity being treated as core components of the data governance process. To this end, principle 2 of the five COBIT principles is directly applicable to data as it speaks to the optimisation of resources. The issues to be addressed on this level include how many repositories of enterprise data are being used by the organisation, whether a functional unified data integration access point exists where data access is effectively shared across applications, processes and analysis (ISACA, 2013).

The impact of data and information compliance on the organisation is also discussed in COBIT 5, with an emphasis on the management of processes that minimise the incidents which can lead to financial loss or the disruption of core business for the organisation (ISACA, 2013).

The identification and authentication of users and their access rights are considered key elements of securing data within the organisation. COBIT 5 stipulates the retention of critical data and business transactions for compliance and regulatory purposes. COBIT 5 also specifies seven enablers designed to drive better information and data governance. Each enabler has measurable goals and metrics which aim to drive better control and lead to incremental improvement in the overall governance of the enterprise's IT. The enablers are outlined below:

1. Management of IT-related business risk,
2. Transparency of IT costs, benefits and risk,
3. Security of information, processing infrastructure and applications,
4. IT compliance with internal policies,
5. Risk thresholds definition and communication,
6. Managing critical IT-related enterprise risk effectively and efficiently
7. Ensuring that IT-related risk does not exceed the enterprise risk appetite (ISACA, 2013).

In the same vein, ISO/IEC 38500 is an IT governance framework which stipulates the responsibilities of directors and other strategic managers in managing IT in a manner that ensures it delivers maximum value and exposes the organisation to minimum risks. Although not as detailed in process as COBIT 5, the principles outlined in this framework align with COBIT and other IT frameworks employed internationally for the governance of IT related matters. The ISO/IEC 38500 offers guidelines for IT corporate governance. The framework recommends three main tasks for directors in the guiding of corporate IT governance; evaluation, directing and monitoring (ISO/IEC, 2008). The three techniques recommended for directors to follow by ISO/IEC 38500 for the purpose of governing IT are:

1. Evaluate the current and future use of IT;
2. Direct preparation and implementation of plans and policies to ensure that IT use meets business objectives;
3. Monitor conformance to policies, and performance against plans (ISO/IEC, 2008).

A cursory examination of all three techniques show a clear alignment of IT to organisation's goals and objectives, thus making the framework relevant to this study as the aim of the data governance maturity evaluation model is to ensure that data becomes a strategic asset which can assist the department in the achievement of its goals and objectives. It is important to investigate the correlation between the actual adoption, or declaration of adoption of these

frameworks and the actual implementation in the Eastern Cape Public Service. The next section, therefore, examines the information governance and data processes in these departments in order to understand the effect of these frameworks on the output of accurate, relevant and verifiable information for effective governance in the province.

A discussion of the attributes of COBIT 5 which directly addresses data governance is important as its principles will inform the process-based checklist which the departments can use when implementing or improving on existing data governance processes in their respective departments.

4.3 Eastern Cape Government Departments and Alignment with COBIT 5 Recommended Processes

This study is focused on the building of a data governance maturity evaluation model for the government departments of the Eastern Cape. Thus, it is important to discuss how available and adapted IT/data governance frameworks are aligned with the actual practices and processes of data governance of the departments. It is also important to map current practices in the departments to the principles of data handling in COBIT 5 and the three accountabilities of evaluating, directing and monitoring set out in ISO/IEC 38500 regarding the governance of data and information assets. The danger of adopting a particular framework and not aligning current practices to its enablers in practice is that the departments remain vulnerable to the risks posed by unmanaged, incorrect data and the negative impact this can have on both fiscal and strategic planning (Ataya, 2013).

In comparing the data management principles of the Eastern Cape Government Departments, it is pertinent to point out that inadequate evidence exists of the implementation of most of the processes recommended by COBIT 5 in managing data. This is important in the light of the fact that government (DPSA) specifically recognises COBIT as the IT framework adopted in public service of the South African Government. Documents made available to the researcher of the Office of the Premier (OTP) such as the policy ICT governance documents clearly outline the requirements for the handling of records and sensitive information according to IT governance procedures outlined in COBIT 5. However, there was scant evidence of the establishment of the protocols which would enable these processes in practical terms (Nogicevs, 2010). Based on the seeming dissonance in required processes and the actual existing processes investigated in these departments, this study conducted a needs analysis to

further understand and contextualise areas where there were lags in data governance within the province. Details of the needs analysis are discussed below.

4.4 Needs analysis for data governance conducted in two Eastern Cape Government Departments.

This chapter discusses COBIT 5 and ISO/IEC frameworks for IT governance and its placement in data governance, which is the focus of this study. The purpose of this section is analysis and interpretation of a needs analysis survey done to determine the depth of need for data governance in the Eastern Cape Government Departments. McKillip, (1987) describes a needs analysis as the process of identifying, understanding and describing "problems" of a target population and possible solutions to the problems. A need is a gap between current state and desirable state (Altschuld & Witkin, 2000). The choice of a needs analysis for this study is based on the fact that insufficient evidence was found in the departments of their current data governance processes and their alignment with COBIT 5 or any other international IT governance framework. The researcher, therefore, considered it important to conduct a survey in order to better understand the 'problems' as this would inform the solution proposed in the conceptual model. This exercise also established the depth of employees' understanding of data governance and their familiarity with the basic concepts of data governance. The data was obtained through closed-ended questionnaires.

The process of data analysis is carried out in this section, with the aim of establishing the relationships between concepts, constructs and variables from the data collected (Cooper & Schindler, 2010). This is important to the purpose of this study as it provides evidence of the departments' positioning with regards to how data has been managed and also gives an insight into the critical areas where evidence of data governance has been lacking currently. The next section discusses the background to the survey, the instrument and the rationale for the choice and number of participants.

4.4.1 Background

The questionnaire instrument consisted of seven pivotal questions on the awareness of data governance in the department (appendix B). Details and rationale for the questions have already been discussed in Section 2.6.2 of Chapter 2. The data collected in this phase of the study was aimed at achieving three objectives namely:

- To confirm or refute what has been established in the literature; that data governance is already a significant issue in government departments and is recognised as such, in spite of the state or stage of its implementation;
- To ascertain the level of awareness and current efforts at institutionalising data governance within government departments;
- To decipher the perception of employees regarding current data management processes and affirm the need for a data governance maturity evaluation model for government departments. This is in order to institute a structured and process-based approach to data management, which will, in turn, assist with risk and compliance issues as well as accurate planning.

The purpose of having these three objectives is to enable the researcher to gain insights into the current level and phase of data governance in these departments, with a view to using this knowledge in the construction of the conceptual data governance maturity evaluation model which will be based on empirical literature and tested with both qualitative and quantitative phases of data collection.

A total of 45 questionnaires were distributed to participants in two departments of the Eastern Cape which cannot be named due to ethical boundaries. Twenty five participants completed the questionnaires satisfactorily, hence a 55.5%response rate was achieved (Table 2.5). The demographic distribution of these participants according to their job profiles is shown on Table 4.1 below.

Table 4.1: Distribution of Participants

Designation	**No of Participants**
Chief Information Officers (CIO)	2
Directors	4
Functional Managers	8
Strategic managers	6
Data capturers and administrators	5
Total	**25**

The bias for strategic managers and managerial participants for this needs analysis was due to the fact that data governance is mostly the forte of managers (Thomas, 2015). The inclusion of IT staff and data capturers was to test the ability of this category of employees to understand and relate to data governance parlance in the departments. This was an important factor as a data governance maturity evaluation model has components which would be implemented by data facilitators. The responsibility of strategic and functional managers is to initiate, plan and implement policies which speak to how data is governed; the management of these policies is for data capturers and lower level managers.

In the analysis process, all participants' answers were allocated the same degree of significance, in spite of their position or the particular government department being investigated. As discussed in Chapter 1 of this study, the exploratory sequential mixed method was employed for data collection in this study. The initial data collected and analysed in this chapter was to confirm the need for a data governance evaluation maturity model for EC departments. The data collection also sought to decipher the areas of strengths and weaknesses in the current data management structure in these departments; in comparison with the recommendations of COBIT framework and the ISO/IEC 38500, both international and well-tested frameworks for data governance which the DPSA has chosen as the IT governance frameworks for national departments.

4.4.2 Findings

As stated in section 4.4.1, the aim of the needs analysis is to investigate, with some depth, the current state of data governance in the departments. The data collection and analysis was done quantitatively. A close ended questionnaire (Appendix B) was considered the best instrument in gaining this understanding (Saunders et al., 2012). The questionnaire instrument was developed from literature, with the IBM Data governance maturity evaluation model and Stanford university data governance maturity evaluation model as the guiding documents for its development. (Stanford, 2013; IBM, 2007).

4.4.3 Discussions

This section presents the findings from the survey and subsequently discusses its implications for the objective of the study.

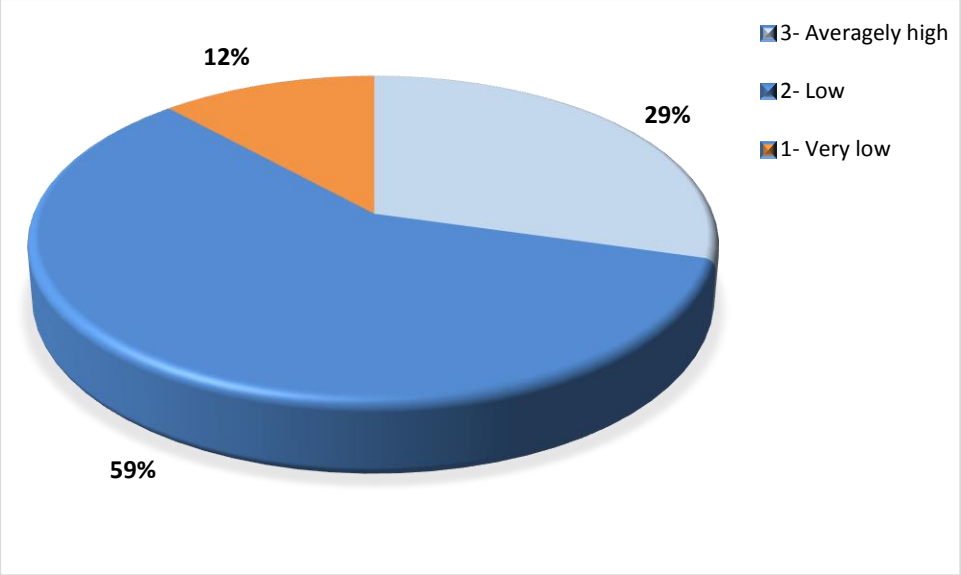

Figure 4.3: Background Information on Data Governance Awareness

Figure 4.3 shows that none of the participants felt that there was a very high level of awareness regarding data governance in the department. A majority of 59% opined that awareness levels were low, while 29% believed awareness was average. Some, 12% of the participants, stated that awareness was very low. The inference from these responses is that the level of awareness about the concept and criticality of data governance in these departments was below average; thereby raising questions about the current data management processes and how they align with the clearly outlined data governance processes in COBIT 5, which is a framework for IT governance and the benchmark for data governance processes in the department. The successful implementation of data governance is the forte and responsibility of senior managers, thus it is important to get the views of staff on what constitutes data governance. The responses show that the level of awareness was below average, hence the justification for the proposed model (DGMEM).

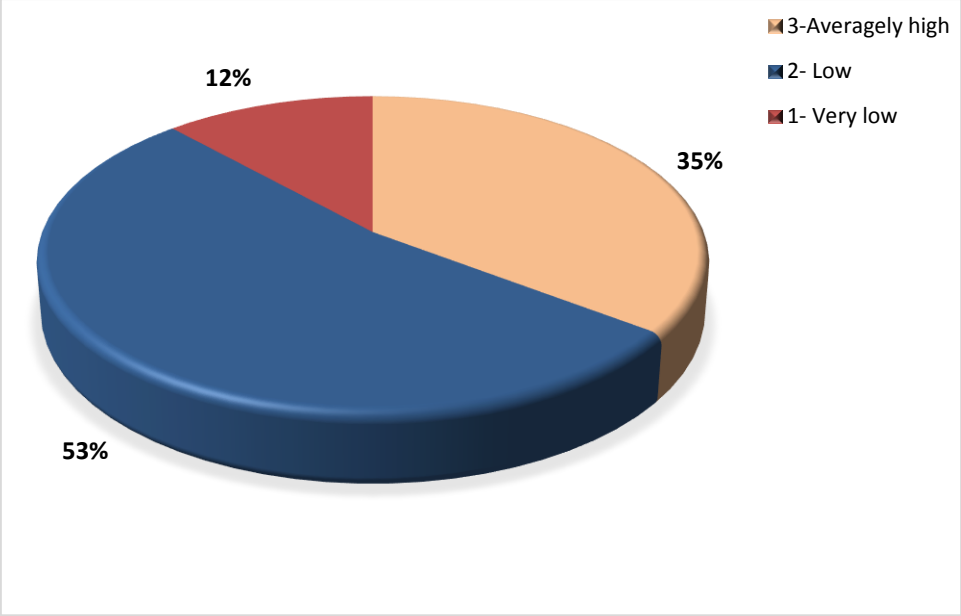

Figure 4.4: Awareness of available Data Governance Policies

Responses to question on the level of awareness regarding available data governance policies and frameworks revealed an inadequate level of awareness about these policies. More than half of the participants, 53% to be exact, stated that awareness levels were low; 35% believed awareness was averagely high and 12% said the level of awareness was very low. This position finds support in literature (Khatri & Brown, 2010).

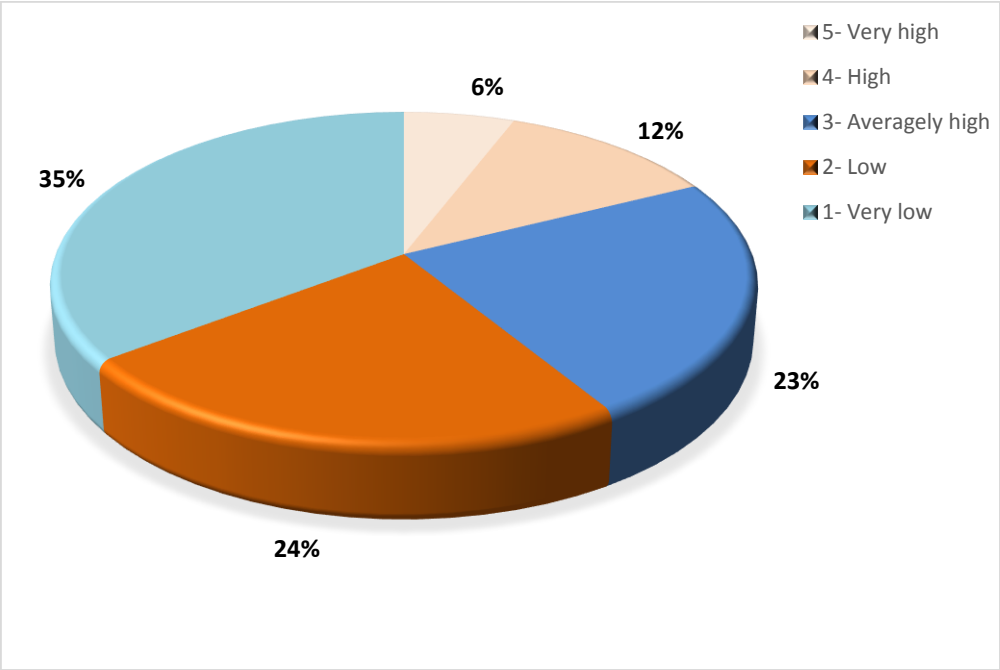

Figure 4.5: Enabling Capabilities for Data Governance

Findings revealed that 35% of the participants had very low awareness of any programme or capabilities for data governance within their organisation, 24% had a low level of awareness, 24% considered the awareness as averagely high while only 6% considered awareness of data governance capabilities as high.

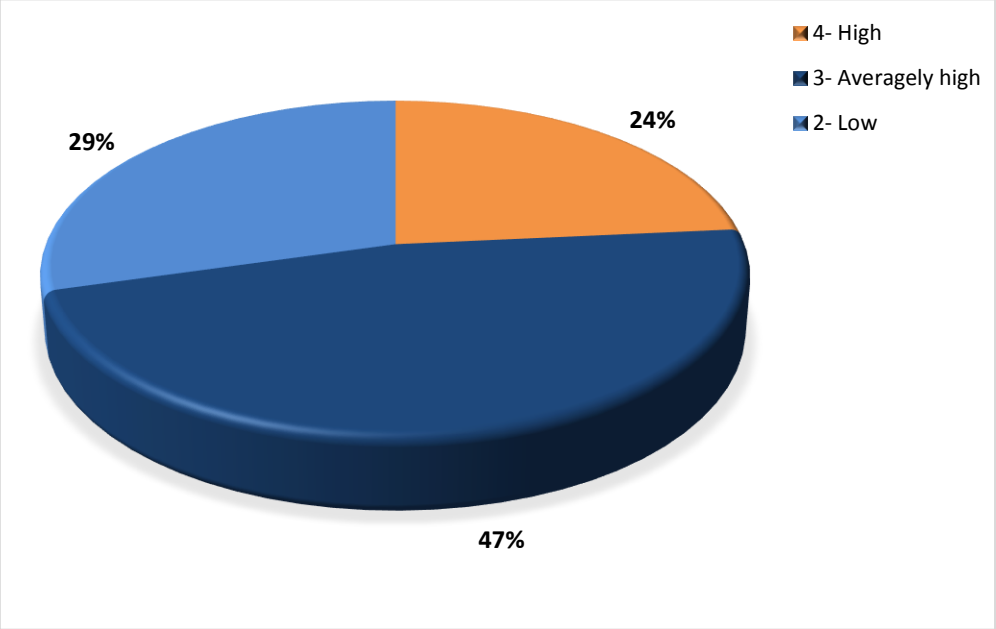

Figure 4.6: Data Governance Roles and Responsibilities

Forty-seven percent (47%) of participants averred that awareness of data governance roles and responsibilities was very high in the department. On the contrary, 29% opined that awareness levels were low while 24% stated the level of awareness was high.

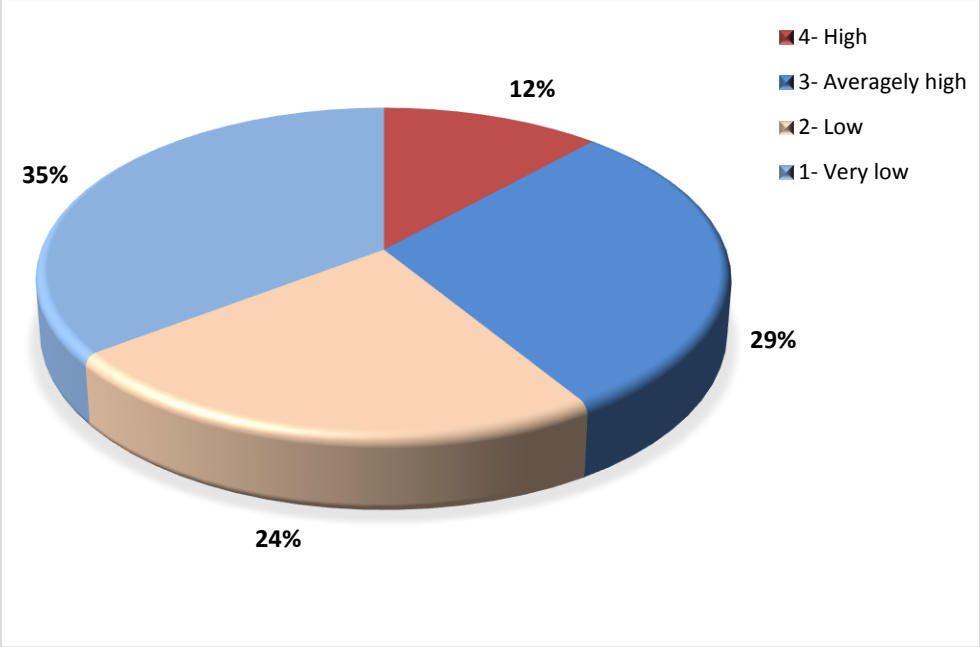

Figure 4.7: To what Degree is Data Governance formally instituted in your Organisation?

The institution of formal data governance processes was considered as very low by 35% of participants , 24% stated that it was at a low level, 29% believed they were averagely high while 12% believed it was high.

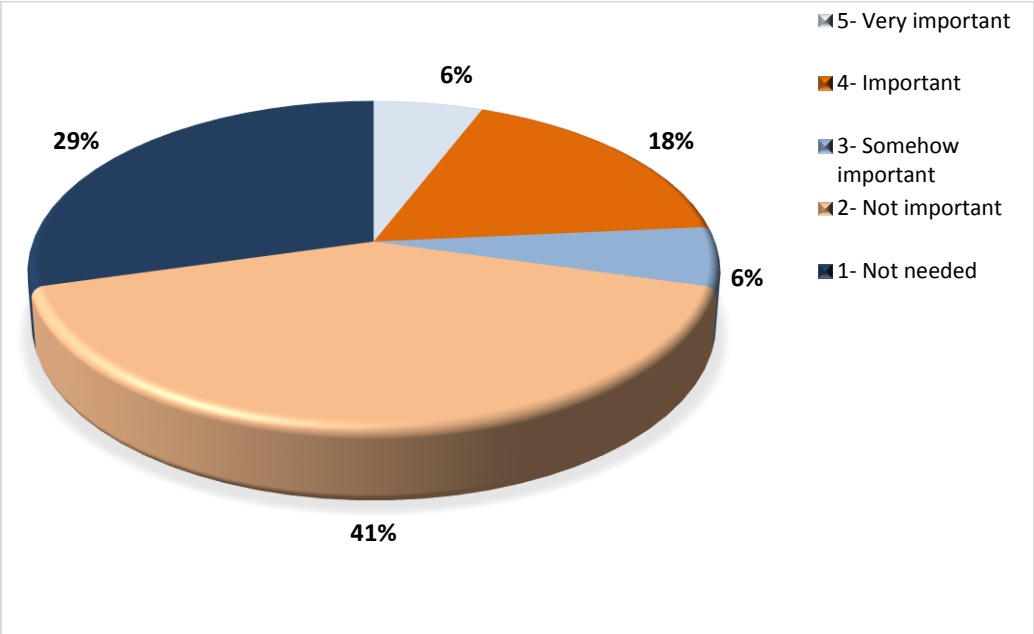

Figure 4.8: How Important is the Implementation of a Toolset for the Development and Implementation of Data Governance in your Organisation?

Only 6% of participants considered the production or implementation of a toolset to govern data as very important. 18% considered it as important and 6% agreed that it is somehow

important. 41% of participants believed this was not an important aspect of the management of their data assets while 29% stated that such a toolset is not needed.

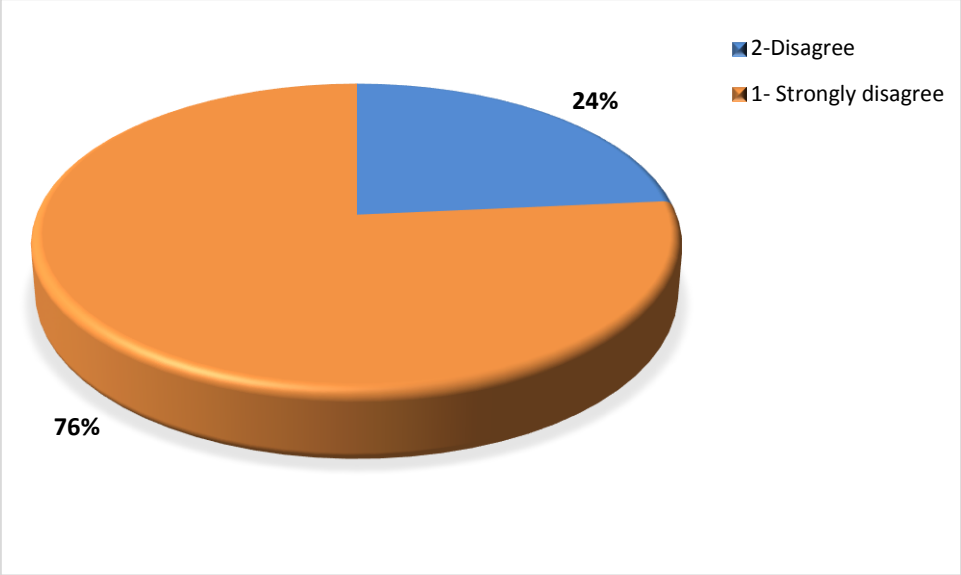

Figure 4.9: Adequate Technological and People Capabilities in Place to actively manage Metadata within the Organisation

Seventy-six percent (76%) of participants strongly disagreed with the notion that there are adequate technology and people capabilities to manage metadata in the department. Twenty-four percent (24%) disagreed. There were no participants who agreed with the statement.

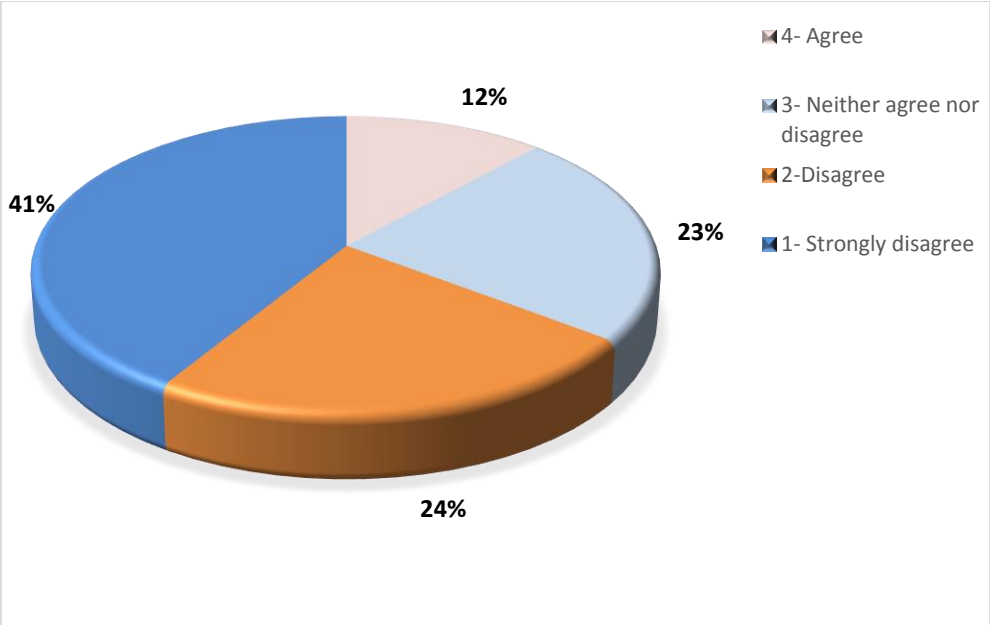

Figure 4.10: Optimisation of Departmental Data Assets

Forty-one percent (41%) of participants strongly disagreed with the notion that data was being optimised in the department, 25% disagreed ,while 24% were neutral.

Summary of Findings

An analysis of the findings revealed that the level of awareness about the concept and criticality of data governance in this department was below average, thereby raising questions about the current data management processes and how they align with the clearly outlined data governance processes in COBIT 5, which is the benchmark for data governance processes in the department. An in-depth analysis revealed that participants who had a good knowledge of data governance roles were the CIO, the IT manager and a senior manager who doubles as the head of strategic planning in the department. The inference from this analysis was that the majority of the staff were not aware of what having a structured data governance programme in the department entailed. The conclusion from this analysis was that data governance and its intricacies still remains the forte of the executives, thereby precluding the rest of the staff in the area of exercising and executing actions which may serve to ensure the sanctity and integrity of data assets. Findings indicated clearly that cross functional management of data assets, established and repeatable processes and information sharing were still relatively unknown and untapped in the government department tested. It, therefore, is believed that there is a place for a maturity model which can assist the department in identifying where they are in terms of data governance practices and how to move to another level.

Findings from the data revealed variances in the understanding of data's importance, depending on the position and designation of the participant within the department. All twenty-five participants considered data to be an important strategic asset for their departments, yet only three participants believed that data is being optimised, with most participants stating that they do not believe data is currently being optimally managed. A considerably low number of the participants stated that they were aware of futuristic plans to formalise data governance in the departments while most were not. An in-depth analysis of the responses revealed that most participants were unaware of the plans to formalise data governance. The responses indicate that data governance is not an unknown concept amongst departmental staff, but most of them had no clear understanding of the processes supporting it in their respective departments.

Responses to the question of the level of awareness about available data governance policies and frameworks revealed an insufficient level of awareness about these policies. In the same vein, there seems to be little awareness of data governance programmes or enabling capabilities

for the actualisation of data governance in the departments. This feedback further reinforces the belief that there is a need for a structured, process-based approach to data governance in the departments as this will ensure the uniformity of purpose and ensure that sound data governance principles are institutionalised in the departments. The inference which can be drawn from this is that the majority of the staff were not aware of the plans, if any, to institute a structured data governance programme in the department. The conclusion from this analysis is that data governance and its intricacies still remains the forte of the executives, thereby precluding the rest of the staff in the area of exercising and executing actions which may serve to ensure the sanctity and integrity of data assets.

In response to the question of available technological and people capabilities for the management of departmental metadata, it is believed that in the current dispensation where data breaches are becoming a major ground for litigations, compliance with several regulatory stipulations form part of the audit process, it, therefore, behoves public enterprises and government departments to ensure there is an audit trail of data and metadata in case of such occurrences. The response is a clear indication of the fact that metadata management is still relatively unknown and untapped in the two government departments tested, therefore there is a definite need for processes which support effective metadata to be introduced in these departments.

This aspect of data governance is important and required if the processes and practices are to be benchmarked against COBIT 5 which is stated by the departments as the framework for managing IT related assets. Table 4.2 below outlines the correlation between COBIT 5/ISO/IEC 38500 and Current Practices in EC Government Departments.

Table 4.2: Correlation between COBIT 5/ISO/IEC 38500 and Current Practices in EC Government Departments

COBIT 5	**ISO/IEC**	**Result Of Needs Analysis**	**Correlation**
Data Governance Structure			
Strategic	Strategic	Unstructured	×
Managerial	Functional guidance	ad hoc	×
Implementation	Objective evaluation of IT Governance processes	ad hoc	×
Data Attributes			
Clear Information Ownership	Accountability	Enterprise Data Management	√

COBIT 5	ISO/IEC	Result Of Needs Analysis	Correlation
Data Governance Structure			
Timely and correct information		None	×
Clear Enterprise architecture and efficiency	Ensuring stakeholders are confident of IT and all related governance activities	None	×
Compliance and Security		Data Security management	√
Data Governance Enablers			
Enterprise resources and service capabilities	Evaluate current and future use of IT	None	×
IT Infrastructure	Ensure the use of IT meets business objective	ad hoc	×
People and Information		ad hoc	×
Alignment with other relevant standards and frameworks	Monitor conformance to policies and performance against plans	None	
Phases of Managing Data Lifecycle			
Plan - objectives identification, architecture, definition of standards and conventions	Evaluating	ad hoc	×
Design - the physical implementation of what was planned	Directing	ad hoc	×
Build/ Acquire - covers the creation of data records, acquisition of data assets and data recovery from external sources	Monitoring	ad hoc	×
Use/Operate - the storage, sharing and disposal of data according to agreed conventions	Directing	ad hoc	×
Process			
Define Data Systems	Responsibility	ad hoc	×
CIO determines accountabilities for each layer of data	Strategy	ad hoc	×
Data definition, classification, security control and data integrity	Evaluation and monitoring	ad hoc	×

COBIT 5	ISO/IEC	Result Of Needs Analysis	Correlation
Data Governance Structure			
A nomenclature of where, how and duration of data retention, and clear guidelines on how such data is disposed of or deleted	Performance	None	×
Unique identification of users, their roles, and access levels in tandem with their business roles within the organisation	Human behaviour	None	×
Compliance guidelines enforced with enterprise's contractors or consultants handling data on behalf of the organisation outside its network or firewall settings.	Conformance	ad hoc	×

4.5 Summary

Chapter 4 discussed the role of technology in the e-government efforts of the South African National Government, the details of data governance processes outlined in COBIT 5 and its relevance to the departments. The relevance of the ISO/IEC 38500 framework to IT governance in South Africa Public Departments was also discussed. The attributes of data governance as proposed by COBIT 5 were discussed, in comparison to what currently obtains in the departments. The chapter thereafter conducted a needs analysis to ascertain the need for the data governance maturity evaluation model envisioned as the output of this study. A quantitative analysis of the responses was conducted and it was deduced that there is a need for the data governance maturity evaluation model to gauge data governance efforts in the departments. The next chapter discusses five maturity models and their relevance to the context and theoretical base of this study.

Chapter 1
Introduction

Chapter 2

Methodology

Chapter 3
Relationship between Corporate Governance, IT Governance and Data Governance

Chapter 4

An analysis of current Data Governance Practices in the Eastern Cape Government Departments

Chapter 5

A Discussion of Five Maturity Models Relevant to this Study

Chapter 6

A Conceptual Data Governance Maturity Evaluation Model

Chapter 7

Presentation of Findings from the Qualitative Data

Chapter 8

Implications of Findings from the Qualitative Data

Chapter 9

Presentation of Findings and Implications of the Quantitative Data

Chapter 10

A Data Governance Maturity Evaluation Model for Government Departments of the Eastern Cape

5.1 Introduction

5.2 Maturity Models

5.3 The Procedural Requirements for the Development of a Scientific Maturity Model

5.4 Rationale for the Choice of Maturity Models discussed in this Chapter

5.5 Justification of the DGMEM and the Gap to be filled by this Study

5.6 Summary

5. Chapter 5: A Discussion of Five Maturity Models Relevant to the Study

5.1 Introduction

Chapter 4 discussed the current efforts of the South African National Government to incorporate IT governance, information management and data governance into government processes. The chapter discussed the positioning of IT within public enterprises and government departments in South Africa, its past and present efforts and the effectiveness of such attempts. The COBIT 5 framework and ISO/IEC 38500, which are the benchmark frameworks for testing the existence, and extent of data governance processes in these departments, were discussed extensively, in comparison with the existing policies and practices regarding data governance. The chapter thereafter discussed the results of a needs analysis questionnaire which was conducted to ascertain the need for a data governance maturity evaluation model that is relevant and appropriate for the Eastern Cape Government Departments. The needs analysis identified areas where there seemed to be a departure from sound international practices for data governance

Chapter 5 discusses five maturity models identified in extant literature as being directly relevant to the objective of this study. These are the Capability Maturity Model (CMM/CMMI), CollabMM, IBM Data governance maturity evaluation model, the GoCoMM and the Gartner Enterprise Information Management Maturity Model. This discussion is preceded by an analysis of a procedure model for maturity models (Becker et al., 2009). A discussion of this procedure model and its application is considered appropriate as it proposes a scientific methodology by which a maturity model and its processes should be crafted in order for it to effectively measure the current state of a particular domain in an organisation. The research applied the principles of Design Science guidelines to arrive at this procedure model. This reinforces its importance and relevance for this study as Design Science is the methodology through which the model for this study is produced. The chapter concludes with a table identifying components of maturity models discussed in the chapter, their placement within the maturity model procedural application model and their relevance to the context of the study. The rationale for the choice of these maturity models is elucidated in the next section of this chapter.

5.2 Maturity Models

It is important that a discussion of maturity models is preceded by an understanding of what a maturity model is. A maturity model is a "*structured collection of elements that describe the characteristics of effective processes at different stages of development. It also suggests points of demarcation between stages and methods of transitioning from one stage to another*" (Okongwu, Morimoto, & Lauras, 2013, p. 8). Maturity models have also been described as consisting of a sequence of maturity levels for a class of objects. "*Maturity models represent the anticipated, desired, or typical evolution path of these objects shaped as discrete stages. Typically, these objects are organisations or processes*" (Becker et al., 2009, p.213). From the two definitions above, it becomes evident that a maturity model encapsulates the different phases or stages where a pre-determined set of processes relevant to the domain has been accomplished. The definitions further highlight the fact that the processes wherein each stage of accomplishment can be measured are structurally defined in an effective maturity model. To this end, we contend that the application or implementation of a maturity model presupposes that it has the following features:

1. Repeatable, valid and measurable processes;
2. It must relate the processes to organisational goals and objectives;
3. It can be benchmarked against available best practices in its domain;
4. Must be relevant to legislative, statutory requirements and tested frameworks;
5. It must determine the resources and components required to move from one level of maturity to another (Eckerson, 2014; Hamel, Herz, Uebernickel, & Brenner, 2013; Korhonen et al., 2013).

Furthermore, maturity models are a valuable tool for benchmarking the current state of an organisation's practices and policies (Wendell, 2009). Maturity models outline a descriptive 'as is' assessment of the entities or organisations under investigation (Poppelbub & Roglinger, 2011). In essence, they provide a prescriptive, clearly articulated set of processes of how to achieve desired improvements in order to get to the desired maturity level from a current level (Poppelbub & Roglinger, 2011). Maturity is multi-dimensional in nature; for an organisation to adapt or use an effective maturity model, the model needs to encompass the full expanse of data as it affects and impacts both the IT and business environment (Poppelbub & Roglinger, 2011). The principle behind a maturity model is to describe the typical attributes or activities that should be exhibited by an organisation at each defined maturity level (Huner, Ofner, & Otto, 2009). The effective assessment of a given domain is done with the aid of a maturity

model. It is crucial that such assessment effectively covers essential attributes of the domain being investigated (Wendell, 2009).

In line with the objective of this study to produce a data governance evaluation maturity model for assessing the state of data governance in the Eastern Cape Government Departments, it is critical for the study to examine, understand and align the processes of the proposed model with the strategic and operational goals of the departments as outlined in the Annual Strategic Plan (ASP). Another important function of a maturity model is that it should provide a guideline for the organisation to move from a lower to a higher level of maturity. These guidelines are the best practice guidance for the domain in which maturity is being measured. For this study, the processes identified in secondary literature will guide the required components of the model which government departments of the Eastern Cape can use as a checklist for assessing how they fare regarding their critical data assets.

There is currently a proliferation of maturity models in various fields of specialisations (Crowston & Qin, 2012; Magdaleno, De Araujo & Werner, 2011; Wendell, 2009; Paulk, 2009). These maturity models transverse a broad spectrum of public and private enterprises, organisations and establishments. It is noteworthy that a high percentage of these models are developed by industry 'experts' who use them for commercial purposes in assisting clients with their data governance processes. They, therefore, are not particularly suitable for measurement in an academic study of this nature. However, a number of organisations have committed time and resources to the development of quality maturity models which are widely quoted amongst industry and academic communities. The next section of this study discusses a procedural model based on Design Science principles which should be followed by maturity models in order for them to pass the test of scientific contribution and rigour. A discussion of this procedure model will serve as a benchmark for identifying the attributes and processes of the maturity models to be discussed in this chapter.

5.3 The Procedural Requirements for the development of a Scientific Maturity Model

Although maturity models have been an important instrument in enabling organisations to gauge their positions with regard to a given context by identifying their 'as is' state vis-a-vis their desired state, a proliferation of these instruments have raised questions about their usefulness and scientific validity (Becker, Knackstedt, & Poppelbu, 2009). It has been argued that processes and methods which led to the development of these models were sketchy and

lacking in scientific documentation (Becker et al., 2011; Jones,1995). To address this shortcoming, Becker et al. (2009) have thus developed a set of constructs to test the scientific foundation and viability of maturity models and their prospective impact on organisations.

The research by Becker et al. (2009) was selected in this study because it used a Design Science approach to cultivate a set of standards for the development of maturity models, as well as a basis for the comparison of existing, but inadequately documented, maturity models. The attributes and procedures specified in the paper were chosen because they align with the goal of the study; the creation of a maturity model for the purpose of evaluation of the state of data governance in the EC Government Departments. The study employed a Design Science methodology to arrive at the procedure model and application, the same set of guidelines that will be used for this study. Furthermore, the approach is comprehensive and integrates well known and tested maturity models such as COBIT 5 in the development of the procedure. The viability and validity of the model were also tested by means of a case study, further strengthening the argument for the usability of the research instrument.

Becker et al. (2009) contend that a maturity model can be described as a scale for the appraisal of an organisation along the evolution path in a progression regarding its capabilities in a certain area. The other task for a maturity model is to provide the conditions which must be fulfilled to reach a particular maturity level. Although this sounds straightforward, in reality, it involves a set of processes that must be supported by pre-determined and pre-tested questions which are relevant to the organisation at hand. The implication of this is that maturity models must be amenable to the peculiar circumstances of the organisation. This method of inquiry also helps the organisation to decide which area of maturity to prioritise according to organisational needs.

In light of the foregoing, the procedural model proposed by Becker et al. (2009) suggests that the first step in a maturity model for any IT domain should be requirements' identification. This stage involves the establishment of a practical catalogue of requirements for the design of a maturity model. In the context of this study, components of effective data governance have been identified in chapters 1 and 2 (Soares, 2015; Thomas, 2015; IBM, 2007; Eckerson, 2006). It was thus essential for this researcher to embark on a needs analysis of the department's data governance requirements as a first step in mapping the current practices to the business processes and strategic goals of the departments. The mapping aided the identification of the gaps and the resultant risks, thereafter outlining the requirements for an effective data

governance maturity evaluation model and the processes identified as required to move from one maturity level to another. The exercise was initially based on secondary literature, as well as identified gaps in the current data governance practices of the departments. The means of determining the gaps were discussed in Chapter 4 of this study, and confirmed in Chapter 7 with the aid of empirical data collection and analysis. This planned process found support in literature (Poppelbub & Roglinger, 2011; Steinhart 2010).

Becker et al. (2009) thereafter proposed a comparison of the requirements which substantiate the justification for a new model and identify how new knowledge can assist in modifying existing models. The rationale for this was the need to justify the creation of a new model, or to find support for the modification or improvement of an existing model which supported the domain under investigation in a better way. Becker et al. (2009) suggested that for this to be done effectively, an iterative method needed to be followed in the development of a maturity model. This was in line with the Design Science guidelines of Hevner et al. (2004) and the recommendations of Peffers et al. (2008) for Design Science methodology in research. This was followed by an evaluation of the principles and premises of a maturity model. Issues of usefulness, quality and effectiveness of a maturity model had to be iterated separately in order to delimit the evaluation criterion and tailor the model to the specific organisation. According to Becker et al. (2009), this process needed to follow guideline 5 of Hevner et al.(2004), (Table 2.3) which specifies research rigour in the evaluation process of the requirements. The problem relevance in the context of the maturity evaluation domain thereafter had to be explicitly stated.

For this study, it was important that the research showed the relevance of the requirements to be evaluated for inclusion in the maturity model. To achieve this, the researcher aimed to gather data from potential users of the maturity model in order to ensure the relevance and usefulness of all the components of the artefact to be created. Additionally, Becker et al. (2009) stated that the prospective application domain of the maturity model, and the conditions for its application and the projected benefits, needed to be determined prior to the design of the model. Subsequently, the results of the findings had to be communicated to the academic community and industry in a way that encouraged critique of the artefact. The communication of the model had to target its users around the conditions of its line of application. It was important to document the design process in detail, showing each step of the process, applied methods and the results of the application. This requirement was in line with the guideline of Hevner et al. (2004) on research communications. Table 5.1 below depicts how Becker et al. applied the outlined processes within specific case studies.

Table 5.1: Synopsis of Design Processes of Maturity Models (Becker et al., 2009)

Requirement	**Analysis Capability Maturity Model (ACMM)**	**Business Process Management Maturity (BPMM)**	**Capability Maturity Model Integration (CMMI)**	**Documentation Process Maturity Model (DPMM)**	**E-Learning Maturity Model (eMM)**	**IS/ICT Capability Maturity Framework (IS/ICT CMF)**
Comparison with existing maturity models (R1)	Comparison with CMMI Using CMMI-stages as pattern	Analysis of existing, but unsatisfactory maturity models in Business Process Management	Transfer of Crosby's Quality Maturity Grid to software development	Based on Software Process Maturity Framework and CMM	Adoption of concepts from CMM and SPICE (Software Process Improvement and Capability Determination)	Analysis of IT management maturity models (Nolan's Stage Theory, CMM, Strategic Grid)
Iterative Procedure (R2)	Development of a first model with literature research and expert interviews. Integration of process areas from CMMI Model modification on the basis of a case study	Derivation of four dimensions "Factor"-dimension initially comprises five factors. Use of Delphi studies for the determination of "factors" and subordinate capability areas	Initially development of Software Process Maturity Framework.. Further, developed into CMM Integration of other models into CMMI Review of intermediary versions.	Discussion of preliminary versions with software Engineers. Iterative cycle of (further) development and application led to four versions (in 1993, 1995, 1996, and 2000)	Application in case studies and workshops led to modifications of model.	Identification of initial indicators through literature research Iterative modeling to eliminate and combine indicators Validation through interviews Final adjustments
Evaluation (R3)	Application by independent persons in the case study No evaluation of maturity levels four and five	Application in case studies over two years Explorative studies Use of Delphi studies for the determination of model components	Preliminary versions of CMM were made accessible for review Discussion of CMM v1.0 in a workshop with ca. 200 experts Widespread applied-on by practitioners	Feedback from software industry Practical applications Additional validation by Cost Construction Model (Boehm 1981)	Validation of first the version at New Zealand university Workshops in Australia and Great Britain Applications in several organisations	Semi-structured interviews with regard to indicators Perspective: tentative empirical study for validation; implementation of an assessment tool; benchmarking study
Multi-methodological Procedure (R4)	Literature research on phases of analytical processes Expert interviews	Literature research Delphi method Expert interviews	Literature research on product quality	Analysis of other theories and models in software development Discussion of model with software industry	Literature research on e-learning processes	Literature research Iterative modelling Semi-structured interviews

From Table 5.1 above, it can be deduced that the process was aligned to the Design Science process of Peffers et al. (2008) through which the DGMEM would be created (See section 2.3.3 and Figure 2.4). This was important as the objective of the research was to create an artefact which would be able to solve real life problems hence the components of a maturity evaluation model needed to deliver relevance and value to the departments which would adapt it. The next section discusses the rationale for the choice of maturity models examined in this study.

5.4 Rationale for the choice of maturity models discussed in this chapter

Chapter 5 discusses five maturity models. An online search of the keywords "Data governance maturity evaluation models" on EBSCO search engine and Google Scholar was conducted on the 6th of March 2016. The search yielded 12,411 and 95,800 results respectively. In spite of the seemingly high number of hits returned by these search engines, a detailed analysis of the most frequently cited articles in the results revealed that the maturity models which followed a recognisable, scientific process in crafting their processes and components were few. A large percentage of the results were maturity models by service providers and IT vendors who used the models to attract clientele (Poppelbub & Roglinger, 2011). Most of these industry data governance maturity evaluation models patterned their maturity models after, and referenced the IBM data governance maturity evaluation model for data governance and the COBIT maturity model as a guide to the generic frameworks and processes on which their models were based (Becker et al., 2009). This result was in tandem with the reservations of several academic researchers about the proliferation of maturity models (Crowston & Qin, 2012; College, 2011; Gheorghe, Massacci, Neuhaus, & Pretschner, 2009).

The CMM, which later metamorphosed into the CMMI, is discussed first as it is widely acknowledged as the foundation of all maturity models (Crowston & Qin, 2012; Paulk, 2009). The IBM data governance maturity evaluation model is discussed next as it is arguably the most widely quoted data governance maturity evaluation model found in the literature (Soares, 2015; Wendell, 2009). The model is a result of years of research into data governance and a brainchild of the IBM data governance council. The council comprises 55 organisations working together to tackle the challenges of compliance, risk, audit and other statutory requirements relating to data and information through a sound data governance program.

The third maturity model discussed is the Gartner Enterprise Information Management (EIM) maturity model. It was chosen as it directly addresses matters relating to data governance and

management within the enterprise. The goals of the maturity model for the organisation are stated thus:

1. Structure, secure and improve the accuracy and integrity of enterprise information.
2. Solve semantic inconsistencies across boundaries.
3. Support the objectives of enterprise architecture (EA) and the business strategy (Newman & Logan, 2008, p. 1).

The fourth maturity model discussed is the Governance and Compliance Maturity Model (GoCoMM). This maturity model was selected because it advocates a methodology of 'how' to achieve compliance with best practices in data governance within the organisation. Proponents argue that the audit background of most maturity models encourages a checklist mentality which allows for errors in ungoverned data to be discovered months after such had occurred. The model thereafter proposed a current and comprehensive plan of ensuring the processes and procedures around data governance are automated in such a way that errors are detectable and addressed as soon as they occur, thereby mitigating the risks for the organisation through early detection and rectification. This systematic, real-time methodology is considered apt for the research problem at hand; government departments handle copious amounts of data, which form the basis of information, fiscal and strategic planning in these departments. It is crucial that data problems are addressed through early detection and correction before they impact negatively on the achievement of the strategic goals of the departments.

The fifth maturity model, the CollabMM is discussed based on its advocacy of collaborative support by all stakeholders in business processes. Data governance processes are implemented by the human resources within an organisation. The importance of people in the achievement of data governance goals and objectives are noted by all the other maturity models. It is believed that the explicit representation of collaborative support promoted in this maturity model will serve to encourage and strengthen a culture of compliance with data governance rules and responsibilities. Building these collaborative processes into the data governance program will, in turn, help such a program succeed in the Eastern Cape Government Departments.

The DGMEM, which is the final artefact for this study will incorporate some of the attributes of the five models into its components. This is in alignment with the pragmatic stance of this study, as the researcher seeks to solve the research problem with a myriad of methods that 'work' in resolving data governance issues in the departments. To this end, the case study at the Eastern Cape Treasury Department, will follow the CMMI' five maturity levels;

incorporate the IBM's data governance "bottom-up" approach to managing data governance; incorporate the principles of 'structure and data integrity' advocated by the EIM maturity model; the continuous audit of data processing in order to eliminate data errors at the point of data entry advocated by GoCoMM and the advocacy of collaborative support by all stakeholders in the CollabMM model. It is opined that all these attributes incorporated into the model will serve to further enhance its ability to robustly address the data governance challenges being faced by the departments. It is important to mention that there are other well-known maturity models which are not discussed in this thesis. Notable among these are the ITSM Process Assesment Supporting ITIL (TIPA), the Project Management Maturity Model (PMMM), the organisational Project Maturity Model (OPM 3) and the Enterprise Architecture Maturity model (EAM). The aforementioned models were excluded from the discussions in this thesis as they are all process-based approaches tailored to manage IT in organisations and IT in projects, respectively. Therefore, they have no direct impact on the goals and objectives of this study and do not fit into the purpose of this study. Furthermore, the overarching principles on which the models are based is already found in the CMMI, thus ensuring that none of the essential components that may be in any of these models is deficient in solving the research problem at hand.

The next section discusses the chosen maturity models which inform the conceptual model for this study. This will be followed by a table identifying the components of a data governance maturity evaluation model identified in the literature in line with the five selected maturity models.

5.4.1 The CCM/ CMMI

The Capability Maturity Model (CMM) was developed by the Software Engineering Institute to identify the stages of growth within an Information Technology domain (SEI, 2010; Paulk, 2009). Most extant literature identifies the CMM as the historical foundation of maturity models (Crowston & Qin, 2012). The CMM and subsequently, the Capability Maturity Model Integrated (CMMI) was developed by the Software Engineering Institute (SEI) originally for the assessment of the capabilities of the United States of America (USA)'s software contractors (SEI, 2010). The development was encouraged and necessitated in part by the frequent occurrence of software development failures which had cost billions of dollars in lost revenue to both governments and companies (Paulk, 2009). The CMM, therefore, was used to define

and develop an organisation's software processes. After the publication of the first technical report of ISO/IEC 15504, the CMM went through several stages of refinement, adaptation and updates between the 1990s to 2000s, incorporating other areas of information technology such as business management, project management and process management (Colleta, 2011). The model, therefore, evolved into the Capability Maturity Model Integration (CMMI), incorporating specific areas of the information technology domain for process improvements. This evolution made it possible to measure maturity in each of these specific areas of IT.

The CMMI has a five level graduated path which outlines the starting point, common language and method of measuring progress. The collection of elements establishes a steady and progressive guideline for an organisation to determine how it fares in a particular field of endeavour. In time, several other fields of specialisation began to model and customise aspects of the CMMI as appropriate to their organisations. Essentially, the CMM defines five levels of process maturity, with each level comprising key process areas which need to be addressed in order for the organisation to mature its process. At the **initial** level, reliance on the skill sets and personal efforts of individual stars within a project is the norm. This leads to chaos; problem-solving is reactive rather than proactive. The second stage is the **managed** level which focuses on effective project management and emphasises meeting budgetary commitments within project times. The **defined** level is focused on developing adaptable software processes and other related organisational assets; thus promoting organisational learning in software processes. The **quantitatively managed** level prioritises the monitoring of established software processes. The final level, which is the **optimising** level, is focused on continuous improvement with the aid of quantitative data already gathered from several organisational lessons (Paulk, 2009).

5.4.1.1 Assessment of the CMM/ CMMI

Critics of the CMM/ CMMI have asserted that the key process areas are flawed and result in unnecessary bureaucracy (Jones, 1995). The concerns ranged from questions of scope, effectiveness of adopting the CMMI and its homogeneity with available international standards such as ISO-9000 which were in use at the time. However, Colleta (2011) clearly demonstrated through empirical evidence that the organisations which used the CMMI have shown measurable progress and significant improvements in software processes. Colletta (2011) argues that the biggest barrier to the validation of CMMI's success remains its representativeness and adaptability to new and ever changing demands in new areas of IT. The

CMMI is important to this study as the expected data governance model for the Eastern Cape Government Departments encompasses data governance processes and this forms one of the strong theoretical foundations of the CMMI. Its evolution and adaptability for process improvement in maturity models, therefore, will be referenced frequently in the course of this research.

5.4.2 CollabMM

Magdaleno, de Araujo and Werner (2011) propose a Process Maturity Model which designs business processes for collaborative support. The model was inspired by the CMMI, the Knowledge Management Maturity Model (KMMM) and the Business Process Maturity Model (BPMM). The four levels of maturity are; (1) **Ad-hoc** (2) **Planned** (3) **Aware** and (4) **Reflexive**. On level 1, collaboration is not explicitly represented in business processes and individuals' efforts take precedence over group efforts. On level 2, business processes become modified and include basic collaborative activities. On level 3, there are processes in place to monitor and control collaborative activities. Group members understand the processes they are involved with, the reasons for the processes, how their roles and responsibilities impact upon the group and the main objectives to be achieved. They are also committed to playing their part in meeting the objectives of the group. On level 4, processes are designed for self-understanding, the identification of the results produced from collaboration and the sharing of knowledge to promote greater benefits for the organisation. Also, on level 4, results of processes are concluded, the strengths and weaknesses are formally documented and communicated throughout the organisation. The authors opine that the explicit representation of collaborative support in business processes would make the practice a culture within an organisation. CollabMM organises the required, necessary or identified collaborative practices for a particular domain in an organisation, thereafter providing a systematic approach to integrating the collaboration practices into business process models.

The CollabMM is considered a relevant maturity model for this study as it proposes an integrative approach whereby data governance processes are ingrained in the business practice of the government departments of the Eastern Cape. The incorporation of collaborative practices and processes into the handling of data assets within this sphere will ensure that silos, which currently exist in the departments are dismantled and a single version of the truth can be reported for information purposes (Magdaleno, de Araujo, & Werner, 2011). As discussed in section 1.5, chapter 1 of this study, a standardised set of requirements for commonly defined,

managed data within multiple user domains will entrench a culture of accountability and repeatable processes for data governance (Khatri & Brown, 2010). The choice of this model for the study is therefore justifiable.

5.4.3 IBM Data governance maturity evaluation model

IBM has been at the forefront of advocacy for strong data governance within organisations for over two decades (Wendell, 2009). In 2008, the company predicted that data governance would become a compulsory reporting item on the agenda of most companies within the next decade (IBM, 2007). The IBM Data Governance Maturity Evaluation Model has been one of the leading maturity models used as a reference point within data governance domain since it was introduced in 2007 (Wendell, 2009). The model is described as a 'breakthrough initiative' by the organisation and was designed with input from fifty-five organisations with the intention of building consistency and quality in data governance with the aid of proven business technologies, collaborative methods and best practices.

The five maturity levels defined by CMMI were adapted for the measurement of maturity level by the IBM maturity model. These five steps have already been discussed in section 5.1 of this chapter. The IBM had categorised the elements of an effective data governance framework into five main domains. These are listed as Supporting Disciplines, Core Disciplines, Enablers and Outcomes. According to the IBM Data Governance Maturity Evaluation Model, there are 11 crucial domains of data governance maturity. Table 5.2 below shows the domain categories and the description of the elements found in them.

Table 5.2: IBM Data Governance Council Maturity Model ((IBM, 2007 p.10)

Category		Description
1.	Organisational Structures and Awareness	Describe the level of mutual responsibility between business and IT, and the recognition of the fiduciary responsibility to govern data at different levels of management
2.	Stewardship	Stewardship is a quality control discipline designed to ensure custodial care of data for asset enhancement, risk mitigation, and organisational control
3.	Policy	Policy is the written articulation of desired organisational behaviour
4.	Value Creation	The process by which data assets are qualified and quantified to enable the business to maximise the value created by data assets
5.	Data Risk Management & Compliance	The methodology by which risks are identified, qualified, quantified, avoided, accepted, mitigated or transferred out
6.	Information Security and Privacy	Describes the policies, practices and controls used by an organisation to mitigate risk and protect data assets
7.	Data Architecture	The architectural design of structured and unstructured data systems and applications that enable data availability and distribution to appropriate users.
8.	Data Quality Management	Methods to measure, improve and certify the quality and integrity of production, test, and archival data
9.	Classification & Metadata	The methods and tools used to create common semantic definitions for business and IT terms, data models, types, and repositories. Metadata that bridge human and computer understanding
10.	Information Lifecycle Management	A systematic policy-based approach to information collection, use, retention, and deletion
11.	Audit Information, Logging and Reporting	The organisational processes for monitoring and measuring the data value, risks and efficacy of governance

For each of the eleven categories listed in Table 5.2, there are sub-categories that further break down the requirements for, and components of, maturity. There are five maturity levels as stated by the CMMI. The IBM maturity model states that an organisation can start with any of the categories, depending on its need and the ability to make a viable business case to justify the choice of the category. Organisations are encouraged to assess their governance maturity levels by identifying data handling and management milestones or benchmarks in their

systems. The model identifies five levels of this stage; ranging from Level **1** where policies guiding regulatory and legal controls are in place, data deemed critical to the policies are identified and risk assessments around the protection of the data assets are carried out. On Level **2**, data related controls are published and shared with the entire organisation; also metadata becomes an important element in the documentation of critical data assets. Level **3** encapsulates clear and unambiguous data policies which reflect the organisation's data policies. On this level, risk assessment for data quality, data integrity and organisation's reporting a single version of the truth are integrated into the project methodology of the organisation. On Level **4**, the value of data is further defined and data governance structures are in place in the organisation. Data models are documented and published at this level. Finally, on Level **5**, data governance becomes part of the business. The Return on Investment (ROI) for data related projects are constantly tracked and the cost of managing data is matched to the business value it delivers.

The IBM data governance unified process depicted in Figure 5.1 below describes a procedural system to both the elements in measuring the data governance maturity of an organisation and the processes to ensure effective data governance.

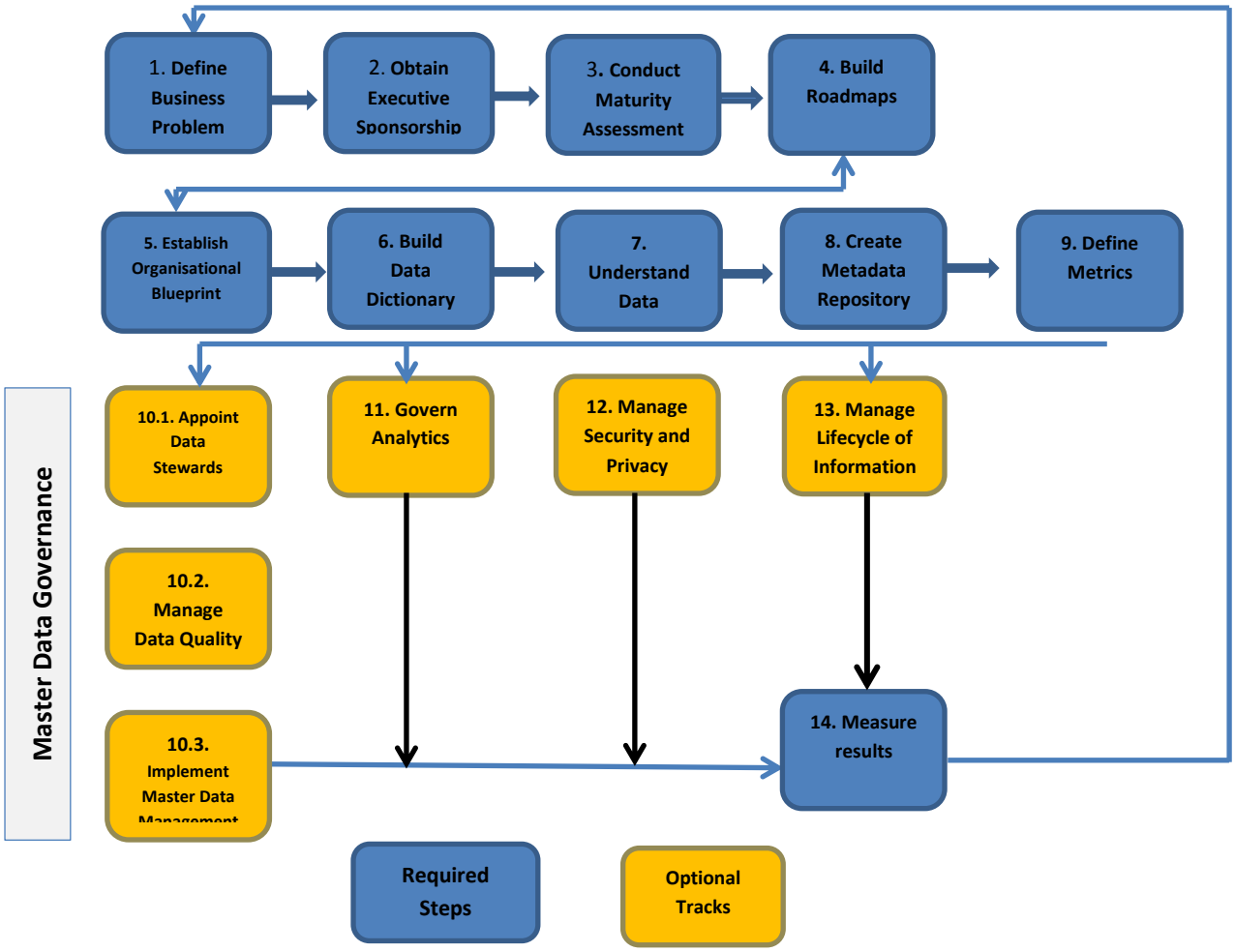

Figure 5.1: The IBM Unified Process for Data Governance Maturity (Soares, 2010)

As depicted in Figure 5.1 above, the model has proposed both required and optional steps in achieving a data governance best practice for an organisation. The IBM Data Governance Maturity Evaluation Model is widely quoted in literature as a useful and comprehensive model for data governance (Soares, 2015; Seiner, 2014; NASCIO, 2009). The model presents both a maturity framework and a set of assessment questions to assist the organisation in having a well-rounded maturity model (Soares, 2010). The IBM Data Governance Maturity Evaluation Model is also among the most widely used of data governance maturity evaluation models (Dismute, 2010). Thus, this model is pivotal to this study as it is currently the most comprehensive data governance evaluation tool found in the course of surveying extant literature for this research. Additionally, there is no known data governance assessment model in the Eastern Cape Government Departments; this tool, therefore, presents a foundation from which the model for this study can be built. The relevant factors out of the 11 categories of the IBM model will be employed in order to develop a well-rounded maturity evaluation model

for the Eastern Cape Government Departments, with particular integration and mapping of COBIT 5 principles of maturity models and the guidance provided by ISO/IEC 38500, both documents which are adopted by the Provincial Government for the governance and management of IT. Additionally, the assessment questions of the IBM model provide the researcher with a useful tool to align and map the data governance assessment questions for the department.

However, it is pertinent to note that an effective data governance model does not necessarily imply that it has covered all aspects of an organisation's peculiar needs (Chalker, 2014). Thomas (2015) and Chalker (2014) both contend that organisations may need to include some crucial elements into their data governance models that are not part of a standard or popular data governance model or framework. An example of this kind of data relates to social media data generated by sales and marketing, mobile data platforms and big data (Chalker, 2014). Due to this reason, the conceptual model may comprise other elements not found in the IBM maturity model or the other maturity models discussed in this chapter, depending on the perceived needs of the departments.

5.4.3.1 The Governance and Compliance Maturity Model (GoCoMM)

The Governance and Compliance Maturity Model (GoCoMM) was proposed by Gheorghe, Massacci, Neuhaus and Pretschner (2009). The authors portend that most maturity models have an audit origin and, therefore, are prescriptive in the sense of evaluating the level of compliance with a predetermined set of objectives. This makes them practical and productive for audit purposes, but does not offer much help with the 'how' of compliance. The inherent principles for GoCoMM and its listed maturity levels are considered as being directly relevant to this study as the objective of the study is not only to identify the maturity level of the departments, but also to clearly elucidate the processes and activities required to achieve data governance maturity on the five levels in accordance with the annual targets and objectives of the departments and the IT policy(ies) in place at any given time.

According to Gheorghe et al. (2009), the model proposed fills a gap that is commonly identified in maturity model literature, that is, the absence of concrete elements and metrics needed to attain higher levels of maturity in a particular context. To this end, the GoCoMM proposes; (1) a maturity model which allows the organisation to continually assess the effectiveness of their controls with regards to the automation and verification of regulatory compliance, (2) a

conceptual model that links controls directly to organisational objectives, thereby providing a strong relevance of the elements in the model to the processes in the context , (3) a carefully sculptured architecture for an IT infrastructure to implement the conceptual model in a way that links maturity to technological automation, (4) measurable indicators to show the extent of process compliance with applicable regulatory requirements and the extent to which these controls are put to effective use. From the aforementioned, there is a clear indication that the GoCoMM has a strong argument for the automation of processes to achieve maturity levels. This attribute maps directly to one of the objectives of this study, which is to ensure the governance of data in such a way that it is aligned to the strategic and security requirements of the departments. One of the objectives of the study is also to ensure, through data governance, that information obtained from the audit of data assets, metadata, data quality and data security is sacrosanct. The maturity levels in the GoCoMM are listed below:

Level 0: Chaos. No adequately documented level of control over business processes. A traditional audit is likely to fail.

Level 1: Control. The business has controls in place, but they are inadequately correlated with objectives. When objectives change, there is no process in place that could say which controls need to change because of the changed objective.

Level 2: Correlation. The controls are correlated with objectives, but they do not (all) operate automatically.

Level 3: Automation. Controls operate automatically, but no indicator judges the performance of processes and controls.

Level 4: Measurement. There are automatically and consistently computed indicators in place that allow continuous assessment of governance and compliance (Gheorghe et al., 2009, p.34).

The GoCoMM is presented by the authors as proactive rather than reactive. This is because audits happen in predetermined time frames, and maturity models typically work with checklists on assets for audit purposes, which are not necessarily correlated to business needs. Furthermore, audit reports happen after the fact, which implies that infractions in terms of data loss, information inaccuracy and poor data quality are discovered after the damage is already done, which may cost the organisations in terms of litigations, regulatory fines and investors' loss of confidence. To this end, GoCoMM proposes a continuous assessment process which identifies and corrects anomalies in the system, rather than doing damage control when some

aberration has already been committed. The CoGoMM proposes an implementation and automation process which enables continuous checking for compliance with the processes listed on a particular maturity level, thus making it easier to meet compliance standards, rather than react to failures in the system brought about by non-compliance.

To this end, the GoCoMM represents a very tightly controlled set of process objectives which ensures the organisation has its goals and objectives matched to the investments made in the implementation of IT infrastructure and human capital required for the purpose of effective governance. This model is very relevant to this study as the researcher aims to produce an artefact which, according to Design Science guidelines and research principles, can solve real life problems (Gregor & Hevner, 2013). Furthermore, Peffers et al. (2008) state that the value of Information System research should be that it provides answers to wicked problems and the solutions should be quantifiable. The maturity evaluation model which is the expected output of this study will be tested for viability and adaptability within the Eastern Cape Government Departments. One of the most important outcomes of this test is that the model is able to assist the departments in achieving positive audit results, a factor that has been a major challenge in the departments since 1994. A discussion of the audit reports of some of these departments, the effect of negative audit reports on revenue allocation and efforts by these departments at improving the result of their audit findings has been carried out in chapter 4 of this study.

Another very important factor which informed the choice of GoCoMM for this study is the way in which the authors have matched the processes stipulated by COBIT 5 for measuring maturity in a straightforward yet ostensibly effective way. This simplicity of implementing the automation of processes is important to this research context as some of the departmental staff are technologically challenged, yet they form an important part of the human resources which must ensure the governance of data in their organisation. To obtain the buy-in of this stakeholder group thus requires an assurance that they understand and relate to the components of a maturity model and are able to implement or at least understand how the processes tie in with their own key performance indicators (KPIs). In light of this, the model will be one of the points of reference for the conceptual model in this study.

Finally, the CoGoMM introduced a crucial and unique element to their model which is worth exploring for the purpose of this study. This is the use of a maturity model as well as an enforcement infrastructure which enables corrective or preventive action during the governance process, rather than during audit times. The model also shows clearly the ‘how to’

derive meaningful and measurable indicators for reaching higher maturity levels by starting from the point of the business process and the related control objectives directly mapping to them.

5.4.4 Gartner's Enterprise Information Management (EIM) Maturity Model

Gartner's Enterprise Information Management (EIM) maturity model was developed and published in 2008, as a response to the perceived need of organisations to identify their level of maturity and to take the requisite action for attaining the next level of maturity. Gartner opined that achieving successful enterprise information management demands a coordinated program and not ad hoc activities within the organisation. Findings from research revealed that most enterprises are in the early stages of EIM, hence the need to empower senior management with the ability to decide on an EIM roadmap fitting the context of their organisation.

The EIM maturity model was chosen as one of the relevant maturity models for this study as it relates directly to the issues of data governance and management. The words `data' and `information' were used interchangeably in the maturity model, thereby confirming that the outlined processes in moving from one maturity level to another were mapped with the criticality of data as an asset in mind. There are six maturity levels in the Gartner EIM model: these are listed below and considered to be fundamental to the achievement of a succinct and proactive, rather than a reactive, methodology for managing data issues.

5.4.4.1 The Six Levels of EIM Maturity

Level 0: Unaware

At this level, the risk of compliance failure, poor quality of important and strategic decisions based on incorrect data and low levels of productivity are rife. The model subsequently lists the attributes of this level of maturity as including the mistrust of data by users; a lack of awareness by managers of the importance of information as an asset; fragmentation and inconsistencies in data issues; the lack of a formal and policy-entrenched architecture to manage information and data assets; an absence of information, data and risk governance across the enterprise; an organisation lacking common taxonomies and a framework to manage the different aspects of data, as well as not knowing the importance of metadata.

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Level 1: Aware

On Level 1, the organisation becomes aware of the need for information management. This level is characterized by a number of prominent features thus summarised; individuals realise the power of information/data and begin to pursue personal projects; conflicts around which data is accurate and reliable are difficult to resolve; awareness is growing about the poor quality of data and people want consolidated data views but IT cannot supply it; there is a keen awareness of data inconsistencies in key areas; the recognition of the necessity for common standards and models become more acute. Roles are created for structured, but not unstructured data contents and e-mail; effort to document risks associated with uncontrolled data assets also begins to happen on level 1.

Level 2: Reactive

On level 2, business leaders have become favourably disposed to the demand for consistent, accurate and timeous information across the whole organisation, and are poised to take remedial measures in response to identified needs. Level 2 is characterized by the realisation that there is value in sharing information across business units; organisation formalises objectives for information sharing to achieve operational efficiency, but does not yet have processes in place to manage the change that comes with such upstream modifications; steps are taken towards cross-departmental information sharing such as master data management (MDM). Nonetheless, the need to tie MDM to business intelligence for maximum business value is not yet recognised; management is now aware of metadata, but does not manage it strategically and data quality problems are addressed only when they become apparent; there is no enterprise content management strategy and there are significant overlaps in master data assets as well as a lack of strict adherence to ERP controls.

Level 3: Proactive

On Level 3, the organisation recognises information as an essential tool for improved business performance and moves from unitary project level information management to EIM, thus adopting an integrated, enterprise–wide approach to data management. The characteristics of this level of awareness are that a high-level sponsor is appointed for coordinating the EIM agenda and vision and a start-up budget appointed for the tasks at hand; standards are set for IM technologies and the Enterprise Information Architecture (EIA) is employed as a guide for EIM; data governance councils and a formal data quality program consisting of data stewards are appointed to assist in ensuring enterprise-wide management of data as an asset; the

organisation has distinct information architecture for analytics, MDM and unstructured data are unified at a logical level and aligned to the EIA.

Level 4: Managed

At Level 4, the organisation considers information as critical to business and has significantly implemented portions of EIM. The organisation also has a consistent information infrastructure. The characteristics of level 4 include that senior management recognises the strategic importance of information; embraces EIM; markets it to all stakeholders and funds an EIM program which addresses the needs of all stakeholders and is aligned with business strategy; policies and standards are defined and the governance council or steering committee resolves all cross-functional information management issues; also best practices are identified and extended across the enterprise; all information management activities are coordinated across the enterprise and several enterprise-wide monitoring systems are automated and fully functional; EIM forms part of the process of planning, designing and developing applications. There is a blend of analytic and operational reporting, thus reducing the need for stand-alone business intelligence or MDM tools; metadata is managed and semantic inconsistencies resolved in order to promote re-use and ensure transparency; metrics are used to measure the gains of EIM and valuation models are used to gauge IT investments.

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Level 5: Effective

At level 5, the organisation is able to aggregate information and harnesses it across the board. Service level agreements (SLAs) are continuously reviewed and updated as deemed necessary to fit the information needs of the organisation. The characteristics of Level 5 are that senior management realises the value of information as a competitive advantage and exploits it for greater efficiency; enterprise information management is linked directly to strategic initiatives such as business process improvements, with data stewards playing active roles in making information transparent to users; EIM is central to the management of compliance and risk; the organisation institutes an EIM group which coordinates all information management efforts, be they master data management, ECM, or business intelligence and data services.

Furthermore, on this level, the organisation has achieved the following EIM goals:

1. Integrated Master data domains;
2. Seamless information flows;
3. Metadata management and semantic reconciliation;
4. Data integration across the IT portfolio;

5. Unified content.

The diagrammed representation of the processes enunciated by the Gartner EIM maturity model is depicted and discussed below:

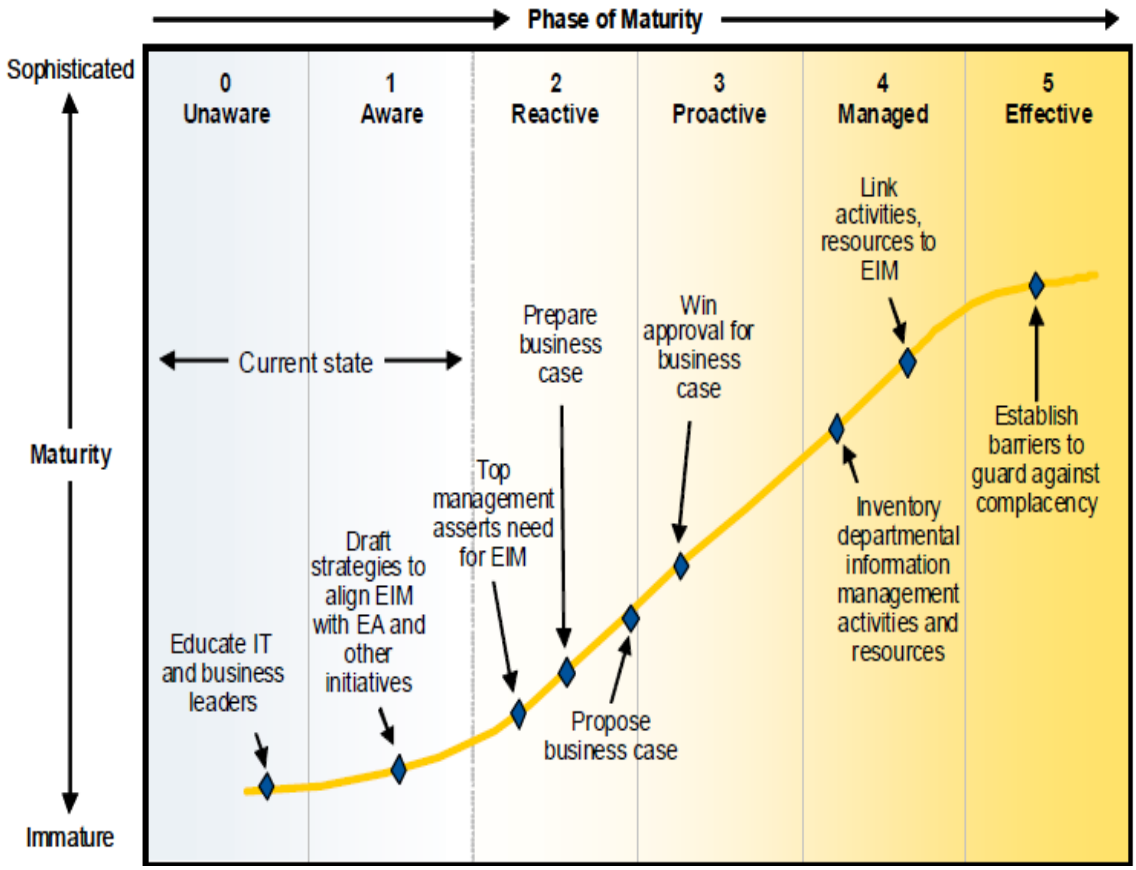

Figure 5.2: Gartner's EIM Maturity Model (Newman & Logan, 2008)

From the diagram, it is evident that the Gartner EIM maturity model is premised on the assumption that most organisations are on level 0 or level 1 of data/ information governance maturity. The steps for moving from 0 to 1 are therefore basic, with the emphasis on formulating an awareness of the need for managing data/ information as an asset. However, bearing in mind the fact that the document was published in 2008, and that regulatory and compliance requirements have widened since then, it is expedient to state that most organisations are already aware of the need for managing the copious amount of data at their disposal (Thomas, 2015). Furthermore, the departments of the Eastern Cape have mostly adopted COBIT for IT governance, and the framework has a subset on the governance of data and information assets, thereby affirming the fact that there is already an awareness of the need to govern data. However, the model's processes on levels 0 to 1 are still relevant as available literature shows no evidence of structured action for data governance in these departments. A

comprehensive discussion of the current state of data governance in EC departments has been carried out in chapter 4 of this study.

It is believed that the EIM maturity model is similar in context and content to the other maturity models discussed in this study; however, the model seems to map best with the GoCoMM as they both place more emphasis on how to identify the steps involved in moving from one maturity level to another. Table 5.3 below chronicles the components of a maturity model and the progressive stages required to achieve maturity from one level to another.

Table 5.3: Components of the Conceptual Maturity Model Identified in Chapter 3 (Informed by Paulk, 2009, Newman & Logan, 2008; Gheorghe et al., 2009; Becker et al., 2009; IBM, 2007; Soares, 2015; Magdaleno et al., 2011)

Maturity Model and maturity levels	Components and processes of maturity models identified in this chapter	Requirement Item (as per Becker et al., 2009)	Support in Literature and Design Science	Relevance to Study
CMM/CMMI Levels 0-5; Initial Managed Defined Quantitatively managed Optimising	Process management Project management Business management All of these are broken down into 23 enabling processes linked directly to business objectives and organisational performance	Commissioned by the SEI due to software development project failures and loss of substantial revenue/ Eliciting customer requirement is a key concept of the CMM/ CMMI	Becker et al., 2009; Colleta, 2011; Paulk, 2009; The CMM/CMMI maps to Design Science guidelines of problem relevance, design evaluation and research rigour.	Although the CMM/CMMI is not a data governance maturity evaluation model, it forms an important theoretical base for all maturity models. Additionally, some of the process areas in CMMI, that is, requirement management and risk management provide specific goals and metrics which can be adapted for a data governance maturity evaluation model for government departments.
IBM Data governance maturity	Detailed eleven domain categories.	Justification of .a business case for data governance is recommended as a	Becker et al., 2009; Soares, 2015; Gregor & Hevner, 2013	The IBM model is a detailed, structured and well-rounded maturity model; it encapsulates both the

Maturity Model and maturity levels	Components and processes of maturity models identified in this chapter	Requirement Item (as per Becker et al., 2009)	Support in Literature and Design Science	Relevance to Study
evaluation model 0-5, adapted the CMMI maturity model stages, that is, initial to optimizing	Each of the 11 domains consists of processes which have already been outlined in chapter 2 of this study. Measurement metrics for model maturity are itemised in the unified process maturity model diagram	starting point for the evaluation of maturity. This aligns to the problem definition domain (R6) advocated by Becker et al. 2009.	Problem relevance, problem definition, Design evaluation and Design as a Search Process	evaluation and the processes required for moving from one level to another.
GoCoMM Level 0-5 Chaos, Control, Correlation, Automation Measurement	Value generating processes are tagged as business processes. Processes that are concerned with making sure that business processes behave according to some set of security or regulatory rules are called control processes. Control objectives are further refined until they can be matched to business objectives. Control objectives that cannot be broken down are undertaken as control activities.	GoCoMM recommends continuous evaluation through automation of data governance processes. This is aligned to Becker's requirement (R3) which advocates that the principles and premises of a maturity model must be evaluated iteratively for usefulness, effectiveness and quality.	COBIT 5, 2012; Becker et al., 2009. Problem relevance, design evaluation.	Although the GoCoMM is not a data governance maturity evaluation model, the principles and processes advocated in the model are deemed critical for the success of data governance in government departments. The control- correlation- automation- measurement approach aligns with COBIT IT governance processes, continuous monitoring of control objectives and aligning them to business needs. The element of real-time risk management is also an important concept to be explored in the context of the government departments, this is in due consideration of the copious amounts of sensitive data handled by these departments.

Maturity Model and maturity levels	Components and processes of maturity models identified in this chapter	Requirement Item (as per Becker et al., 2009)	Support in Literature and Design Science	Relevance to Study
	Control activities are implemented by control processes.			
Gartner's EIM MM Levels 0- 6 Unaware Aware Reactive Proactive Managed Effective	Delivery of information efficiency across individual business units. Normalising information silos through consolidation. Common standards, tools and semantics. Information sharing through cross-functional projects. Enterprise information architecture (EIA) as the assurance for the data governance program. Advocates the use of scenarios to indicate how processes on each maturity level will save costs and mitigate risk. Guidelines for enforcing data archiving and retention periods.	Recommends creating an awareness of the need to manage information and data as organisational assets as a starting point in measuring the phases of maturity. This aligns with requirement 6(R6). Problem relevance, design evaluation, design as a search process	Newman and Logan, 2008; Gartner, 2009; Chalker, 2014.	This maturity model directly addresses data issues. Although information and data are used interchangeably in the model, the focus on the importance of managing data gives it relevant context for this study. The requirement of highlighting the benefits is also an important factor in selling the concept of data governance and its importance to the departments.

Maturity Model and maturity levels	Components and processes of maturity models identified in this chapter	Requirement Item (as per Becker et al., 2009)	Support in Literature and Design Science	Relevance to Study
	Data models are aligned with EIA.			
CollabMM Levels 1-4 Ad-hoc Planned Aware Reflexive	Each process should be designed for collaborative support. Enforcing collaboration through systematic and explicit incorporation into business processes. Attributes of the process in the model include; communication planning, individual artefacts integration, social awareness, information distribution, tracking, explicit knowledge sharing, process awareness, collaborative awareness, coordination, group memory, assessment and closure.	The identification of the steps which organise the required collaborative practices and match them to business needs for effective data governance are proposed as the starting point of the maturity model. This is aligned to requirement 4 (R4) which speaks to a multi-methodological approach based on the problem relevance to business needs.	Becker et al. 2009; Soares, 2015; Gregor and Hevner, 2013. Problem relevance.	CollabMM is relevant to this study as it is the only model which places emphasis on the incorporation of collaborative support for every process. Collaboration is crucial to the success of data governance efforts in the departments as organisational culture and buy-in of stakeholders are important factors in achieving success.

5.5 Justification of the DGMEM and the gap to be filled by this study

Following from the discussion of several maturity models in this chapter, the logical question would be, "Why is there a need for another maturity model? Why does this study not adapt one of the models discussed to the context at hand, rather than develop yet another model?" As stated in Chapter 1, section 1.2, the main objective of the study is to produce a data governance maturity evaluation model for measuring the maturity level of data governance in the Eastern Cape Government Departments. The maturity models discussed in this chapter are all models which assume a reasonable level of sophistication in the procedural handling of data assets in an organisation. However, the literature in Chapter 4, sections 4.3 and 4.4 reveals a severe disconnect between the policies of government on IT, and by extension, data governance and what occurs in practical terms in the departments currently. The needs analysis conducted to confirm or disprove the literature also served to confirm that data governance is still a misunderstood or unexplored concept in these departments (see sections 4.4, 4.4.2 and 4.4.3). Many of the senior managers did not show a clear understanding of the difference between governance and management. They also did not have a critical view of how to manage their data assets in a manner which promotes validity, accuracy and accountability. The literature in Chapters 3 and 4, the relevance of the IBM Maturity Model to the context of Eastern Cape Government Departments' data processes informed the DGMEM. The findings from primary data serve to further refine the model and include components which are of direct relevance to the context of the study. Table 6.1 in Chapter 6, section 6.4 where the model is presented, details the gaps in the other maturity models that are projected to be filled by the DGMEM.

5.6 Summary

Chapter 5 examined the procedural application of scientific processes based on well-known Design Science principles and guidelines to craft maturity models. It was opined that a proliferation of maturity models does not necessarily attest to their efficacy or validity. The chapter thereafter discussed five maturity models which were considered relevant to the context and objectives of this study. These were CMM/CMMI, CollabMM, GoCoMM, IBM Data Governance Maturity Evaluation Model and the Gartner Enterprise Information Management maturity model. The models were selected from a myriad maturity models based on the relevance of their components to the production of a data governance maturity evaluation model for the Eastern Cape Government Departments. Additionally, the models were often

quoted in literature and satisfy the requirement of scientific rigour advocated by the procedure application model recommended by Becker et al. (2009).

The five models discussed in this chapter were analysed with a view to deciphering their applicability to the construction of a conceptual data governance maturity evaluation model for the Eastern Cape Government Departments. In view of this, a table summarising the components of a maturity model and its processes was presented at the end of the chapter. Chapter 6 presents the conceptual DGMEM.

Chapter 1
Introduction

Chapter 2

Methodology

Chapter 3
Relationship between Corporate Governance, IT Governance and Data Governance

Chapter 4

An analysis of current Data Governance Practices in the Eastern Cape Government Departments

Chapter 5

A Discussion of Five Maturity Models relevant to this Study

Chapter 6

A Conceptual Data Governance Maturity Evaluation Model

Chapter 7

Presentation of Findings from the Qualitative Data

Chapter 8

Implications of Findings from the Qualitative Data

Chapter 9

Presentation of Findings and Implications of the Quantitative Data

Chapter 10

A Data Governance Maturity Evaluation Model for Government Departments of the Eastern Cape

Chapter 6 Conceptual Data Governance Maturity Evaluation Model

6.1 Introduction

6.2 Model Foundation

6.3 Model Development Process

6.4 Model Development Steps

6.5 The Primary Components

6.6 Secondary Focus Areas

6.7 Additional Components of the DGMEM

6.8 Summary

6. Chapter 6: Conceptual Data Governance Maturity Evaluation Model

6.1 Introduction

Chapter 5 discussed five maturity models which were considered pertinent and pivotal to the objective of this study. These are namely the CCM/CCMI, which is considered as the foundation of all maturity models, the CollabMM, GoCoMM, IBM Data Governance Maturity Evaluation Model and the Gartner Enterprise Information Management maturity model. The details of these models were discussed in accordance with their relevance to the construction of a conceptual data governance maturity evaluation model for the government departments of the Eastern Cape.

Chapter 6 covers the constructs included on the DGMEM model in order to effectively answer the primary research question. The research question is: **How can a data governance maturity evaluation model enhance data governance processes in the Eastern Cape Government Departments?**

The PRISMA statement was employed to select relevant, current literature on data governance attributes and the maturity elements required in answering the research question. The process of thematic analysis was followed in the literature, with the analysis being informed by the six steps of thematic analysis proffered by Krippendorff, (2013). The next section discusses the meaning of a model and the theoretical foundations on which the conceptual DGMEM is based. Figure 6.1 below details the stage at which Peffers' process has been applied in the research and development stage of the DGMEM in this chapter.

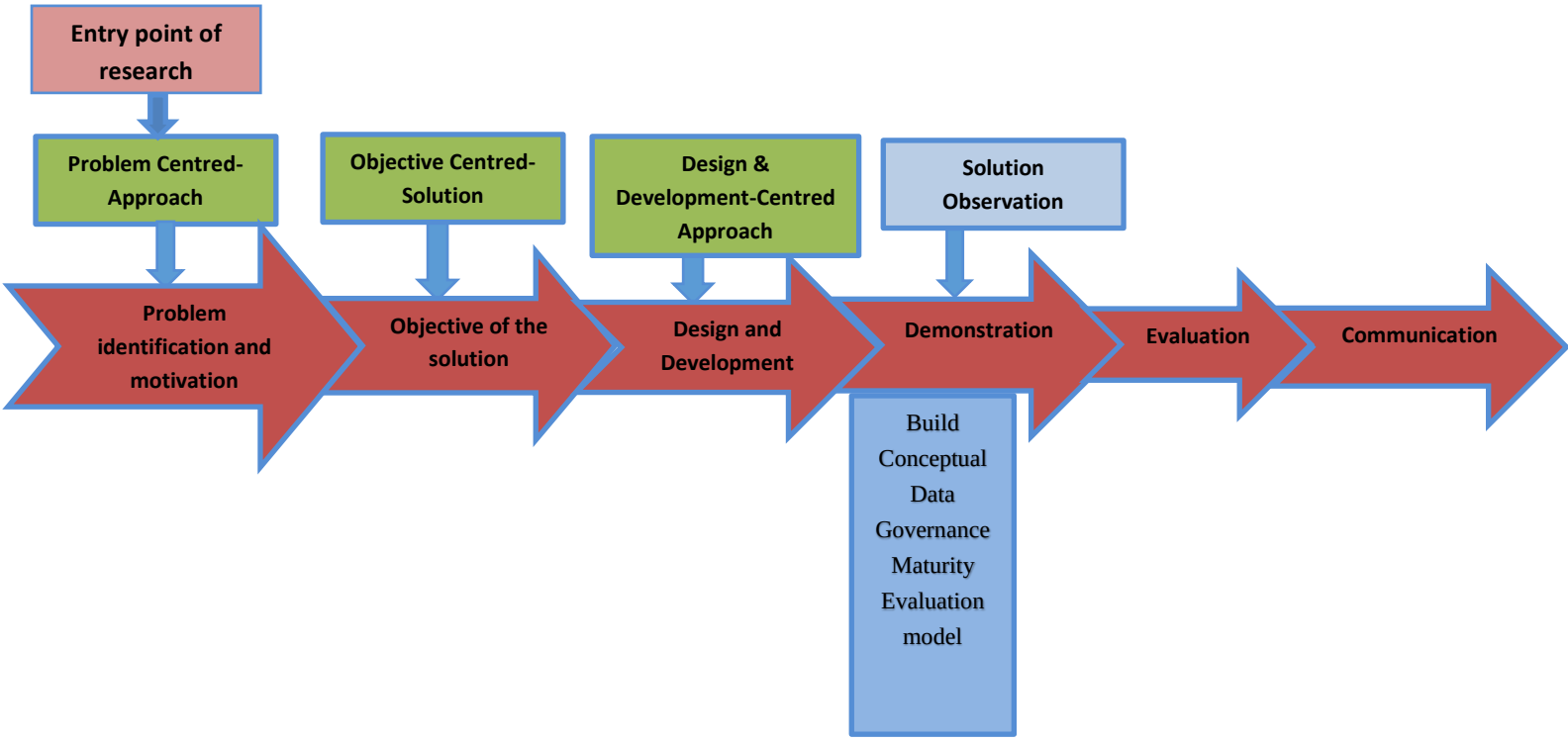

Figure 6.1: Current Stage of Research based on Peffers' Process

Figure 6.1 above depicts the current stage of research. The conceptual model development is the phase 2 of the research demonstration stage on the Pfeiffer's DSRM process (see Figure 2.4, section 2.3.3 in Chapter 2). This is also a critical stage of the resolution of the research problem. The next section discusses the foundation of the model.

6.2 Model Foundation

A model is described as the representation of an existing thing or a proposed structure which is indicative of a particular design or style, and represents a description of the most prominent aspects of a phenomenon (Brynard, Cloete, & De Coning, 2014). Walker and Avant (2011) describe a model as the symbolic representation of empirical experience. This symbolism may be represented by words, physical material or mathematical connotations. In the same vein, Chin and Kramer (2011) describe a model as an attempt to objectify a concept in order to bring it to life with less abstraction. The purpose of a model of any object is to represent the reality to a certain degree of precision. The DGMEM is projected to represent the reality of data governance and its different stages of maturity in the EC Government Departments. The process through which a model is developed is multifaceted, yet it has to be fluid to

accommodate diverse changes (Brynard et al., 2014). The process of model development is discussed in the next section.

6.3 Model Development Process

As previously stated, the process of model development is complex. The stage of conceptualisation focuses on three elements namely the context, the content and the process (Chinn & Kramer, 2011). Context refers to the extenuating circumstances in which the study is conducted, or the background of the study. The context of this study is the government departments of the Eastern Cape. Some of the major factors to be considered in the context of the study includes critical issues relating to data accuracy of information in government departments; the enormous risk presented by undue and authorised access to organisational data as exemplified by various data breaches in recent times; the consistent audit failure of EC departments in the annual auditor general's reports; the millennium development goals of the South African government (NDP 2030) and the availability, but inadequate use of international best practices for data governance (Soares, 2015; Eckerson, 2014; DPSA, 2013). The success of the aforementioned factors is anchored on accurate and current data from the provinces and the need for citizens' data to be managed and protected (Ifinedo, 2012). The context of the study has already been discussed exhaustively in section 4.2.1, chapter 4. The content of the model depicts the theoretical background of the study, and also reflects how the supporting theories underpin the components of the proposed maturity model. The model is expected to become a useful tool to counter the challenges associated with data governance in EC Government Departments. Lastly, the process refers to the pathway, or procedures involved in the crafting, development and validation of the model (Chinn & Kramer, 2011). The process by which the DGMEM is developed has been clearly outlined in chapter 2, which focused on the methodology for the study. The DSRM process of Peffers et al. (2008) is selected as it represents a practical, objective way of solving the research question with the requisite rigour for a study of this nature. The process is also aligned to Design Science guidelines, which are the chosen research paradigm for the study. The next section describes the steps of model development and how these were applied to the development of the conceptual model.

6.4 Model Development Steps

This study has elucidated the methodology, the process and the manner in which the conceptual DGMEM model is produced. However, it is important to discuss the steps of model

development followed in this project. The conceptual model, and steps in which the components were derived, are discussed in the next section of this chapter. The DGMEM is presented in Figure 6.2 below in order to make the discussion of its components meaningful and relatable. The DGMEM maturity process model which symbolises or gives guidelines on how to measure the maturity level of each vital components of the DGMEM is presented on Table 6.1, immediately after the model itself. This is done for ease of reference.

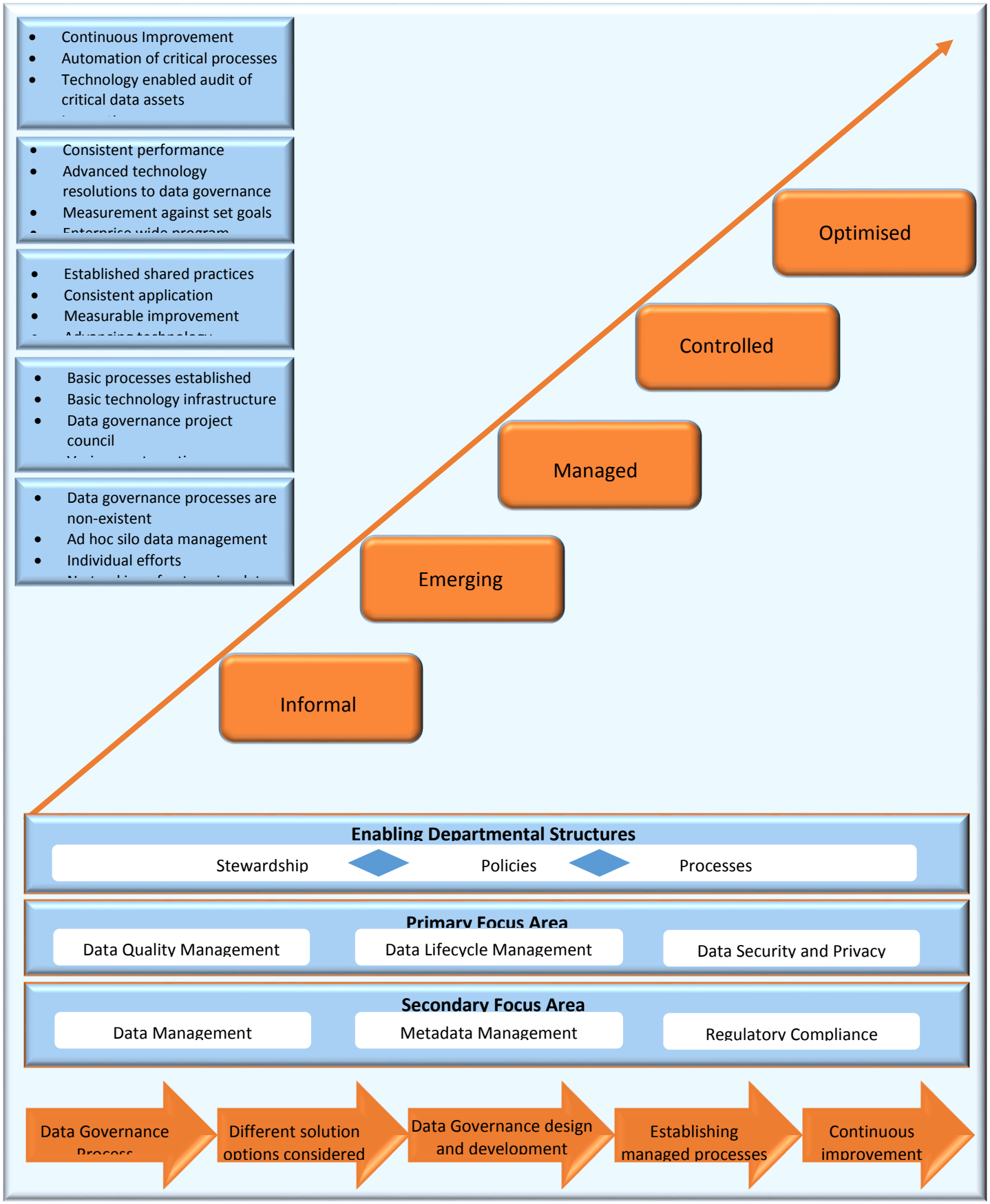
Continuous Improvement
Automation of critical processes
Technology enabled audit of critical data assets
Consistent performance
Advanced technology resolutions to data governance
Measurement against set goals
Established shared practices
Consistent application
Measurable improvement
Basic processes established
Basic technology infrastructure
Data governance project council
Data governance processes are non-existent
Ad hoc silo data management
Individual efforts
Optimised
Controlled
Managed
Emerging
Informal
Enabling Departmental Structures
Stewardship
Policies
Processes
Primary Focus Area
Data Quality Management
Data Lifecycle Management
Data Security and Privacy
Secondary Focus Area
Data Management
Metadata Management
Regulatory Compliance
Data Governance
Different solution options considered
Data Governance design and development
Establishing managed processes
Continuous improvement

Table 6.1: DGMEM PROCESS MODEL

Awareness					Formalisation						Technology		
Maturity Level	People	Policies	Process	Data Breaches	People	Stewardship	Data Quality	Master Data Management	Policies	Metadata Management	Capabilities	People	Process
1	There is very limited awareness of the purpose and value of data governance.	Most stakeholders are unaware of any policies. There is no structured documentation of data governance processes.	Stakeholders are unaware of any data governance processes. Data asset adheres to no known protocol	There are no known processes in place for managing or mitigating data breaches	The organisation does not have any definitive roles with regards to data governance	No data stewardship roles and responsibilities are defined. The IT team drives data requirements	Data quality efforts are sporadic and usually driven by specific business needs	There is no common understanding of what represents organisation's master data	There are no formal data governance policies in place	There is very limited understanding of the value of metadata hence it is inconsistently collected and storage is ad hoc and mostly project-based	There is no understanding of basic data governance capabilities and technologies	Employees perform ad hoc data governance and management efforts. Data issues are mostly manually resolved.	There are no named data governance technologies in the organisation.
2	There is limited awareness of data governance. Data roles and responsibilities have not been clearly and consistently articulated	Limited awareness of data governance policies. Policies documented but awareness levels are low and there are inconsistencies in application and availability	Limited awareness of data governance processes. There are a number of processes in place for data input, access and usage but they are not consistent across departmental units	The policy stipulates or gives direction to managers on how data breaches can and should be addressed, but there are no specific guidelines or processes defining this.	Data governance roles are defined and formally recognised by executives and senior management	Very limited, defined data stewardship roles and responsibilities. Business analysts mostly drive data requirements for the organisation.	Best practice data quality activities have been defined, but are not consistently implemented	Basic definitions and representations for Master data domains are developed by stakeholders	High level data governance policies are in place. These policies are accessible and distributed to stakeholders.	There are some definitions of technical roles and responsibilities. Some metadata templates are in place for capture of structured content	Some categories of data governance technology capabilities exist, but are not fully defined within the organisation.	A small unit of employees are trained to assess and manage data issues. There is no organised system of managing the technology around data assets	There are named technological artefacts and processes to support data governance. However the processes are inconsistently applied and compliance vary across organisational units.

3	**Senior managers are aware of data governance and focused on a strategic plan to maximise data assets. Other employees are are also able to relate to these plans.**	**Senior managers have an awareness of the intricacies and details of data governance policies but most other employees do not.**	**Senior managers have a basic understanding of data governance processes, but these are mostly undocumented and not ingrained in the data governance process of the organisation**	**There are process - based guidelines for employees to follow in the case of suspected or comfirmed data breaches**	**Relevant personnel have been recruited to fill some of the identified roles. The personnel understand their responsibilities within the context of data as a business asset.**	**Data stewardship roles and structures are defined and filled but are still operating in functional silos.**	**The development of data quality standards are a part of the organisation's data assets activities. They form part of scheduled activities in the data governance lifecycle**	**Master data owners drive resolution of and homogeneity of different aspects of data. They also ensure master data is supported and maintained in a manner which aligns to business value of the organisation**	**Data policies are tailored to some specific aspects of organisation's data. They are well defined and regarded as best practice**	**There is a central repository for the collection and storage of institutional metadata. Storage of metadata on structured content is automated**	**Data governance technology capabilities are well defined and communicated in the organisation**	**Data governance technology functions are organized into specific roles.**	**There are named data governance technologies to govern data assets and these are well communicated across departmental units.**
4	**Senior managers and employees are aware of data governance and involved in the implementation of its processes**	**All stakeholders have access to a common repository where data policies are held; they also get access to updated or modified content**	**Processes are well documented and all stakeholders are familiar with process steps.**	**The processes of how to contain, communicate and manage data breaches are clearly outlined in policy documents and all stakeholders are familiar with these processes.**	**Data governance roles are designed and organised purposefully to support specific data related functional areas. Most stakeholders are participating in data governance activities**	**Stewardship roles are represented across multiple business units and functions**	**Data quality management forms part of the reporting activities of the organisation**	**There are named personnel responsible for ensuring the appropriate use of master data and the enforcement of compliance with master data usage policies**	**Data policies are standard. Stakeholders across the organisation are conversant with data policies and adhere to them.**	**There are named personnel in charge of metadata. There is a structured, centralized repository for metadata**	**Home grown data governance solutions are sought for some of the data governance capabilities. Solutions are available for all defined classes of capabilities**	**There are named personnel in charge of data governance technologies. The personnel have integrated the use of technology to govern data into daily data processes**	**Data governance technologies are part of the automated process of governing data. There are infrastructural capabilities in place to ensure adherence and compliance**

5	**All stakeholders have a good understanding of the importance of DATA GOVERNANCE and the active roles they must play in executing the program.**	**Data policies are held at a common portal, stakeholders are part of the development process and policies are well understood.**	**Data processes are in built into the daily activities of the organisation. Stakeholders fully understand the importance of a common approach to data governance processes and continue to seek process improvements.**	**Data breach mitigation policies and processes are part of an integral data governance programme and everyone understands the importance of these processes to the success of the organisation in managing breaches.**	**Data governance roles are filled as required. Regular meetings amongst the different role players and formal documentation of activities is compulsory**	**There is a data stewardship board whose members are representative of all the units in the organisation**	**Data quality activities and remediation forms part of data management in both active and inactive (archived) data assets.**	**Multi-domain master data centre is in place. Named personnel take responsibility for synchronization of master data and enforce compliance with master data policies.**	**Compliance with data policies is enforced and breaches are investigated**	**A metadata solution which provides a single entry point for both structured and unstructured data is in place throughout the organisation. There is a metadata management committee which enforces metadata approved procedures within the organisation**	**Every defined data governance capability is mandatory within the organisation**	**Personnel are subject matter experts in the area of using current international best practice technologies to govern data assets.**	**Data governance technologies are designed to meet business needs and values of the organisation. A set of data technologies are deployed, audited and measured against data standard policies within the department.**

6.4.1 Definition and Classification of Concepts

The PRISMA statement was employed in the literature review process in order to ensure the soundness, relevance and academic merit of selecting and discussing components of an effective data governance program which may arise from secondary literature (Moher et al., 2009). Consequently, the primary concepts for an effective data governance evaluation program were classified based on the IBM's Data Governance Maturity Evaluation Model (2007). The IBM model has been discussed in section 5.4.3, Chapter 5. As stated in section 6.1 of this chapter, a model consists of parts of a complexity which are being represented in simple terms to make it empirically relevant (Walker & Avant, 2011). For the DGMEM to be relevant in the context of this study (Eastern Cape Government Departments), concepts which are interdependent and related were classified together, at the core of the model. Also, based on the peculiar nature of the data assets of most of these departments (sensitive personal and financial data), the three components of data management, metadata management and regulatory compliance were grouped as secondary focus areas. As depicted in Figure 6.2 above, the base of the model is a five-step process which depicts the entire procedure which the maturity model goes through from problem identification to the path of continuous improvement. The maturity levels and the features of each stage are depicted at the top of the core components of the model. Table 6.1, which follows the model is a depiction of what activities are representative of each maturity level for different aspects of the data governance programme. Details of the DGMEM's components are explained in the course of this chapter. The process of model evaluation by the researcher is discussed in the next section of the chapter.

6.4.2 Model Evaluation Process

This step refers to the researcher's evaluation of the model and not the iterative process by which subject matter experts and relevant stakeholders evaluate the relevance of the model. It is pertinent that a researcher does the first critical evaluation of the components of the model before the collation of the parts of the whole (Poppelbub & Roglinger, 2011). The researcher needs to ask certain critical questions which will guide the process through which the model is being crafted. According to Poppelbub & Roglinger (2011), a good maturity model contains a number of attributes stating clearly the way it has improved on other similar models and/ or further enhanced the problem-solution domain. In this vein, the researcher must ask certain fundamental questions such as:

- How clear is the model? This question addresses the issues of structural clarity, semantic clarity and structural consistency.
- How simple is the model? This question addresses the ability of the stakeholder community to understand and interpret components of the model without needing significant assistance in order to interpret the basic concepts. The stakeholder community should be able to understand and apply a structured diagram which depicts the purpose and intents of the model.
- How applicable and generalisable are the components and theories to the model? Can they be applied with positive results in a related or different context in response to data governance challenges?
- How important is this model and how does it creatively, but scientifically, solve the research problem? (Huner, Ofner & Otto, 2010; Poppelbub & Roglinger, 2011; Seekoe, 2014).

In light of the aforementioned, this study leans heavily towards the process recommended for maturity model development by Huner, Ofner and Otto (2010). This is represented diagrammatically in Figure 6.3 below:

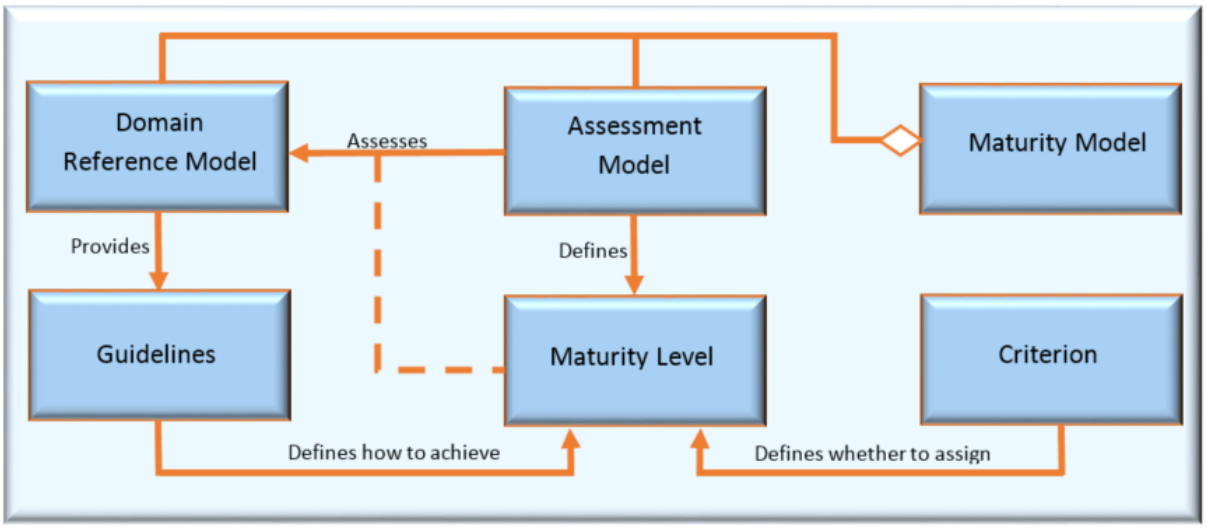

Figure 6.3: Components of a Maturity Model (Huner et al., 2010)

From Figure 6.3 above, Huner et al. (2010) suggest that a domain reference model provides the guidelines for achieving maturity levels. The data governance maturity evaluation model proffered by IBM, the CollabMM and the Gartner EIM maturity models are reference models on which the DGMEM is built; all of these models have been discussed exhaustively in Chapter

5 of this study. This new model is necessitated by the context of the research as the components of the maturity models listed do not necessarily encapsulate the requirements of the EC Government Departments, as revealed from the result of the needs analysis survey discussed in section 4.4, Chapter 4. The adoption of COBIT 5 processes and the ISO/IEC 38500 as benchmark frameworks to support the objective of this thesis provide an assessment model which already outlines how to measure the relevance and usefulness of the domain reference models. These models are in line with the data governance needs of the EC Government Departments. This conforms to the pragmatic philosophy, and the Contingency Theory, which is the underlying theory for the study. The attributes of the discussed maturity models which are included in the DGMEM are based on data governance needs within these departments. The function of a preliminary conceptual model is to test the various components through empirical evidence; thereafter iteratively improve on the model before a final model is proposed. Three basic ground blocks are adapted for the DGMEM. This is diagrammed in Figure 6.4 below.

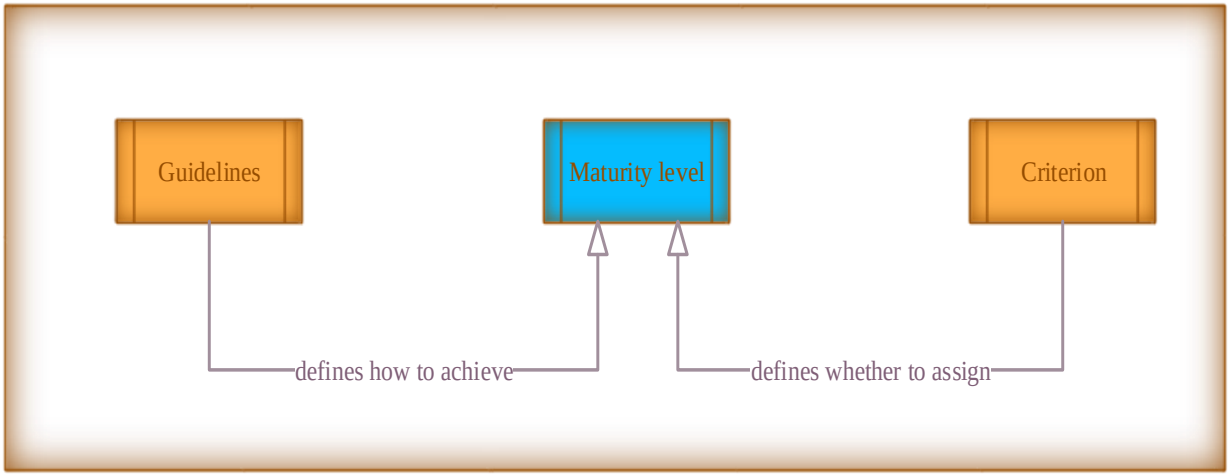

Figure 6.4: Building Blocks of the DGMEM (Informed by Huner et al., 2010)

The rationale for the choice of the three blocks is based on the context of this study. The literature and a sample survey of current practices conducted in Section 4.4 of Chapter 4 established that data governance is not entrenched in the processes of these departments. Thus, the idea of an evaluation maturity model is to help departments understand their current state in terms of governance of data assets, their alignment with the strategic goals of the Provincial Government and how all of these crystallise into service delivery for the citizens. It is important that a maturity model be kept simple, with a process-based document stipulating what each progressive stage in the data governance maturity of an organisation constitutes. The guidelines

reflect critical data governance processes in each domain reviewed in literature and included in the conceptual model. At the other end of the spectrum are the criteria for the choice of the domain area, that is, data quality, security and privacy. In this regard, the guidelines relate to how the process of attaining a certain level of maturity is achieved; the criteria of measurement speaks to the context of the departments and which components of data governance are essential to the achievement of departmental goals. The inclusion of all the data governance attributes as articulated in widely quoted data governance literature is not essential for this study as the philosophy for the DGMEM is "what works". Having discussed the context, content and process regarding the different aspects of the model, the next section of this chapter discusses the various components of the conceptual DGMEM.

6.5 The Primary Components

The three components which form the primary focus area of the conceptual model are data quality management, data lifecycle management and data security and privacy. The three aforementioned areas were chosen as primary areas based on secondary literature and responses from the needs analysis (Chapter 4). At the core of quality information is quality data which satisfies the verifiable, accurate and complete (VAC) criteria for data. Data lifecycle management encapsulates the entire process of data management to its disposal. The data security and privacy component is essential to the protection of data assets leading to effective data governance for the enterprise. Additionally, data security and privacy component is vital to the security and control of all the data assets of the enterprise as data breaches could occur at any stage of its lifecycle if not properly managed. Each component is examined in greater detail in order to justify its inclusion as a primary component in the DGMEM.

6.5.1 Primary component 1: Data Quality Management

Data quality refers to the fitness of the data for intended use in operations, decision-making and planning (Berson & Dubov, 2011). The DGMEM espouses data quality as a key component to the success of any data governance maturity evaluation model. According to Crowston and Qin (2012), scientific data management is required as organisations become more data intensive, with the need to process large amounts of data on a computational scale. The authors advocate new requirements for gathering and representing data in order to derive the maximum impact from its management. Data quality management has been brought to the

fore, given the importance of data to decision-making in the knowledge economy. There is currently a deluge of IT tools designed to ensure the sanctity of data throughout its lifecycle. Some of these tools are Informatica, IBM Hadoop, SAP and SAS (Gartner, 2016). Broadly, the criteria for data quality, as stated in several academic writings are validity, accuracy, completeness, consistency and uniformity (Soares, 2015; Thomas, 2015; Eckerson, 2014). For the purpose of this study, we examine data quality as it affects the business of the Eastern Cape Government Departments. To do this effectively, the three most important factors relating to data quality, namely, validity, accuracy and completeness are discussed in depth.

The validity of data in government departments is dependent on a number of factors. One of the most important factors is the culture of the organisation (Thomas, 2015). The crusade for good quality data must start at the top, with the executive driving the culture which supports the process for data quality. Data capture and data veracity must be governed to guarantee the validity of data. Although there are several propositions on how best to ensure the validity of data, integration is considered as one such important factor for the purpose of this study. Data integration combines heterogeneous information sources and provides the interface for accessing the integrated source (Martin, Poulovassilis, & Wang, 2014). Martin et al. (2014) propose an iterative data quality assessment embedded into the process of data integration. This principle of ensuring data quality within the process of integration is in agreement with the literature previously reviewed in chapter 3 (Figure 3.4). Martin et al. (2014), asserts that the critical factor in data integration is to define the factors and ontology representative of quality requirements in the subset which is being regulated. This view is supported by Wang et al. (2012), as they propose an ontology-based framework which takes into account the different quality requirement from each user and thereafter derives a quality framework which is supported by verifiable measurement metrics (Wang et al., 2012). This view is also supported by COBIT which is adopted for the study as a best practice framework with a detailed focus on metrics, processes and governance (ISACA, 2013). The COBIT process for achieving this is DS 11: Manage Data. In the control process: Manage Data, it is a business requirement for data to remain complete, valid and accurate during input, update and storage. Based on the foregoing, the critical success factors for ensuring data quality in the EC departments are inferred as:

1. The requirements for data entry in the departments must be unequivocally stated. The data entry policy must be enforced with the support of technology at all levels throughout the organisation. The standards for data entry and requisite corrections to

data should be enforced at the point of data entry. This presupposes that data input, processing and output are formalised and enforced. The data held in suspense till the corrections are effected must also be accounted for.

2. There must be a definitive responsibility matrix for data ownership throughout the organisation. The entire organisation must also understand what constitutes integrity requirements for data and ensure they are widely accepted throughout the organisation.
3. As data is transformed across divergent platforms, it is important that its integrity is maintained. The transformation of data must be done in a manner that meets changing business demands and emphasizes a decreased reliance on manual data input and re-entry (De, Hu, Meduri, Chen, & Kambhampati, 2016). The departments may need to employ the use of data management and processing tools for the purpose of cleaning data (Seiner, 2014). These solutions ensure that data quality is assured, dirty data is cleansed and archived data is protected, thereby ensuring there is valid and available data whenever there is business demand for its use. However, there are several reservations about the cost and security of these tools. These arise from sharing sensitive organisational information with data vendors who are not direct stakeholders in the organisation (Smallwood, 2014).

6.5.2 Primary component 2: Data Lifecycle Management

Data lifecycle (DLC) management is defined as the process by which data is managed from its inception to archiving or deletion (Sinaeepourfard et al., 2016). Data lifecycle involves the process of data capture, curation, analysis and visualization (Gray, 2009). The importance of this component is exemplified by the US National Science Foundation's policy which states that no project proposal will be accepted without a definitive data lifecycle management plan (Crowston & Qin, 2012). On the other hand, African economies and government businesses start multi-million dollar projects with no thought of how the data will be managed (Ifinedo, 2011). The purpose of data lifecycle management is to deliver seamless, efficient and safe access to data sources and repositories. This is critical in order for data stakeholders to be able to extract any form of value in enterprise data assets. Thus, the efficient management of data has become a key topic for effective data-to-value generation. The urgency of data lifecycle management has become more apparent with the advent of big data, Internet of Things (IoT) and unparalleled invasion of individuals' privacy through social media and other related technologies (Huner et al., 2009). Most DLC models or frameworks are prescribed or defined

for specific domains and data sets. Several data lifecycle management models or tools have been prescribed by vendors; however, most of the well-known DLC frameworks are designed for big data management (Smallwood, 2014; Khatri & Brown, 2010). Furthermore, the models are tailored to specific environments and are thus not easily adaptable to other unrelated environments or contexts (Suer & Nolan, 2012). Although there are several traditional technologies for data management, such as Relational Database Management Systems (RDBMS) and more recently, the Extract-Transform-Load (ETL) process, workflow tools, Product Data Management software, this study considers the Comprehensive Scenario Agnostic Data Lifecycle (COSA-DLC) model (discussed in Section 6.5.2.1 below), the most suitable for the purpose of managing DLC in government departments (Sinaeepourfard, Garcia, Masip-Bruin, & Marin- Torder, 2016). The rationale for the choice of this model is based on its comprehensiveness. The 6Vs, which are much quoted amongst DLC practitioners, are addressed by the model. The six Vs of data lifecycle are listed as value, volume, variety, velocity, variability and veracity. The model is also considered suitable as it can be easily adapted to any particular scenario and, therefore, meets the pragmatic philosophical stance of this study which seeks to answer the research question by building an artefact which is "fit for use" by government departments.

As discussed in Table 4.3, Chapter 4, the management of the lifecycle of data, and the organisation of varied and complex data sets during their entire lifecycle are a task for the data governance function in any organisation. This process includes data generation, data acquisition, data preservation, and data processing. All these steps are important to the realisation of a well governed data environment. Furthermore, with recurrent data breaches, reporting metrics and an overall emphasis on the audit trail of data plus the additional challenges arising from the management and processing of big data sets, it is believed that this model presents a more comprehensive and adaptable model than others previously listed. Another strength of this model is that, unlike most models which were built for specific environments and tailored to address particular use cases or forestall certain events in the particular environment, the DLC model goes beyond these technologies. It furthermore provides a global framework for data management and organisation, from data creation to data consumption, which is not related to any particular hardware or software technology or system. The versatility and adaptability of this model therefore makes it very relevant to this study. The relevance of the model to this study is discussed in the next section.

6.5.2.1 The Comprehensive Scenario Agnostic Data Lifecycle Model

The main difference between the Comprehensive Scenario Agnostic DLC (COSA-DLC) model and other DLC models aforementioned is hinged on its design. It considers all phases of data management and organisation, from data acquisition to data preservation and processing, but incorporates other important aspects of data governance such as security, privacy and data quality. The process by which this is achieved is depicted in Figure 6.5 below.

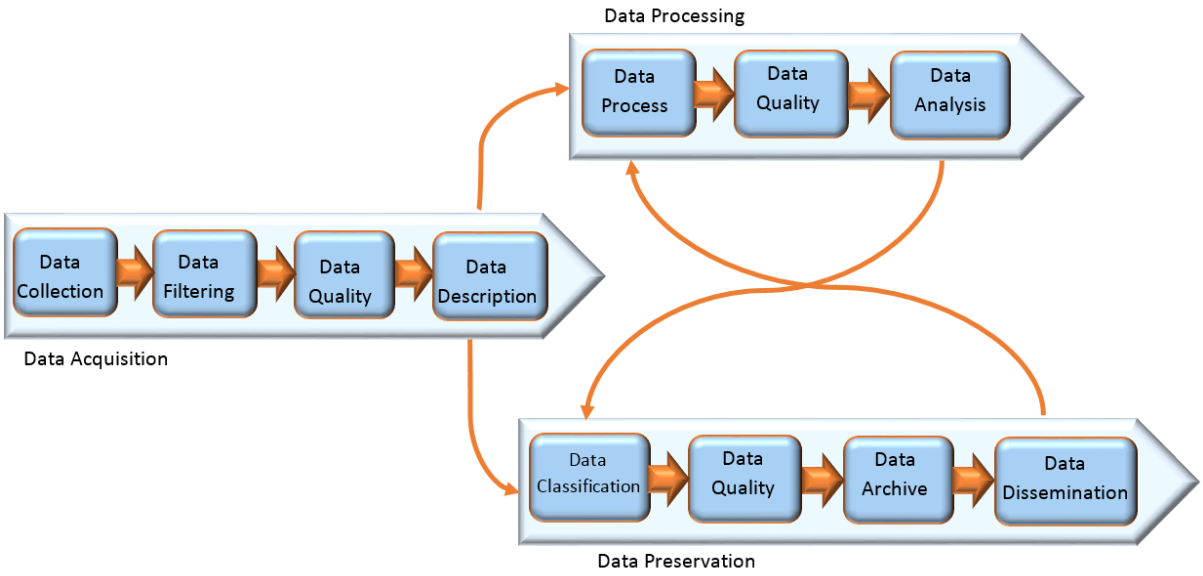

Figure 6.5: The Proposed DLC Model (Sinaeepourfard et al., 2016)

As depicted on Figure 6.5 above, the main data processes are further broken into sub-processes, in which the issues of data quality and data integration are addressed. The COSA-DLC model is organized into three main blocks, namely, Data Acquisition, Data Processing, and Data Preservation. Thereafter, each block is broken down into a set of detailed data processes in the specific block. This is in alignment with coverage of all data cycles in that particular block and is specified in lifecycle management phases, defining all policies, actions and any essential interrelated phases. As portrayed in Figure 6.5 above, the Data Acquisition block is responsible for data collection, assessment of data quality, and the tagging of data with any additional description required for the specific business model or context. The Data Preservation block then stores the data as it gets processed, through the Data Processing block. The Data Preservation block is responsible for data storage, performing any eventual action related to data curation or data classification. The Data Processing block performs the main data processing function, extracting knowledge or generating additional value, through sophisticated data analysis techniques. After this cycle has been achieved in all three main

process areas, data can be delivered to stakeholders for decision-making or archived for future use. This approach for data lifecycle management is considered suitable for the departments as they grapple with multiple data sources, untrained data stewards and a myriad other challenges. This model offers agility and a real time check on both the input-output process of data management, while still providing an opportunity for the data to be usable and current in line with departmental policies (DPSA, 2013). The COSA-DLC model's adoption of the 6Vs also helps to ensure that no aspect of the data management process is left unmanaged. COSA-DLC offers a number of potential benefits which are itemised below:

1. The model is futuristic as it has a system for the management and organisation of global datasets.
2. It provides easy customisation to any kind of scenario.
3. It incorporates the improvement of data quality in any specific context.
4. Its leanness and focal process design eliminates the waste of effort on the part of data architects and enables them to design an efficient architecture (Sinaeepourfard et al., 2016).

6.5.3 Primary Component 3: Data Security, Privacy and Risk Management

There was an estimated 40% increase in reported data breaches in developed economies in 2016 (Kharif, 2017). Although the total cost of these breaches in financial and reputational loss has not been formally quantified, reports by Gartner (2016) and Forrester research (2016) has estimated the cost to be well above one billion dollars. No figures has yet been found for the African continent, suggesting that data breaches likely go unreported due to the fear of income and reputational loss to the affected organisations (Ifinedo, 2014). According to Cooper (2015), the extent of data breaches which affected big corporation like Target in 2013, and the US Office of Personnel Management (OPM) in 2015 led to the theft of personally Identifiable Information (PII) and Personally Identifiable Financial Information (PIFI) of an estimated 70 million people in Target's case, and over four million people in the case of OPM. These figures are a revelation of how critical data security has become in this era. The risk presented by ungoverned or poorly governed data has become very high. In light of this, any plan for the management and governance of data must address the privacy and security of data assets (Soares, 2016). The inclusion of data privacy and security as a primary component of the DGMEM underscores the importance of this aspect of data governance. The main objective of government departments of the Eastern Cape is to deliver efficient and effective service to

the citizens of the province. To achieve this aim, there is need for data collection, analysis and storage. However, without the proper governance structures in place to ensure the data that is collated are safe from theft or unauthorised access, the fallout of a breach could be catastrophic. As stated in the reports regarding OPM, the data breach was possible due to serious deficiencies in the way data security was being handled in the department. Not only is it possible for the data to be breached if not properly governed, it is also likely to put the victims of the data breach in personal and financial distress. To this end, ensuring data security and privacy of the citizens who have entrusted the government with very sensitive and personal information becomes a priority. The assurance presented by a data governance model which takes this into account as a primary component is important. In other words, ensuring the security of sensitive and personally identifiable data, and mitigating the risks of unauthorized disclosure of the data is a top priority for an effective data governance plan. As discussed in Chapter 4, provincial and national governments need to have an enterprise mindset towards the management of data assets (Kushner & Villar, 2008). The results of the Needs analysis conducted in section 4.4, chapter 4 reveals that there exists a disparity and disconnect in the way data is managed from unit to unit within each department. This can be translated to mean that data maturity is on different levels in a single department. It is important that best practices regarding data security and privacy is maintained. Several of the literature from developed economies alludes to the management of public service data within the ambit of a risk portfolio (Lipunstov, 2014; Ifinedo, 2012). This is done in a structured way for the reasons listed below;

1. It presents a structured context for profiling data and determining its intrinsic value to different stakeholders; state government, the citizens and its potential value to criminals.
2. It analyses the potential for unauthorised change to data points, the effect of such changes and thereafter determines the necessary security measures to forestall such an occurrence.
3. The regulatory and compliance requirements for state departments such as the Sarbanes-Oxley Act of 2002 in the US and the Companies Act of South Africa (2008) also imposes fundamental associated security measures on the way data is being governed in state departments.

In view of the above, it is believed that the GoCoMM maturity model discussed in section 5.4.2 of Chapter 5 finds relevance in this component as it outlines a concise methodology of aligning potential risk with a corresponding control activity for its prevention or/ and mitigation. Control activities which are for managing risk includes policies, procedures, and guideline, practices

or organisational structures (Gheorghe, Massacci, Neuhaus, & Pretschner, 2009). Control activities are implemented by control processes. As an example, user password management is a control activity which is supported by the control process of looking up a user's authentication credentials. Control and correlation means that for every stipulated control activity, there is a corresponding control process matched. In GoCoMM, reaction and control infrastructure enforces policy by technical means. Data governance processes enforce controls to ensure access is limited to those authorised for it. This can be done by blocking unauthorised events, modifying them or automatic notification of the data owner upon the transition of personal data. This process is considered as a more effective control than the activation of an audit process after the fact. This means that once there is an existing control activity, it can be matched to a control process, allowing for quantifiable measurement of its effectiveness. The next segment of the model consists of the secondary focus areas comprising of data management, metadata management and regulatory compliance.

6.6 Secondary Focus Areas

According to Poppelbub & Roglinger (2011), a prescriptive maturity model will include improvement processes. This will encapsulate data management, which is considered a sub-component on this model. Metadata management is an important sub-component as it relates closely with the accountability for data breaches, data leakages or alteration which ties in with the importance of data governance to compliance and security, and finally the regulatory compliance aspect as it relates to data governance. As discussed in chapter 3 section 3.3, the financial markets and the global meltdown of the 2008 era has led to a renewed scrutiny of data and its integrity in both private and public enterprises, thereby leading to several legislative and procedural compliance requirements for both public and private institutions. These compliance and regulatory requirements have already been discussed exhaustively in Chapter 3 of this thesis. In light of these developments, the author considers it pertinent to integrate the regulatory compliance aspect into the maturity model. This will serve the purpose of ensuring that the entire process of data governance is carried out with the mind-set of accountability to the relevant bodies in government. The following section discusses each of these sub-components in depth;

6.6.1 Data Management

Data Management (DM) is the process by which all organisations deal with, and deliver their data assets (Kooper , Maes, & Lindgreen, 2011). In the same vein, enterprise data management (EDM) depicts an organisation's ability to correctly define, efficiently integrate and effectively retrieve data for both internal and external use (Soares, 2014). Some of the disciplines included in EDM or DM are master data management (MDM), data integration, database management, metadata management, reference data management and more recently, big data management. Management encompasses the process of defining technical and business terms which will make data integration more efficient. An effective data governance program typically includes all the policies outlining data definitions and how a company's metadata will be governed (Data Management, 2011). It is thus considered critical to include data management in the model as it forms the bedrock of some of the processes for the departments to manage their data assets. Data management also speaks to the policies regarding data governance within government and the gaps which need to be filled in order for these departments to effectively manage their data assets. Data management explores the details of who is accountable for the creation, modification and interpretation of data processes (Bahrman, 2011).

6.6.2 Metadata Management

Metadata is generally defined as data about data. The purpose of metadata is to describe the characteristics of data as it moves through several stages from creation transformation, storage, archival, and consumption (Soares, 2014, Sherman, 2005). Metadata also defines the location, perceived importance, quality and the relationship of any data to other assets in the organisation which are considered worth managing (Soares, 2014). Metadata creates a repository for tracking all data sources within the organisation and ensures the security and traceability of all data sources. Business metadata defines key business terms, the relationship between the terms, associated business rules and reference data. Technical metadata, on the other hand, relate to information about the assets, models and process elements commonly used in IT systems (Wang et al., 2012). According to Carlos, Chen and Garcia-Garcia (2007), some of the challenges around metadata include the transformation of semi-structured and unstructured data, overcoming the inconsistencies and incompleteness in metadata and managing multiple data types whilst keeping record of all the sources. In view of the several regulatory and compliance rules that have given data governance its current impetus, it is imperative that a metadata repository be maintained. Moreover, the validity and relevance of

the information must be without question. Ordonez et al. (2007) proposed the aggregation of linked documents and the use of a relational database as a central metadata repository. In the context of this study, the EC Departments need to determine who is responsible for metadata and how many data sources are essential to add to the metadata management repository in order to meet audit, compliance and vetting requirements for the Department's data assets.

6.6.3 Regulatory Compliance

The third secondary focus area of the DGMEM is the aspect of regulatory compliance. In the South African context, although the King code of governance resonates both in the private and public sector, the code does not enforce the terms of reference as they are merely prescriptive. In spite of this, the Companies Act of 2008 does outline the responsibilities of company executives with regards to divulging financial and personal information. The information required by auditors and reports by other forms of government stem from the data assets of these departments. COBIT 5, ISO/IEC 38500 and the Companies Act stipulate that data sources are verifiable, accurate and complete. This component is thus included in the conceptual model in order to satisfy the requirements of the law with regards to data and information governance. Additionally, in COBIT 5, which is the benchmark framework for this study, compliance with regulatory requirements is embedded into the processes and practices regarding both data and information governance (ISACA, 2013). It is also pertinent to note that COBIT processes encourage consistency and a holistic approach to data management within enterprises. It is thus critical that the maturity model reflects this element as stated by Poppelbub and Roglinger (2011). Following a detailed discussion of the key elements of the maturity model, the next section is focused on the explanation of the additional features of the model.

6.7 Additional Components of the DGMEM

Additional components are included in the model as they provide a view of how the research methodology translates into the maturity model. The first additional component is explained further in Figure 6.6 below. The diagrammed arrows below are a depiction of how the research has followed the Peffers' process from problem identification to the evaluation stage. The Peffers' process has been discussed exhaustively in Section 2.3.3 of Chapter 2.

Figure 6.6: The DGMEM Process Model (Informed by Peffers et al., 2008)

The last process (communication of research) is not included in the model yet as it is believed that the current model will go through several iterations before the step of communication of results. The stages depicted in Figure 6.6 are in line with Peffers' process steps 1-5 which comprise (1) Problem identification and motivation (2) Objective of the solution (3) Design and Development (4) Demonstration (5) Evaluation. As already discussed in the methodology, the literature review, followed by a needs analysis which was conducted in Chapter 4 (section 4.4) both confirmed the existence of the problem. Following a confirmation of the problem's existence, it was deduced that a maturity model presented the best means of solving the research problem. The rationale for this choice was based on the review of extant literature and a cursory look at current departments' practices on data governance. The analysis revealed that most of the departments were still unable to distinguish between data governance and information governance (see Chapter 3, Section 3.4, Table 3.2). Furthermore, it was realised that most of the processes regarding the handling of data assets in these departments were ad-hoc and not succinctly outlined. The third arrow alludes to the design and development of the DGMEM with a focus on solving the research problem. This focus was enhanced and enabled by previous maturity model components which have already been discussed exhaustively in Chapter 3 of this study. This component confirms the implementation of the Peffers' process in the DGMEM model. The next component, the enabling departmental structure is diagrammed in Figure 6.7 below.

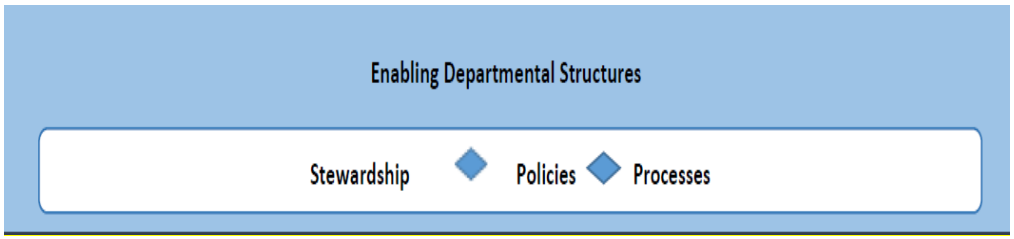

Figure 6.7: Enabling Departmental Structure (Informed by Soares, 2015; Thomas, 2015)

At the top layer of the conceptual model, the three features of stewardship, policies and processes go hand in hand. They encompass the departmental structures which must be in place for data governance to be effective and efficient in these departments. According to IBM (2007), stewardship is a quality control discipline aimed at ensuring custodial care of data asset enhancement, risk mitigation, and organisational control. Policy refers to the written or spoken pronouncements of how people should behave in a given situation (Soares, 2014). One of the important steps for this study is the production of a process-based document which will help the staff of the departments to manage the various aspects of the data governance programme. On stewardship, the data governance council recommends the position of data stewards, who report to the CIO or CDO (DAMA International, 2015). Data stewards are the middle level managers tasked with the responsibility of ensuring adherence to data policies and processes. It is imperative that these sets of employees are able to effectively deploy the processes around data governance within the policies adopted by the department. As an example, departments of the Eastern Cape are compelled by legislation to adhere to COBIT principles in the management of IT resources (DPSA, 2013). This implies that structural processes such as stipulated in COBIT and discussed extensively in Chapter 5, Section 5.2.1 must be in place for effective data governance in organisations. To this end, it behoves the stewards to ensure data gets the right 'fit' in the information policies of the department. Figure 6.8 below serves to illustrate how these three elements fit together in ensuring that data governance has the right support structure to manage the data assets of the organisation.

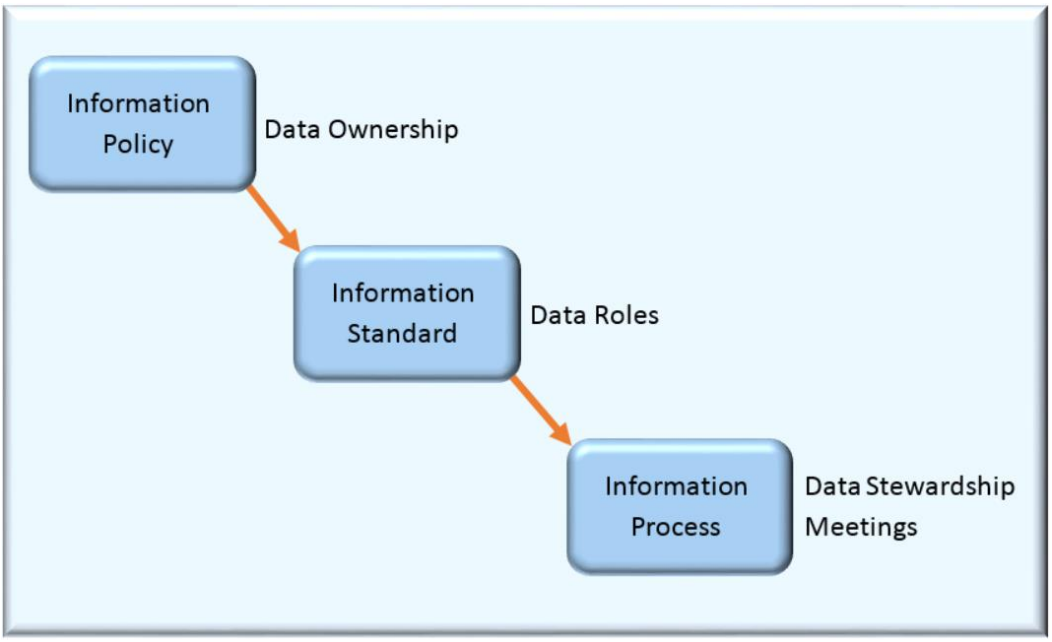

Figure 6.8: A Hiercachy of Information Policies, Standards and Procedures (Bahrman, 2011)

The process depicted in a hierarchy is an indication of how the data governance maturity evaluation model progresses. The intent or purpose of the DGMEM is to assist the departments in the evaluation of their current state with regards to how their data assets are handled, with a process template of how to move from a lower level of maturity to a higher level. The DGMEM is prescriptive in nature. which therefore affords an opportunity to both the researcher and senior managers in the department to have a first-hand experience of the model's "fit for purpose". This is in line with the principle of Design Science which states that an artefact must solve a "real life" problem (see Table 2.2, p.13). The different maturity levels depicted on the model have already been discussed exhaustively in Section 3.2, chapter 3, of this thesis.

The final aspects of the conceptual model are the blocks on the left side of the model. These are indicative of the characteristics of each maturity levels on the right. The features can thus be matched as indicated in Figure 6.9 below.

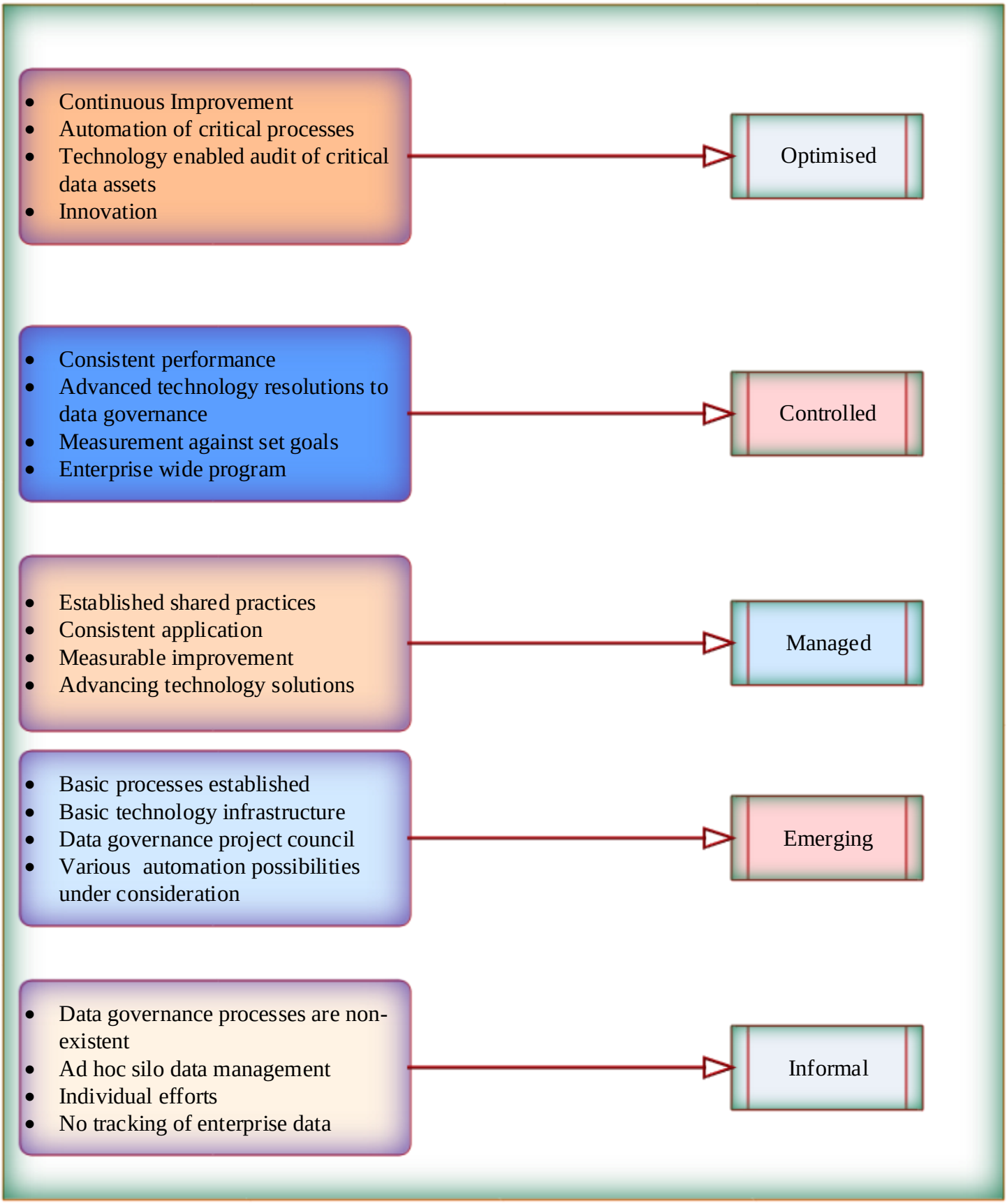

Figure 6.9: Characteristics of each Level of Data Governance Maturity (Informed by Gartner, 2013; IBM, 2007)

In Figure 6.9, the model seeks to encapsulate the various stages and peculiar attributes of each level on the data governance spectrum. This alignment is necessary as it enables the departments a quick view of their current data governance maturity stage and provides an aspirational view of where they desire to be.

6.8 Summary

This chapter discussed the components of the DGMEM, with a view to explain the components included in the conceptual model and the motivation for their inclusion. The chapter discussed each of the components of the DGMEM with reference to its origin in extant literature and relevance to the context of the study. The chapter also aligned the attributes of what constitutes a good maturity model to the components of the DGMEM. Chapter 7 presents the results of empirical evidence collected to ascertain the practical usefulness and usability of the DGMEM.

Chapter 1
Introduction

Chapter 2

Methodology

Chapter 3
Relationship between Corporate Governance, IT Governance and Data Governance

Chapter 4

An analysis of current Data Governance Practices in the Eastern Cape Government Departments

Chapter 5

A Discussion of Five Maturity Models relevant to this Study

Chapter 6

A Conceptual Data Governance Maturity Evaluation Model

Chapter 7

Presentation of Findings from the Qualitative Data

Chapter 8

Implications of Findings from the Qualitative Data

Chapter 9

Presentation of Findings and Implications of the Quantitative Data

Chapter 10

A Data Governance Maturity Evaluation Model for Government Departments of the Eastern Cape

Chapter 7

Presentation of Findings from the Qualitative Data

7.1 Introduction

7.2 Description of Participants

7.3 Pilot study

7.4 The Researcher's Role

7.5 Data Analysis

7.6 Findings from the Qualitative Questions

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7.8 Summary of Findings

7.9 Summary

7. Chapter 7: Presentation of Findings from the Qualitative Data

7.1 Introduction

Chapter 6 presented and discussed the components of the conceptual data governance maturity model (DGMEM) that was developed from extant literature. The rationale for the inclusion of the constructs on the model was presented and the features of the primary and secondary areas as they relate to current data governance practices in the departments were discussed. Chapter 6 also discussed the requisite departmental structures which need to be in place for the DGMEM to be practical and usable in these departments. Chapter 2, section 2.4, discussed the exploratory sequential mixed method employed for the purpose of data collection and analysis for this study. The exploratory sequential design was adapted for the data collection phase of study from the variety of mixed method approaches available. The rationale for the sequence of events in a sequential exploratory mixed method design for data collection and analysis was that it was an effective way to learn about the phenomena under investigation. It used the rich data typically generated by qualitative data as a way of understanding the depth of the issues regarding the phenomenon under investigation, thereafter following up with a quantitative enquiry in order to garner more confidence about the generalisability of the study. This approach is suitable for answering research questions on a subject topic of an exploratory nature in its given context (Creswell & Poth, 2009). This enabled the researcher to draw out themes and patterns from the survey instrument, thereby giving a rich context to findings which might not have been achievable with the use of a singular quantitative questionnaire. Chapter 7 presents empirical data which was collected across four government departments in the Eastern Cape.

To answer the research question, "**How can a data governance maturity evaluation model enhance data governance processes in the Eastern Cape Government Departments?",** this study applied various phases of collecting data as part of the exploratory sequential mixed method design for the process of data collection and analysis. The artefact (DGMEM model, explained in Chapter 6) was built through a design science process, and in accordance with Peffers et al. (2008) Design Science process (diagrammed in Figure 2.4, chapter 2) The first phase of data collection for the study was by means of a quantitative data collection instrument to confirm the need for the study in the problem domain (section 4.4, Chapter 4). Findings from the results confirmed what had been established in literature; EC departments do not have a data governance structure and hence a study of this nature would be beneficial to them if the model is applied. A conceptual data governance model named the "Data Governance Maturity

Evaluation Model" (DGMEM) was subsequently developed from extant literature. Findings from the needs analysis and subsequent development of the DGMEM strongly provided an answer to sub-question 2 of the study which is phrased thus, **"What are the components of an effective data governance framework required to support data management in the Eastern Cape Government Departments?"**.

7.2 Description of Participants

A qualitative questionnaire hosted on Google Forms was employed to test the components of the DGMEM presented in Chapter 6 and their relevance to EC departments' data processes. Google Forms is an online survey instrument which allows participants to complete questionnaires and submit online (Snolnoki & Hoffmann, 2013). Online surveys are considered a suitable means of collecting qualitative data whereby the researcher's presence has minimum influence on the participant's views and opinions (Snolnoki & Hoffmann, 2013). The demographic data is presented in this section; demographics are an important part of analysis as it puts the perspective and perception of the participants into the context of the study.

Participants were drawn from across four departments of the Eastern Cape Province. A total of 45 questionnaires were sent out to directors, senior managers, middle level managers, IT managers and data capturers in the selected departments (Table 7.1 below). The rationale for the choice of participants and their designations was based solely on the context of the study; data governance in Eastern Cape government departments. The participants were staff who dealt with data issues in various capacities in the workplace. Out of the 29 which responded, only 25 participants answered the questions satisfactorily (Table 2.5). Four participants stated '**I do not know'** to a cumulative average of 87% of the questions, a response which is considered unsuitable for a qualitative inquiry. The four responses were therefore deleted from Google forms. The 25 completed questionnaires represents a 55.5% response rate. The sample size was considered adequate as a topic such as data governance is predominately the forte of senior personnel. Qualitative data analysis does not typically have an ideal sample size, and the determinant of how well a phenomenon has been dealt with depends on the saturation level of the topic during the analysis (Creswell & Poth, 2009). Participants from the IT unit were included as they play an active role in the digitalisation and security of data assets. Data capturers and administrators who dealt with the entry and input of data were also included as they are usually the first line of data entry in the departments. Personnel who had very little to do with data decisions and its handling were excluded from the study. Table 7.1 below shows the distribution of participants.

Table 7.1: Description of Participants

Designation	No
Directors	3
Deputy directors	3
Senior managers	8
Strategic managers	3
Administrators	4
Data capturers	4
Total	**25**

7.3 Pilot study

A pilot study was conducted to test the validity and trustworthiness of the questionnaire instrument in adequately addressing the research objectives. The pilot study was conducted between the 22nd February and 2nd of March 2017. Eight participants from two government departments and five participants from the academic community participated in the exercise. The motivation for using participants from government departments in the Eastern Cape is due to the context of the study; it was important to ensure that the questions were relatable to this group of people as the actual questionnaire is primarily addressed to them. Participants were asked to determine whether the questions were simple, unambiguous and logical to their work context. The pilot study yielded the required results as the input of departmental participantparticipants and those in academia assisted in further refining the research instrument. A number of participants believed some of the questions regarding certain aspects of the conceptual model were too technical and may be difficult to understand for some departmental staff. The questions were thus further modified to enhance easy understanding without losing the intended meaning of the particular component. The questions were thereafter published on Google Forms on the 3rd of March 2017.

Responses were later exported to Excel, cleaned and reviewed for spelling errors before being exported to Nvivo. After exporting to Nvivo, the first set of coding was done using the section headings on the questionnaire as the main themes, while the questions formed the sub-themes. Following an in-depth reading to look for recurring patterns and themes, the responses gave rise to sub-themes. The emerging themes were then analysed and findings from them presented. An initial collation and analysis of the responses to the online questionnaire revealed that some of the participants' answers did not provide the required insight into the questions, as it traditionally expected from a qualitative study. To balance some of the neutral answers from

the survey instrument, the researcher conducted focus group discussions in three departments to further enrich the data towards validating the findings. Analysis of the focus group exercise is presented on Tables 7.3 to 7.14. The importance of the qualitative data collection phase is that it provides rich contextual data, which enables the researcher to establish whether or not the conceptual model is able to meet the main objective of the research in its given context. Responses enable the investigator to reach into the 'minds' of the participants and probe any misgivings regarding aspects of the conceptual model which they may consider irrelevant to their department's data governance or management context. This phase is also important as it presents the opportunity for the researcher to examine parts of the whole through emerging themes and connect the parts into a meaningful narrative which can be synthesised with relevant literature and empirical evidence. The inquiry, through the questionnaire and focus group activities were designed to explore interpretations and draw meanings that would help to unearth the critical components of data governance which must be included on the final artefact.

The focus group discussions yielded thought-provoking ideas and opinions about data governance from the respective departments. Unfortunately, two department only allowed the details of the discussions to be recorded on notes whilst the third allowed audio recordings as well. Participants stated that data issues were sensitive and they preferred not to be 'quoted'. However, the absence of a recording device enabled a free flow of conversation which yielded some insight into some previously unconsidered aspects of the research context. Discussion and analysis of focus group is presented after the analysis of the qualitative questionnaires.

7.4 The Researcher's Role

With the choice of an exploratory sequential design method of data collection, the role of the researcher is to ensure that the interpretive aspect of data analysis is preserved from bias as much as possible (Wild & Diginnes, 2013). This phase of the Design Science process is identified as the Design and Development phase (Section 2.3.3, Chapter 2 for the study's application of the Peffers' process) Since the artefact had then been designed, this phase was to ensure it was developed in relevance and would be fit for use in the government departments which are the problem domain. Although this was very difficult to achieve, a key characteristic of addressing this problem was for the investigator to decide on her method of involvement and interaction with the data from the planning stage. In this study, the researcher was closely involved in the data collection process for a number of reasons:

- Historically, government employees are not favourably disposed to answering questions for research purposes. To counter this challenge, a lot of groundwork took place to ensure the requisite clarifications were given at meetings with prospective participants, and necessary approvals were obtained before data collection commenced.
- Although data governance was not a new field to most of the participants, the issues under scrutiny made the majority uncomfortable as they had to admit to being unaware of most of the processes with regard to the essential components of data governance.
- In spite of the fact that the questions were piloted both within department staff and academia, some of the participants required to be talked through the rationale behind the questions, hence the researcher spent a great deal of time interpreting the questions' relevance to the context of the study.
- Some participants, especially lower level staff like data capturers found it difficult to understand some of the concepts like metadata, higher level authentication hence the questions were explained to them in the local language, isiXhosa. The process is diagrammed below:

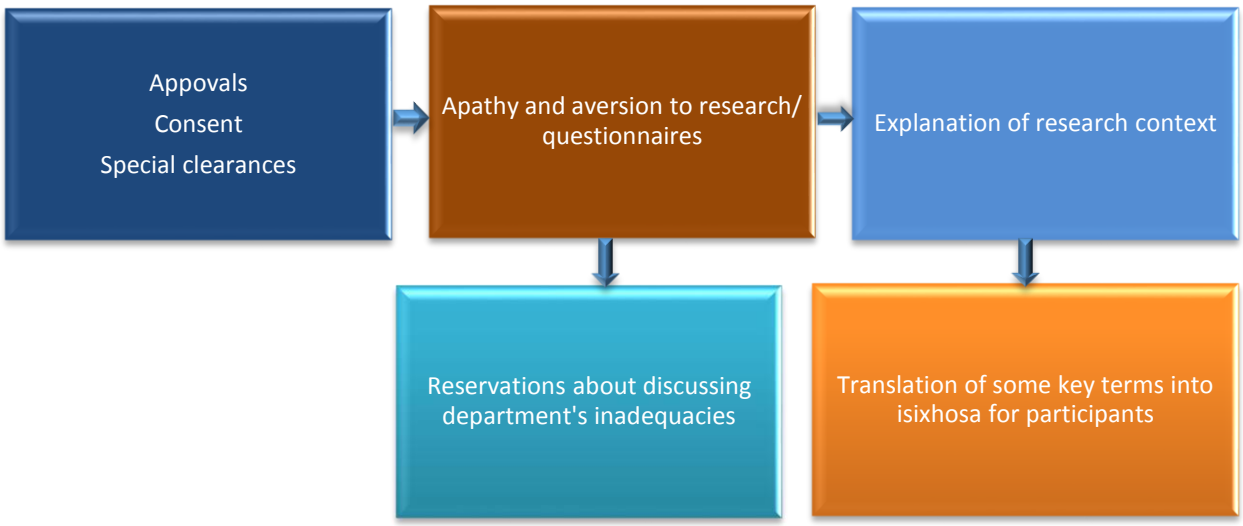

Figure 7.1: Data Collection Process (Source: Self)

7.5 Data Analysis

As soon as the data collection phase was concluded, the investigation proceeded to the presentation and analysis stage. According to Leedy and Ormrod (2013), analysis involves an intricate process of inspecting the relationship between concepts, deciphering and isolating elements of data and synthesising the findings in a way that answer the research question. As

already discussed in the introduction, data from the qualitative questionnaire was coded using Nvivo 11 (NVivo, 2015). This process is diagrammed in Figure 7.2 below and discussed in details in Section 7.4.

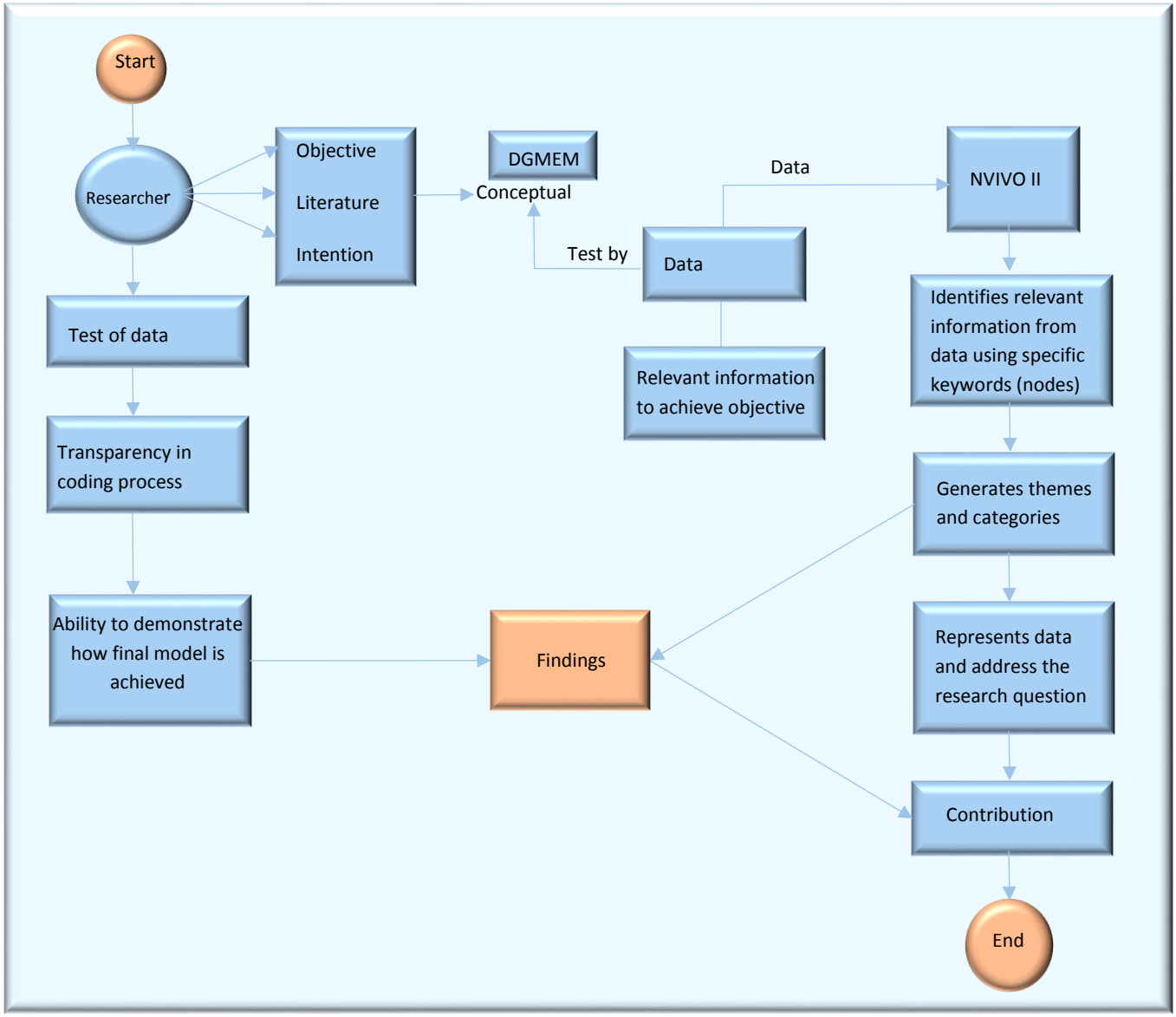

Figure 7.2: Analysis of Qualitative Data with Nvivo 11 (Source: Self)

7.5.1 Data Coding Steps

Data coding is the process of sorting data based on concepts and themes (Patton, 2015). This process can be done manually or with the assistance of a qualitative software. The analysis for the study was done in two ways; the questionnaires were analysed using Nvivo 11 (NVivo, 2015) and the focus group discussions were analysed thematically in line with the research question and the study's objective of presenting a data governance maturity evaluation model for Eastern Cape Government Departments. The categories and themes were drawn mainly

from the review of literature in the data governance domain. Themes were then categorised and Nvivo was used to organise the themes into nodes. The analysis process for this study went through the six data analysis steps identified in qualitative research (Creswell, 2014; Marshall & Rossman, 2010):

1. **Reading/data immersion:** The data was read frequently over a period of three weeks after completion of collection. This enabled the researcher to familiarise herself with the data and think through the patterns (obvious and inferred) emerging from the data collected. This process also involved cleaning up the data. As stated earlier, four responses were deleted as they offered virtually no information that could be coded into any of the emergent themes.
2. **Coding:** As previously discussed, Nvivo was used to identify themes, and subthemes were explored within the codes. The pre-determined codes were based on the researcher's theoretical lens and based primarily on the purpose of enquiry regarding the DGMEM.
3. **Display of data:** The data relating to themes were displayed, discussed and nodes summarised in the context of relatedness to research objectives and relevance to the conceptual model.
4. **Developing hypothesis, questioning the data set and verification:** This is the process where meanings were extracted from the data towards solving the research problem.
5. **Data reduction:** The information was filtered to ensure the most relevant, essential concepts and relationships had been used towards answering the research question.
6. **Interpretation:** In this process, the core meaning of the data was discussed as it impacted upon the solution to the research problem. Data from the focus group discussion and questionnaires were triangulated in order to provide a solution to the research problem.

The six steps presented above were employed to conduct the qualitative analysis and interpret the data for this study. Nodes were developed for the study based on predetermined codes, the emergent information from extant literature and the themes that led to the crafting of the conceptual model. The nodes, developed from the Nvivo software, and the themes from the focus group discussions formed the basis of the data analysis. Leedy and Ormrod (2013) aver that an assessment of data begins with a great deal of information and engagement with the data through inductive reasoning. This enabled the researcher to sort, categorise and reduce the data to a set of themes which could then be applied to the research problem at hand (Mayring,

2014)za. In a mixed method study of this nature, the interpretation of data could only then be concluded after data integration, after which the final report could be written.

7.5.2 Brief description of the departments where the survey was conducted

In line with the confidentiality clause signed by the researcher, the departments where data was collected were identified as D1, D2, D3 and D4. A brief synopsis of the four departments was considered essential as it helped to give a fundamental understanding of the context of the study. D1 could be described as a service-oriented department, with a mandate to ensure that the provincial government delivered essential and efficient service to the different arms of government in the EC. D2 was basically engaged in providing health services to the citizens of the Eastern Cape Province, D3 had an oversight function of the different aspects of government while D4 was charged with the responsibility of providing social services to EC residents. The common denominator which informed their inclusion in the research was the fact that they all handled critical data sets in the province. The departments were mandated to collect, process and report on various data aspects including the social security numbers of citizens, medical records and a host of other sensitive information which went through many channels and layers of accessibility by different personnel. It was deemed important to use these participants as data management and governance played a huge role in their work processes. D1 and D2 required additional permission for data collection and focus group activities, in spite of the researcher's presentation of the University's ethical clearance certificate. The required forms were processed, submitted and approvals granted before data collection was allowed in the departments. It is important to state that the intention of the researcher was not to compare data governance processes between the participating departments. For the purpose of the study, the four departments were taken as a collective in investigating the research problem and proffering a solution.

7.5.3 Emergent Themes and Sub-themes

As stated in Chapter 2, Section 2.5.5, the data analysis for this aspect of the study was qualitative, hence it was considered crucial to discuss the characteristics of a qualitative study as it pertained to the investigation of the research problem at hand. Table 7.2 below details the approach taken by the researcher in undertaking the qualitative part of this study.

Table 7.2: Exploratory Sequential Method of Data Collection

Characteristic	Description	Application to this study
Questionnaire	Data is collected through a qualitative questionnaire instrument. Although this process is done independently of the researcher, there were many trips to government departments as some of the participants' required additional information around the meaning of metadata, before completing the questionnaire.	Research participants were mainly government employees who dealt directly or indirectly with data issues.
Focus groups	These were conducted in three departments. The first focus group consisted of 5 attendees and lasted for an hour, the second group consisted of 3 participants and the duration was 1hour 20 minutes, while the third focus group discussion consisted of 3 participants and lasted for an hour.	Participants were mainly senior managers who were in a position to make data decisions and understood policies and their impact on the way data is managed.
Inductive data analysis	Data was analysed inductively. This approach generates meanings from the data set in order to identify patterns and relationships for the purpose of building a theory.	The purpose of the qualitative data phase was to confirm or disprove the relevance of the components of the conceptual data governance maturity model. The data was therefore interpreted and synthesised in order to re-evaluate and re-work the DGMEM in alignment with the adapted theories and findings from the data.
Theoretical grounding	The study adopted the Contingency Theory and the Institutional Theory; both of these theories are applied to the context of data analysis and are brought to the fore in discussions of the findings in a separate chapter (8).	The final artefact would be derived after findings from the data analysis were employed to determine which components of the conceptual model were relatable and relevant to the data context of the departments.
Interpretive inquiry	The researcher undertakes to painstakingly interpret the data collected without bias or personal interpretation.	The data was analysed with the Nvivo 11 software and the focus group discussions were analysed thematically. Although the themes were derived based on extant literature which led to the conceptual model, there is no rigidity of purpose and the researcher is open to new variables and new components being developed from the analysis to better suit the

Characteristic	Description	Application to this study
		context of the departments with regards to data governance.
Holistic account	The researcher needs to develop a detailed and all-round approach to the phenomenon under study.	The research methodology and the adaptation of the Peffer's et al.(2007) process ensured that the researcher had a holistic view of the research problem.

[Informed by Braun and Clarke (2013); Bygstad and Munkvold (2011); Creswell (2007)

The next section discusses the themes and sub-themes derived from the use of Nvivo 11 in analysing the qualitative data.

7.5.3.1 Themes and Sub-themes

According to Arsham (2006), a model is a representation of reality and is primarily designed to aid in understanding, managing, controlling and changing that reality to suit a particular context. By ensuring that the model was designed using well-founded theories and results from empirical studies, as well as subjecting it to cycles of reviews, it was able to meet the needs for which it had been designed. The questionnaire instrument was designed with the intention of validating or disproving the components of the conceptual data governance model according to the context in which it was set. The themes and sub-themes in the instrument, therefore, were according to the components in the model. After exporting to Nvivo, the first set of coding was done using the conceptual headings on the questionnaire as the main themes, while the questions formed the sub-themes. After an in-depth reading to look for the recurring patterns and consistencies, the responses also gave rise to sub-sub-themes. The question headings were used as the main themes for the responses. The main themes are listed below:

- Rules and rules of engagement for data governance;
- People and Process Capabilities;
- Data Quality;
- Compliance and Risk Management;
- Metadata Management;
- Data Security and Privacy Management.

All of these themes represented the critical features on the DGMEM spectrum.

7.6 Findings from the Qualitative Questions

7.6.1 Rules and Rules of Engagement for Data Governance

The first set of questions were under the theme "Rules and Rules of Engagement for data governance". The questions were designed to assist in answering research sub-questions 2 and 3 which were stated thus; (1) **Sub-question 2**: What are the components of an effective data governance framework required to support data management in the Eastern Cape Government Departments? (2.) **Sub-question 3**: How do existing current data governance practices in the Eastern Cape Government Departments align with international best practice frameworks such as COBIT and ISO/IEC 38500? Emergent themes to the questions posed in Section 1 of the survey are listed here below. Policies in place for data governance and management in the four departments were listed as follows;

1. Administrative filing system Circular no 2 of 2015.
2. District Health Management Information System (DHMIS).
3. Minimum Information Security Standards.
4. OTP Records Management Policy.
5. The Promotion of Access to Information Act (PAIA).
6. The Corporate Governance of Information and Communication Technology Policy Framework (CGIT); and
7. The Records Service Act 7 of 2003.

Regarding the level of consistency in the way data was collected, handled and archived in the department, responses were varied. Most participants stated that there was no consistency in the way data processes were handled in the departments. The reasons given for this perceived inconsistency included a lack of awareness of the policies, especially by lower level staff in the departments; a limited understanding of the requirements and guidelines pertaining to data governance inherent in these policies; some participants felt it was the responsibility of the managers to enforce and uphold the rules pertaining to data governance. They were of the opinion that managers were not doing enough to enforce these rules. Many of the participants also believed that the majority of employees did their work without applying the rules and they reported a general attitude of indifference from staff to existing policies. Twenty-three percent of the participants stated that there was consistency in data collection, handling and archiving. They believed that staff followed the policies as stipulated. However, 77% felt that existing rules and policies were not being followed in the way data was handled in the departments.

On the policies available for the revocation of data authority and data access should the need arise due to an occurrence which may have compromised departmental data, participants in D2 quoted Section 5.4 of the DHMIS policy as the recourse tool for the revocation of access rights in that particular department. Participants in other departments were of the opinion that the Human Resources (HR) unit would apply disciplinary measures based on stipulated policies for managing breaches of contract, but not according to any specific data governance rules of engagement. A few participants quoted the Promotion of Access to Information Act, No 2 of 2000 (PAIA) as a guiding tool for the revocation of data access rights. Findings indicated that with the exception of D2, there were no structured data governance policies in place that could be used to deter the abuse of data access privileges in the other three departments, just the same rules applying to employees when they breached their work contracts.

Participants were asked to state how much control the department had over the privacy of data assets in the hands of consultants and external stakeholders. The three themes that emerged from the responses were:

a) there were policies in place to manage the privacy of data assets, but there were serious compliance problems.
b) access to confidential information was controlled by IT policies
c) stakeholders were mandated to sign Service Level Agreements (SLAs) and confidentiality contracts.

From the emergent themes in the data, it was obvious that there were policies in place to support the control of confidential information with external stakeholders and consultants, but the processes did not enforce them nor directly monitor the application of these policies and adherence to the SLAs by external stakeholders.

7.6.2 People and Process Capabilities

The next segment of the questionnaire probed the people and process capability regarding data governance in the departments. This segment of the questionnaire related to sub-questions 2 and 3 in answering the main research question. Sub-question 2 read as: "**What are the components of an effective data governance framework required to support data management in the Eastern Cape Government Departments?"** As shown on the DGMEM (Figure 6.2, Chapter 6), the enabling layer of the model which determined the success of

implementation was dependent on the people capability of stewardship, and how this factor impacted the processes and policies which drove data governance. It was thus important to establish if the current people capability in the departments aligned with sound data governance principles as they were outlined on the model. Sub-question 3 probed the alignment between the existing practices in the Eastern Cape Government Departments and best practice frameworks such as COBIT and ISO/IEC 38500, both benchmarking frameworks for this study. This also directly related to the processes in these departments and an investigation into whether or not they were aligned with the frameworks adopted by the DPSA.

Responses to the question of functional structures currently in place for data governance in the departments yielded the following sub-themes;

- Records management and registry did the processing, storage and management of data.
- Data was captured, coded and referenced by registry staff.
- IT managers verified and authenticated the data captured; and
- The National Health Information Systems Committee of South Africa (NHISSA) oversaw the management of data in the Health Services sphere.

Regarding the process of assigning data roles in terms of capturing and verifying data, the general response was that there were no clear cut roles assigned in the departments. Administrators were often assigned the role of capturing data within their units, with data capturers typically employed on an ad-hoc basis for projects or training programmes. Senior managers were responsible for verification of data. The exception to this finding was in D2 where data capturing, authentication and verification were dependent on the roles assigned to personnel, based on the Department of Health Management Information Systems (DHMIS) and the Standard Operating Procedure (SOP). Seventy-two percent of the participants stated that there were dedicated data stewards in their departments, and they expressed that these dedicated stewards were domiciled in IT.

The following scenarios / processes were used by participants across the four departments in describing the process of capturing data in their departments:

- Data was captured by the administrator / capturer / clinician.
- A file number was generated for every new piece of correspondence.
- Data was coded and referenced.
- Managers authorised and verified data.

- Line managers / clinic managers / project managers needed to be notified if changes were requested to the data set; and
- Data was stored, archived and made available on request from the Records or Archives units.

Participants described the processes in place for data governance in their respective departments as follows:

- Data governing and management processes were determined from internal processes based on policies;
- Monitoring and control processes were determined by policy managers and they determined which personnel did the monitoring, authentication and verification of data; and
- For D2, the process was spelt out and duly outlined in the DHMIS.

Participants were asked to state how the processes of data entry, verification and authentication were supported by available technology artefacts in their respective departments. The following is a summary of their responses:

1. The four-eyed principle, a process whereby data went through four levels of authentication before it was archived for future use;
2. There were computer artefacts to promote fast data processing and the minimization of errors at the input stage;
3. Referencing and coding processes were verified and managed at every level;
4. The government had transversal systems like PERSAL, LOGIS, BAS for managing data; and
5. Two departments stated that they had MIS designed for their specific work systems which checked for duplication and also verified data.

Regarding the alignment between data handling processes in the department and the two international governance frameworks chosen as benchmarks for the governance of data assets in the departments, seventy six percent of the participants were of the opinion that the processes were not aligned with COBIT/ ISO/IEC 38500 processes. Twenty four percent of the participants stated that there was some form of alignment with the frameworks even though it was not explicitly stated.

In describing the processes in place for the resolution of data issues, specification of data quality requirements and the establishment of accountability, those listed below were the emergent themes:

- There were different levels of review for data at both district and provincial levels.
- Issues were handled on a case by case basis as they occurred.
- Periodic pre-audit and internal audits were done to check the aforementioned issues; and
- Employees were encouraged to be guarded and to stick to all data management policies available in the departments.

Below are the processes that were in place for the enforcement of decision rights regarding data assets of the department. The rationale for this question was to probe the practise of decision rights as it pertained to data assets within the department.

- Access was denied to unauthorised persons.
- The effective administration of the PAIA and the DHMIS processes included the revocation of access and withdrawal of access privileges to employees deemed to compromise the privacy and security of data assets; and
- The departments followed HR policies at they pertained to the Information Security guidelines.

7.6.3 Data Quality

The next section focused on the quality of data and how the departments ensured the available data had the quality rating pertaining to data governance. Participants were asked how their department accounted for the truthfulness and accuracy of data in the various units. Most of the participants stated that this was done by proper data monitoring, but failed to elaborate on what constituted proper data monitoring for their context. About 32% of the participants said this was done through periodic internal and external audits, and that senior managers had a duty to ensure that data was accurate and truthful. Sixteen percent of of the participants also stated that this was done by sticking to the parameters set out in the data management policy. Participants were thereafter tasked to list all the available data quality tools in their departments. Below is a summary of all the data quality tools listed by participants:

- Informatica software;
- Physical data quality checks for verification, accuracy, consistency and relevancy;
- The national data quality check parameters on the DHMIS; and
- Staff training programmes for data capturers and other data stakeholders in the department.

Responding to the question on how frequently data audits were done and the events that prompted data audit in the department, there were conflicting opinions on the frequency of, and the catalyst for data audits. Fifty percent of the participants stated that audits were conducted annually, thirty four percent stated that they were conducted quarterly and sixteen percent of participants stated that data audits were only conducted if there were reported data breaches or threats to the privacy and security of data. In the same vein, there was inconsistency in the responses to the question of how often data monitoring and cleansing was carried out in the departments. Most participants opined that data cleansing was done quarterly, others said it occurred between a 3- 5 year window, yet others stated it was a yearly exercise while some participants stated that the exercise was only carried out when there had been data breaches or unfavourable audit outcomes.

Participants were asked to discuss all the problems caused by poor data quality in their departments. The most mentioned of all data quality problems was data inaccuracy due to input errors from the onset. This was said to occur from the moment when data was being entered into hard copies, that is, registers on a project and also when being transferred from hard copies to soft copies. Following close on its heels was the issue of compromised data from stakeholders - this occurred when consultants and service providers had submitted incorrect data sets for any number of reasons on conclusion of their contracts. Problems arose when these data sets could not be verified and the stakeholder in question was unable to resolve the issues arising from their submissions. Lack of data integration across units, incomplete and improper migration from old systems to new ones and the duplication of data were among the challenges mentioned as problems associated with data quality in the four departments. All of these problems lead to inaccurate planning and flawed decision-making which ultimately resulted in poor service delivery. The resultant effect of this was negative audit outcomes and this led to the Eastern Cape Province scoring low in the delivery of efficient services when compared with other provinces in the Republic of South Africa.

7.6.4 Compliance and Risk Management

The next main theme was on compliance and risk management regarding data assets in the departments. The questions under this theme were asked to determine the level of employees' understanding of information policies and their compliance with these policies when handling data assets in their line of work. This was aligned with sub-questions 3 and 4 which both addressed the current data governance practices in the department, while seeking ways of improving on them for more efficient and effective data governance.

Participants were asked to describe how the department ensured compliance with government laws and policies regarding the handling of data assets. Seventy-three percent of participants stated that this was done through periodic verification of data assets plus daily internal monitoring for compliance with PAIA and DHMIS policies. Twenty-seven percent of the participants stated that there were no processes in place to monitor compliance. Participants were then asked to describe how the departments ensured that data was delivered to end users in a timely, accurate, consistent and usable format. The following sub-themes emerged from the responses:

- By complying with the data governance processes prescribed by PAIA and other relevant policies;
- By encouraging monthly and quarterly reports as specified by the DHMIS;
- Staff were adequately trained for accurate capturing of data; and
- With the use of information technology such as e-mails, Excel spreadsheets, software for data capturing and analysis.

Participants were asked to describe the protocols in place to ensure data was delivered to all stakeholders through the most economical and optimal use of departmental resources. The responses are listed below:

- Spreadsheets were used to capture and transfer data;
- Policies guaranteed authorisation to managers and supervisors for data access;
- Data was sent through electronic e-mails; and
- Twenty-eight percent of participants had no idea of any known protocol on this issue.

7.6.5 Metadata Management

Regarding the theme of metadata management, participants were required to describe the process of metadata management in their respective departments. Most of the participants did not understand what metadata stood for and were not aware of any process for managing it. The few who were aware, stated that the process was managed by the IT department. In the same vein, most of the participants were unaware of a metadata language repository in their department. When participants were asked who was in charge of metadata storage and retrieval, 40% stated that IT was in charge, one participant said it was the Data Centre team and some said it was the main registry in charge of all data assets. Regarding the processes in place for access restrictions, decision rights and accountability for metadata, 84% of participants were unaware of the processes involved. A few believed that the IT department managed the process according to PAIA standards. Also, 89% of the participants were not aware of the technological capabilities in place to manage data, with a few stating that IT made use of basic technologies to manage metadata.

7.6.6 Data Security and Privacy Management

The next section was about data security and privacy management. The questions probed the process by which data was secured in the various departments, how access and decision rights to structured and unstructured data were determined, the protocol for the classification, authentication and administration of sensitive data, the protocols to address and prevent data breaches and the rationale behind the departments' data security and privacy settings. Participants described the process of data security in the departments as:

- The DHMIS Policy outlined the process of data security;
- There was strict adherence to the PAIA policy; and
- User rights and access level management depending on employees' level were the tools used to control data security.

Additionally, participants affirmed that the audit of data security and privacy settings, and how often these security settings were changed or updated depended on two major factors, namely, when there was a threat to data and whenever an employee left the department and their access rights were revoked. Reasons given for the updating of security settings included IT security related risks, identified breach of security and routine review of certain security protocols.

Protocols for the classification, administration and authentication of sensitive data were listed by some of the participants as;

- Coding, filing and archiving; and
- Referencing according to the department's protocol.

Four participants (16%) said they were unaware of any such protocols, while some said the protocols were as outlined in the PAIA and DHMIS policies. Most of the participants stated that the process of access and decision rights to structured and unstructured data was mainly at the discretion of the managers or the IT unit, while a few were not aware of the process by which this was determined. Regarding the processes in place to address data breaches, most participants stated that there were steps outlined in either HR policies or risk management policies. Two participants indicated that their department had an Information Security policy which took effect in case of such breaches.

7.6.7 Data Lifecycle Management

The next section of the question was on the management of the lifecycle of data. The questions in this section endeavoured to determine the categories of employees allowed to sort, retrieve and delete archived data. They also covered the challenges faced in managing data through its entire lifecycle, the protection of sensitive data from unauthorised disclosure and the management of data from inception through to deletion. Furthermore, participants were tasked to list all known data entry points for their departments, as well as to describe the protocols for determining and categorising the lifecycle of categories of data assets. This section also sought to investigate the rules existing for data collection and archiving, and the possible measures in place to mitigate data risks in the department.

Responses on how the department managed its data assets from inception to deletion yielded the following themes:

- Coding of collected data;
- Indexing;
- Data referencing;
- Data being used for planning and decision-making; and

- Data being archived for five years according to national policy for government data assets.

Some of the challenges recorded in managing data through its lifecycle were stated by the participants as (1) errors in data capturing which might result in defective planning (2) inaccuracy and inconsistency in data capturing (3) the lack of a standardised process for data tracing and usability. Thirty-two percent of the participants stated that these issues were festering as staff were aware of the requirements, nevertheless they were not following the due process.

Most of the participants listed the policies / protocols in place to determine the lifecycle of categories of departmental data as the DHMIS policy, the provincial IT policies on data management and the PAIA policies. A few participants stated that they had no idea whether or not such protocols existed. The IT managers and registry staff were listed as the employees who had the authority to sort, retrieve and delete archived data. On the question of whether all employees understood the importance of managing data throughout its lifecycle, the majority of participants answered in the negative, stating that most of them were not aware or knowledgeable about data policies and those who were aware did not usually follow the stipulated policies with due diligence and consistency. A number of participants contended that though there were recurrent data issues from time to time, many employees knew the implication of ungoverned data. Participants listed some of the measures in place to mitigate data risks as:

- Ensuring that DHMIS policy on data security was implemented effectively across all facilities;
- Setting up of audit committees to investigate and discuss ways of mitigating such risks; and
- Frequent data back up to guard against the loss of data.

Some of the ways by which the department protected sensitive data from unauthorised disclosure were described as allowing limited access to sensitive data for a few personnel through (1) having accountability rules in place for sensitive data (2) password protection from unauthorised persons to access the data (3.) personnel being made to sign non-disclosure contracts and management ensuring that policies were followed.

Participants were asked to list all known data entry points in their respective departments and the results indicated the following list:

1. Various projects across the province;
2. Clinics;
3. Citizen Service registration points;
4. Provincial offices;
5. Municipalities;
6. Supplier registration; and
7. Consultants and service providers

In the same vein, participants were asked to discuss the rules which exist for data collection and archiving in their departments. Most of the participants stated that they were guided by PAIA policies, a few stated that the department's MIS had its own validation parameters while 32% said they were not aware of such rules.

Following on the initial analysis of the data results above, a decision was made to embark on focus group discussions in order to collect additional data on some of the questions. It was believed that this would create further insights around the relevance of the DGMEM to the processes of the departments.

7.7 Findings from the Focus Group Discussions

These focus group activities were conducted in three of the four departments where the qualitative questionnaires were administered. A focus group activity could not be conducted in D4 due to unavailability of the relevant personnel. The first focus group involved 5 attendees and lasted for an hour, the second group consisted of 3 participants and the duration was 1hour 20 minutes, while the third focus group discussion comprised of 3 participants and lasted for an hour. The outcome of the focus group activities are presented in Tables 7.3 to 7.14 below.

Table 7.3: Understanding of Data Governance and Relevance to Department's Work Processes.

Question	What is your understanding of data governance as it relates to your job?	Emergent Themes
P1	"I am not familiar with the term, do you mean data management? We have processes in place to	Data governance (hereafter referred to as DG) was not understood in its

Question	What is your understanding of data governance as it relates to your job?	Emergent Themes
	manage data and the Strategic unit manager plays an oversight role in this regard. Record and Knowledge Management Unit ensures data preservation."	context, mistaken as and used interchangeably with data management (hereafter referred to as DM).
P2	"Does data governance not mean the same as data management? With regard to the work I do, data governance is important since we must have correct information to act on citizens' complaints."	Participant was not sure if DG and DM were the same. Understood the importance of data governance in the context of getting the correct information to deliver effective service to the public.
P3	"I am part of the national policy decision-making committee and data governance is generally covered under the different policies in place, that is, records management, PAIA, and some other policies depending on department."	DG was treated as an integral part of policies guiding information and records management.
P4	"Data governance is basically the same as data management, and is guided by the internal and external policies about managing data. It is very important in my line of work because we need data to do our planning."	Participant understood the importance of data, but believed DG and DM were the same.
P5	"Data governance is the function which sets the policies and plans for how data should be managed. Although we don't really call it data governance here, we do have a number of policies in place about how the department's data should be used."	Participant had a good understanding of what constituted DG, but averred that it was not in place at the department to any great extent.
P6	"We do have in place data processes, I imagine this is the same as data governance. We use data for many things, even to manage employees and also our stakeholders, South Africans waiting for us to excel in the province, hence we pay attention to our data."	Participant understood the value of data, but was not quite sure what data governance meant and how it differed from DM.
P7	"Data governance comes under IT governance, as these are the protocols specifying how data should	Participant understood the meaning, context and value of data governance.

Question	What is your understanding of data governance as it relates to your job?	Emergent Themes
	be managed. As IT, we are responsible for the digital storage and preservation of data assets here."	
P8	"Data governance is the way things are set in place to make sure data is well looked after. I am part of the committee on Audit outcomes. We have now realised the role of data in government."	Participant understood that data governance was the foundation for sound data management processes and also acknowledged an understanding of the critical role played by data in government.
P9	"Data governance is the position of senior managers on how data is used, released and saved in the organisation. Policy makers in the department try to ensure our data assets are maximised positively."	Participants understood the domain of data governance and who should be in charge of it.
P10	"Data governance is the way data is handled, not sure about the difference between it and management. However, we do manage our data well here. From capturing to uploading there are established processes to make sure we have the highest standard of correct information on our records."	Participant could not distinguish between DG, DM and data handling; considered current practices to be sufficient to safeguard data assets in his department.
P11	"Data governance, isn't that the same as managing data? We take our data things seriously here, you know. Lives may depend on us having the correct information on record for patients."	DG was considered the same as DM, Participant understood the value of data and acknowledged its importance in the processes of the department.

Table 7.4: Rules or processes governing data collection, input and storage in the department

Question	Let's talk about the rules or processes governing data collection, input and storage in the department	Emergent Themes
P1	"I am not sure if we can call them rules per se, but we have a way of collecting data. If on a project, the project manager has a register where all participants and their details are registered. This	Participant established that a process for data collection, input and data storage existed.

Question	Let's talk about the rules or processes governing data collection, input and storage in the department	Emergent Themes
	list is then given to the data capturer who enters it into a computer, then she will ask the manager to verify and validate it against the actual register, then the project is uploaded locally and sometimes to the national MIS records. Let my colleagues also say something in case I have missed it."	
P2	"The process is the same as expressed by P1."	Participant acknowledged the steps detailed by P1, as they were in the same department.
P3	"We also have the same process in my unit, except our own data is usually generated via PERSAL, which has its own inbuilt checks and balances. Although we cannot totally rule out human error, the system is very reliable."	Participant affirmed the department's ownership of MIS for their work processes including data.
P4	"We are in the same unit (indicates P1) hence we use the same system. However, the problem is that some of our managers in the regions are not very active, sometimes they make a lot of mistakes on the registers. We try to clean up the dat,a but this is difficult when the volume is large."	Participant acknowledged the presence of the MIS, but raised concern about its usage and correctness of data coming from the regional offices. Participant believed the errors from the origination data sources, that is, regions led to errors in the data process.
P5	"As the record management unit, the data that comes to us is basically for safe keeping and for ensuring the knowledge base of the department, which is data based, is kept safe and can be accessed by stakeholders as and when needed. In this way, we keep hard copies of registers, files and other records from different units within the department. We also decide with other managers on who can access these files and the process is that anyone who makes requisition for files must sign for them, and return them to us in an agreed time period. Currently we have embarked on a project to automate all department's records and our IT guys are very involved in the project."	P5's involvement with data was different, consisted of safekeeping on behalf of the department. Nonetheless there was a structured process to how the data was handled. The unit was also going through a transformation process whereby data assets were being completely automated, with extra security steps included.

Question	Let's talk about the rules or processes governing data collection, input and storage in the department	Emergent Themes
P6	"As an administrator in HR, I use counter books to keep a record of all data related transactions and it is my responsibility to keep these counter books safe. They don't have duplicates and if lost and necessary HR steps were not registered in the system, there is no proof of that event anywhere else."	P6 had a manual, unique way of storing data on counter books, However, this system was not dependable as the counter books might be lost or misplaced.
P7	"We do things according to regulations. I think the basic is ensuring that the correct data is available for people to get their work done."	Participant opined that data processes were according to regulations, but did not state what those regulations were and how they applied to data processes.
P8	"There are policies in place to guide us in how we store and retrieve data. Once you are given access by your line manager to capture a certain dataset into the system, it is expected of you to make sure you correctly capture or transfer the data from a hard copy to a digital version. According to the policy or rule, your manager does a random check of the data and then okays it for referencing and storage."	Participant stated that data processes were guarded by policies. He further detailed the processes currently in use at the department.
P9	"As health services provider, our data collection is taken seriously from the moment a patient record is opened. The department has an effective MIS which ensures data is checked for quality. There are also some physical checks and verifications which are carried out at our facilities, that is, at the clinics.	Participant had an efficient MIS which had processes in place for data input, verification and quality checks.
P10	"Most of the data I deal with come from our various projects around the province. The rules are for the data to be correctly captured from the fields under the authority and watchful eyes of the project managers. They then file their reports and hand over the data to us. We as managers thereafter mandate our data capturers to digitise the records, we verify their input and then upload the data for future reference and use."	P10 was dependent on regional managers for data. Managers in his unit thereafter verified the correctness of the data before storage.

Question	Let's talk about the rules or processes governing data collection, input and storage in the department	Emergent Themes
P11	We deal with data that is already in the system. Our job is to hold the data assets of the department in trust for safekeeping. There is a requisition, release and retrieval method for all data assets held by our unit on behalf of the department."	Participant was a custodian of data assets and his unit had a process in place to manage the data assets under his care.

Table 7.5: Control of Departmental data in the hands of external stakeholders

Question	How much control does the department have over data in the hands of external stakeholders', that is, consultants?	Emergent Themes
P1	"You know human beings can only be told what is right, they cannot be forced to comply. We sign confidentiality agreements with all external parties getting access to our data, but we have no way of knowing if they keep their side of the agreement by not sharing the data or not."	There was no known method of ensuring that external stakeholders complied with data confidentiality agreements.
P2	"We sign SLAs and each sub-contractor has to sign a confidentiality clause regarding their access to our data. We don't really have the ability to stop them from sharing our data since they mostly work with our records outside the physical office building."	Only SLAs were signed, but there was no way to enforce adherence.
P3	"The knowledge and record management unit has a number of control measures in place to manage data given to outsourced personnel. We control documents through volume numbering, which means we can easily detect if a page or two was taken out of the records. The current migration process to digitalise data will ensure that it is impossible to make copies or do dummies of documents as the system will immediately raise a red flag."	Control measures included page numbering. Process to digitalise data was underway, with inbuilt security measures to prevent copies or dummies of documents.
P4	"We honestly do not have much control, mostly due to the demands of the job, some of our regional	Regional managers left data in the hands of external stakeholders at will.

Question	How much control does the department have over data in the hands of external stakeholders', that is, consultants?	Emergent Themes
	managers do not fully understand the importance of these data and they leave it in the hands of data capturers, external consultants without demanding accountability for the data."	
P5	"Beyond the SLAs, no control over them."	No control over contractors other than the SLAs.
P6	"I don't think we have much control apart from signing SLAs with them."	No control over contractors other than the SLAs.
P7	"This is a bit difficult, the reason being we have different types of external stakeholders. Our weakest points are in the regions as most of the consultants there are not properly monitored and there are occurrences of data loss. Of course they sign contracts, but then how many people read the small print?"	Weakest link in data loss or manipulation were the regions.
P8	"I think the current system is ok, we make them sign contracts with a confidentiality clause and so far, so good."	SLAs only, no method of enforcement.
P9	"The thing about consultants and departments' data is that we are not very sure of when things will go wrong. Some of them have a tendency to forget they are not department staff, the only control is we signed agreements with them and also they are not allowed to take sensitive documents out of the building but then e mail and all those things are still there."	SLAs only, no method of enforcement.
P10	"Our data is safe in their hands, they know the implication of leaks and loss of data. I also think it is important to note that this department uses consultants mostly for projects, not sensitive matters."	Data was safe as they knew the implications of leakages occurring through them.
P11	"They sign performance and confidentiality agreements, We believe we are safe."	SLAs only, no method of enforcement

Table 7.6: Assignment and adequacy of data roles in the department

Question	How are data roles assigned across the department? Do you think the current formula is adequate?	Emergent Themes
P1	"Every unit has its own system. Generally the senior manager is the custodian of data for his department and has data capturers and middle managers who verify the data below him. There are silos in the department when it comes to how data is managed. This creates problems when you need to access some data from another unit hence I am not convinced that this is the best system. I think we can do better at creating a synergy such that data roles are well defined, maybe by the Strategic Management Unit. This will even make the work of the SMU easier as they will only have to pull data from the same source."	Data roles were not really synchronised nor structured according to DG known frameworks, data roles were assigned.
P2	"As my colleague has said, there are silos in the department and this has created a situation whereby everyone has his/her own style of managing data. There are no dedicated data stewards, I am not sure we have really considered the importance of data to the achievement of our strategic objectives. Also it will be very difficult to ask HR to recruit someone just to oversee data. It will seem as if the job's KPA is too narrow to warrant a post."	Data roles were not really synchronised nor structured according to DG known frameworks. There was a belief that the justification for data roles could not be sufficiently supported for funding.
P3	"We do have data capturers and administrators who are expected to capture the necessary data in the department, which to my mind is a data role. Also, managers are accountable to the national for reporting on data especially as regarding budgeted projects and targets. I think the difference is that we do not use the formal terms in the department."	Dedicated data roles were limited to data capturers. Managers were expected to devise their own way of managing data in their domain.
P4	"I don't want to repeat what has been said by everyone, but I can definitely say the current system is not good enough. We keep raising the same issues on the accuracy of data every year. We are hoping that with the new focus on using IT to work smarter, we can begin to see a change in the way we	Implied that there were no data roles and believed the system could be made much smarter.

Question	How are data roles assigned across the department? Do you think the current formula is adequate?	Emergent Themes
	make use of computers to generate better accuracy."	
P5	"There are no distinct data roles known to us. In record management, our job is to accept the data on behalf of the units and make sure they are kept and released according to policy."	No distinct data roles in record management.
P6	"No one will approve a dedicated data role to be created. The current system is not adequate. I think we keep having the same problems with our audit reports due to this unsolved issue."	No data role and there were inadequacies in the current system.
P7	"Data roles are dependent on the designation of individuals. We do not actually have specific posts just for data, each manager has a working data structure which he has to monitor and manage. He also uses his discretion, of course, based on existing policy, to determine who should be in charge of confidential issues."	No distinct data roles, managers were expected to manage data issues as they deemed fit.
P8	"Data roles are not available here unless you are referring to the unit keeping records. What they do there is to label, archive and release the data when required."	No data roles, only Archives and Records.
P9	"The current system is failing us. The role played by data has not yet been understood and respected. I do not see anyone dedicated to data issues in my department, at least."	No dedicated data roles. The understanding of data's place for the successful performance of the department's strategic plan was not yet recognised.
P10	"The data roles in the department are not about governance. We have data capturers, but that is about it. They report to managers who are expected to verify their work before it is uploaded and shared with others. We seldom get complaints in the workplace, hence I assume everyone is happy with this system."	Data roles were limited to capturing by data capturers. No complaints, the system seemed to be working.
P11	We have no data roles, but we are coping well, although we have problems with the quality of data.	No data roles. Issues of, and with, data quality.

Table 7.7: Adequacy of Technology tools for protecting data

Question	Are there adequate technology artefacts to protect data within the department?	Emergent Themes
P1	"We do have access to computers, laptops and other IT gadgets, but the basic style of managing the data, for obvious reasons is that we have both soft and hard copies. Each staff has their own sign in and password but in all, sensitive data is not really that difficult to access for someone who wants to."	No special technological artefacts or MIS but the department had computer and hard copies of critical data.
P2	"I believe so, there are definite passwords which gives access to each employee. It is expected that each person working with a dataset should know how to save and possibly protect their documents if the need arises."	No special technological artefacts, but access control measures were in place.
P3	"I am not sure how to answer the question. Although we do have computers and printers etcetera, I think an MIS which is designed to capture the important data for each unit would be a better option than us having different templates and using different applications. You will see some of the reports are done in Word, some in Excel format and it is a problem to crystallize different styles like that when you are trying to come up with a concise report in limited time."	Access to computers, but no special MIS. Different units capturing data in different formats also created problems.
P4	"I will say not really. For example, we still use counter books to register some processes, even though the entire system from advertisement to recruitment is supposed to be logged in the system. There are quite a number of incidents whereby this did not happen and we now have to depend on the counter books to trace the actions. This is difficult and open to possible alteration or loss of the booklet."	There were critical processes which were still recorded manually. These datasets were open to loss or mishandling.
P5	"Yes and no. We have computer applications like Excel which can be protected by the user or locked from being altered or edited. In the same vein, there should be specialised software applications that have built-in security measures to protect the data."	Computer applications in use, but no dedicated MIS for departmental data.
P6	"I don't think so. The system does not have any checks and balances ."	None, the current system had no checks and balances.

Question	Are there adequate technology artefacts to protect data within the department?	Emergent Themes
P7	"Yes, we have our own DHMIS policy; a dedicated system which sets our roles and responsibilities in very specific ways. This is, of course, backed up by the necessary MIS which enables policies, hence I will say we definitely have the required support in technology."	Yes, the DHMIS.
P8	"It depends how you want to describe technological artefacts. We definitely have tools like computers and other support system like internet and things, but in the real sense of having extra features on the computer, no. We use Excel for data management once the data has been recorded."	No, Excel was used mostly to manage the data.
P9	"Like my colleague said, we have the DHMIS which is backed by policy. We don't have a problem in that area."	Yes, the DHMIS.
P10	"I think so. Technology allows us to associate levels of data with personnel. For example, if there is a leakage of sensitive electronic information, it is easy to trace the personnel who had access to such information. The only problem we are having is that many of our colleagues do not fully understand the technology they are using so you find problems here and there."	Yes, the technology enabled the trace of digital footprints hence it was easy to pinpoint where and when leaks occurred.
P11	"Yes, we do have the technological support. Our financial Information Systems is top notch, we do not have a problem with securing data on it. However, it does not have the capacity to detect certain unauthorised activities if the right log in has been punched into the system."	Financial Information Systems secured data.

Table 7.8: Correlation of Data Processes to COBIT and ISO/IEC 38500

Question	Are you familiar with COBIT and ISO/IEC 38500? Can you say that the department's data processes follow the principles of both frameworks? The DPSA states that they have adopted both frameworks for IT governance nationally.	Emergent Themes
P1	"I have heard of it. They are mentioned in the CGIT IT governance policies, but we do not use or follow the processes. I am not even sure how it is implemented."	Not familiar, vague recollection of the two frameworks.
P2	"I am familiar with COBIT, a private company wanted to do some training on it for us two years ago, but it was not approved. We don't use it."	Awareness of COBIT, but no depth of information on how the processes worked or related to the department's context.
P3	"No."	None whatsoever
P4	"No, I don't think so as it does not even ring a bell."	None
P5	"Yes, I do know the terms, but we do not apply any of their features here."	Awareness, but no application of COBIT or ITIL in work processes.
P6	"No, I am not."	None
P7	"I am, I have done the COBIT Foundation training. We are in the process of getting the entire unit to do the training. It has been a learning curve and we are eager to implement some of the processes."	Yes, trained in COBIT foundation
P8	"The two frameworks are in the CGIGT policy documents, but I cannot really say that we use it. I am sure IT will know more about how it works."	Awareness of both frameworks, but no idea how they related to his department.
P9	"Not really, I have heard about COBIT, but we do not use it for data, we only use the policy guidelines to manage data."	Awareness of COBIT and how it had helped to shape certain policies.
P10	"I am not familiar with it."	None whatsoever.
P11	"Yes, the department has been trying to implement COBIT for IT governance."	Awareness of COBIT the department's effort to implement it for IT Governance

Table 7.9: Tools for measuring or improving Data Quality

Question	Can we say data in the department meets the VAC (valid, accurate and complete) criterion? Are there tools to measure or improve data quality?	Emergent Themes
P1	"Frankly, no. The system of entering and storing data is very dependent on individuals and even the manager's oversight responsibility is sometimes inadequate to cover the volume of data being generated."	No
P2	"We have the Internal Control Unit (ICU) which acts as a check on the units within the department. They are like the internal police who should ensure that data is accurate and complete."	ICU conducted checks, but no quality check tools.
P3	"The data processes make it impossible for anyone to say with confidence that data is VAC. What experience has shown in this department is that most of the entry level staff do not have the skills they need to handle large volumes of data. The effect of this is that many of them are unable to do a thorough job of getting clean data onto the spreadsheets."	No, data processes were unstructured and prone to mistakes.
P4	"There are no standard procedures for managing data, hence we have so many templates for the job. This in itself is problematic as the staff is always creating data for new assignments, making the data management process a mess."	No, as there were no standard procedures for measuring data.
P5	"I can say our data process has improved a lot. However, you have to realize that we also have incoming data from the regions and the process of managing data in the district is not really very strong. I cannot say we are 100% yet, but we are working towards it."	No, there is a high volume of data coming from the regions and there is no structured process for data collection in the regions.
P6	"No, there are no tools to measure data quality. We are depending on our staff to do the necessary things to make the data correct, especially when it comes to the records we keep in hard copies like registers and ledgers. The data is always required at	No, data accuracy depended solely on employees doing what was expected of them.

Question	Can we say data in the department meets the VAC (valid, accurate and complete) criterion? Are there tools to measure or improve data quality?	Emergent Themes
	audit times and the AG scores us low due to missing records and other such things."	
P7	"I believe so, especially with our digital data. The DHMIS has a quality assurance feature which checks the quality of input. As per some of the physical data from the clinics, we also have a checking process. I believe our systems are very accurate."	Yes, inbuilt quality checks on the DHMIS
P8	"I don't think we can say that. You understand that there are different levels of data management, the administrators sometimes do not do the required quality assurance when they are under pressure. Unfortunately, managers can only check some of the data and not everything, so we sometimes end up with the problems of data duplication, missing information and poor quality data. We rely on line managers to check the data before it is indexed and archived."	No, volume of data did not allow for thorough checks, only random sampling.
P9	"Yes, the DHMIS policy has its own quality checks."	Yes, inbuilt quality checks on the DHMIS
P10	"We are not there yet. There are serious challenges as we have data coming from multiple sources. It is difficult to keep the quality at the point we would like without a sort of integrated technological system therefore we are still facing the challenge."	No, multiple data sources made it difficult to achieve this.
P11	"I must say there has been great improvement in our data processes, but we have no technology to measure. I think one of the problems we are having is a lack of commitment to measurable improvement. We have had several consultants here with creative solutions to our data problems, but they are never awarded the contracts."	No, there was no technological artefact to measure if there was any incremental improvement in data processes.

Table 7.10: Problems associated with poor Data Quality

Question	What are the problems associated with poor data quality in the department?	Emergent Themes
P1	"I believe I speak for everyone in the room when I say the Auditor General's report is a major headache. The department struggles to get a clean audit each year and this has been a major dent in our KPAs."	Negative audit outcomes.
P2	"The problem of poor data is that our Strategic Management Unit finds it hard to be sure of the data on which their projections are based. You understand this problem is a major headache as this has an effect on the financial year if the plan is based on inaccurate data."	Lack of confidence in the data for planning purposes.
P3	"Many problems arise from poor data quality. Unreliable data affects the projections of the department, reflects badly on the management and also make Audit time a nightmare as the claims made by us are found to be either inaccurate or cannot be reconciled."	Irreconcilable figures, poor audit outcomes and a negative outlook for the entire department.
P4	"The trouble we have with verifying data sources and making sure that the data which come to the Records Department are not really data quality issues. I really cannot say much on this subject as we only act as Custodians of the data."	Verification of data's authenticity was not the task of Records Management.
P5	"We cannot plan with confidence if the data is not correct. Also poor quality data affects our plans in the sense that our reports will not be representative of the true picture."	Poor planning, leading to poor execution due to incorrect data.
P6	"It makes our reports inaccurate and this can cause problems at both reporting and KPA levels."	Inaccurate reporting.
P7	"The problems from poor data quality are many. The biggest problem facing this department as a result of this is the issue of not knowing how many citizens we are actually helping with the poverty alleviation programmes. You can imagine a spreadsheet with duplicate IDs, incomplete names and surnames, incomplete phone numbers. How	Inaccurate reported performance figures.

Question	What are the problems associated with poor data quality in the department?	Emergent Themes
	does the data capturer manage to correct such data when capturing onto the system when the project is over? Some of the registers are poorly managed by external consultants."	
P8	"Data is very important to the work we do here. The problems include bad planning based on our forecasting with faulty data, the negative reports we get from the AG. The panic whenever it is audit time can also be avoided if these problems are solved."	Fallout from poor forecasting based on inaccurate data. Negative audit reports.
P9	"To my mind, the problem with the poor quality of data in our department is very serious. With units working in silos, you find that it is impossible to cross reference data that is supposed to be common to the department. As an example, you find registers for job opportunities does not match the appointments, names on the payment schedules from Finance do not correlate to the appointees' names. Such things reflect very badly on us at Audit times and national meetings.	Inconsistencies and contradictions in the dataset.
P10	"The problems are too numerous to mention. My two colleagues have mentioned some of them already. The most worrying one for us is that it makes nonsense of our planning. You know how it makes you insecure when you present data that you are not very sure is the true state of affairs."	Lack of confidence to present data at the national level.
P11	"Data problems here are legendary. Physical data meant to be translated into a digital format are manhandled leading to damage. Of course when the person is making the entry and some part of the data is gone, he or she will make it up instead of reporting the incident and getting blamed. I have seen that happen on more than three occasions here. Also the department cannot fully guarantee that the data we report is true as so many discrepancies are found in them."	Carelessness in data handling led to data inaccuracies, that is, with project registers.

Table 7.11: Familiarity with Metadata Management

Question	Are you familiar with metadata? How is metadata managed for sensitive data in the department?	Emergent Themes
P1,P3, P4, P5,P9, 10, P11	"I have no idea what metadata is"	Six participants were unfamiliar with the term `metadata'.
P2, P6	I have a basic idea of what metadata is. I would think that IT is in charge of it."	Two participants had a basic understanding of what constituted metadata.
P7	"Metadata is data about data. It is valuable to government because it captures information such as identity documents, addresses, marital status and so on which can be used by stakeholders."	One Participant was very familiar with the term and its implication for data governance.

Table 7.12: Protocols in place to address Data Breaches

Question	What protocols are in place to address and mitigate data breaches in the department?	Emergent Themes
P1	"Managers have recourse to HR processes of discipline when there are leaks in the department, but there are no formal rules to address such problems."	No formal processes outlined solely for data governance, but there were HR disciplinary processes.
P2	"There are HR policies in place, also we have the Risk Management document to ensure that the data breaches are minimized if not entirely avoided. Also, the department has the ICU to assist with such problems."	HR policies, Risk Management policies.
P3	"There are no standard procedures in place. However, there are clauses in HR policies that are used for punitive measures wherever breaches occur. The mitigation is usually too late as the information leaked cannot be retrieved. In most instances, the department just works to close such gaps."	No standard data governance procedures, but HR had policies in place.

Question	What protocols are in place to address and mitigate data breaches in the department?	Emergent Themes
P4	"Not that I am aware of."	No awareness.
P5	"The internal control unit acts as an oversight in the event of this kind of thing happening, but I am not familiar with their process."	ICU played a role.
P6	"I really don't know of any."	No awareness.
P7	"There is the Risk Management policy, I imagine there are measures in the policy to cater for how data is managed in such circumstances."	Aware of the Risk Management policy but unsure of the processes inherent within it.
P8	"It depends on the severity of the risk. HR has notified everyone about the procedures of safeguarding data, hence the culprit will be dealt with accordingly. Mitigating data breaches is difficult because it is always a leak or loss of data, which of course cannot be resolved, but can only be managed."	HR
P9	"Mitigation of data breaches has no standardised rules. It depends on how the manager wants to manage the situation, but definitely HR will deal with the person based on outlined policies."	No standardised rules, but HR dealt with such cases according to policy guidelines.
P10	"Internal control and HR are in charge of addressing personnel responsible for serious breaches. There are procedures in place to manage such occurrences. It is very difficult to mitigate data breaches, I think the best plan is usually to strengthen the weak areas."	HR and ICU had procedures to mitigate such occurrences.
P11	"There must be, but I am not quite sure how it works. The major problems we have that can be called data breach are people giving their access rights to colleagues when they are under pressure."	Not aware of the procedure.

Table 7.13: Protection of Sensitive Data from Unauthorised Access

Question	How does the department protect sensitive data from unauthorized access and disclosure?	Emergent Themes
P1	"This depends on the units themselves. My colleagues and I agree that the units mostly work in silos here. Senior managers are the only one with authorised access to sensitive data. The problem you find is that people sometimes authorise their subordinates to gain access to the data, and then the personnel goes into the system whenever they need information, not minding that it should not be so, then eventually that data becomes compromised."	Access rights for sensitive data was given to senior managers only. Unfortunately, some of these managers shared their access rights with others, compromising the principle of protecting these datasets.
P2	"Things work a little differently in my unit. The FMIS is strictly protected by passwords and other security checks. As you can imagine, the kind of information we handle are of a personal nature so nobody but the user must be able to access it."	The Financial Management Information System had very strict security checks in-built.
P3	"My experience is that this is very difficult. Up till now, we still use counter books to record certain processes and information. The administrator is in charge of the books and if they are lost or damaged, then the data is lost as well."	The system was very porous, especially with regards to physical data records.
P4	"If things are done according to the policy, only authorised personnel will have access to sensitive data. Also, the Records and Knowledge Management Unit is in charge of all the physical or hard copies of documents and there is a protocol for releasing sensitive data."	There were protocols in place for releasing sensitive data.
P5	There are no laid down methodologies for doing this."	No known processes.
P6	"This is difficult as we have many people, both internal and external working with our data."	Many personnel were accessing data at different levels. No known processes to mitigate breaches.
P7	"There are many data sources in the department. It is very difficult to do this without an integrated system and uniform data rules."	No, there were too many data sources and no technological integration.

Question	How does the department protect sensitive data from unauthorized access and disclosure?	Emergent Themes
P8	"We deal with personal financial information hence there are stringent rules for access. I think the system we use is already designed to do this effectively."	Stringent access rules and rights. Effective system.
P9	"I believe the managers know how to do this, we only follow the guidelines and they have to make sure that data is protected by them."	Managers were expected to provide the guidelines to protect data.
P10	"Sensitive data usually has limited access by personnel. Protecting this data is done by way of passwords and authentication."	Password authentication and limited access rights.
P11	"The Record Management Unit and archives have a procedure for protecting data and this applies as well. In the case of digital data, I assume it just means that people should keep their computers safe."	Physical secure facilities for storing data assets.

Table 7.14: Ways of managing Data and how a Maturity Model can help to achieve this

Question	Discuss ways in which you think data can be better managed? Do you think a maturity evaluation model can help to achieve this aim?	Emergent Themes
P1	"To my mind, the first step is for us to identify all the data points and agree on a uniform policy for storing and maintaining data. I think it can assist us to know where we are failing."	An identification of all data points and a uniform policy for managing all data related issues.
P2	"I agree with my colleague that we need to structure data management in a uniform way across the board."	Data management and handling had to be structured uniformly, department wide.
P3	"I am of the opinion that we as a department need to have a workshop to first of all understand what data means to us, then we can chart a way forward in making sure there is a uniform way of managing the bulk of data we have. Also, the maturity model will be a great help as some of the components are	Workshop to discuss what data meant and chart a way forward in better harnessing data assets. Some of the components of data governance discussed here were not even existing in the department, such as, metadata.

Question	Discuss ways in which you think data can be better managed? Do you think a maturity evaluation model can help to achieve this aim?	Emergent Themes
	not even considered here. I think only IT will understand what metadata is, and I am not too sure they keep such records."	
P4	"The maturity model will be a great help for us to even identify our data problems and start thinking of ways to solve them."	The proposed maturity model could be used to identify data problems and also assist in finding solutions to them.
P5	"I agree with colleagues, we cannot do the same thing and expect better results. We first of all need to agree that data should be for the common purpose of helping us to plan better and get our deliverables right. Then we must all have the same common purpose and policy to manage the data."	Defined what data was and how it must be managed, also its impact on departmental deliverables.
P6	"I think what should happen is that we extend this focus group activity to other managers in the unit. Some of the things we have discussed are things that we should have been doing, but somehow we did not have the perspective. Also, there is serious laxity when it comes to data quality in the department hence every audit period is a stress. I think this maturity model will really assist us to have a rounded view of what our data should be like, then we can start working towards the plan."	There had to be greater participation of senior managers in data governance discussions. The maturity evaluation model would help to give a rounded view of what constituted good data governance.
P7	"This conversation should be for the whole department. The problem is that we sweep our problems under the carpet and just put out fires at Audit or reporting times. You cannot come here during audit and meet anybody willing to talk to you. This model will only help us if we agree to implement it and create the terms of reference towards doing that."	There needed to be open conversation about data failings and how data governance could assist in solving the problems.
P8	"The model can definitely assist us. We have seen from this thing that several aspects of data are not attended to. I think the way forward is to engage all stakeholders and decide to manage our data better in the future."	The model had shown several aspects of data that no one was attending to. There was need for inclusive engagement of all stakeholders to chart a better course for data management in the future.

Question	Discuss ways in which you think data can be better managed? Do you think a maturity evaluation model can help to achieve this aim?	Emergent Themes
P9	"It is simple. If everyone commits to just following the policies available, data will be ok. I think the way this model can help us is by giving us something to measure our processes against."	Employees needed to follow laid down procedures. The DGMEM would assist as it provided a measurement yardstick for data processes.
P10	"Data issues need serious and strong leadership. People do not like change, there must be someone strong who will make them do it. I personally believe everyone knows the right thing to do, but people are just not doing it since there are policies and guidelines in place to assist with the process of working with data."	Strong leadership was required to achieve data governance.
P11	"The first step is for all the units of a department to agree on a uniform data structure. It is easier for this to happen if there is something like this model to drive uniformity and accountability. The truth is that people do not want to be measured or held accountable. The MIS is good, but also the buy-in of all staff regarding all data assets besides financial can only strengthen the department."	All units needed to have a uniform data governance and management process. People did not want to be held accountable for their failures hence the reluctance to adapt formal processes.

7.8 Summary of Findings

The findings from the qualitative questionnaires and the focus group activities were presented in Section 7.5 and 7.7 respectively. The findings from the focus group activities did not appear to negate results from the qualitative study. However, the nature of the discussions indicated underlying challenges and a severe lack of cohesion in data management within these departments, to the extent that the provincial offices were far ahead of the regional offices in managing departmental data (See Table 7.5). Also, there existed a seeming helplessness with regards to how this culture could be changed. In the same vein, it emerged from the discussions that units in two of the departments operated in silos, and there were no syntheses in the way data was managed amongst them. The term `data roles' created confusion around data stewards and data capturers. While participants stated that they had dedicated data stewards on the questionnaires, the focus group revealed that these were in fact data capturers (compare Section 7.6.2 and Table 7.6). One of the unintended consequences of the focus group discussions was

the finding that most of the senior managers who participated acknowledged the need for changes to data processes and made very useful suggestions on how an enterprise-wide culture of awareness could be driven (See Table 7.13). This was very important as awareness and buy-in were the first steps toward remedial action with regards to instituting a strong data governance programme in organisations (Soares, 2015). The implications of the findings and their influence in further refining the DGMEM are discussed in Chapter 8.

7.9 Summary

Chapter 7 presented findings from the empirical data collection which was done to test the relevance of components of the DGMEM to data processes in government departments of the EC. Themes from the online questionnaire, which was completed by 25 participants, were analysed using Nvivo 11. Findings from the focus group discussions carried out in three departments were also presented, with the emergent themes from the discussions. In line with the sequential exploratory mixed methods design adopted for this study, Chapter 8 presents the implications of these findings as well as how the findings impact on the DGMEM. The synthesis of the two qualitative methods adopted in this chapter thereafter informs the quantitative data collection.

Chapter 1
Introduction

Chapter 2

Methodology

Chapter 3
Relationship between Corporate Governance, IT Governance and Data Governance

Chapter 4

An Analysis of Current Data Governance Practices in the Eastern Cape Government Departments

Chapter 5

A Discussion of Five Maturity Models relevant to this Study

Chapter 6

A Conceptual Data Governance Maturity Evaluation Model

Chapter 7

Presentation of Findings from the Qualitative Data

Chapter 8

Implications of Findings from the Qualitative Data

Chapter 9

Presentation of Findings and Implications of the Quantitative Data

Chapter 10

A Data Governance Maturity Evaluation Model for Government Departments of the Eastern Cape

Chapter 8

Implications of Findings from the Qualitative Data

8.1 Introduction

8.2 Discussion and Implications of Findings from the Qualitative Questionnaire

8.3 Implications of the Results of the Focus Group Activities

8.4 Summary of Changes Made to The Conceptual Model Based on Findings from the Data Analysis

8.5 Summary

8. Chapter 8: Implications of Findings from the Qualitative Data

8.1 Introduction

Chapter 7 presented the findings from the results of the qualitative data analysis. The first stage of data collection presented was the open-ended questionnaire administered to 45 participants across four EC Departments. The second stage was the findings from the focus group activities conducted in three departments. This chapter interprets and finds meaning in the responses from the data, synthesises them with the literature review and the underlying theories of the study. Chapter 8 also highlights the manner in which these findings have served to enhance or confirm the conceptual model in line with the research objectives. It is important to state here that both methods of data collection are serving the purpose of testing the components of the conceptual DGMEM, which was derived from extant literature and fundamentally influenced by the IBM data governance maturity model of 2007 (Section 5.4.3, Chapter 5).

Additionally, Chapter 8 reconciles the findings from the empirical data collection in Chapter 7, links them with the existing body of knowledge and literature review undertaken in Chapters 2, 3 and 4. The implications of findings from the questionnaire and focus group activities are interpreted sequentially for each theme as it is believed this is the more logical way to deduce meanings from the analysed data.

8.2 Discussion and Implications of Findings from the Qualitative Questionnaire

8.2.1 Rules and Rules of Engagement for Data Governance

Participants listed 7 different policies as being in place for the governance of data assets in the departments. From the list of policies generated by the responses, it was reasonable to state that there were adequate policies to guard information, and by extension, data management in government departments (Section 7.6.1, Chapter 7). These policies were expected to guide the way data was handled in the departments. It thus followed logically to probe whether these policies were made available to the relevant stakeholders, that is, the data handlers in these departments and if they actually acted as a guide to the staff when it came to data handling and management. According to the IBM Data Governance Council and the Data Governance Institute (Chapter 3, section 3.7), policies were the starting point of an effective data governance programme. Policies should be the first level on any data governance maturity programme (IBM, 2007). The IBM Unified Process for Data Governance Maturity (Soares,

2010) also had clearly articulated a roadmap for achieving sound data governance which stipulated a definition and unequivocal articulation of what was expected to be part of a data governance programme (Figure 5.1, Chapter 5). Data governance has become a regulatory requirement in most countries (IBM Data Governance Council, 2008). It, therefore, was appropriate for the departments to have policies in place which alluded directly to data governance and were readily available to employees. The data governance framework stated that rules and rules of engagement regarding data governance must include data rules and definitions, including the 'how' of controlling data assets to ensure their safety and accuracy (Thomas 2014). These rules were found in policy documents regarding the departments' assets such as data, human resources, finance and other pivotal assets. In line with the Institutional Theory adopted as an underlying theory for this study, the evolution of data governance processes was underscored by 'how' processes were performed. The policy documents listed by the participants showed that there were indeed policies in place to guide the governing of data assets. However, responses on the level of consistency in the way data was collected and treated revealed a definite lack of consistency in data governance and management. Some of the reasons cited for this were; lack of awareness of data policies; indifference and a limited understanding of how these policies impact data assets and the outcome in the departments' performances. The implication of the findings was that, although there were policies to reference in these departments regarding how data should be managed, the actual processes did not reflect the use or application of these policies. According to Weill and Otto (2011), data governance seeks to promote desirable data processes and, therefore, develops guidelines and standards in line with organisational strategy, plans and culture. The contradiction with the findings was that these policies had been put in place by the national government (DPSA, 2013) to manage data and information, but this study found no empirical evidence to support a culture or process of implementing them (see 7.5.1, chapter 7). Results also suggested that managers were failing to enforce these rules.

As stated in Chapter 3, section 3.3, and in line with the COBIT 5 and ISO/IEC 38500 guidelines, data governance should be a subset of IT governance and, therefore, managers have a fiduciary duty to protect the data assets of the organisation the same way other physical and material assets are protected (ISACA, 2013). Furthermore, Saetang and Haider (2012) and Alles and Piechocki (2012) aver that there should be tools, measurable processes and technological practices to drive the data governance process. All of these activities should be geared towards supporting the goals of the department, whether they be the provision of

effective public services, healthcare, poverty alleviation and/ or job creation. An analysis of the findings revealed that the few participants who stated that there was consistency in the way data rules were governed, presented no evidence to support their position.

Pertaining to the revocation of access rights in cases of breaches in data security, misuse of data authority or percieved irregularities in data handling which might compromise departmental data, only participants in D2 had a structured MIS which had in-built features to prevent and deter data breaches. D1, D3 and D4 all stated that they expected HR and senior managers to manage breaches, but did not mention any data governance tools for managing the process. The implication of this finding was that, with the exception of D2, data breaches and unauthorised access were still regarded as part of a disciplinary process which applied to all other issues in the departments. According to Thomas (2015) and Soares (2015), there needed to be adequately defined parameters with regards to how detterances were enforced in cases of data breaches (Table 3.3, Chapter 3). In the same vein, ISACA (2013) and the IoDSA (2009) stipulated that data breaches, and the fallout thereof, are the responsibility of directors and they have a fudiciary obligation to ensure that that such occurences are avoided, and when they happen, are mitigated timeously. The IBM Maturity model also encouraged compliance management through the audit of information and reporting of incidents. It is averred that an effective data governance programme/model must include compliance features which are unequivocal and implementable, otherwise data breaches may be unnoticed, untreated and this leaves the department at great risk. The implication of the responses, therefore, served to suggest that it was required that the departments have a structured methodology for managing the fallout of data breaches, which was not neccesarily dependent on HR policies, but could be measured in line with well known data governance best practices. This would ensure that data protection was assured and there were detterants before damage was done to critical data assets. The inclusion of this critical component on the DGMEM is expected to assist with this process. With this finding, it is believed that the process document should reflect the seriousness of data breaches under data privacy and security as it has become a serious problem in organisations (Section 6.6, Chapter 6). This is neccesary in line with the Contingency Theory and recommendations by COBIT 5 (Chapter 4, Section 4.2.1 and Figure 4.1). In the same vein, findings indicated that data in the hands of external stakeholders such as consultants, project managers and other stakeholders with access to the department's data assets were predicated on signed SLAs and confidentiality agreements. There were no other precautions or security features to discourage data sharing, data theft and/or data manipulation by these entities, with the exception of D2 whose MIS grants limited access to its data and had in-built strict validation

and authentication parameters. From the literature, (Section 6.5.3, Chapter 6), there was a reported 40% increase in data breaches in 2016 (Kharif, 2017). The cost of these breaches to the affected organisations were estimated to be over 1 billion United States dollars. In the case of government departments of the Eastern Cape, the risks are multifaceted. The departments handle sensitive data on behalf of the citizens, financial data to account for various government programmes and strategic documents which speak to the futuristic plans to deliver on campaign promises as is typical of a democratic government. Secondary literature on the current data governance practices within the EC Departments revealed a lack of strong leadership in the implementation of sound data governance principles (See 4.1.2, Chapter 4). Ochara, Kandiri, and Johnson (2014) and Matavire et al. (2010) posited that a lack of leadership made effective governance of data assets a goal which was difficult to realise. Additionally, results of the needs analysis conducted in Chapter 4, Section 4.4, pointed to the fact there was a definite need for clear accountabilities and definition of roles around data governance. This aspect of data governance was important and required if the processes and practices were to be benchmarked against COBIT 5 which was stated by the departments as the framework for managing IT and data related assets.

This study adapted Design Science for the construction of the artefact (DGMEM). The process of Peffers et al. (2008) was adapted for the iterative steps of model construction. To refresh the reader's mind, the outcome-based iterative process is shown below. The full picture of how the Peffers et al. (2008) process was applied to this study is depicted in Figure 2.4, Chapter 2 of the study.

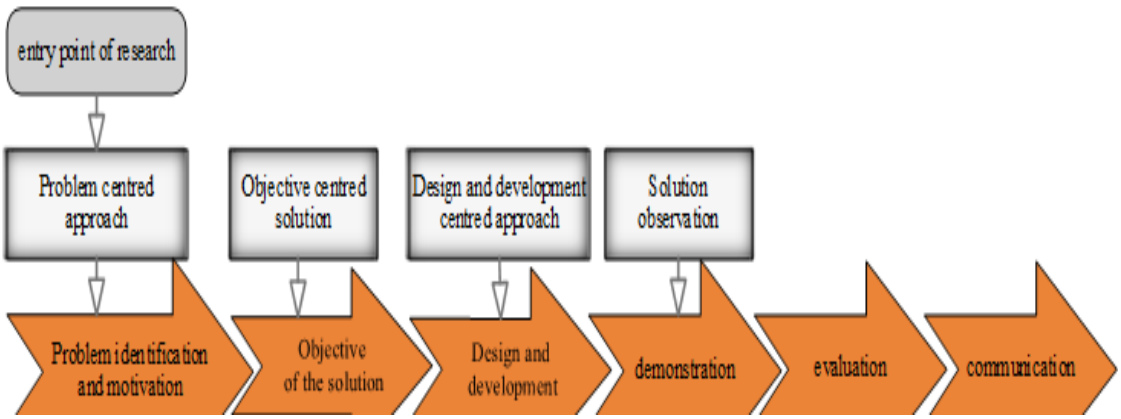

Figure 8.1: Peffers et al. (2008): Process application to this Study

From the diagram above, it is surmised that the Contingency and Institutional Theories are the best fit to actualise a plan with which the concepts and components of the model will be employed to effectively and efficiently evaluate the practices around data governance in the departments. This is towards the aim of proffering a solution to the identified problems. The process document, which was developed as a checklist for the departments to benchmark the different aspects of data maturity was also a way to measure the 'how to' part of moving from one maturity level to a better one. According to Johansson, Eckerstein and Malmros, (2016), one of the best ways to gain a marked improvement in the handling or management of an IT related task such as data governance is to use a maturity model as an evaluative tool of the 'as is' state, and thereafter fill out the gaps between the findings and decide on a path to progression. The implications of the findings on the current data governance practices, including the policies which guided different aspects of the data governance field were expected to impact on the next iteration of the model as well as on the process document. Thomas (2015) and Soares (2015) stated that data governance was not a domain whereby the organisation could safely adapt any model as its own. Rather, the organisation had to give careful consideration to which aspects of data governance were critical to its success or the achievenment of its goals and decide on a path of incremental maturity.

8.2.2 People and Process Capabilities

The next section of the questionnaire discussed the implications of findings on questions probing the people and process capabilities regarding data governance in the departments. This segment of the questionnaire related to sub-questions 2 and 3 in answering the main research question. Sub-question 2 was stated thus, "**What are the components of an effective data governance framework required to support data management in the Eastern Cape Government Departments?"** Findings from the data indicated a number of ways in which data was managed functionally in the departments. The overriding emergent theme from the findings was that record management did the coding, referencing and storage of physical data assets while IT oversaw the process of managing and storing digital data. D2 was the exception in that a national body (NHISSA) oversaw the management of data in the health sector. The implication of this finding was the fact that end-user data had a process of management, albeit vague and unstructured. However, COBIT 5 encouraged an end-to-end management of data assets in such a way that no aspect of data was left ungoverned from inception to deletion (see Figure 4.1, Chapter 4). COBIT 5 (ISACA, 2013), and the Data Governance Council, (IBM

Data Governance Council, 2008) recommended that the success of a data governance program was predicated on the careful consideration of all aspects of organisational data. The implication of this finding was that the functional processes around data governance were grossly inadequate to ensure the validity, accuracy and correctness of the data. An assessment of the input-output process was required in the departments. One of the maturity models discussed in Section 5.3.4, Chapter 5 (GoCoMM) proposed an implementation and automation process which facilitated continuous checking for compliance with the processes listed on a particular maturity level. This level of data governance would ensure that there were functional structures for managing data assets on an end-to-end basis, thereby minimising the risks that could arise from the gaps created by the current functional structures in the departments. Data roles were also not clearly assigned in the departments. Administrators typically captured data as part of their work specifications, while data capturers were employed to work on projects as the need arose. Managers were then expected to verify and authenticate data. As had been the pattern during this analysis, D2 was the only exception to this practice, with data roles assigned to personnel based on the DHMIS policy and the SOP. The findings thus implied there was a gap in the assignment of dedicated data roles for the oversight of the entire data process. This finding also negated the recommendation by Korhonen et al. (2013), and Khatri and Brown, (2010), which stipulated that data roles must be assigned for organisations to effectively maximise the potential of their organisational data (Section 3.5, Chapter 3). As the findings presented on Table 7.6, Chapter 7 revealed, policy managers determined the personnel in charge of monitoring, evaluating and verification of data. This related back to the argument that data assets could not be maximised in the departments unless there was a data governance strucuture which aligned the organisation's roles with the goals and objectives and determined how best to engage with the data towards achieving this aim (Table 3.3, Chapter 3). There seemed to be available technological artefacts in place at the departments to input and store data. However, the available technologies were in support of work processes and not neccesarily for managing data. With the advent of Big Data, tools such as Hadoop, which originated from the Apache tOracle Master Data Management tools (ORACLE, 2017), among others, were being employed in the private sector to maximise data sets in the organisation. This was essential in a knowlegde economy in which data was optimised to meet the goals of the organisation (Matavire, et al., 2010). Although it could be argued that departments did not neccesarily need to do the same level of competitve data mapping as is the case in the private sector, the fact remained that data was a strategic asset that drove digital transformation. The correct mapping of data assets had thus been the hallmark of developed economies as opposed

to the trial and error system of fiscal planning commonly found in the developing world (Ifinedo, 2012).

Only 24% of participants believed there was any kind of correlation between their work processes and the processes in COBIT 5 and ISO/IEC 38500. A quarter of the participants stated that they did not know if there was any correlation, while the rest had a vague understanding of the two frameworks, but could not relate them to any of their current work processes. The implication of the results for data governance was that the current processes for governing and managing data did not correlate with international best practice in the data governance sphere. The implication was that ad-hoc, reactive rather than proactive data management was in place within the province. This ultimately resulted in the situation in which there were no uniform approaches to data issues as each unit treated data management at their own discretion. This did not augur well for government departments as they dealt with a myriad data sources. An unstructured approach only served to aggravate the inaccuacies and inconsistencies commonly seen in data sets across the provincial departments (APP, 2014). According to Lipunstov (2014) and Wendel (2009), it was important that government agencies took into account all their data sources and synthesised them for uniformity, quality checks and veracity. It, therefore, was important that these departments had a data governance approach which for all the data elements that ensured the above. In the same vein, findings regarding the processes in place for the resolution of data issues, specification of data quality requirements and the establishment of accountability revealed diverse processes across the departments. Most of the participants stated that employees were encouraged and required to adhere to management policies. This response implied a loose system of accountability which expected employees to do the right thing when it came to data protocols. This response directly negated what the data revealed in the four departments. Most of the senior managers averred that staff knew what was expected of them, but usually deviated from expectations. Research had also shown that with regards to governance issues, high level policies had to be translated to expected processes and procedures which needed to be clearly articulated in layman's language for all levels of stakeholders (Soares, 2015; Eckerson, 2014). In the same vein, the theoretical basis of the Institutional Theory stipulated that an evolving and improving process articulated the procedures through which change was happening (Meyer and Rowan, 1977). It was virtually impossible for a data governance structure to show a measurable improvement in practice without the stakeholders having a full understanding of what was expected regarding the critical components of the data spectrum (Jacobson, 2009). The findings regarding decision rights indicated an average level of uniformity or structure across D1, D3 and D4. Eighty-five

percent of participants alleged that there were parameters in place which excluded unauthorised persons from gaining access into the system. Additionally, they contended that the PAIA stipulated conditions and action steps for the revocation of access rights to data in the departments. Furthermore, the privacy and sanctity of data assets relied heavily on who had the right of access to view, alter and authorise both digital and physical copies. D2 on the other hand, had entrenched processes, both for physical and digital data assets. Although the DHMIS policy did not directly adapt the processes of COBIT 5 and ISO/IEC 38500, it could be argued that the system had been configured in such a way that it enabled an effective governance model which was in tandem with the recommendations stated in COBIT 5, DS 11: Manage data (Section 6.4.1, Chapter 6). For D1, D3 and D4, it stood to reason that leaving such a critical aspect of data accessibility to trust in the employees ability and willingness to do the right thing based on policy could lead to difficult situations whereby it became virtually impossible to hold a specific individual accountable without recourse to an outlined process of dealing specifically with data breaches. Purpose-built data governance programmes had specific operating models which were designed to integrate tasks around data in a coherent, measurable manner.

8.2.3 Data Quality

According to Statistics South Africa (StatsSA, 2010), data quality is defined in terms of "its fitness for use". The South African Statistical Quality Assurance Framework (SASQF), outlines 8 dimensions of data quality, namely, relevance, integrity, timeliness, accessibility, reliability, completeness, accuracy, coherence and comparability (STATSsa, 2010). These dimensions are in tandem with several data quality attributres found in the literature regarding data governance. Literature describes the attributes of data quality in Chapter 6, Section 6.4.1, as validity, accuracy, completeness, consistency and uniformity (Soares, 2015; Thomas, 2015; Eckerson, 2014). In this section, participants were required to focus on the ways and means by which the departments ensured that data quality was maintained. Seventy-five percent of the participants stated that data quality was assured through proper monitoring, but were unable to expatiate on what data monitoring entailed in their respective departments. This depicted a lack of procedural quality practices in the departments. Some of the participants stated that quality was assured through pre-audit and internal audit checks. This system could also be argued as inadequate as this was done after the fact, that is, after the data had already been collected and organised. Data quality was regarded as a key component of the DGMEM. Section 6.4.1 of

Chapter 6 exhaustively discussed the attributes of data quality as discussed in frequently quoted literature (De, Hu, Meduri, Chen, & Kambhampati, 2016; Smallwood, 2014; Seiner, 2014). The implication of this finding was that data quality remained a pivotal issue in the departments and must remain a primary key component of the DGMEM. Following from this question, participants submitted that inaccuracies and inconsistencies in data assets and reports remained the biggest challenge facing their departments with respect to the management of data assets. The lack of data integration across different units of the same departments and incomplete data from external stakeholders, namely, consultant project managers also formed a notable barrier to the quality of data assets in the departments. The direct implication of this finding was that data restructuring and possible re-classification of what constituted premium data management in the departments was required. Furthermore, as long as this key issue was not addressed, the problem of negative and unqualified audits would continue to persist in the Eastern Cape. It, therefore, was important that the DGMEM Process document made provision for the prioritisation of the key elements of data quality. The maturity model GoCoMM (5.3.5, Chapter 5) recommended continuous evaluation through automation of data governance processes and continuous monitoring and online- or real time data quality monitoring for critical data assets of the departments (Gheorghe, Massacci, Neuhaus & Pretschner, 2009). In as much as this might not be achievable in real time, given the nature and context of some departmental data collection, it was reasonable to contend that some of the principles stated in this model could be applied to the quality of department data, albeit in a more structured yet practical way which would involve training for data stakeholders.

8.2.4 Compliance and Management of data assets

As has been established in literature, measurable compliance is a key element to the success of a data governance programme in any organisation (Sarbanes-Oxley, 2016; Seiner, 2014; Khatri & Brown, 2010). This section sought to gauge the level of employees' understanding of policies and compliance with them in the four departments that were under investigation. The implication of the findings presented under 7.5.4 of Chapter 7, was that a department's compliance with information, and by extension, data assets handling was done according to policy frameworks guiding these assets. However, 27% of the participants concurred that there were no measures in place to gauge actual compliance, only policies which stipulated what represented compliance. Furthermore, there was no empirical evidence to suggest that there was employee compliance with these policies. The exception to this finding was the DHMIS

which specified monthly and quarterly reports detailing data processes, compliance parameters and an in-built quality check feature. The participants also believed that there were adequate protocols in place for sharing data, that is, e-mails, electronic spreadsheets and due authorisation for the release of physical data assets. The implication of this was that there were no integrated systems yet for smartly sharing data within the departments. This was in spite of the fact that many departments had common data demographics which could be smartly shared across departments, such as by linking applicants on the job portals of government to actual placement, identity documents and their payment details. This kind of well-defined and structured link could assist in determining the actual number of job opportunities created and expose ghost workers or/and other fraudulent activities. There were many applications which could be used to enable these processes, such as SharePoint and Google Apps for work. These applications presented a digital footprint that empowered the organisation to trace who was present and sharing data at a particular point, making the process of tracing data breaches easier and employees more accountable. The implication of the finding was that compliance and risk management processes were not yet formalised in these departments, further increasing the risk of data breaches and leakages of sensitive information. This clearly showed that data governance in these departments was still at a low.

8.2.5 Metadata Management

Findings on the theme of metadata management, the responsibility for storage and retrieval of metadata and a common language repository for metadata revealed that 72% of responses had no idea what represented metadata and did not know whether or not there was a repository for a common metadata language. The remaining 28% had a very basic understanding of what represented metadata and believed that IT was in charge of its storage, retrieval and the definition of a common language repository for it. The implication of this finding was that metadata was currently not considered a vital or even essential data governance component in the departments. This finding, while it may not have been considered a crisis for D1, D3 and D4, there had been a considerable increase in health litigations, especially for public healthcare facilities around the country (Malherbe, 2013). With an active metadata management system, some of the claims and counter claims from medical staff and aggrieved patients could be easily verified to establish timelines, resolve conflicts and reach settlement within a matter of days. Also critical in the context of metadata was the inability of department staff to pinpoint exactly who could be accountable for metadata management. As stated by Weber, Otto, and Osterle

(2009), each organisation required a data governance configuration which took a set of critical factors into account. Some of these factors were organisational strategy, efficiencies, service orientation and structure. To this end, it stood to reason to argue that the lack of understanding of metadata might have been a result of the fact that most of these departments had previously had no need, nor seen the importance of collecting the details about their data sets. However, as data breaches got more sophisticated and fraudsters perfected the art of online fraud, one of the ways in which organisations could keep themselves protected was by keeping top-quality metadata repository in cases where matters arose that might lead back to tracing the data source (Berson & Dubov, 2011). The Contingency Theory of data governance is premised on the belief that an organisation's effectiveness and the relationship between its characteristics is determined by its contingencies (Weber, Otto, & Osterle, 2009). It, therefore, was logical to argue that not all of the four departments, and by extension, all the departments of the Eastern Cape Province had a need to include metadata management in their data governance evaluation process. The implication of this assessment was that the inclusion of metadata as a secondary component of the DGMEM was subject to the applicability of relevant processes in the department. To refresh the reader's memory about metadata, the researcher draws on the definition of metadata by TDAN.com (2012). The data governance publication describes metadata as "data about data, which defines the context and content of a data object". Metadata is the link between the business need and the data value. The importance of metadata management (which is defined as the activities which ensure that metadata is created at the first point of data entry, stored in a repository for future use and carefully controlled to eliminate inconsistencies and redundancies) lies in the functional capacity of metadata to impose discipline and control on data collection from the point of entry.

This argument was further strengthened by the finding that the DHMIS was already an encompassing system which detailed the policies and processes of data handling from inception to deletion (DoH, 2011). In direct contrast to this were the other departments where it seemed there was a much less intense culture of accounting for data about data. This finding thus implied that a data governance maturity evaluation model, which would assist in solving the research problem, did not essentially need to incorporate all the elements of metadata management as outlined in extant literature.

8.2.6 Data Security and Privacy Management

Findings about data security and privacy management revealed that policy guidelines were in place to manage data security in all the four departments of inquiry. For D2, the DHMIS outlined the process of data security. D1, D3 and D4 attributed data security processes to strict adherence to the PAIA policy, the Government Communication and Information Systems (GCIS) or the strict control of access level management of data assets. The two major factors which necessitated changes to security settings were a perceived threat to data and the revocation of employees' rights when they left the employment of the department. It also did a periodic check and review of security settings and protocols. The implication was that privacy and security in all four departments were currently being managed somehow, as none of the participants implied or expressed ignorance of at least one security system or check for data. However, the frequency and enforcement of security protocol seemed to be irregular and unstructured. The implication of this finding was that data security and privacy were already considered as pivotal in the departments. The researcher therefore submitted that this component should be retained in the DGMEM, but with modifications to the process document to reflect a more structured approach to the security and management of data assets. Findings relating to the protocols supporting the classification, administration and authentication of sensitive data implied that coding and referencing were the usual means of achieving these. Implications of findings in the context of sensitive data from 16% of participants indicated they had no awareness of how sensitive data was managed in their departments. This finding negated the principle of inclusion with regards to data governance protocols for all employees as recommended by Soares (2015). According to Soares (2015), ensuring the success of a data governance project was predicated on the ability to implement it enterprise-wide. COBIT 5 agreed with this as depicted in Principle 2, Section 4.2, and Chapter 4 which speak to the principle of covering the enterprise from end to end. Closely related to this, findings indicated that the steps to address data breaches were generic and outlined in HR policies, Information Security and Risk Management policies. There was no evidence to suggest that a structured plan or data related policy existed which could serve as a step-by-step guide for what was required in cases of data breaches. To narrow it down, there were four dimensions to managing a data breach in an organisation (Thomas, 2016). These steps are, (1) Preparation for any eventuality; (2) Investigating the actual incident; (3) Notification of affected personnel; (4) Post incident. The implication of the findings were that the protocols for data breaches in the departments did not seem adequate, given the potential of such breaches to make the citizens of the Province vulnerable if, and when, their personal details were exposed. It, therefore, stood

to reason that a data governance programme for the departments needed to capture the essence of remedial action required and be sustainable in the event of such data breaches. Literature in Chapter 3, stated that one of the most important aspects of metadata management was its ability to classify data and its contents (Ordonez, Chen & Garcia-Garcia, 2007). Here again, the usefulness or criticality of an active metadata management programme within the data governance programme becomes apparent. It is instructive to note that 48% of the participants alluded to data breaches being dealt with according to the risk management plan. This implied that employees in the department had an awareness of a risk management plan. However, when asked to expatiate on what processes addressed data breaches in these documents, participants were unable to pinpoint them. It was thus logical to state that the inclusion of this attribute on the DGMEM was required or important to a well-rounded data governance programme in the departments. To reiterate this further, the definition of IT governance as "a set of responsibilities and practices exercised by the board and executive management with the goal of providing strategic direction, ensuring that objectives are achieved, ascertaining that risks are managed appropriately and verifying that the enterprise's resources are used responsibly" (IT Governance Institute, 2005 p.23) further reinforced the role of senior executives in ensuring the safety of all departments assets, including data.

8.2.7 Data Lifecycle Management

Data lifecycle management constitutes an important component of the DGMEM. As shown from numerous data breaches worldwide (See 8.1.1 above), it is imperative that organisations adapt a working system which is able to effectively manage data in such a way that the entire lifecycle is managed and accounted for by data governance. From the findings presented in Section 7.5.7, Chapter 7, coding, indexing and referencing were popularly used to manage data from inception to deletion in the departments. Furthermore, the South African National Government had a five year archive rule before government data assets were discarded or deleted (7.5.7, Chapter 7). It was instructive to note that some categories of data were considered sensitive and did not have the deletion / expiry rule. It was thus surmised that the departments currently had a working stystem for data lifecycle management. However, evidence from the data revealed that this system was inadequate in comparison with the stipulation by literature for maturity models and COBIT 5 recommended processes (Section 6.4.2, 6.4.2.1 Chapter 6 and Table 4.2, Chapter 4). D2 was the only department where participants were able to clearly articulate the entire process of data collection to deletion. The

D2 process involved (1) Data collection; this stage included data collation, data processing, data verification and application of data validation rules; (2) analysis based on certain indicators which were pre-set in the DHMIS policy; thereafter presented in graphs and charts which were used for decision-making and budgeting; (3) deletion or archiving of data was also based on strict parameters outlined in the DHMIS policy. As findings in this study have shown consistently, D2 seemed to be the only department where the handling of data was strongly structured and employees were able to clearly articulate the protocols involved in the governance and management of data. As expressed by the participants themselves, and in agreement with extant literature discussed extensively in 6.4.2, Chapter 6, this lack of strict strucuture for managing data lifecycle led to several challenges in the course of managing data. These challenges included (1) errors in data capturing (2) Inaccuracies in data records, storage and retrieval and (3) serious vulnerability of organisations to data-related challenges such as theft, unauthorised access and security breaches. Additionally, the ability of data to generate value for the organisation was dependent on the resources harnessed (Suer & Nolan, 2012). This had become even more critical with the different data sources that departments contended with in the current information age. This had a very stong implication for data assets as a key element in the functional success of these departments. In spite of this, 28% of participants stated that they had no idea how data was managed from inception to deletion. It also emerged that Records and Archives decided on the sorting, retrieval and deletion of archived data and not the data owners in business. This situation did not augur well for data sets as the business owner was better positioned to determine which data was fit for particular purposes and which data could still be considered useful even after the five year expiration period. Both the Contingency and Institutional Theories state that the context of an organisation dictates how it handles data governance related issues. In this context, it was stipulated that employees should be trained to understand the importance of the different aspects of data lifecycle management. The Comprehensive Scenario Agnostic Data Lifecycle (COSA-DLC) model (discussed in section 6.4.2.1 of Chapter 6) depicted an effective system of achieving this aim, and could be modified to fit peculiar needs of each department. The rationale for data lifecycle management as a primary component of the DGMEM has already been discussed in Section 6.4.2. An analysis of the responses also showed that a meagre 16% of participants believed that all employees understood the importance of data within the departments. This implied that 84% of participants did not believe that colleagues were following procedures, or working with data based on established processes as they did with tangible assets such as physical or financial assets. This confirmed findings in literature stipulating that data governance needed the buy-in

of top management, followed by sustained and continual education or training on what constituted an effective data governance and how the organisation could achieve the aim (ISACA, 2013). It emerged that password protection, limited access and accountability rules were in place for the protection of sensitive data. Finally, participants listed multiple access data entry points in their departments. The implication of the findings was that there was a great reliance on existing policies within the departments for the purpose of managing data lifecycle, but contradicted findings from the data which showed that 84% of employees did not believe that policies and procedures were well understood or adhered to. It is thus opined that the DGMEM Process document stipulated a clear evaluation path for what constituted an effective data lifecycle management. The next section discusses the implication of findings from the focus group discussions.

8.3 Implications of the results of the focus group activities

As presented in Table 7.3 to 7.14, Chapter 7, the researcher conducted focus group discussions in order to shed more light or further confirm how the DGMEM aligned itself to the current data practices in the Eastern Cape Province. This was in line with the exploratory sequential mixed methods for data collection employed, and also to further reinforce the implications of the findings from the qualitative data collection phase. The implication of the findings are discussed in this section with due reference to the Data Governance framework. It is noted here that the purpose of the focus group activities was not to prove or disprove the findings from the qualitative data, but to strengthen the argument for or against the ability of the DGMEM to assist the departments in managing their data assets better as a way of answering the research question.

8.3.1 Understanding of Data Governance and Relevance to Departments' Work Processes

Only 27% of participants understood the difference between data governance and data management. Most of the participants alluded to understanding the importance of properly managing data assets, but could not understand that data governance was an over-arching domain which should set out the principles of data management in the departments (Data Governance Institute, 2015, p.1). Given the high calibre of staff involved in the focus groups (Table 7.2, Chapter 7), this was a problem as the decisions driving data governance were supposed to be made by this set of people. The implication was thus that rather than the

departments being positioned as proactive agents in terms of their data assets, the decision makers were engaged in ad-hoc data management which did not sync with sound data governance principles as found in literature and according to this study's benchmark frameworks' recommendations (ISACA, 2013; Alles & Piechocki, 2012). It was surmised that the DGMEM would enable the management and staff of the departments to gain an understanding of the overarching elements of an effective data governance programme as well as empower them to measure how well they were doing on a continuum of a data governance spectrum.

8.3.2 Rules or Processes governing data collection, input and storage in the department

Question 2 related to the rules governing data governance in the departments. It emerged that the departments had some known processes, but they were not regarded as rules per se. Some had MIS to direct the processes around data collection, input and storage; and expressed the confidence in these MIS to ensure the sanctity of the data. However, it emerged that a considerable number of employees still managed the data in their charge manually. The maintenance of counter books to record critical recruitment processes implied that data around these processes could easily be compromised or stolen. Furthermore, because these processes were not regarded as rules per se, participants expressed the opinion that reports from the regions did not show the evidence that regional staff followed these processes as evidenced in the poor quality of the datasets submitted by them.

8.3.3 Control of Departmental data in the hands of external stakeholders

On the question of how much control a department had over data assets in the hands of external stakeholders, the emergent theme was that there was no methodology to ensure compliance with SLAs from the department to the consultants. Archives and Records Management had some control measures which included page numbering and indexing in place to deter data removal. The unit was also currently in the process of digitalising its entire registry, with built-in security features to prevent photocopying, screen grabs and other means of duplicating documents. It was believed that these inadequacies revealed a weak link in the security protocols of these departments. Regional managers had been known to leave sensitive data in the hands of external stakeholders for long periods of time, with no regard for their safety and confidentiality. This finding implied that the Privacy and Security component of the DGMEM

was an essential attribute for data to be managed effectively. Furthering this agenda, the DGMEM process document for the incremental stages of data governance maturity needed to include a roadmap which depicted a structured way to deal with external stakeholders and their access to departmental data.

8.3.4 Assignment and adequacy of data roles in the department

It emerged that data roles were not defined or synchronised according to COBIT or other known data governance frameworks. As was revealed in the qualitative questionnaire, each unit had its own system of handling the collection and input of data, thereby creating diverse data collection systems and avoidable inconsistencies across units in the same departments. The data roles identified by P3 alluded to data capturers who were employed for the purpose of projects and not as data stewards or for data governance roles such as data officers. The implication of this finding was that there were no personnel in place dedicated to the cause of proper and structured data governance in the departments. This was in direct conflict with recommendations by data governance frameworks such as the IBM data governance framework (IBM, 2007) and COBIT 5 (ISACA, 2013). These frameworks stated that the conveyance of a data governance council and assignment of data roles were crucial for the implementation of a functional and effective data governance programme as there needed to be someone driving the programme and ensuring there was sustained support for the processes (De Haes & Van Grenbergen, 2015).

8.3.5 Adequacy of Technology Tools to Protect Data

Regarding the availability of special or dedicated technological artefacts to support the management of departmental data, only two out of the 11 participants stated the use of the DHMIS for effectively managing data assets. Two participants also alluded to the use of Financial Information Systems for managing data. Other participants mentioned the use of Excel spreadsheets and computer artefacts, but these were not specialised data management applications and they did not possess the ability to assess or process datasets for the departments. The implication of this finding was that most of these departments still made use of basic computer applications to manage their data and therefore had no recourse to specialised tools for data management purposes.

8.3.6 Familiarity with COBIT/ ISO/IEC frameworks

Three participants were familiar with COBIT processes. One of them had completed the COBIT foundation training programme. All other participants across the three departments had a vague recollection of having heard the term before, but could not relate the frameworks to their data governance processes. These finding confirmed what the qualitative inquiry had suggested in 7.5.2, Chapter 7; that these frameworks were adapted by DPSA in principle, but were yet to be implemented in the departments. Participants also stated that there had been no known implementation of the processes in their respective units. It, therefore, stood to reason to aver that the processes for managing data were not following the principles laid out in COBIT/ ISO/IEC 38500.

8.3.7 Adequacy of Technology Tools to Protect Data

It emerged that there were no specific tools to measure data quality in the departments. The Internal Control Unit in D1 conducted periodic spot checks on internal data and kept a tight control of how data was presented and used in the most prudent and effective way. The disadvantage of Internal Control's effort to work on the data was a limitation as the data entries were made by people and the spot checks might miss a vital aspect of data governance. The exception to this finding was the D2, which averred that the department's MIS had in-built data quality and data verification functions. Aside from this, participants stated that there were no tools which immediately measured or determined an incremental improvement with data quality. The entry of data from multiple sources also constituted a major source of inconsistencies and redundancies in the data.

8.3.8 Problems associated with poor quality data sets in the departments

Findings in this area have already been presented in Table 7.10, Chapter 7. All of these negative outcomes led to a lack of confidence in strategic plans drawn from these data sets and other complications such as irreconcilable figures, poor fiscal and physical planning and inaccurate reporting across the many units of the same departments. The implication of this was the inability of managers to understand and make use of useful data for budgeting and strategic planning purposes. This also affected the KPI's of departmental managers.

8.3.9 Familiarity with Metadata Management

Sixty-four percent of participants stated that they had no idea what the term "metadata" meant. Two participants had a basic understanding of what constituted metadata, whereas one understood what metadata stood for and its critical role and implications for data governance. This was also a confirmation of findings in the first strand of data collection which suggested that participants did not fully understand the concept of, and the principles of metadata management. As depicted on Table 1.1, Chapter 1 of this study, metadata management was a vital aspect of data governance as it enabled the smart use of data assets and helped to categorise and classify related data objects. It was thus surmised that this component needed to be retained on the model as this would assist in improving data governance processes in the department. Metadata provided the ability to sort through and locate particular instances of data easily. Typically, it comprised details of the time and date of data creation, the creator of the data and the computer network location where it was created. Information such as these were vital for data stakeholders especially when the integrity of the data came under question or there were disputes to resolve regarding data sets.

8.3.10 Protocols in place to address and mitigate data breaches in the departments

HR policies and Risk Management protocols were principally used to manage data breaches in the departments. None of the participants alluded to any data governance structure for the management of data breaches. Again, this finding indicated the absence of a structured data governance programme which had remedial activities in place, designed specifically for the purpose of managing data challenges. This did not augur well for the departments as data breaches required specialised management, as discussed in section 8.1.1 of this chapter.

8.3.11 Protection of sensitive data from unauthorized access and disclosure

Findings indicated that protection of sensitive data was generally dependent on access rights settings and management. In the case of D2, the DHMIS had an effective authentication level with stringent access rules. In the same vein, the Financial Management Systems also had the same principles protecting sensitive data. However, from the findings, the provision for these security measures mostly covered the aspect of digitalised data assets and not the physical assets of the organisation. The personnel in Archives and Records Management opined that there were set rules in place to manage the data assets. However, these rules did not cover files and documents which had already been signed out legitimately. According to P7, the

departments consisted of multiple data points and with no integrated method of managing data, the possibility of sensitive data being accessed by the wrong personnel was extraordinarily high. This was a confirmatory finding for the inclusion of the data privacy and management on the DGMEM.

8.3.12 Discuss ways in which you think data can be better managed? Do you think a maturity model can help to achieve this aim?

This particular question was a lead-on from all the preceding questions. The aim of this question was to assist the researcher in answering the primary research question. It was surmised that in practical terms, and based on the findings thus far, data governance had not been strongly implemented in the three departments tested, hence it was critical to ask the question in a relaxed forum such as the focus group. There was consensus among all participants that the current data management method was inadequate to tackle the myriad problems arising from data inefficiencies and related complications. Among the recommendations was a uniform policy for addressing all data related issues; a workshop with mainstream and strategic data stakeholders in the departments to agree on the value of data to the departments and a charter to drive a way forward regarding governing data assets. Participants strongly recommended the use of the DGMEM as a benchmark document to assess all points of data attrition, and to put in place a plan to remedy or mitigate the situation.

8.4 Summary of Changes Made to The Conceptual Model Based on Findings From the Data Analysis

Following from the analysis of the qualitatitive phase of data collection presented in this chapter, it became apparent that a number of changes were required in order to make the model more relevant to the context of the Eastern Cape government departments. Bearing in mind that participants did not have a view of the model when the questions were posed, the researcher inferred, based on the responses that these changes would make the model more relatable to current data governance needs and also make for easier interpretation of the components of the model. The changes are outlined on Table 8.1 below and the adjusted model presented in Figure 8.2 below it.

Table 8.1: Changes made to the Conceptual DGMEM based on data analysis

Conceptual model	Changes made	Rationale
Shows no link between the maturity stages and the attributes associated with them.	Arrows indicating the attributes of each maturity model and linking them are provided on the adjusted model.	Findings reveal that most participants in the department are not versed in data governance maturity processes, hence it is important to make the model as easy to interpret as possible.
The fourth point on the attributes of the Optimised stage of data governance lists **Innovation** as an attribute of Optimised data governance without elaborating on what this attribute means and how this can be done.	Innovation- data transformed to knowledge, creates wisdom.	COBIT 5 outlines the Information Cycle whereby business processes (supported by IT Processes) produce data which needs to be processed and transformed into information, which is analysed into knowledge, which is then applied to create wisdom (ISACA, 2013). The results of data analysis clearly shows that most of the managers consider data as key to the positive achievement of their KPIs hence the need to highlight the fact that innovation must be geared towards turning data into a knowledge base which produces information that creates the wisdom for the departments to achieve their strategic objectives.
Under enabling departmental structures, stewardship is listed before policies.	The model lists Policies first, followed by Stewardship and then Processes.	The consistent thread through the results show that there are policies in place for data governance but inadequate stewardship to implement an effective data governance plan. The logical progression therefore is that there are policies in place, which data stewards are expected to employ in the implementation of data processes.

The changes are shown diagrammatically on Figure 8.2 below.

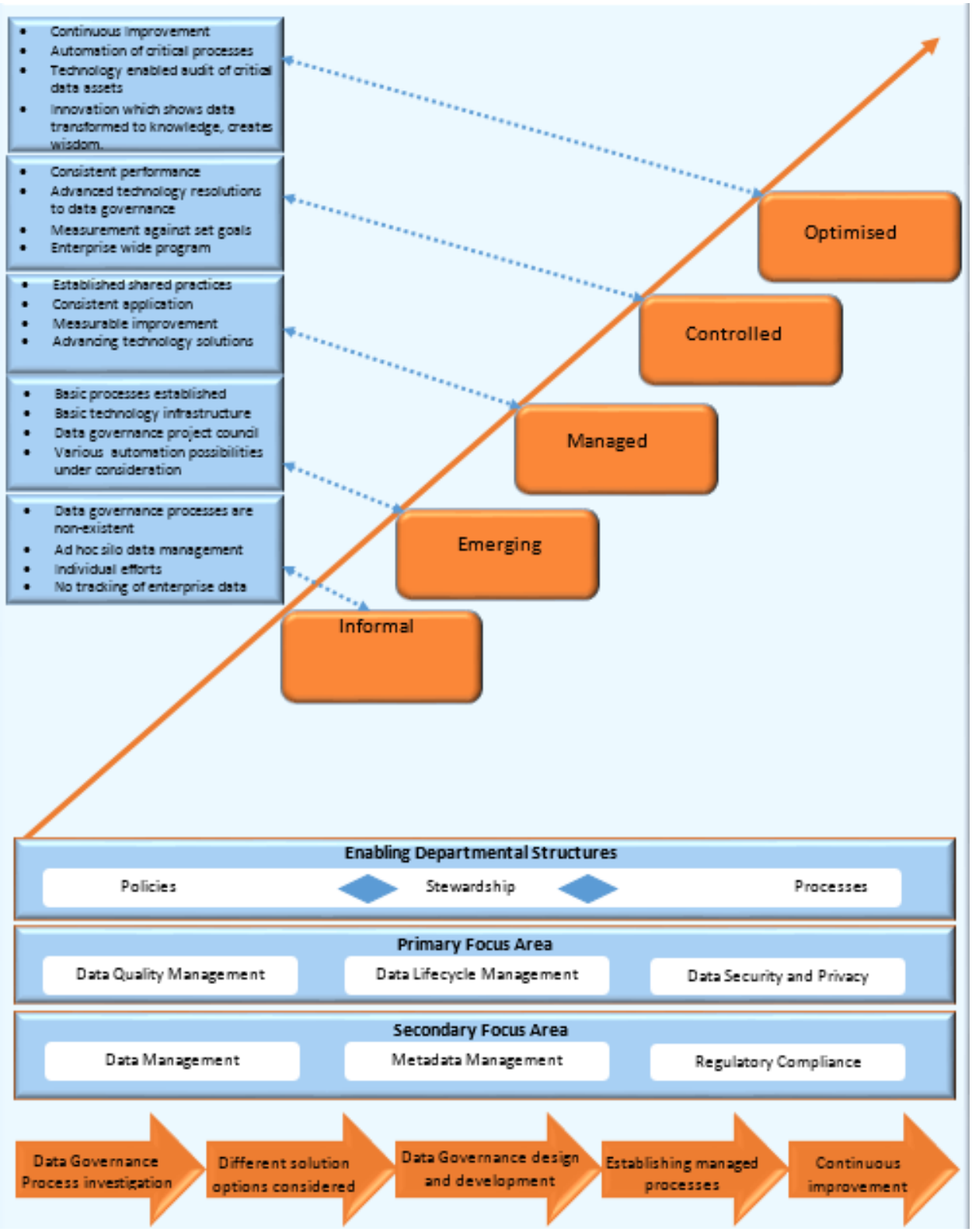

Figure 8.2: Changes made to the Conceptual DGMEM based on data analysis

8.5 Summary

Chapter 8 discussed the implications of the findings to the empirical data presented in Chapter 7. This chapter sought to create a synthesis between data governance frameworks, literature regarding the use of maturity models to measure data assets and the theories adapted for the study. Changes were also made to the model based on the findings from the data. Chapter 9 will present the findings from the quantitative data collection, which is analysed through the software tool: SPSS. The aim of the exercise is to be able to triangulate the different data sources with a view to making requisite adjustments to the DGMEM and its process document according to Design Science iterative processes and in line with the Contingency and Institutional theories adopted for the study.

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Chapter 10

A Data Governance Maturity Evaluation Model for Government Departments of the Eastern Cape

Chapter 9

Presentation of Findings and Implications of the Quantitative Data

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9. Chapter 9: Presentation of Findings and Implications of the Quantitative Data

9.1 Introduction

As stated in Section 7.1, Chapter 7 where the findings of the first phase of data collection were presented, the exploratory sequential data collection and analysis method adopted for this study implied that the findings of the first phase (testing the conceptual model against data processes in the EC Departments) informed how the questions for the second phase (testing the actual application of the model in 'real life' setting) should be structured. The implications were discussed in chapter 8, and the results of the qualitative data collection phase were a determinant of the direction the quantitative questionnaire should take. In order to get participants to answer questions with an informed mind at that stage of the study, the conceptual model was then presented to stakeholders in the chosen context of study, and they were required to test the components in different areas by way of close-ended questions. The rationale behind this method of analysis was to further test the reliability, predictability and possible replication of the study, with the possible assurance of obtaining similar results.

9.2 Quantitative Questionnaire

The over-arching aim of this chapter is to answer the question, "How will data governance components within the maturity evaluation model assist the departments in ensuring better governance of their data assets?" According to Leedy and Ormrod (2016), quantitative research answers questions regarding relationships among quantified variables through statistical analysis for the purpose of explaining, predicting and controlling phenomena. In the same vein, Creswell and Plano Clark (2011) argued that the best approach to a new research area is to explore the situational reality of the topic under investigation, first through a qualitative data collection and analysis process, thereafter using a quantitative approach to further confirm or reinforce the validity of the findings. The rationale for this method lies in the fact that the rich data collected will shed light on all angles of the research problem with a view to finding the best solution within the context of the study. This is in line with the Pragmatic philosophy guiding the study, and aligns with the Contingency and Institutional Theories already discussed in Chapter 2. Data governance is not entirely a new area of research, but the investigation of processes which will enable the successful implementation of an effective data governance programme with the aid of a maturity evaluation model is a novel research area in the domain of government departments. It is, therefore, justifiable that this method of inquiry be employed for this research.

9.2.1 The Impact of Qualitative Findings on the Quantitative Questionnaire

According to Creswell and Plano Clark (2011), the researcher has to make the decision about which aspects of the qualitative findings are critical to the design of the quantitative instrument in order to generate the 'true picture' of the context and successfully generate data relevant to the phenomenon at hand. The findings from the qualitative data painted a definitive picture of the need for components of the DGMEM, hence the questions on the quantitative questionnaire were for the purpose of testing components in each of the focus areas with the aim of adjusting the model accordingly, if the need arose. According to Sanderson and Fisher (1994), and more recently, Creswell and Plano Clark (2011), there are a number of factors to consider as criteria for the development of the quantitative questionnaire. These are outlined below:

1. A clearly articulated description of what needs to be measured, why and the underlying theory which supports the measurement parameter. This was done in this study by identification of the applicability of the various components of the DGMEM in the departments as the dependent variable to be measured. The theories backing up this route of enquiry were the Contingency and Institutional Theories. An in-depth review of the literature justifying the choice of these theories was carried out in Chapter 2 of this study.
2. Ensure the questions are simple, unambiguous and relatable to the target audience, that is, the participants. This criterion was adhered to, as much as practicable, in the formulation of the questions. However, it is important to keep in mind the fact that certain data governance terms cannot be oversimplified hence the careful selection of participants for this phase of the study.
3. Determine the scale of measurement and design of the survey instrument. Clearly articulate the scale of measurement with due consideration for the appropriateness and conciseness of the problem. The five point Likert scale was employed for the purpose of this questionnaire. The Likert scale measure is discussed in section 9.2.2.1. The 5 point Likert scale was considered the most effective means of measurement in this instance as it captures the essence of what the DGMEM should or should not do with regards to data governance and management in the departments.
4. Review of questionnaire instrument. This was done by the researcher through booking an appointment with the university's statistician who reviewed all the questions in line with the research objectives towards the goal of confirming that

the questions were structured in a manner which ensured that they measured aspects of the DGMEM in line with the researcher's intention and end goal.

5. Test the instrument with a chosen sample. The research instrument was administered to a group of nine participants as a pilot. There were no further adjustments to the questionnaire from this exercise.
6. The final criteria is an evaluation of the instrument. This was done through the SPSS analysis which conducted tests for validity, reliability and item variances. Results of the analysis will be presented in Sections 9.5 to 9.8. The next section discusses scaling and the Likert scale used as measurement for the quantitative questions.

9.2.2 Scaling

A scale is a tool or mechanism by which participants' responses are differentiated with regards to the variables of interest on a particular study. Scaling refers to the ability of the researcher to assign numbers to a dataset with the intention of deriving a relationship between the object and the characteristics involved (Blumberg, Cooper, & Schindler, 2008). Furthermore, scaling involves the assignment of numbers or other symbols to a class of objects for the purpose of attributing certain characteristics to the object in a particular context. Scaling allows the investigator to measure, to a certain degree of precision, the variation in the properties being measured. There are four typical kinds of scale; nominal, ordinal, interval and ratio. The style of scaling employed for the quantitative aspect of this study is identified as ordinal (Miller & Salkind, 2002). The Likert scale is discussed in the next segment of the chapter.

9.2.2.1 Likert Scale

There are many methods of scaling which are identified in literature (Babbie, 2012; Creswell & Plano Clark, 2011; Blumberg, Cooper, & Schindler, 2008;). Some of these are outlined below:

1. Thurston scale - This is a measurement technique which aims to develop a weighing format which generates a group of indicators regarding a variable.
2. Semantic Differential - is a questionnaire format which requires a Participant to rate a phenomenon in terms of two opposing adjectives. Participants are usually required to make use of qualifiers such as 'extremely' and 'seldomly' to explain the phenomenon being investigated.
3. Dichotomous scale - This scale seeks to elicit only a yes or no answer regarding the phenomenon under investigation.

4. Guttmann scale - This method is a composite measure used to summarise several discreet observations, with a view to obtain a more general view of the phenomenon.
5. Bogardus Social Distance scale - This scale measures the innate willingness of people to participate in social interactions, to varying extents of proximity, with other kinds of people.
6. *Likert scale - This is a composite measure which is considered effective in the measurement of relative intensity of items on a phenomenon. Ratings on a Likert scale typically range from strongly agree to strongly disagree on a continuum. The Likert scale is an extremely popular measurement scale due to its ease of analysis and it is fit for contemporary questionnaire design. The Likert scale was thus the choice of measurement for this research as it is considered the best method for measuring the opinions and beliefs of the participants with regard to the applicability, relevance and usefulness of the DGMEM.*

The next section discusses the questionnaire development process(Appendix E).

9.3 Questionnaire Development Process

The emergent themes which were a great influence on the relevant questions for this phase of the study are categorised under three broad headings. Details of these have been exhaustively discussed in Chapter 8 of the study. The themes were, (1) all participants agreed, in varying degrees of urgency, that there was need to re-appraise and re-evaluate the current data governance practices in their departments; (2) Both the primary and secondary focus areas of the DGMEM were relevant and a process of implementing the maturity steps would be beneficial to data handling in the departments. With these findings in mind, the researcher embarked on a process of designing and distributing the questionnaire to relevant stakeholders in the same departments where the qualitative data had been collected, with an additional 15 participants from three other departments that were not an initial part of the qualitative questionnaire. The entire process, sample size and rationale for phase 2 of the study will be discussed in the next section of this chapter.

As stated in the introduction, the questions for Phase 2 of the study were informed by the findings from Phase 1. In that vein, the questionnaire was designed to test the efficacy and usability of the artefact, the DGMEM. The aim of this aspect of the study was to further reinforce or debunk some of the findings from Phase 1; affirm the ability of the model to solve

the research problem in a real world context and make final adjustments to the model in line with relevance to work processes in the departments where the questionnaires were administered. In this phase, participants were availed both the DGMEM and the context and then the purpose and process of the components were explained to them. Those participants who were part of the initial data collection also saw the model for the first time as it had not been distributed at that stage for fear of it becoming an undue influence in the pattern of answering questions on what constituted data governance components in their respective departments. The rationale for sharing the model with participants at this stage was to enable them to answer the questions in an informed manner, that is, by relating the components and processes directly to their own data processes. This was in line with the Contingency Theory and the Pragmatist philosophy which underscore this study. A critical aspect of answering this research question was that the solution had to be applicable in solving 'wicked problems' in the data governance domain of EC Departments (Pries-Heje & Baskerville, 2008). As was revealed in the literature, and confirmed by findings from the empirical data, there were many governance problems or challenges stemming from the lack of governance of data in the province. It was, therefore, important to ensure that the solution was one that had practical workability when it was implemented. The questions (see appendix E) were divided into five main sections which are listed hereunder:

1. Applicability of the DGMEM;
2. People, Policies and Capabilities;
3. Alignment with COBIT 5/ ISO/IEC 38500;
4. Expected results from the implementation of the DGMEM; and
5. Missing components of the DGMEM.

The questionnaire comprised a total of 41 questions which were grouped under the categories stated above. A 5-point Likert scale method was used to answer the questions. The weighting of the answers were the same and every question was deemed essential to the matter at hand in its segment. The questions were hosted on Google Form and participants were required to complete and submit them electronically. This method of data collection was desirable as it guaranteed minimum interference from the researcher and also ensured independence of the Participant in an environment where there were many people filling out the same form. The questionnaire was distributed online to 66 participants. A total of 50 responses were recorded, representing a 75.7% response rate. The participants were chosen from these six departments due to their designation's relevance to data related matters. It was impossible to confine the

survey to the initial four department as some of the participants from the qualitative study declined participation in the second phase, coupled with the researcher's intention to test the model in a new context to see if the results would be similar. It is noteworthy to mention that participants in the additional three departments did not struggle to understand or familairise themselves with the model and the principles of how it could help their data governance processes.

9.4 Questionnaire Implementation

In line with standard practice and according to Leedy and Ormrod (2016), there must be an unambiguous, simply constructed set of instructions to participants which accompany every questionnaire. This is necessary as it provides an assurance of the desired outcome of the survey to the Participant and gives an unequivocal indication of what is required of him or her (Miller & Salkind, 2002). For this phase of the study, the researcher had to book individual appointments with most of the participants to present the DGMEM to them and explain the rationale behind Phase 2 of the study. With those participants who were part of the Phase 1 of the study, this was not a rigorous exercise as they already had a grasp of the context and objective of the study. The participants from the additional three departments were talked through the components of the DGMEM, and this proved to be a useful venture as the majority of them seemed to understand the research context and could easily relate the data governance components to their own data requirements and processes. Two potential participants declined participating in the study after the process was explained to them. One of them opined that thinking through the answers in her work context would be a time consuming exercise while the second stated that his department had never been known to adapt new strategies / models hence he saw no reason to participate in any such exercise. As the informed consent, which formed Section 1 of the online Google Forms correctly stated, there was no obligation on the part of participants to follow through on prior telephonic agreements to be part of the study. A great deal of time was therefore spent in ensuring that willing participants had the requisite knowledge of the model and on obtaining their consent before the questionnaire link was finally sent to them for completion. Furthermore, participants were assured of the confidentiality of their participation. The ethical clearance certificate was requested by a number of participants in the new participating departments and this was made available to them.

9.4.1 Segmentation of the Questionnaire

The quantitative questionnaire was divided into five sections. Although the questions all had equal weighting, the number of questions per segment varied according to what the researcher deemed important and required more attention in gauging the overall relevance of the DGMEM to government departments and their data processes. These segments are now discussed below.

9.4.1.1 Applicability of the DGMEM

Eleven of 41 questions covered the DGMEM's applicability. All of the questions in this segment were meant to probe the model's applicability to the data processes of their departments. This was critical in re-aligning the components to have more relevance, if there were areas of the primary or secondary focus that could be readjusted based on the responses. The questions were primarily influenced by findings from the qualitative data which suggested that there were critical data problems around the key areas where data should have been well managed in the departments (see 7.8 and Chapter 8). The responses were thus a catalyst for the questions asked in this regard. Again, this was aligned with the methodology adopted for this study, pragmatism - 'what works', and the Contingency Theory that underpinned the study. The next segment of the questionnaire is discussed below.

9.4.1.2 People, Policies and Process Capabilities

There were five questions in this segment of the questionnaire. The aim of the segment was to confirm or disprove what the literature and empirical evidence suggested, that the capabilities in the three key areas listed above were not adequate to manage or sustain a data governance programme in the department. The questions were thus asked in light of the current evidence, keeping in mind that the participants then had access to the model and were able to directly relate the model to their daily work processes.

9.4.1.3 Alignment of COBIT 5/ ISO/IEC 38500 to Data Processes on the DGMEM

Findings from the qualitative data indicated that there was a dearth of understanding of the international frameworks which were benchmark frameworks for this study. The significance of the finding was that the DPSA had stipulated that these frameworks, specifically COBIT, be used. It was important to probe this aspect, the Process document, which delineated or specified which process was required or recommended for a department to move from one maturity level to a higher one. It is imperative to note that the COBIT component was not on the DGMEM, in other words, COBIT was not one of the processes on the model. This was due to the fact that

the COBIT framework encapsulated the "how" of managing different aspects of a data governance programme, hence it spoke holistically to all the process areas of the DGMEM. The rationale behind the inclusion of this particular segment in the quantitative questionnaire was the fact that findings from the qualitative data were conflicting regarding how the awareness of, and training on COBIT processes had impacted the way data was being handled in these departments.

9.4.1.4 Expected Results from the Implementation of the DGMEM

The next section of the quantitative questionnaire was on the expected end result of implementation of the model within the departments. This section asked specific questions around the expectations of participants if the model were to be implemented in their departments. This aspect was also deemed critical, in view of the objective of the study, which was to provide a usable, useful and relevant artefact which could lead to the solution, or at least the mitigation of data-induced complications in the departments. Additionally, there was an expected outcome which spoke directly to the ability of managers to take full charge of the data assets of the organisation. It was important to probe whether this aspect of data governance was likely to be addressed by the implementation of the DGMEM as it was then or if there was a need to re-evaluate the model to include decision rights as an element of the data governance process.

9.4.1.5 Missing components of the DGMEM

This segment sought to probe whether there were aspects of data governance in these departments which the model had not addressed. Although utmost care had been taken in this research to adhere to sound research methodology, the principles of the PRISMA Statement and the Institutional and Contingency Theories, it was entirely possible that certain data elements were missing on the DGMEM which were part of the departments' data processes. The segment therefore sought to shed some light on the possibility of this through the questions. This was to ensure that new information could be dealt with and used to further refine the model.

9.5 Data Handling Process

Fifty participants completed the questionnaire and this sample was considered very adequate due to the nature of the study; data governance was the forte of a selected few in the departments. At the completion of data collection, the data was exported to an Excel spreadsheet for a preliminary assessment. In line with the nature of a quantitative questionnaire,

the responses were weighted on a 5 point scale continuum, hence there was no need for transcription or anything that could compromise the integrity of the dataset. Thereafter, the data was exported to the SPSS package for in-depth analysis. The results are presented in the next section of the chapter.

9.6 Presentation of Quantitative Data Analysis

9.6.1 Introduction

This report explains and presents the overall findings of this research. SPSS version 24 was used for analysis and all tests were carried out at 5% level of significance. The researcher used descriptive statistics such as graphical tables, pie charts and bar charts to aid the analysis of data and make the results clearer. The results of the study, in relation to the research objectives, are also presented. A one-sample T-test was used to test for equality of means for the theoretical constructs. The justification for the one sample t test has already been presented in Section 2.7, Chapter 2 of this study.

9.6.2 Internal Consistency

Table 9.1: Reliability Analysis

Variable/s	Valid N	Items Used	Cronbach's α
Applicability of DGMEM	50	11	0.593**
Capabilities	50	5	0.607**
Alignment of COBIT	50	13	0.677**
Expected Results	50	8	0.627**
Missing Components	50	5	0.632**

**Significantly acceptable reliability, Notes: Applicability of DGMEM = Applicability of the Data Governance Maturity Evaluation Model (DGMEM); Capabilities = People, Policies and Process Capabilities; Alignment of COBIT = Alignment of COBIT 5/ISO/IEC 38500 to Data Process on the DGMEM; Expected Results = Expected results from the implementation of the DGMEM; Missing Components = Missing Components of the DGMEM

Table 9.1 above shows the reliability of each scale as it relates to the variables measured. The Cronbach's alpha for the scales ranged from 0.593 to 0.677 which showed high reliability coefficients for the study variables.

9.6.3 Demographic profile of the participants

A descriptive approach was used to describe the demographic variables of the study (see Table 9.2 below).

Table 9.2: Descriptive Statistics for Biographical Variables

Variable	Levels	df	f	Valid %
Gender	Male	1	24	48.0
	Female		26	52.0
Age	< 25 years	2	6	12.0
	25 – 44 years		29	58.0
	45 – 59 years		15	30.0
Tenure	< 1 year	3	4	8.0
	More than 10 years		11	22.0
	More than 2 years		8	16.0
	More than 5 years		27	54.0

N=50

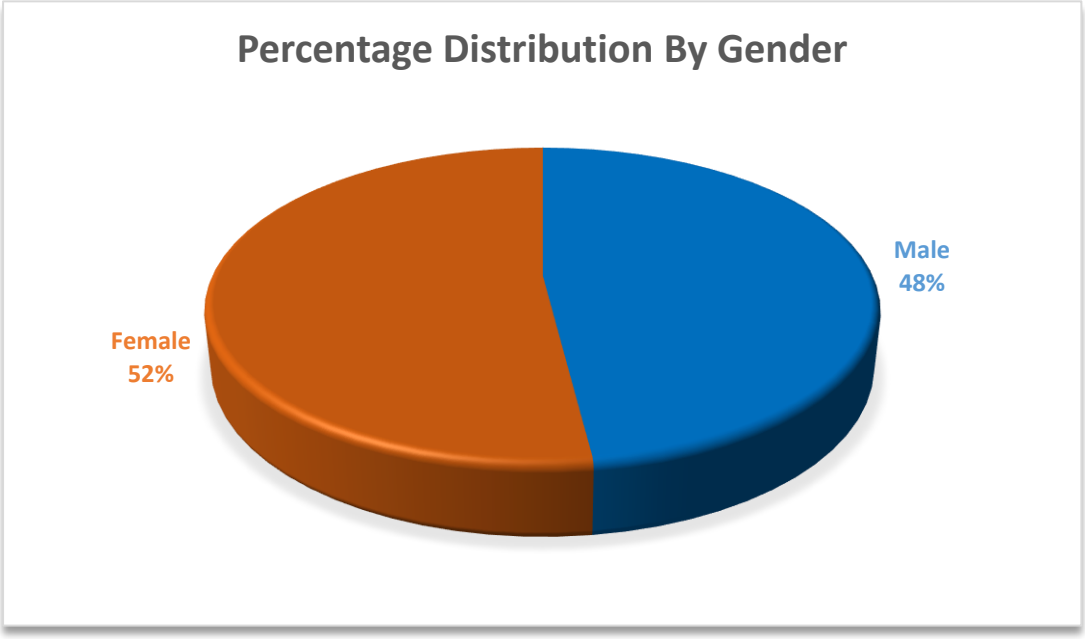

Figure 9.1: Gender Distributions of Participants

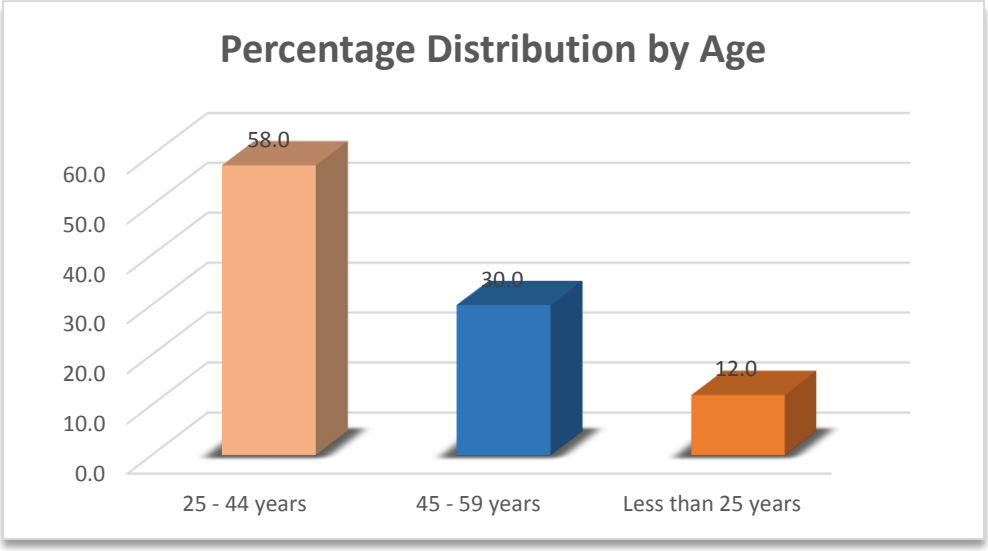

Figure 9.2: Age Distributions of Participants

Figure 9.2 above shows that the majority of the participants (58.0%, n = 29) were in the age group 25-44 years, while 30.0% (n=15) were in the age group 45-59 years. Only six participants (12.0%) fell in the age category less than 25 years.

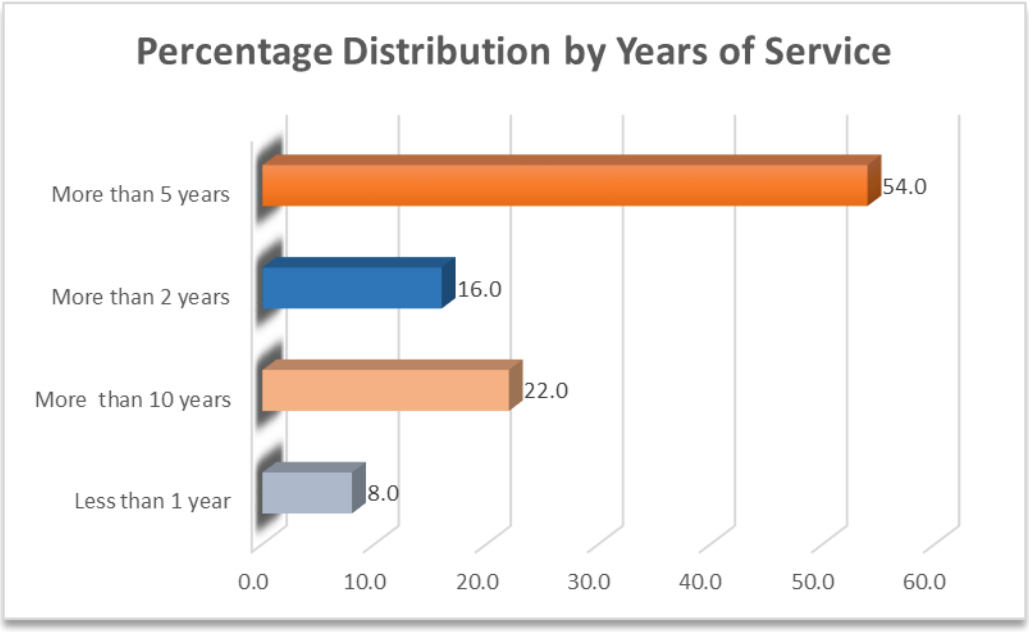

Figure 9.3: Percentage Distributions of Participants by Tenure

From the results in Figure 9.3, the inference could be drawn that the majority of participants (74%) had been in the departments for over five year hence they would be very conversant with the data processes within their units. This was a positive for the study in the sense that results obtained from the questionnaire could be assumed to be based on credible information and experience garnered by participants over the years.

9.7 Perceptions of Participants on Various Data Management and Governance Processes

A one-sample T-test was done to infer Participants' views and perceptions on various data handling/management and governance processes using self-constructed constructs which they had responded to in the questionnaire and in each case the means were compared to a stipulated mean level. The given p-values are for these comparisons.

9.7.1 Applicability of the Data Governance Maturity Evaluation Model (DGMEM)

The table below shows the summary of the findings on the applicability of the Data Governance Maturity Evaluation Model (DGMEM) within the department. There was a strong indication from the data gathered in the study that most participants agreed that the Data Governance Maturity Evaluation Model (DGMEM) was applicable within the department. However, in terms of relating to all the components of the secondary focus areas of the DGMEM the participants did not significantly agree with this component (t=-3.344; p = 0.002). Results are presented in the tables and figures below.

Table 9.3: Applicability of the Data Governance Maturity Evaluation Model (DGMEM)

	Statement	Mean(SD)	N(%)Agree
1	The DGMEM is a useful tool to evaluate data governance maturity in my department. **(APP1)**	4.30(0.46)	50/50(100.0)
2	I am able to relate to all the components of the primary focus areas of the DGMEM. **(APP2)**	4.24(0.59)	48/50(96.0)
3	I am able to relate to all the components of the secondary focus areas of the DGMEM. **(APP3)**	3.52(1.02)	31/50(62.0)
4	The processes on the DGMEM for measuring data governance maturity will ensure the verifiability, completeness and accuracy of data. **(APP4)**	4.14(0.57)	47/50(94.0)
5	It is possible to evaluate the maturity level of this department based on this model. **(APP5)**	4.64(0.53)	49/50(98.0)
6	The lifecycle of data will be better managed with the components of the process areas of DGMEM. **(APP6)**	4.24(0.43)	50/50(100.0)
7	Issues of data security and privacy have been adequately addressed by the DGMEM. **(APP7)**	3.96(0.49)	45/50(90.0)
8	The model has addressed & incorporated data management processes relevant to my department. **(APP8)**	4.30(0.51)	49/50(98.0)

9	The importance and management of metadata is adequately covered in the DGMEM. **(APP9)**	3.90(0.79)	37/50(74.0)
10	Regulatory compliance and audit requirements will be met if the DGMEM is implemented. **(APP10)**	4.26(0.57)	47/50(94.0)
11	Both the primary and secondary process areas of the DGMEM present a full picture of our data needs. **(APP11)**	4.40(0.73)	47/50(94.0)

N=50, Statistically significant differences (* p < .05). Statements were rated on a 5-point scale from 1 (disagree strongly) to 5 (agree strongly). N Agree is the number of participants who gave a rating of 4 (agree) or 5 (strongly agree).

Findings from this construct indicated a strong level of agreement with the statements probing the applicability of the DGMEM in the departments. The lowest mean score on this variable had a mean score of 3.52(1.02). This was a clear indication that participants believed very strongly that the DGMEM was relevant and applicable to their data governance processes. Below are graphical representations of the findings on the applicability of the Data Governance Maturity Evaluation Model (DGMEM).

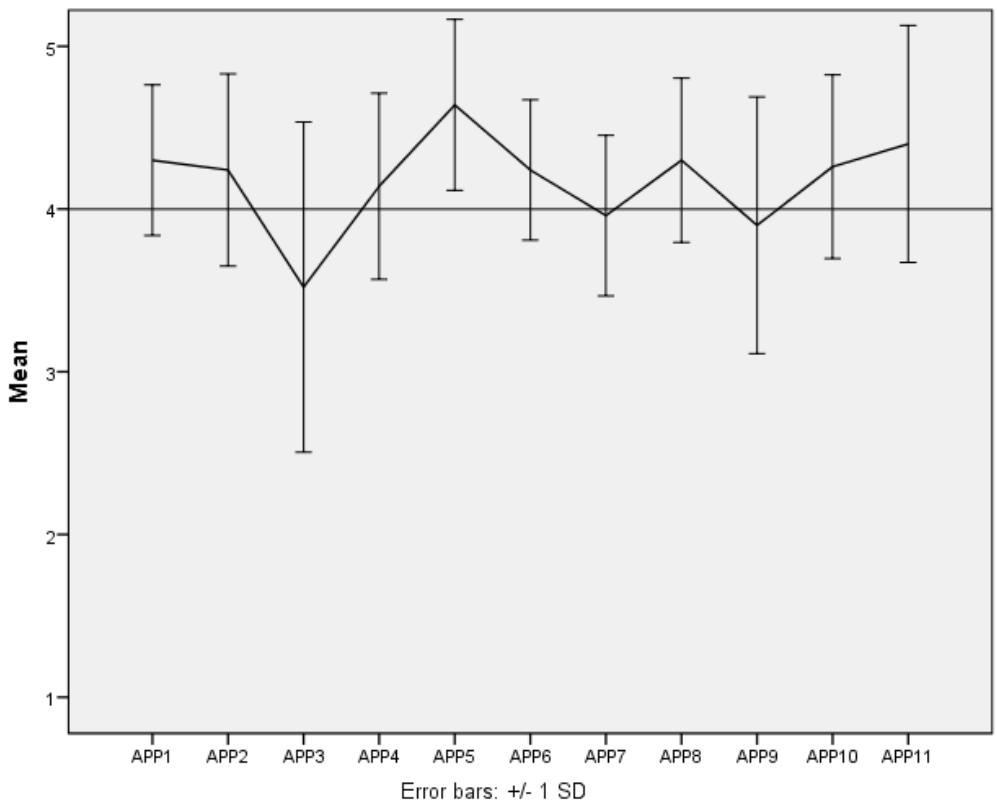

Figure 9.4: Mean Responses on applicability of the Data Governance Maturity Evaluation Model (DGMEM).

Table 9.4: One Sample T-Tests for the Mean Responses on Applicability of the Data Governance Maturity Evaluation Model (DGMEM).

	Statement	Mean(SD)	df	t-value(Sig)
1	The DGMEM is a useful tool to evaluate data governance maturity in my department. **(APP1)**	4.30(0.46)	49	4.583(0.000)**
2	I am able to relate to all the components of the primary focus areas of the DGMEM. **(APP2)**	4.24(0.59)	49	2.871(0.006)**
3	I am able to relate to all the components of the secondary focus areas of the DGMEM. **(APP3)**	3.52(1.02)	49	-3.344(0.002)*
4	The processes on the DGMEM for measuring data governance maturity will ensure the verifiability, completeness and accuracy of data. **(APP4)**	4.14(0.57)	49	1.731(0.090)
5	It is possible to evaluate the maturity level of this department based on this model. **(APP5)**	4.64(0.53)	49	8.615(0.000)**
6	The lifecycle of data will be better managed with the components of the process areas of DGMEM. **(APP6)**	4.24(0.43)	49	3.934(0.000)**
7	Issues of data security and privacy have been adequately addressed by the DGMEM. **(APP7)**	3.96(0.49)	49	-0.573(0.569)*
8	The model has addressed & incorporated data management process relevant to my department. **(APP8)**	4.30(0.51)	49	4.200(0.000)**
9	The importance and management of metadata is adequately covered in the DGMEM. **(APP9)**	3.90(0.79)	49	-0.896(0.374)
10	Regulatory compliance and audit requirements will be met if the DGMEM is implemented. **(APP10)**	4.26(0.57)	49	3.256(0.002)**
11	Both the primary and secondary process areas of the DGMEM present a full picture of our data needs. **(APP11)**	4.40(0.73)	49	3.883(0.000)**

(*) Represents statistically lower mean. (i.e. lower than 4)

(**) Represents statistically higher mean. (i.e. higher than 4)

9.7.2 People, Policies and Process Capabilities

Table 9.5: People, Policies and Process Capabilities

	Do you agree with the following statements	Mean(SD)	N(%)Agree
1	We have all three components of enabling departmental structures for an effective data governance. **(CAP1)**	3.16(1.04)	24/50(48.0)

2	I believe there are capable human resources to activate the processes in the process model for DGMEM. **(CAP2)**	3.08(1.10)	25/50(50.0)
3	There are adequate policies in place to ensure successful implementation of data governance processes. **(CAP3)**	4.00(0.83)	44/50(88.0)
4	I believe my department is able to achieve the maturity levels based on the process document. **(CAP4)**	4.32(0.59)	49/50(98.0)
5	There are dedicated data stewards to ensure successful graduation from one maturity level to another. **(CAP5)**	2.38(0.95)	6/50(12.0)

N=50, Statistically significant differences (* $p < .05$). Statements were rated on a 5-point scale from 1 (disagree strongly) to 5 (agree strongly). N Agree is the number of participants who gave a rating of 4 (agree) or 5 (strongly agree).

Table 9.5 depicts the outcome of the People, Policies and Process capabilities variable on the questionnaire. The results confirmed the findings of the qualitative segment analysis (Sections 8.2.2 and 8.3.2 of Chapter 8). CAP3 and CAP4 both returned a mean of 4.00 and 4.32 respectively, which indicated that the majority of participants agreed there were adequate policies in place for the successful implementation of data governance in the departments and that the departments were able to achieve maturity with the help of the DGMEM and its process document. However, in line with findings from qualitative data, participants did not agree that there were dedicated data stewards to ensure the successful implementation of a data governance programme within their departments. CAP1 and CAP3 returned a mean of 3.08, indicating that participants either agreed or were neutral regarding the adequacy of departmental structures and capable human resources to activate data governance in the departments. Below are graphical presentations on the findings on People, Policies and Process Capabilities.

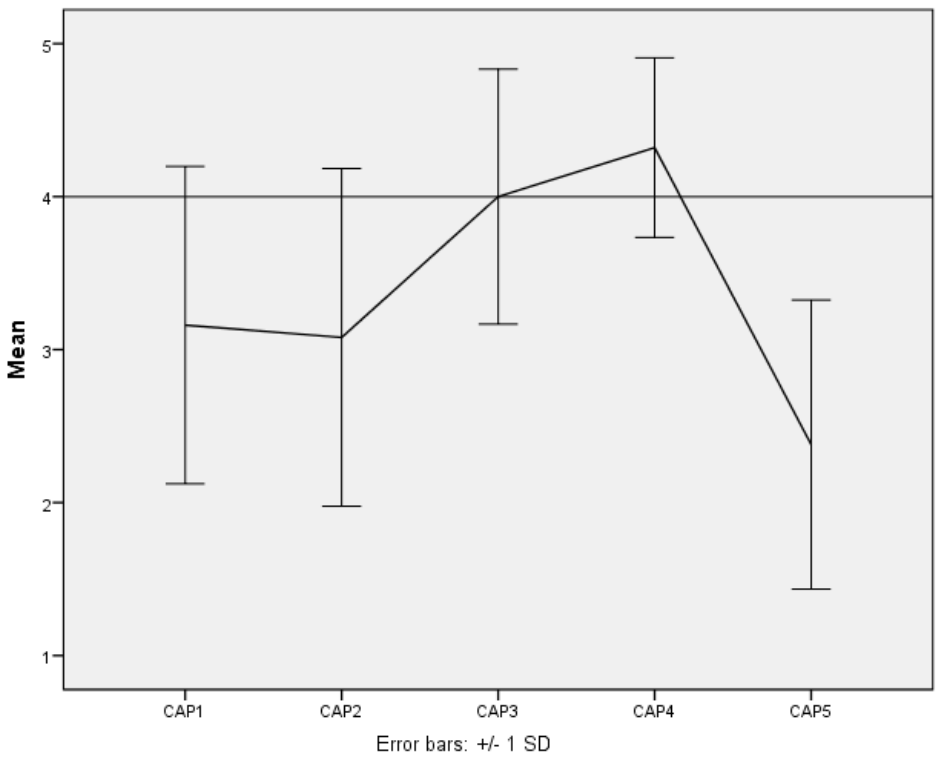

Figure 9.5: Mean Responses of People, Policies and Process Capabilities

Table 9.6: One Sample T-Tests for the Mean Responses on People, Policies and Process Capabilities.

	Do you agree with the following statements	**Mean(SD)**	**df**	**t-value(Sig)**
1	We have all three components of enabling departmental structures for an effective data governance. **(CAP1)**	3.16(1.04)	49	-5.726(0.000)*
2	I believe there are capable human resources to activate the processes in the process model for DGMEM. **(CAP2)**	3.08(1.10)	49	-5.895(0.000)*
	Do you agree with the following statements	**Mean(SD)**	**df**	**t-value(Sig)**
3	There are adequate policies in place to ensure successful implementation of data governance processes. **(CAP3)**	4.00(0.83)	49	0.000(1.000)
4	I believe my department is able to achieve the maturity levels based on the process document. **(CAP4)**	4.32(0.59)	49	3.855(0.000)**
5	There are dedicated data stewards to ensure successful graduation from one maturity level to another. **(CAP5)**	2.38(0.95)	49	-12.119(0.000)*

(*) Represents statistically lower mean. (i.e. lower than 4)

(**) Represents statistically higher mean. (i.e. higher than 4)

9.7.3 Alignment of COBIT 5/ISO/IEC 38500 to Data Process on the DGMEM

The table below shows the summary of the how participants viewed the Alignment of COBIT 5/ISO/IEC 38500 to Data Processes on the DGMEM. The results are further presented and discussed in the graphics that follow.

Table 9.7: Alignment of COBIT 5/ISO/IEC 38500 to Data Process on the DGMEM

	Do you agree with the following statements	**Mean(SD)**	**N(%)Agree**
1	The process areas of the DGMEM match to COBIT 5 and ISO/IEC 38500 principles of data governance **(ALI1)**	3.76(0.72)	30/50(60.0)
2	There is no correlation between COBIT 5 and ISO/IEC 38500 and the work processes in the department **(ALI2)**	2.50(0.79)	8/50(16.0)
3	We have been adequately trained in COBIT 5 and ISO/IEC 38500 IT/ data governance processes. **(ALI3)**	2.80(1.07)	18/50(36.0)
4	I am familiar with the process requirements for data governance in these frameworks **(ALI4)**	3.41(1.21)	30/49(61.2)
5	There is clear information ownership as stipulated by COBIT 5 in my department **(ALI5)**	3.16(0.91)	23/50(46.0)
6	There is a clear and usable enterprise architecture for data efficiency as stipulated by COBIT 38500. **(ALI6)**	2.46(0.89)	7/50(14.0)
7	The department has a clearly articulated plan-objective-architecture for data governance. **(ALI7)**	2.32(0.82)	6/50(12.0)
8	Enterprise resources and service capabilities as outlined by COBIT are present in my department. **(ALI8)**	2.82(0.92)	16/50(32.0)
9	The storage, sharing and disposal of data according to agreed conventions is in place. **(ALI9)**	3.36(0.90)	31/50(62.0)
10	Data systems are well designed and well documented in my department. **(ALI10)**	2.54(0.79)	8/50(16.0)
11	There is clear definition, classification and security control of data assets in my department. **(ALI11)**	2.38(0.83)	7/50(14.0)
12	There is a unique identification of users with their access levels in my department. **(ALI12)**	3.86(0.76)	42/50(84.0)
13	Compliance guidelines are enforced with consultants and contractors dealing with departmental data. **(ALI13)**	2.39(1.15)	12/49(24.5)

N=50, Statistically significant differences (* $p < .05$). Statements were rated on a 5-point scale from 1 (disagree strongly) to 5 (agree strongly). N Agree is the number of participants who gave a rating of 4 (agree) or 5 (strongly agree).

Table 9.7 depicts the findings on the alignment of COBIT 5 and ISO/IEC 38500 to data governance processes on the DGMEM. The results confirmed the outcome of the qualitative phase of the study (Sections 8.2.6, 8.2.7 and 8.3.6, Chapter 8). ALI1, ALI5, ALI9 and ALI12 were the four variables which returned a mean of 3.00+ out of the thirteen components testing the alignment of COBIT 5 and ISO/IEC 38500 to data processes on the DGMEM, indicating that participants agreed or strongly agreed with these statements. The other variables all returned a mean score ranging from 2.38 to 2.86, which indicated that they disagreed with the statements or were neutral. This feedback aligned with the qualitative findings regarding the alignment of COBIT 5 and ISO/IEC 38500 to work processes in the departments in the sense that most of the participants only had a vague understanding of what the frameworks were, and were unfamiliar with its processes. The implication of this was that the departments still had a need to train staff on these processes as the DPSA had chosen them as benchmark frameworks for IT, and by extension, data processes in National Government. The attribute which stood strongly correlated across the three data collection methods was ALI12, which spoke to the security aspect of having unique identification and access levels for data in the departments. The variable returned a mean score of 3.86, an indication that access rights in the departments were secured with consistent authentication credentials. This factor was important as it indicated a level of control of access to the departments' data assets. Below are graphical representations of the findings on Alignment of COBIT 5/ISO/IEC 38500 to Data Process on the DGMEM.

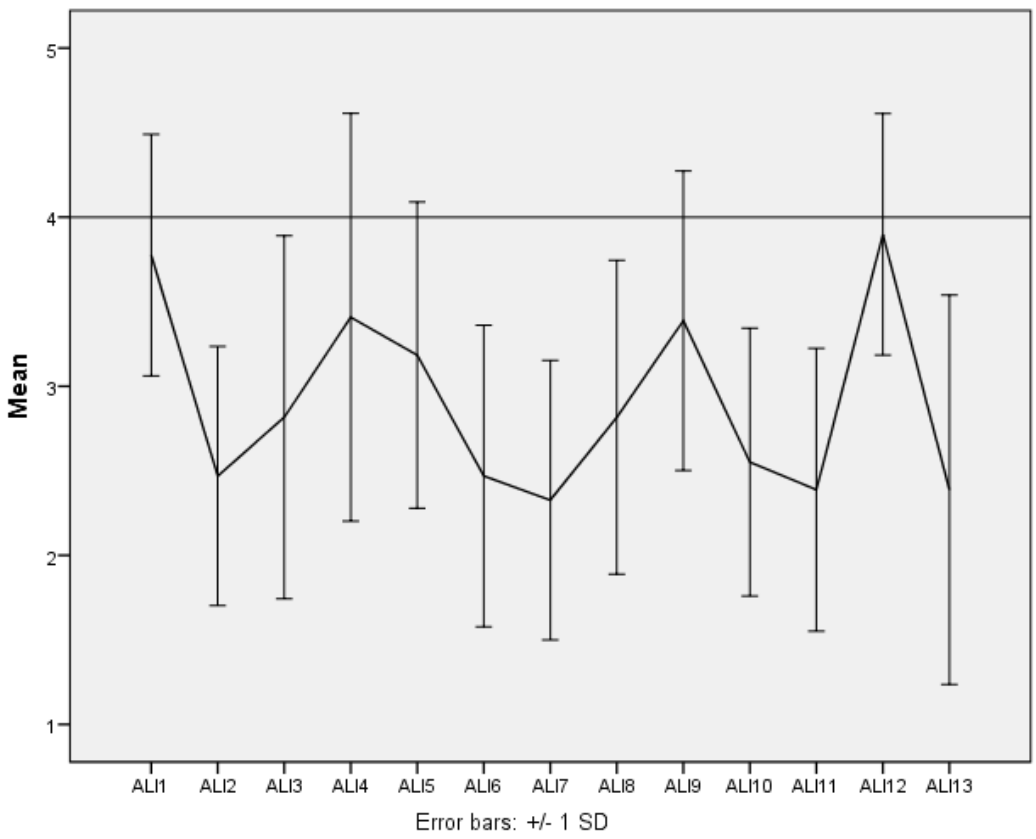

Figure 9.6: Mean Responses of Alignment of COBIT 5/ISO/IEC 38500 to Data Process on the DGMEM

Table 9.8: One Sample T-Test for the Mean Responses on Alignment of COBIT 5/ISO/IEC 38500 to Data Process on the DGMEM

	Do you agree with the following statements?	**Mean(SD)**	**Df**	**t-value(Sig)**
1	The process areas of the DGMEM match to COBIT 5 and ISO/IEC 38500 principles of data governance **(ALI1)**	3.76(0.72)	49	-2.370(0.022)*
2	There is no correlation between COBIT 5 and ISO/IEC 38500 and the work processes in the department **(ALI2)**	2.50(0.79)	49	-13.444(0.000)*
3	We have been adequately trained in COBIT 5 and ISO/IEC 38500 IT/ data governance processes. **(ALI3)**	2.80(1.07)	49	-7.937(0.000)*
4	I am familiar with the process requirements for data governance in these frameworks **(ALI4)**	3.41(1.21)	49	-3.435(0.001)*
5	There is clear information ownership as stipulated by COBIT 5 in my department **(ALI5)**	3.16(0.91)	49	-6.516(0.000)*
6	There is a clear and usable enterprise architecture for data efficiency as stipulated by COBIT 38500. **(ALI6)**	2.46(0.89)	49	-12.298(0.000)*

7	The department has a clearly articulated plan-objective-architecture for data governance. **(ALI7)**	2.32(0.82)	49	-14.502(0.000)*
8	Enterprise resources and service capabilities as outlined by COBIT are present in my department. **(ALI8)**	2.82(0.92)	49	-9.080(0.000)*
9	The storage, sharing and disposal of data according to agreed conventions is in place. **(ALI9)**	3.36(0.90)	49	-5.039(0.000)*
10	Data systems are well designed and well documented in my department. **(ALI10)**	2.54(0.79)	49	-13.103(0.000)*
11	There is clear definition, classification and security control of data assets in my department. **(ALI11)**	2.38(0.83)	49	-13.796(0.000)*
12	There is a unique identification of users with their access levels in my department. **(ALI12)**	3.86(0.76)	49	-1.309(0.197)
13	Compliance guidelines are enforced with consultants and contractors dealing with departmental data. **(ALI13)**	2.39(1.15)	49	-9.802(0.000)*

(*) Represents statistically lower mean. (i.e lower than 4)

(**) Represents statistically higher mean. (i.e higher than 4)

9.7.4 Expected Results from the Implementation of the DGMEM

Table 9.9: Expected Results from the Implementation of the DGMEM

	Do you agree with the following statements?	**Mean(SD)**	**N(%)Agree**
1	The DGMEM will assist us in achieving better data quality. **(EXP1)**	4.60(0.50)	50/50(100.0)
2	Issues of access rights and authentication will be better defined through the DGMEM. **(EXP2)**	4.38(0.53)	49/50(98.0)
3	I believe the DGMEM will encourage the department to seek a higher maturity level. **(EXP3)**	4.54(0.54)	49/50(98.0)
4	The DGMEM will have no impact whatsoever on our data processes. **(EXP4)**	1.80(0.76)	2/50(4.0)
5	Issues of data security and privacy will be resolved if the DGMEM is implemented. **(EXP5)**	3.92(0.44)	45/50(90.0)
6	Regulatory compliance will no longer be an audit problem if the DGMEM is implemented. **(EXP6)**	4.14(0.54)	46/50(92.0)
7	Data management issues can be resolved with the DGMEM. **(EXP7)**	4.60(0.50)	50/50(100.0)
8	The DGMEM will help to create the necessary buy-in for data governance in the department. **(EXP8)**	4.16(0.79)	45/50(90.0)

N=50, Statistically significant differences (* p < .05). Statements were rated on a 5-point scale from 1 (disagree strongly) to 5 (agree strongly). N Agree is the number of participants who gave a rating of 4 (agree) or 5 (strongly agree).

Table 9.9 summarised the results of the expected results from the implementation of the DGMEM. This variable sought to gauge the expectation of the participants if the DGMEM was implemented in their respective departments. All the variables except one (EXP4) scored a mean between 3.92 to 4.60. This was indicative of a very high level of agreement among participants that the model would assist the departments in the resolution of different aspects of data governance problems if implemented. EXP4 required participants to agree or disagree on whether the DGMEM would have no impact on their data processes. Ninety-six percent disagreed with the statement hence the question returned a mean score of 1.80. This was a confirmation that the DGMEM was perceived as a veritable tool to impact upon data processes in the department. Below are graphical representations on the expected results from the implementation of the DGMEM.

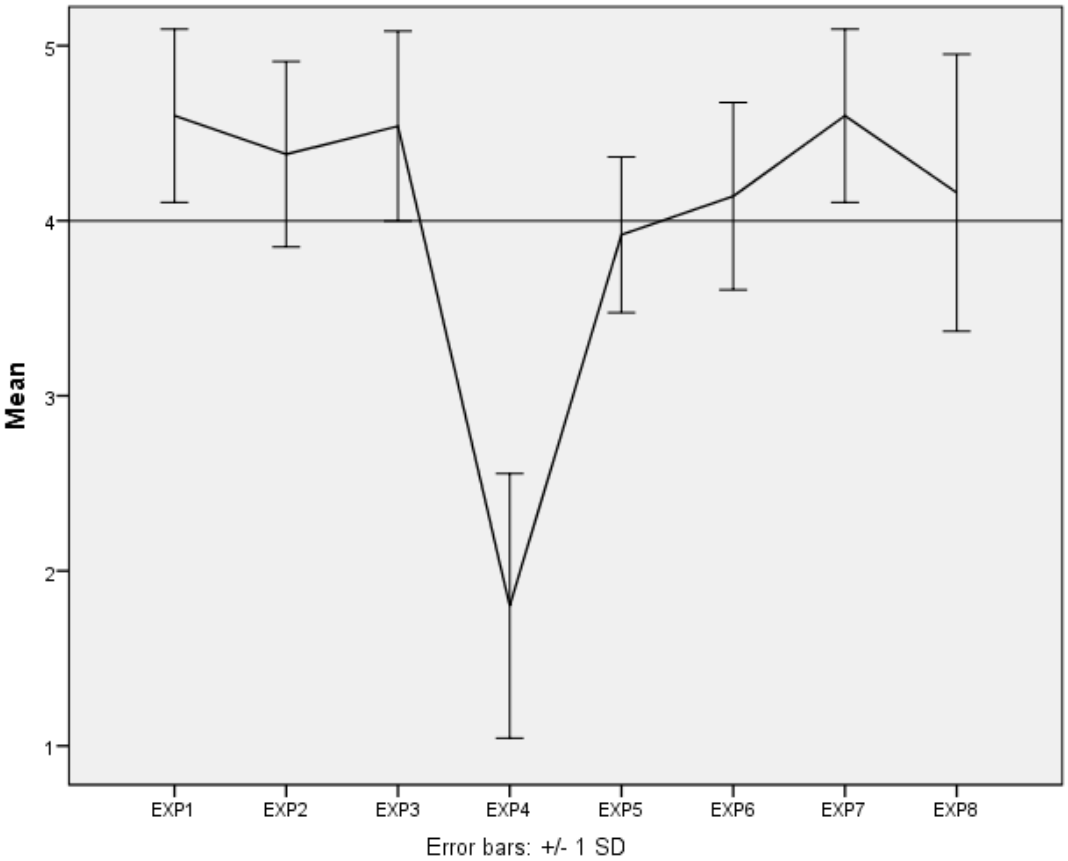

Figure 9.7: Mean Responses of Expected Results from the Implementation of the DGMEM

Table 9.10: One Sample T-Tests for the Mean Responses on Expected Results from the Implementation of the DGMEM

	Do you agree with the following statements?	Mean(SD)	df	t-value(Sig)
1	The DGMEM will assist us in achieving better data quality. **(EXP1)**	4.60(0.50)	49	8.573(0.000)**
2	Issues of access rights and authentication will be better defined through the DGMEM. **(EXP2)**	4.38(0.53)	49	5.067(0.000)**
3	I believe the DGMEM will encourage the department to seek a higher maturity level. **(EXP3)**	4.54(0.54)	49	7.039(0.000)**
4	The DGMEM will have no impact whatsoever on our data processes. **(EXP4)**	1.80(0.76)	49	-20.579(0.000)*
5	Issues of data security and privacy will be resolved if the DGMEM is implemented. **(EXP5)**	3.92(0.44)	49	-1.273(0.209)
6	Regulatory compliance will no longer be an audit problem if the DGMEM is implemented. **(EXP6)**	4.14(0.54)	49	1.851(0.070)
7	Data management issues can be resolved with the DGMEM. **(EXP7)**	4.60(0.50)	49	8.573(0.000)**
8	The DGMEM will help to create the necessary buy-in for data governance in the department. **(EXP8)**	4.16(0.79)	49	1.429(0.159)

(*) Represents statistically lower mean. (i.e lower than 4)

(**) Represents statistically higher mean. (i.e higher than 4)

9.7.5 Missing Components of the DGMEM

Table 9.11: Expected Results from the Implementation of the DGMEM

	Statement	Mean(SD)	N(%)Agree
1	There are data elements in my department which are not on this model. **(MIS1)**	2.50(0.76)	8/50(16.0)
2	There are data elements on the model which are not relevant to my department. **(MIS2)**	2.30(0.79)	8/50(16.0)
3	The DGMEM needs to be reconstructed to suit my department's needs. **(MIS3)**	2.18(0.48)	2/50(4.0)
4	I believe the DGMEM, as it is, has all the data elements for a successful data governance maturity evaluation suitable for my department. **(MIS4)**	4.28(0.50)	49/50(98.0)
5	The DGMEM process model is too complicated to work in my department. **(MIS5)**	2.18(0.69)	2/50(4.0)

N=50, Statistically significant differences (* p < .05). Statements were rated on a 5-point scale from 1 (disagree strongly) to 5 (agree strongly). N Agree is the number of participants who gave a rating of 4 (agree) or 5 (strongly agree).

Regarding this variable, the researcher's intention was to inquire if the components of data governance on the DGMEM comprehensively covered the essential aspects of data governance as found and discussed in extant literature. To avoid a situation in which participants were confused as to the actual meaning of the questions on this variable, it was decided that the best path was to indicate a set of negative statements about missing elements on the model. Four out of the five elements of this variable returned a mean of less than 2. 60, with the lowest (MIS5) scoring a mean of 2.18. This indicated that participants strongly disagreed with the statements on this variable. MIS4, which states thus "I believe the DGMEM, as it is, has all the data elements for a successful data governance maturity evaluation suitable for my department" scored a mean of 4.28, which indicated that participants believed the statement to be strongly true. Findings regarding this variable aligned with the qualitative findings (Section 8.2, Chapter 8). A graphical representation of the missing components on the DGMEM is presented below.

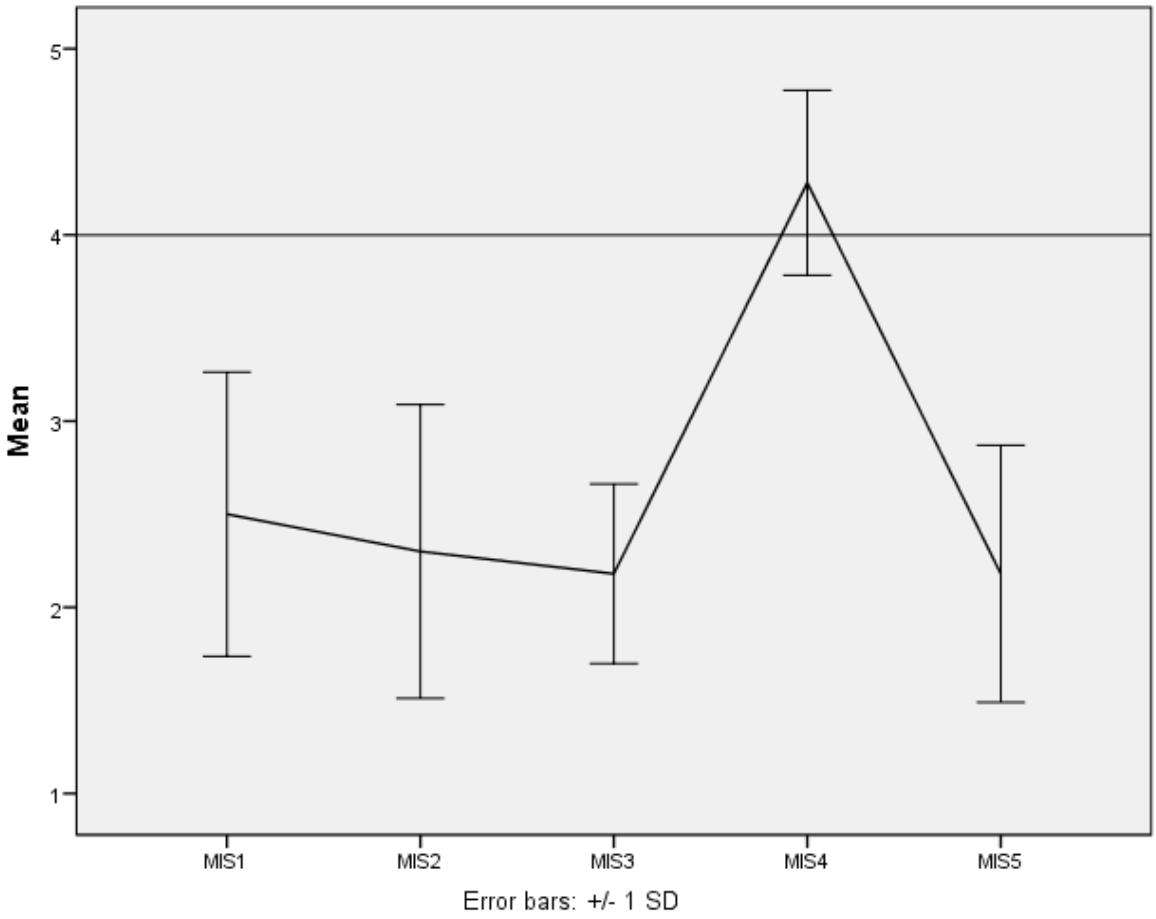

Figure 9.8: Mean Responses of Missing Components of the DGMEM

Table 9.12: One Sample T-Tests for the Mean Responses on Missing Components of the DGMEM

	Statement	Mean(SD)	Df	t-value(Sig)
1	There are data elements in my department which are not on this model. **(MIS1)**	2.50(0.76)	49	-4.636(0.000)*
2	There are data elements on the model which are not relevant to my department. **(MIS2)**	2.30(0.79)	49	-6.274(0.000)*
3	The DGMEM needs to be reconstructed to suit my department's needs. **(MIS3)**	2.18(0.48)	49	-12.032(0.000)*
4	I believe the DGMEM, as it is, has all the data elements for a successful data governance maturity evaluation suitable for my department. **(MIS4)**	4.28(0.50)	49	18.229(0.000)**
5	The DGMEM process model is too complicated to work in my department. **(MIS5)**	2.18(0.69)	49	-8.394(0.000)*

(*) Represents statistically lower mean**.** (i.e Lower Than 3)

(**) Represents statistically higher mean**.** (i.e Higher Than 3)

9.8 Descriptive Analysis on Main Variables

Table 9.13 below shows the mean levels of the theoretical/Main variables, that is, Capabilities (mean = 3.3880; SD=0.0.57344); Alignment of COBIT (mean = 2.9137; SD=0.41324) and Missing Components (mean = 2.6880; SD=0.31079) were all moderately low for the study sample whilst Applicability of DGMEM (mean = 4.1727; SD=0.27930) and Expected Results (mean = 4.0175; SD=0.23147) were all moderately high for the study sample.

Table 9.13: Descriptive Statistics of Study Variables

Study Variable	N	Min	Max	Mean	SD
Applicability of DGMEM	50	3.55	4.91	4.1727	0.27930
Capabilities	50	2.40	4.40	3.3880	0.57344
Alignment of COBIT	49	2.08	3.77	2.9137	0.41324
Expected Results	50	3.25	4.50	4.0175	0.23147
Missing Components	50	2.20	3.40	2.6880	0.31079

N=50 for all samples and Statements were rated on a 5-point scale from 1 (Strongly Disagree) to 5 (Strongly Agree). *Notes*. **Applicability of DGMEM** = Applicability of the Data Governance Maturity Evaluation Model

(DGMEM); **Capabilities** = People, Policies and Process Capabilities; **Alignment of COBIT** = Alignment of COBIT 5/ISO/IEC 38500 to Data Process on the DGMEM; **Expected Results** = Expected results from the implementation of the DGMEM; **Missing Components** = Missing Components of the DGMEM

The one-sample test revealed that only Missing Components (mean=2.69, SD=0.31, t=-0.7099, p=0.000) had a mean level that was significantly lower than 3, thus suggesting that overall participants disagreed with the items of this variable in the questionnaire. The findings also revealed that generally participants neither agreed nor disagreed on Alignment of COBIT 5/ISO/IEC 38500 to Data Process on the DGMEM (mean=2.91, SD=0.41, t=-1.46, p=0.150) whist they generally agreed on the Applicability of the Data Governance Maturity Evaluation Model (mean=4.17, SD=0.28, t=29.69, p=0.000) and on Expected Results from the implementation of the DGMEM (mean=4.02, SD=0.23, t=31.08, p=0.000). The results are presented in the table and figure below.

Table 9.14: One Sample T-Tests for the Mean Responses of Theoretical Variables

Variable	N	One Sample T Test Statistics			
		Mean(SD)	df	t-value	(Sig 2-tailed)
Overall:					
Applicability of theDGMEM		4.17(0.28)	49	29.690	0.000**
Capabilities		3.39(0.57)	49	4.784	0.000**
Alignment of COBIT		2.91(0.41)	48	-1.463	0.150
Expected Results		4.02(0.23)	49	31.083	0.000**
Missing Components		2.69(0.31)	49	-7.099	0.000*

(*) Represents statistically lower mean**.** (i.e. lower than 3)

(**) Represents statistically higher mean**.** (i.e. higher than 3)

Notes. **Applicability of DGMEM** = Applicability of the Data Governance Maturity Evaluation Model (DGMEM); **Capabilities** = People, Policies and Process Capabilities; **Alignment of COBIT** = Alignment of COBIT 5/ISO/IEC 38500 to Data Process on the DGMEM; **Expected Results** = Expected results from the implementation of the DGMEM; **Missing Components** = Missing Components of the DGMEM

Table 9.14 depicts an overall summary of the implications of the findings from the data. According to the analysis of the main variables, three of the variables, namely, Applicability of the DGMEM, People, Policies and Processes Capabilities and Expected Results of

implementing the DGMEM had mean scores of over 3.3880. This provided evidence that participants were agreed on the ability of the model to positively enhance data processes within their departments. On the other hand, the results of the remaining two components which were, Missing Components on the DGMEM and Alignment of COBIT 5/ ISO/IEC 38500 to data processes on the DGMEM and the departments, were also considered as positive and confirmatory of what had been found in the qualitative data. As a way of ensuring that participants were able to relate to the questions on the missing components on the DGMEM, most of the questions requested that the participants agreed or disagreed as to whether there were missing components on the DGMEM which were relevant to their data processes, if the DGMEM needed to be reconstructed for it to be relevant to their departments. A negligible 2% of participants stated that they agreed with these statements while 98% disagreed. The implication of this result was that participants neither believed there were missing data components on the DGMEM nor that the model needed to be reconstructed to suit their department's data needs. Also, the statement, "I believe that the DGMEM has all the data element for a successful data governance maturity evaluation suitable for my department" yielded a mean of 4.280.50 which indicated that only one participant disagreed or was undecided about this statement, while the rest agreed or strongly agreed. To this end, it was reasonable to state that the seemingly low score of 2.69 for this component on Table 9.14 was a clear indication of the participants' belief that there were no significant data governance elements missing on the DGMEM. In the same vein, the results showed that the DGMEM did not need to be reconstructed for it to be effective in their departments. The second component on Table 9.14 which scored a mean of 2.91 was the questions regarding the alignment of COBIT 5 to the processes on the DGMEM. This was also not surprising as the qualitative data had shown that most participants only had a vague awareness of what the data governance processes were. It was logically impossible for these participants to reasonably project the alignment between COBIT and the DGMEM processes without a clear understanding of what was involved in these processes. All in all, the one sample T-test for the mean responses of a summary of all the theoretical variables (Table 9.14) depicted the confirmation that the DGMEM, in line with its theoretical grounding in Design Science and a pragmatic philosophy of "what works" had proved to be a fit for the departments in terms of data governance maturity evaluation. The results of the summary of all the variables are presented graphically on Figure 9.9 below.

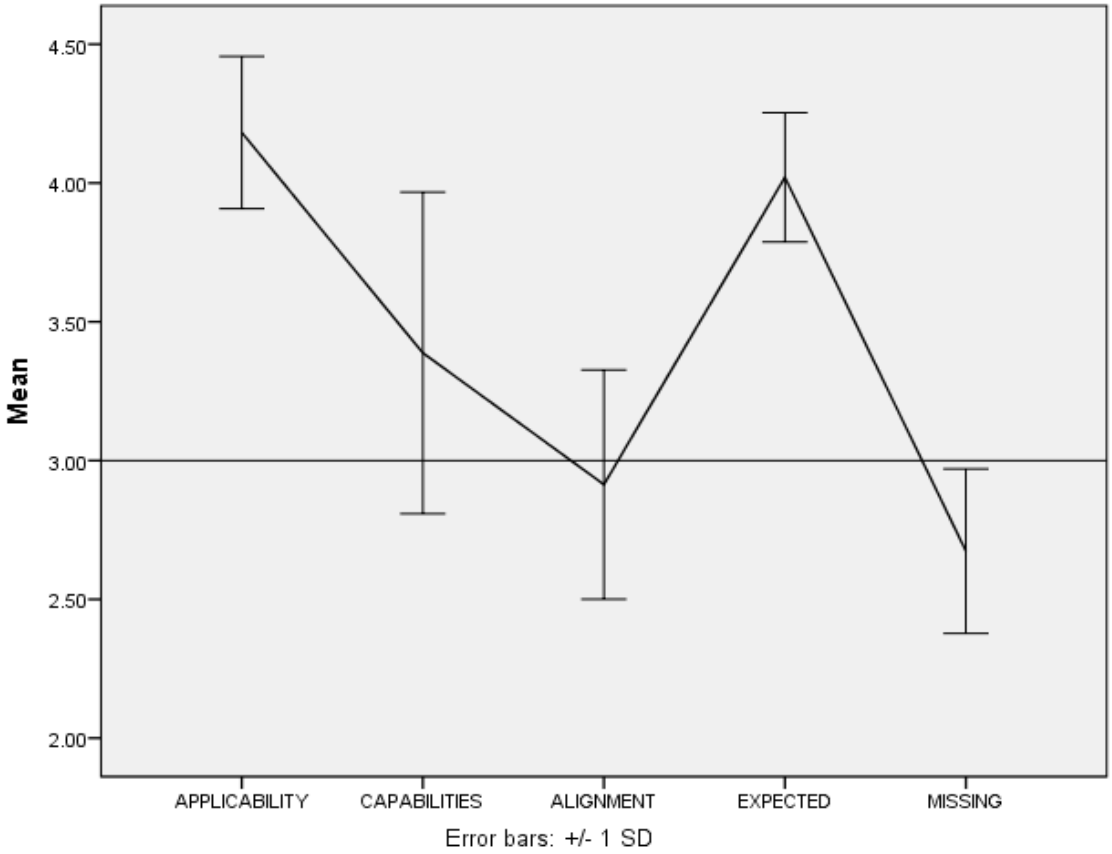

Figure 9.9: Mean Responses of Overall Theoretical Variables

The implications of the findings from the SPSS analysis of data are discussed in the next section of the study.

9.9 Implication and Summary of Findings

9.9.1 Summary of Quantitative Findings

From the findings presented in Sections 9.6 and 9.7 above, it can be summarised that the quantitative data unequivocally confirmed what was found when the qualitative data was analysed: the DGMEM, if applied, could assist the government departments of the Eastern Cape in improving their current data governance processes. As a way of refreshing the reader's mind, the research question being answered read, **"How can a data governance maturity evaluation model enhance data governance processes in the Eastern Cape Government Departments?".** The results of the Cronbach's alpha test presented on Table 9.1 indicated a high reliability score for the test variables (0.593 to 0.677), which confirmed that the items measured in the quantitative strand of the study were a true reflection of the intended measurement of the components of the DGMEM. Furthermore, from Figure 4.3, the calibre

and experience of the participants gave the assurance of the fact that they were indeed individuals who had been working in these government departments for a reasonable period of time hence their responses to data issues in their departments could be considered informed. Fifty-four percent of the participants had worked in their respective departments for over five years, while 22% had put in over 10 years of service. It is thus opined that these participants had a fairly grounded understanding of the data issues within their organisations. The next section compared the results from the quantitative analysis with the results of the qualitative findings presented in Chapter 8. As already discussed in Section 2.6 of Chapter 2, data triangulation was employed to merge the results of the qualitative and quantitative reports, this with the aim of strengthening the results of the inquiry and building confidence in the reliability and replicability of the study.

9.10 Data Triangulation

In order to further ensure the reliability and validity of findings from a research study, researchers usually engage different methods of data collection and analysis. To this end, triangulation has become a standard method when multiple sources of data have been used in a study (Creswell, 2014). Triangulation is described by Cohen and Manion (2000) as an attempt to explain fully, the richness and complexity of human behaviour by studying it from multiple standpoints. The process of triangulation consists of comparing information from two or more data sources. For this study, triangulation involved the comparison of data from the qualitative questionnaire, focus group discussions and the quantitative questionnaire. An important feature of data triangulation is that the datasets basically measure the same or very closely related constructs hence the deficiency in one method of inquiry is compensated for by the vigour of the other. The qualitative strand of this study was embarked upon as a test of what represented data governance in the EC Government Departments. The same constructs were measured through the focus group discussions, just to get an in-depth understanding regarding the data governance processes in the departments. The final phase of data collection was a confirmatory test of the conceptual model in line with findings from the qualitative data. It is important to state that although the three methods of enquiry in the study were measuring the same constructs towards the goal of ascertaining the relevance and usability of the DGMEM in its set context, the wording of the questionnaires was different. This was due to the fact that the qualitative questionnaire measured the constructs based on the conceptual model which was grounded in literature, while the quantitative measured the constructs of the DGMEM as a test

of the data governance processes of the participating departments. The findings from the five main variables which make up a summary of the components of the DGMEM across the three sources of data are now compared and presented in Table 9.15 below. It is important to state that no further changes were made to the DGMEM from the findings of the quantitative data as the results are mostly confirmatory of what the qualitative data has shown.

Table 9.15: Comparison of Findings from the Two Phases of Data Collection

Qualitative Construct	Corresponding Quantitative Construct	Focus group	Findings from the Qualitative analysis	Findings from the Quantitative analysis	Conclusion
Rules and Rules of Engagement for data governance; data governance policies; consistence in data collection, handling and archiving; revocation of data authority and access; control of data in the hands of external stakeholders;	Applicability of the DGMEM to data governance processes in government departments; evaluation of data governance maturity; applicability of all the primary focus areas on the DGMEM; applicability of all the secondary focus areas on the DGMEM; verifiability and completeness of data; better control of the lifecycle of data; security and privacy; data management processes; importance of metadata; regulatory compliance	Rules or processes governing data collection, input and storage in the department; the discussions centred on the same data elements as on the questionnaire.	8.2.1 There was minimal awareness of the rules that govern data and the various aspects of data processes were not uniform or implemented as part of work processes in the departments.	Table 9.3 Nine out of the eleven questions measuring these parameters on the quantitative construct scored a mean of 4.24/ 5, which showed that the participants agreed on the applicability of the components as a means of enhancing data processes in their departments. Two of the constructs scored 3.52 and 3.90 respectively, still a confirmation of the perceived accuracy of the DGMEM and its ability to directly impact upon data processes in the departments.	Results of the quantitative findings confirmed the findings from the qualitative strand of the inquiry.
People, Policies and Process Capabilities; functional structures for data governance; data roles; dedicated data stewards; current data capture/ nomenclature in the department;	People, Policies and Process Capabilities; stewardship, policies and processes; capable human and material resources; incremental achievement of maturity if DGMEM is applied.	Understanding of data governance as it relates to work processes/Assignment of data roles in the department	8.2.2 There are policies in place to guide the data and information management processes of the departments (section 7.6.1, Chapter 7). However, participants did not consider the people aspect of data	Table 9.5 The results of this phase were aligned with and consistent with the qualitative findings. The mean for the presence of adequate policies was 4.00, but most participants said there were no dedicated stewards to actualise data governance progression on the maturity spectrum (Mean of 2.38/5). Participants were also undecided as to whether there	Results of the quantitative findings confirmed the findings from the qualitative strand of the inquiry.

Qualitative Construct	Corresponding Quantitative Construct	Focus group	Findings from the Qualitative analysis	Findings from the Quantitative analysis	Conclusion
			roles and capabilities to be adequate in instituting data governance in the departments. Also, the processes currently in place did not support internationally recognised data governance processes.	were adequate human resources in place to actualise a data governance programme.	
Compliance and Risk Management	Alignment of COBIT 5/ ISO/IEC 38500	Familiarity with COBIT and ISO/IEC 38500. Does the department's data processes follow the principles of both frameworks?	8.2.6 Few participants were familiar with COBIT5/ ISO/IEC 38500 principles. Data processes currently do not follow the frameworks' recommended processes. The remaining seven components returned a response from 2.50/5 which depicts that participants neither agreed nor disagreed. In	Table 9.7 The results were conflicting with regards to this variable. Only five of 11 components under this variable had a score of 3.16/5 which indicated that participants agreed or strongly agreed with the statements.	Result of the quantitative finding confirmed the findings from the qualitative strand of the inquiry.

Qualitative Construct	Corresponding Quantitative Construct	Focus group	Findings from the Qualitative analysis	Findings from the Quantitative analysis	Conclusion
			the same vein, most of the participants neither agreed nor disagreed with the statements regarding COBIT 5 implementation. Findings from the focus group activities indicate that most participants are not very familiar with COBIT processes, they only had a vague idea of what it is.		
Critical elements of the data governance programme, that is, Data quality; Metadata management; Data Security and Privacy Management	Expected results from the implementation of the DGMEM in relation to data quality, data access and authentication rights, higher maturity level, data security and privacy, regulatory compliance and data management	Critical elements of the data governance programme, that is, control of data in the hands of external stakeholders; data quality criteria built into work processes; problems with poor data quality; metadata management; protection of	8.2.3, 8.2.4, 8.2.8, 8.2.9, 8.2.11 There was consensus in both in the questionnaire and focus groups that data governance in the critical areas was inadequate, that is, data quality management and in some cases such as	Table 9.9 Six out of 8 components of this variable loaded a mean of 4.14/5 and above. This indicated that there was consensus among the participants in that the DGMEM, if implemented, would greatly assist the department in resolving data issues in the critical areas discussed in the model. The component which had a mean score of 1.80/5 (EXP 4) asked participants to agree or disagree with the statement “The	Result of the quantitative findings confirmed the findings from the qualitative strand of the inquiry.

Qualitative Construct	Corresponding Quantitative Construct	Focus group	Findings from the Qualitative analysis	Findings from the Quantitative analysis	Conclusion
		sensitive data from unauthorised access	metadata management, it was non-existent.	DGMEM will have no impact whatsoever on our data processes". As expected, only two participants agreed with the statement hence the low score on the component. Results also confirmed that issues of data security and privacy would be resolved with the DGMEM	
Areas of data governance not covered in the current processes of the department	Missing data governance components on the DGMEM.	Ways of managing data better in the department	8.1.7 Participants (with the exception of D2) were unable to articulate the process of data management from inception to deletion. There was consensus that data was not being optimally managed as an asset from the results, and advocacy for a uniform policy to govern data was very strong. Participants also stated that a maturity evaluation model would	Table 9.11 The participants on this variable most consistently agreed that the DGMEM had all the data elements required for the departments to have a successful data governance maturity evaluation. The mean score on the questions MIS 1, MIS2, MIS3 and MIS 5, was 2.18/5, an indication that participants strongly disagreed or disagreed with the statements. MIS4, which stated that the DGMEM had all the data elements required, had a mean score of 4.28/5, thus confirming the result of the qualitative data which stated a definite need for a structured approach to data governance in the departments.	Results of the quantitative findings confirmed the findings from the qualitative strand of the inquiry.

Qualitative Construct	Corresponding Quantitative Construct	Focus group	Findings from the Qualitative analysis	Findings from the Quantitative analysis	Conclusion
			assist in trying to remedy or mitigate the current situation.		

From Table 9.15 above, it is evident that the data from the three sources was used to test the DGMEM's relevance and applicability. Findings were consistent with the ideas and practicalities of data governance documented in current and widely quoted literature regarding the subject matter (The Data Governance Institute, 2015; IBM, 2007; Steinhart, 2010 and Soares, 2015). These concepts and components had been expansively discussed in the literature review carried out in Chapters 3, 4 and 5 of the study. It, therefore, was not surprising that participants found the DGMEM to be a robust tool which could enhance the data governance processes in their departments. The entire process of research leading up to this point in the research is diagrammed in Figure 9. 10 below:

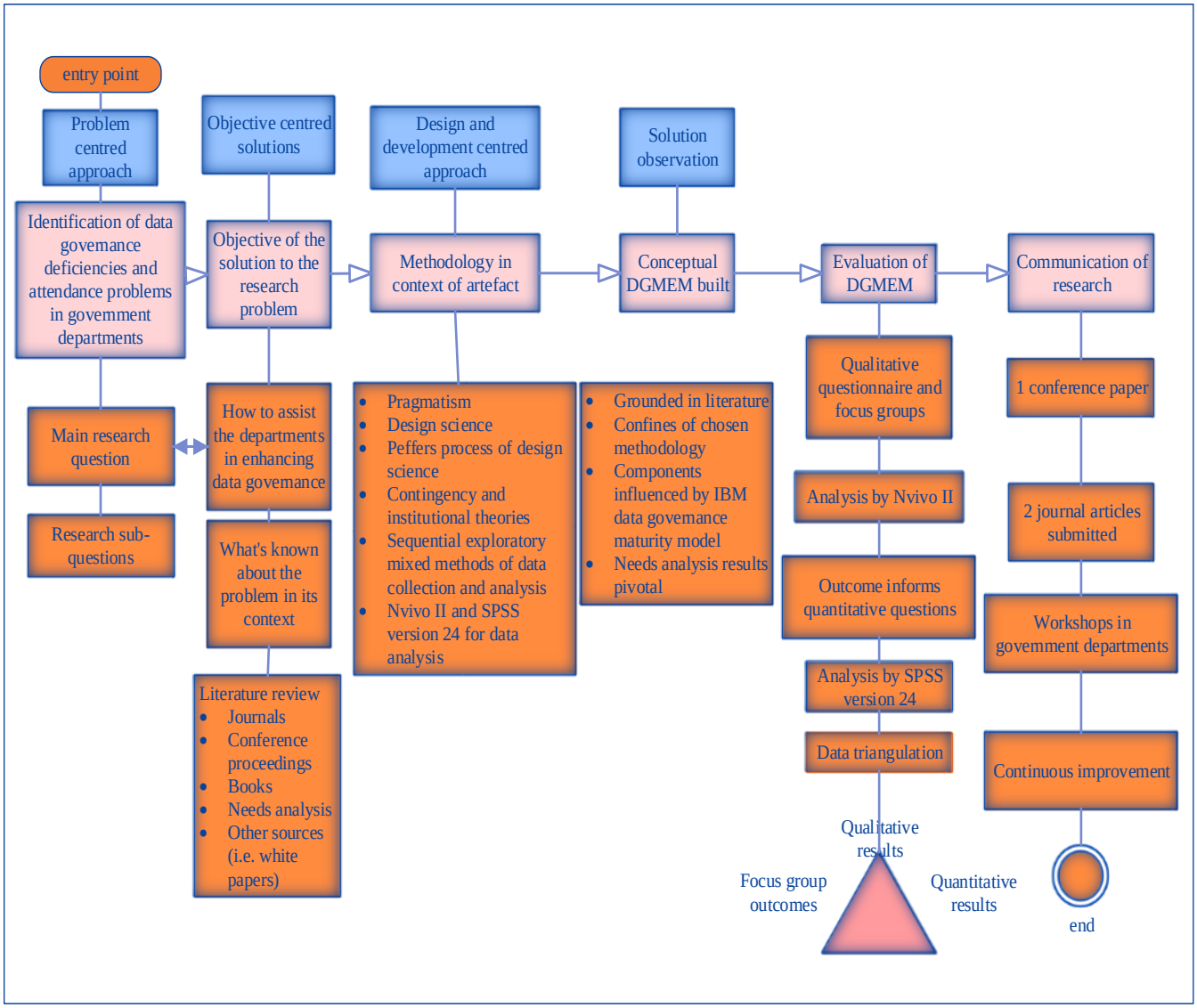

Figure 9.10:The Entire Research based on Peffers' Process (Source:Self)

9.11 Summary

Chapter 9 presented the analysis and implications of the quantitative data collection done to confirm the relevancy and applicability of the DGMEM in govermment departments of the Eastern Cape Province. Findings from this phase of the study served to confirm what was found in extant literature and confirmed by the qualitative phase of the data collection and analysis. Findings confirmed that the DGMEM is a veritable and useful tool which can assist the departments in enhancing their data governance processes. The data from the three sources were triangulated to ensure rigour and generalisability. Chapter 10 thereafter gives an overview of the entire research project and presents a conclusion to the study.

Chapter 1
Introduction

Chapter 2

Methodology

Chapter 3
Relationship between Corporate Governance, IT Governance and Data Governance

Chapter 4

An analysis of current Data Governance practices in the Eastern Cape Government Departments

Chapter 5

A Discussion of Five Maturity Models Relevant to this Study

Chapter 6

A Conceptual Data Governance Maturity Evaluation Model

Chapter 7

Presentation of Findings from the Qualitative Data

Chapter 8

Implications of Findings from the Qualitative Data

Chapter 9

Presentation of Findings and Implications of the Quantitative Data

Chapter 10

Conclusion:A Data Governance Maturity Evaluation Model for Government Departments of the Eastern Cape

Chapter 10

Conclusion:A Data Governance Maturity Evaluation Model for Government Departments of the Eastern Cape

10.1 Introduction

10.2 Overview of Research

10.3 Contribution of Research to Body of Knowledge

10.4 Research Evaluation

10.5 Personal Reflections

10.6 Conclusion

10. Chapter 10: Conclusion Chapter

10.1 Introduction

This study set out to answer the primary research question, "**How can a data governance maturity evaluation model enhance data governance processes in the Eastern Cape Government Departments?".** To enable the researcher to answer this primary question, a set of four sub-questions were developed. The objective of the study was to develop and produce a data governance maturity evaluation model to assist the government departments of the Eastern Cape in governing their data assets. Chapter 10 summarises the entire thesis; the contents of each chapter, its relationship with the research question, and how it helped to answer the main question. This is important as it forms the roadmap for the way the entire research was conducted and clearly outlines how the conclusion was reached. The DGMEM, which was developed from the literature and is the primary output of this study was also appraised in line with the research question and how this model has been able to address it. The final DGMEM is appraised and the contribution made by the study is discussed in the form of theoretical and practical contributions. The personal reflections of the researcher are presented in this chapter, after which suggestions for future research are discussed.

10.2 Overview of Research

The research set out to answer the primary research question, **"How can a data governance maturity evaluation model enhance data governance processes in the Eastern Cape government departments?".** The study set out to answer this main research question with the help of four sub-questions which were outlined in Section 1.3 of Chapter One. Chapter one of the study was dedicated to outlining the research problem, the objective and the setting of a context for the study. The theories and benchmark frameworks for the proposed DGMEM were also discussed. This was followed by a brief outline of the methodology through which the study's objectives would be achieved, and the scope of work which the project intended to cover.

In Chapter 2, a robust discussion of the methodology for the study was conducted. Methodology is a very critical bedrock of any research as it forms the scientific pathway by which the research objective is achieved. A justification of the choice of Pragmatism as the paradigm on which the research was based and Design Science as the method was given. The Design Science Process model of Peffers et al. (2008) was chosen as the six step process through which the artefact was built while the seven guidelines of Design Science, by Hevner et al. (2004), were adapted for the iterative process of model construction. The chapter also

considered the four cycle view of Design Science which incorporated the Change and Impact cycle as important to the context of this study (Government Departments of the Eastern Cape Province). This was considered important as the province, with an estimated population of 7 million people (STATSsa, 2015) was among the poorest and most poorly governed in the Republic, hence any meaningful research in this context had to have the ability to positively impact upon the data processes of the departments with a view to improving service delivery for the teeming population. The employment of the PRISMA statement as the means of selecting the literature to review out of the vast array of literature in the data governance domain was discussed, followed by an exposition of the survey instrument for the empirical data collection phase of the study. This was followed by a presentation of the envisaged data analysis process and the overall research strategy. The chapter concluded with a discussion of evaluation criteria for the study as well as the ethics binding the researcher within the confines of known research principles.

Chapters 3, 4 and 5 formed the three critical chapters where the epistemology grounding the conceptual model was explained. The three chapters attempted to answer the sub-questions for the research by examining the contents and context of the research in great depth. Sub-question 1 which was stated as, **"What is the importance of maturity models in evaluating available data governance processes in the Eastern Cape Government Departments?"** was answered by Chapter 5 which discussed five maturity models which were considered relevant to the DGMEM. The importance and import of maturity models in evaluating maturity of data governance processes was discussed, as well as the justification of an entirely new maturity model instead of adapting one of the already existing ones. Chapter 4 was matched to sub-question 2 which asked, "**What are the components of an effective data governance framework required to support data management in the Eastern Cape Government Departments?**". The chapter sought to answer this sub-question through a cursory examination of current corporate governance, IT governance and data governance processes in the province. This was done to gain an in-depth knowledge of data processes that existed currently within the department. The sparsity of information in this regard led the researcher to embark on a needs analysis survey to ascertain the level or non-existence of data governance in the departments. The result of that survey was presented in Section 4.4, Chapter 4, by means of pie charts. The survey further served to reinforce the fact that data governance was not structured in the departments hence the need for a maturity evaluation model to gauge data governance activities. Chapter 4 also provided answers to sub-question 3, "**How do existing**

current data governance practices in the Eastern Cape Government Departments align with international best practice frameworks such as COBIT and ISO/IEC 38500?". The data management principles of these two frameworks were discussed in Section 4.2.1 and 4.2.2 respectively. The literature revealed that the attributes of an effective data governance programme as advocated by COBIT 5 were absent in the departments. The final sub-question, **"How will data governance components within the maturity evaluation model assist the departments in ensuring better governance of their data assets?"** formed a consistent thread throughout the literature review. Chapters 3 and 4 presented the components of an effective data governance programme as found in literature and in the COBIT 5 / ISO/IEC frameworks respectively in tabular form (Sections 3.7, Chapter 3 and Table 4.2, Chapter 4). The discussions of maturity models in section 5.4 of Chapter 5 also deliberated at length the benefits of a maturity model and how it could serve to enhance the data governance and management processes in the Eastern Cape Government Departments. The literature review synthesised the entire findings from secondary literature, with the results of the needs analysis and thereafter produced a conceptual data governance evaluation model in Chapter 6 of the study.

The conceptual data governance maturity evaluation model was constructed based on the outcome of the literature reviewed in Chapters Three to Five. This was in accordance with the methodological process of Peffers et al. (2008), which was depicted in Figure 2.4, Chaper 2. The Peffers process stage where the model was developed was the second stage which referred to having an **objective-centred solution**. It is important to note that the attribute of a mental mode which Peffers et al. alluded to in their paper was a reference point in the construction of the artefact (Peffers et al., 2008, p.10). The components of the model were also heavily infuenced by the IBM 2007 maturity model. The chapter presented a comprehensive, step by step explanation of the model, its components and how it was regarded as a fit in the context of the pragmatic worldview of this research for solving data governance problems in the departments. Arguably, the critical issues which informed the components of data governance included on the model were influenced by the context of the study; the government departments of the Eastern Cape, and findings from reviewing literature on the best approach to developing a solution in the domain at hand. A discussion of the elements which impacted on a model was held in section 6.3 of Chapter 6. Some of the major factors considered in the context of the study included recurring challenges relating to data accuracy in government departments; the enormous risk presented by undue and authorised access to organisational data as exemplified

by various data breaches in recent times; the consistent audit failure of EC Departments in the annual Auditor General's reports; the millennium development goals of the South African Government (NDP 2030) and the availability, but inadequate use of, international best practices for data governance (Soares, 2015; Eckerson, 2014; DPSA, 2013). The chapter wove an intricate account of the literature and contextual base of the research objective into the explanation of all components of the conceptual model.

Chapters 7, 8 and 9 constituted the third phase of the study. Chapter 7 embarked on the empirical validation of the DGMEM which was presented in Figure 6.2, Chapter 6. As alluded in Chapter 2, the method of data collection and analyis adopted by the researcher was the sequential expolratory method. This aligned with the pragmatic paradigm of the study in building an artefact which was able to solve real life 'wicked problems'(Pries-Heje & Baskerville, 2008). The process of data collection and analysis through the use of the NVivo 11 software was discussed and the resultant findings from the data were presented. Furthermore, findings from the focus group activities were discussed. Chapter 8 was thereafter dedicated to a discussion of the implications of findings for the DGMEM as a result of the data. In Chapter 9, the outcome of the qualitative phase of the data analysis led to the formulation of the questions for the quantitative strand, in line with the principles of an exploratory sequential mixed methods study. The quantitative inquiry was by means of a 5-point Likert scale questionnaire which was hosted on Google Forms. The datasets were analysed using SPSS version 24 and presented in tables and graphs. Chapter 10 summarised the entire research and presented some reflections on different aspects of the study. The chapter also made suggestions for future research before giving some concluding remarks. The next section of the study is dedicated to reflections of the researcher on different aspects of the research.

10.3 Contribution of Research to Body of Knowledge

The main contribution made by this study to the body of knowledge in the data governance domain is the Data Governance Maturity Evaluation Model (DGMEM). This model is proposed as a guide for government departments to evaluate their 'as is' state in the area of governing and managing their data assets. The idea is to take steps toward moving from their current state into a more improved, more efficient stage. Such a stage would offer better value and more efficient results to how data is managed in the departments. The model also includes a process-based document which depicts the steps which need to be taken in order for them to move from one maturity level to another on the data governance spectrum. Although there are a number of maturity models currently in existence, the researcher is not aware of any maturity

evaluation model which is tailored for the peculiar needs of public enterprises in the Republic of South Africa such as the DGMEM. The next section of the study describes the theoretical contribution made by the model to the existing body of knowledge.

10.3.1 Theoretical Contribution

According to Rugg and Petre, (2010), the claim to have made a significant or orginal contribution to the body of knowledge in an area of inquiry must be substantiated by the evidence of the contribution. This can be done by answering four important questions:

1. What is the contribution?
2. Why is it important?
3. How will it enhance or improve knowledge in its area?
4. Where would the benefits accruable from the contribution be felt, in other words, what are the expected outcomes of the contribution in the chosen domain?

Rugg and Petre (2010) and Holweg and Van Donk (2009), state that conceptual frameworks or models serve different purposes depending on the context of study. For this study, the DGMEM is aligned to the description of Rugg and Petre (2010) which speaks to the implemention of a theoretical principle, showing how it can be applied in practice; making the ideas or components tangible and demonstrating through empirical inquiry that the concept is relatable to stakeholders in its context and has the ability to lead to process improvement in its chosen field. To this end, the theoretical contribution of the DGMEM is the fact that it is theory driven, and the theories have been supported and validated by intense empirical findings from stakeholders in the government departments of the Eastern Cape. All three sources of data collection and analyses have proved beyond reasonable doubt that the model is applicable in government departments and the mean score of 4.32/5 regarding the applicability of the model assures that the model has the capability to solve a real life problem of data governance in these departments. The theoretical contribution for this study was achieved through adherence to sound principles of a methodological literature review as exemplied by the PRISMA statement, the grounding of the solution domain in the Contingency and Institutional Theories and the building of the artefact based on Design Science principles. The benchmarking of the solution artefact processes against international IT and data governance frameworks such as COBIT 5 and ISO/IEC 38500 also ensured a sound theoretical contribution of the artefact to the body of knowledge in its domain.

10.3.2 Methodological Contribution

A methodological contribution relates to suitably and correctly applying theoretical concepts and theories developed in other contexts to a current study (Cooper & Schindler, 2010). The successful application of concepts and theories developed in other contexts to this research is further proof of its scientific foundation and the fact that the research can be replicated using the same tools and methods. The pragmatist philosophy asserts that there is no single best 'scientific' method that can lead the way to indisputable knowledge (Creswell, 2014; Bunniss & Kelly, 2010; Guba & Lincoln, 1994).

Methodological is concerned with the various tools that are used to collect and analyse data in the attempt to find answers to the research question (Cooper & Schindler, 2010). The main methodological contribution of this research is the application of Pragmatism as a paradigm. Pragmatism asserts that truth is what works best in providing a solution to the research problem at hand and does not hold an absolute view of 'how to' obtain a solution to the research problem. A robust discussion of Pragmatism as a paradigm has been conducted in Section 2.3, Chapter 2 of the study. Pragmatism allowed the researcher to conduct a thorough empirical test of the model based on the exploratory sequential mixed methods data collection and analysis process as there were no limitations imposed by the restrictions of other world views which embrace a certain kind of data collection method. That is, Positivism is aligned to quantitative inquiry.

Another methodological contribution of the study is the Design Science Process of Peffers as the method for constucting the artefact. A combination of this method and the application of both the Contingency and Institutional Theories to the process of building an artefact resulted in a model which can be applied to solve a "real life" problem. This is a very important factor in the current research 'world order' where universities are no longer encouraged to be ivory towers, but required to produce research which is relevant to solving societal problems (Khazragui & Hudson, 2014).

10.3.3 Practical Contribution

The DGMEM makes a practical contribution to the body of knowledge in the data governance domain by providing a structured approach for public enterprises to manage their data assets. As discussed in Chapter 5, a maturity model offers a hierachy of improvement processes which can be applied to measure how well a particular aspect of an orgnisational process is managed. The DGMEM (Figure 6.2, Chapter 6) is a model which represents the components of a well

structured, and well managed set of processes for data governance. The model also has a process document with a set of recommended processes which can be used to identify how to move from one level of maturity to another. The DGMEM provides a practical contibution in the following ways:

1. Five levels of maturity;
2. Process of linear ascendancy;
3. Measurement of maturity and improvement processes can be priortised according to department's peculiar needs;
4. The DGMEM process document clearly articulates what is involved in each level of maturity;
5. The model can be used to sell a data governance programme in government departments;
6. The problem of operating data management silos in the departments can be resolved through the implementation of the model across all units in a particular department;
7. Government departments of the Eastern Cape Province can use the model to address audit queries with regards to the validity, accuracy and completeness of data;
8. The expected outcome of using the DGMEM is diagrammed below.

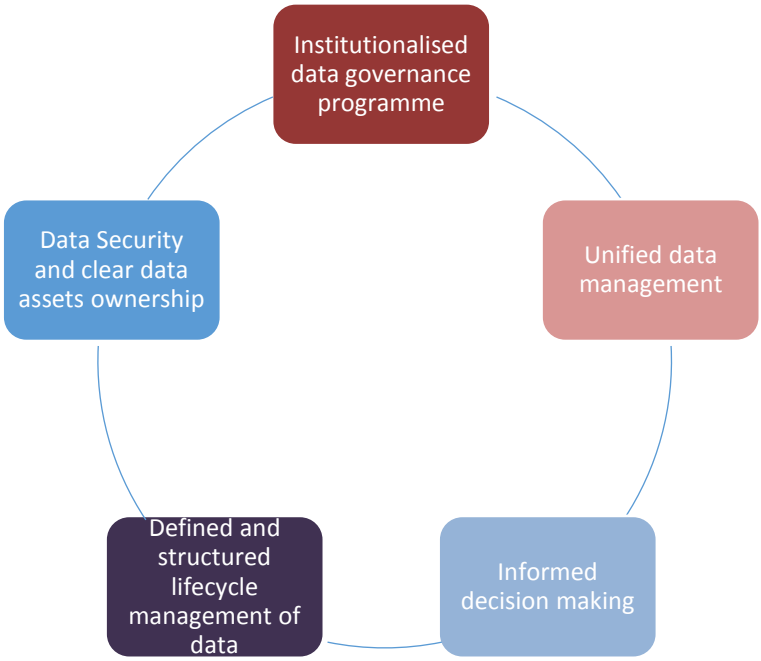

Figure 10.1: Expected Outcomes of Implementing the DGMEM

10.3.4 Assesment of Research Contribution

As discussed in Chapter One of this study, data governance covered much more than data for its own sake. The argument of setting governance parameters for data assets resonated in the fact that data was central and key to succesful forecasting, fiscal planning and accurate future growth projections. Based on findings from the quantitative questionnaire, which was completed by participants with a view of the model and attendant maturity processes document, it was opined that the model was relevant, relatable and also applicable in their contexts. The model has therefore made a practical contribution towards creating an awareness of what data governance entailed and the required action plan to move from one level of maturity to another on the critical aspects of data governance.

According to Whetten and Bentley (2007), there are four important factors to be considered when an assesment of a doctoral contribution to the body of knowledge is being made. These factors are:

1. What factors should form part of the contribution's explanation?
2. How are the chosen factors interrelated?
3. Why are the selected factors chosen over other available factors in the same domain?
4. What are the underlying theories supporting the model?

The answers to these questions posed by Whitten and Bentley (2007) have been asnwered consistently in the course of writing up this research. The very nature of the methodology guiding this research includes the continous evaluation of the artefact's components based on literature and situational context of the government departments in question. The next section discusses the evaluation criteria followed by this research.

10.4 Research Evaluation

According to Herselman and Botha (2015), evaluation is an important and crucial activity in the DSR process because it is the proof of whether an artefact works in its context or not. It is important to decide on the evaluation criteria for an artefact based on the objective of the study. This encompassess the **what**, **where** and **how** according to which the said artefact will be evaluated. Hevner et al. (2004) already provide guidance on how to conduct Design Science research. However, evidence of a rigorous design evaluation should consist of such criteria as the validity, utility, quality and efficacy of the artefact (Herselman & Botha, 2015). Evaluation is critical to ensuring both the credibility and integrity of a design artefact. The criteria listed are discussed in relation with the study on Table10.1 below:

Table 10.1: Research Evaluation Criteria as applied to this Study

Evaluation Criteria	Application to this study
Validity - are we building the right artefact to solve the research problem?	The resercher believes very firmly that the DGMEM is the right artefact in assisting the departments to better manage their data assets. The process of data collection and analysis revealed a lack of stucture; the evidence from the three sources of data collected all revealed that the DGMEM is applicable in their work context.
Utility - Is the model able to produce the desired results in its given context?	The DGMEM has been shown, through its availability to participants on the qualitative phase of data collection, to be considered as a useful tool in measuring data governance 'as is' and to enable the departments to move from one maturity level to another.
Quality - Is the artefact able to stand the test of time and rigour?	As the DGMEM was produced based on carefully selected literature in the data governance and maturity model domains, and the guidelines for artefact development process was engaged by the reseacher, it is believed that the artefact which was developed out of this level of methodological rigour can stand the test of time and rigour.
Efficacy - How useful and dynamic did the target audience find the artefact?	Based on a mean score of 4. 6/ 5 recorded in the SPSS analysis, it can be confidently assumed that the model is considered as useful and usable for the intended purpose.
Summary	The DGMEM has been evaluated based on the four given criteria and has met the requirement of an artefact evaluation process.

10.4 Personal Reflections

The past three years have been an amazing journey into a depth of knowledge that is inexhaustible. I came into the doctoral programme believing that I understood the fundamentals of research, having competed two masters degrees previously. The process of building the artefact in question (the DGMEM) has completely cured me of that belief.

As Design Science recommends bulding artefacts to solve real life problems iteratively, there were so many angles and undulations to the process of ensuring the problem had relevance, that the context acknowledged the problem and that the solution could be applied to solve the

problem. The choice of Pragmatism as a paradigm for the study also made me question my worldview on some seemingly 'absolute' truths. In all, I have grown tremendously both in conceptualising ideas, and in observing the world around me through critical lenses while thinking about what is possible. The research process has also freed my mind from the "success as a measure" orientation resulting from my background and the result-driven society I come from, hence I currently view all of life as interconnected and humans with the ability to pragmatically find unlikely ways of making changes to systems and improving the lot of mankind.

In trying to gather data from government departments for this study, I have met different people from diverse walks of life. One lesson taken away from all the meetings is that the complexity of people is not neccesarily a negative attribute. Those who made the most useful contributions to this study were those who I felt would not assist in the course of the work. The experience of presenting my work at conferences has also added to my depth of knowledge about my own 'selfhood' and given me more patience with others. In summary, this journey has been both about finding answers to a research question and finding the rest of me in the process.

10.5 Conclusion

The study presented a compelling argument for a maturity model that could assist the government departments of the Eastern Cape Province to govern their data assets. An exploratory inquiry into the data processes of the Province's government departments has shown a lack of structure in the way data is handled. The situation is undesirable, and could lead to dire consequences, considering the significance of accurate, complete and verifiable data to the fiscal and strategic planning of developmental governance in the current information age.

The study's context, the Eastern Cape Province, which has an estimated population of seven million people is reputedly among the poorest and most poorly governed in the Republic, hence any meaningful research in this context should have the ability to positively impact upon the data processes of the departments with a view to improving service delivery for the teeming population. It is believed that accurate, timely and verifiable data is critical to the usefulness of information, which creates knowledge; and is a singular, most important factor in the attempt by government to have a sound theoretical and factual basis for their strategic and fiscal planning.

A conceptual maturity evaluation model (DGMEM) was developed from extant literature. The model was thereafter tested rigorously through an exploratory sequential mixed method data collection and analysis process. The final artefact, which was built through the Peffer's et al. (2008) Design Science process, and based on Hevner et al.(2004) seven design science guidelines was tested by empirical data collection across seven departments in the Eastern Cape Province. The consistency and reliability of the findings across the diverse work processes in these departments has given the researcher confidence that the model can be applied across a broad spectrum of public enterprises. The DGMEM is thus considered a veritable tool for the departments to evaluate their current data processes, with a view to incrementally improve on their data governance processes by following the guidelines of the

DGMEM and its various data components, with the help of the Process document. It is thus averred that the government departments of the Eastern Cape Province will be better positioned to manage their data assets if the model is implemented in the various departments.

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Appendices

Appendix A- Ethical clearance certificate

University of Fort Hare
Together in Excellence

ETHICAL CLEARANCE CERTIFICATE
REC-270710-028-RA Level 01

Certificate Reference Number:	HER061SOLA01
Project title:	**A Data Governance Maturity Evaluation Model to enhance Data Management in Eastern Cape Government departments.**
Nature of Project:	PhD
Principal Researcher:	Olutoyin Olaitan
Supervisor:	Prof M Herselman
Co-supervisor:	Dr N Wayi

On behalf of the University of Fort Hare's Research Ethics Committee (UREC) I hereby give ethical approval in respect of the undertakings contained in the above-mentioned project and research instrument(s). Should any other instruments be used, these require separate authorization. The Researcher may therefore commence with the research as from the date of this certificate, using the reference number indicated above.

Please note that the UREC must be informed immediately of

- Any material change in the conditions or undertakings mentioned in the document
- Any material breaches of ethical undertakings or events that impact upon the ethical conduct of the research

The Principal Researcher must report to the UREC in the prescribed format, where applicable, annually, and at the end of the project, in respect of ethical compliance.

Special conditions: Research that includes children as per the official regulations of the act must take the following into account:

Note: The UREC is aware of the provisions of s71 of the National Health Act 61 of 2003 and that matters pertaining to obtaining the Minister's consent are under discussion and remain unresolved. Nonetheless, as was decided at a meeting between the National Health Research Ethics Committee and stakeholders on 6 June 2013, university ethics committees may continue to grant ethical clearance for research involving children without the Minister's consent, provided that the prescripts of the previous rules have been met. This certificate is granted in terms of this agreement.

The UREC retains the right to

- Withdraw or amend this Ethical Clearance Certificate if
  - Any unethical principal or practices are revealed or suspected
  - Relevant information has been withheld or misrepresented
  - Regulatory changes of whatsoever nature so require
  - The conditions contained in the Certificate have not been adhered to

- Request access to any information or data at any time during the course or after completion of the project.

- In addition to the need to comply with the highest level of ethical conduct principle investigators must report back annually as an evaluation and monitoring mechanism on the progress being made by the research. Such a report must be sent to the Dean of Research's office

The Ethics Committee wished you well in your research.

Yours sincerely

Professor Gideon de Wet
Dean of Research

15 June 2016

Appendix B- Needs analysis questionnaire

A Data Governance Maturity Evaluation Model to enhance Data Management in Eastern Cape Government Departments

Introduction

Thank you for taking time to participate in this academic exercise for a doctoral thesis in the Department of Information Systems, University of Fort Hare, East London, South Africa. The estimated time for the completion of this questionnaire is 30 minutes. Please be assured of the confidentiality of your identity and responses. Your responses will only be used for academic purposes. The researcher is bound by the code of ethics stipulated in her ethical clearance certificate no HER061SOLA01. Please find below an Informed consent form for your signature signalling your agreement to wilfully participate in the survey. Thank you.

Informed Consent Form

Informed Consent: A Data Governance Maturity Evaluation Model to enhance Data Management in Eastern Cape Government Departments

Principal Investigator: Olutoyin. Olaitan

Supervisor: Professor Marlien Herselman

Co-supervisor: Dr Ntombovuyo Wayi

Dear Participant

Thank you for taking time to participate in this evaluation exercise meant for an academic research project. Kindly see it as your contribution towards the furtherance of effective governance in South Africa through the use of accurate data for fiscal planning. The goal of the study is to produce a Data Governance Maturity Evaluation model which the departments can use to measure their level of maturity in terms of effective data governance practices aligned with global trends. This will assist stakeholders and custodians of data assets in government departments to understand how to best manage data as a critical asset and also showcase a process-based approach to managing data more effectively.

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confidential and there will be no “come-backs” from the answers you give. Please feel free to contact me (Olaitan Olutoyin) on telephone number 0767815033 if you require further clarifications. Thank you.

INFORMED CONSENT FORM

I hereby agree to participate in research regarding data governance in government departments. I understand that I am participating freely and without being forced in any way to do so. I also understand that I can stop this interview at any point should I not want to continue and that this decision will not in any way affect me negatively. I understand that this is a research project whose purpose is not necessarily to benefit me personally. I have received the telephone number of a person to contact should I need to speak about any issues which may arise in this interview. I understand that this consent form will not be linked to the questionnaire, and that my answers will remain confidential.

……..

Signature of participant Date……..

Question 1: Please rate the level of awareness about data governance in your department?

Very high	High	Averagely high	Low	Very low

Question 2: Please rate the level of awareness about available data governance policies in your department?

Very high	High	Averagely high	Low	Very low

Question 3: What id the level of awareness regarding the available capabilities or data governance programmes in your department

Very high	High	Averagely high	Low	Very low

Question 4: How would you rate your awareness of data governance roles and responsibilities?

Very high	High	Averagely high	Low	Very low

Question 5: To what degree is data governance formally instituted in your organisation?

Very high	High	Averagely high	Low	Very low

Question 6: How important is the implementation of a toolset for the development and implementation of data governance in your organisation?

Very important	Important	Somewhat important	Not important	Not needed

Question 7: Are there adequate technological and people capabilities in place to actively manage metadata within the organisation?

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree

Question 8: Do you think data assets in the department are currently being optimised?

Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree

Thank you for your time.

Appendix C- Qualitative Questionnaire

A Data Governance Maturity Evaluation Model to enhance Data Management in Eastern Cape Government Departments

Introduction

Thank you for taking time to participate in this academic exercise for a doctoral thesis in the Department of Information Systems, University of Fort Hare, East London, South Africa. The estimated time for the completion of this questionnaire is 30 minutes. Please be assured of the confidentiality of your identity and responses. Your responses will only be used for academic purposes. The researcher is bound by the code of ethics stipulated in her ethical clearance certificate no HER061SOLA01. Please find below an Informed consent form for your signature signalling your agreement to wilfully participate in the survey. Thank you.

Informed Consent Form

Informed Consent: A Data Governance Maturity Evaluation Model to enhance Data Management in Eastern Cape Government Departments

Principal Investigator: Olutoyin. Olaitan

Supervisor: Professor Marlien Herselman

Co-supervisor: Dr Ntombovuyo Wayi

Dear Participant

Thank you for taking time to participate in this evaluation exercise meant for an academic research project. Kindly see it as your contribution towards the furtherance of effective governance in South Africa through the use of accurate data for fiscal planning. The goal of the study is to produce a Data Governance Maturity Evaluation model which the departments can use to measure their level of maturity in terms of effective data governance practices aligned with global trends. This will assist stakeholders and custodians of data assets in government departments to understand how to best manage data as a critical asset and also showcase a process-based approach to managing data more effectively.

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……..

Signature of participant Date:……..

Demographic Information

What is your gender? Please mark with an X

Male	Female

What is your age group?

60 years and above	59- 45 years	44- 25 years	Less than 25 years

In what way are you involved in data handling/data management and data governance processes in the department?

Questions start from here and are divided into sections according to the Conceptual model and research questions.

Rules and rules of engagement for data governance

1.	What are the policies for data collection/ data input and data archiving in the department?
2.	Do you believe there is consistence in the way data is collected, handled and archived in the department? Please give reasons for your answer.
3.	Are the rules of data collection/input and archiving consistently being followed in your department? If yes, kindly substantiate your answer, if no, please give reasons why not.
4.	What kinds of policies are in place for the revocation of data authority and data access should the need arise?
5.	Are the rules of data collection/input and archiving consistently being followed in your department? If yes, kindly substantiate your answer, if no, please give reasons why not.
6.	How much control does the department have over the privacy of data assets in the hands of consultants / external stakeholders?

People and Process Capabilities

1.	What functional structures are currently in place for data governance in the department?
2.	How data roles are assigned across the department i.e. who captures the data and who verifies it?
3.	Does the department have dedicated data stewards? Are they domiciled in business or in IT?

4.	How does the process of data capture / nomenclature currently work in the department?
5.	Describe the processes in place for the governance of departmental data
6.	How are the processes of data entry, verification and authentication supported by available technology artefacts in your department?
7.	How are the current data handling processes in your department aligned to international IT governance frameworks such as COBIT and ITIL?
8.	What are the processes in place for the resolution of data issues, specification of data quality requirements and the establishment of accountability?
9.	What are the processes in place for the enforcement of decision rights regarding data assets of the department?

Data Quality

1.	How does the department account for the truthfulness and accuracy of data in the various units?
2.	What are the data quality tools available in the department?
3.	How often is data audit conducted in the department and what kind of event prompts such audit?
4.	How often is data monitoring and cleansing carried out within the department?
5.	State the problems caused by poor data quality which the department is currently experiencing?

Compliance and Risk Management

1.	**1.** How does the department ensure compliance with government laws and policies regarding the handling of data assets?
2.	**2.** How does the department ensure that data is delivered to end users in a timely, accurate, consistent and usable format?
3.	**3.** What are the protocols in place to ensure data is delivered to all stakeholders through the most economical and optimal use of departmental resources?

Metadata Management

1.	Describe the process of metadata management in your department?
2.	Are you aware of a metadata common language repository within the department? Please explain your choice of answer
3.	Which team or personnel is in charge of metadata for both storage and retrieval?
4.	What are the processes in place for access restrictions, decision rights and accountability for metadata?
5.	What technological capabilities are in place for managing metadata?

Data Security and Privacy Management

1.	Describe the process of data security management within the department
2.	What prompts the audit of data security and privacy settings and how often does this take place?

3.	Describe the protocol for the classification, administration and authentication of sensitive data?
4.	By what process are access and decision rights to structured and unstructured data determined?
5.	Describe the protocols in place to address and mitigate possible data breaches

Information Lifecycle Management

1.	How is data managed from inception to deletion?
2.	What are the challenges faced by the department in managing data throughout its lifecycle?
3.	What are the challenges faced by the department in managing data throughout its lifecycle?
4.	What are the policies/ protocols in place to determine the lifecycle of categories of departmental data?
5.	What category of employees have the right to sort, retrieve or delete archived data?
6.	Do you think all data stakeholders understand the importance of correctly managing data throughout its lifecycle? Please explain your answer.
7.	What are the measures in place to manage potential risks that may arise with regards to the department's data assets?
8.	How does the department protect sensitive data from unauthorised disclosure?
9.	How many data entry points are you aware of in the department? Please list all.
10.	What kinds of rules exist for data collection/ data input and data archiving in your department?

Thank you for your time.

Appendix D- Quantitative Questionnaire

Quantitative Questionnaire

Section 1: Introduction and Background to the Study

Thank you for taking time to participate in this academic exercise for a doctoral thesis in the Department of Information Systems, University of Fort Hare, East London, South Africa. The estimated time for the completion of this questionnaire is 30 minutes. Please be assured of the confidentiality of your identity and responses. Your responses will only be used for academic purposes. The researcher is bound by the code of ethics stipulated in her ethical clearance certificate no HER061SOLA01. Please find below an Informed consent form for your signature signalling your agreement to wilfully participate in the survey. Thank you.

Section 2: Informed Consent Form

Informed Consent: A Data Governance Maturity Evaluation Model to enhance Data Management in Eastern Cape Government Departments

Principal Investigator: Olutoyin. Olaitan

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Section 3- Demographic Information

1. What is your gender?
2. What is your age group?
3. How long have you worked in this department?
4. In what way are you involved in data handling/data management and data governance processes in the department?

Section 4- All questions are rated equally on Likert scale of 5-1, with the weighting being as follows;

1. Strongly agree
2. Agree
3. Neither agree or disagree
4. Strongly Disagree
5. Disagree

Section 1: **Applicability of the Data Governance Maturity Evaluation Model (DGMEM)**

1) Strongly Agree 2) Agree 3) Neither agree nor disagree 4) Strongly Disagree 5) Disagree					
	1	**2**	**3**	**4**	**5**
1. The DGMEM is a useful tool to evaluate data governance maturity in my department.					
2. I am able to relate to all the components of the secondary focus areas of the DGMEM.					
3. It is possible to evaluate the maturity level of this department based on this model.					
4. I am able to relate to all the components of the primary focus areas of the DGMEM.					
5. The processes on the DGMEM for measuring data governance maturity will ensure the verifiability, completeness and accuracy of data.					
6. The lifecycle of data will be better managed with the components of the process areas of the DGMEM.					
7. Issues of data security and privacy have been adequately addressed by the DGMEM process document.					
8. The model has addressed and incorporated data management processes relevant to my department.					
9. The importance and management of metadata is adequately covered in the DGMEM.					
10. Regulatory compliance and audit requirements will be met if the DGMEM is implemented in my department.					

1) Strongly Agree 2) Agree 3) Neither agree nor disagree 4) Strongly Disagree 5) Disagree					
	1	**2**	**3**	**4**	**5**
11. Both the primary and secondary process areas of the DGMEM present a full picture of our data needs.					

Section 5- People, Policies and Process Capabilities

1) Strongly Agree 2) Agree 3) Neither agree nor disagree 4) Strongly Disagree 5) Disagree					
	1	**2**	**3**	**4**	**5**
12. We have all three components of the enabling departmental structures for an effective data governance programme i.e. Stewardship, Policies and Processes.					
13. I believe there are capable human/ capacity resources to activate/ action the processes required in the process model for the DGMEM					
14. There are adequate policies in place to ensure the successful implementation of data governance processes in the department.					
15. I believe my department is able to incrementally achieve the maturity levels based on the process document.					
16. There are dedicated data stewards to ensure the successful graduation from one maturity level to another within the department.					

Section 6- Alignment of COBIT 5/ ISO/IEC 38500 to Data Processes on the DGMEM

	1) Strongly Agree 2) Agree 3) Neither agree nor disagree 4) Strongly Disagree 5) Disagree				
	1	**2**	**3**	**4**	**5**
17. The process areas of the DGMEM match to COBIT 5 and ISO/IEC 38500 principles of data governance.					
18. There is no correlation between COBIT 5 and ISO/IEC 38500 and the work processes in the department.					
19. We have been adequately trained in COBIT 5 and ISO/IEC 38500 IT/ data governance processes.					
20. I am familiar with the process requirements for data governance in these frameworks.					
21. There is clear information ownership as stipulated by COBIT 5 in my department.					

	1) Strongly Agree 2) Agree 3) Neither agree nor disagree 4) Strongly Disagree 5) Disagree				
	1	**2**	**3**	**4**	**5**
22. There is a clear and usable enterprise architecture for data efficiency as stipulated by COBIT 5/ ISO/IEC 38500 in my department.					
23. The department has a clearly articulated plan-objective-architecture for data governance.					
24. Enterprise resources and service capabilities as outlined by COBIT are present in my department. 25. The storage, sharing and disposal of data according to agreed conventions is in place within my department.					
26. Data systems are well designed and well documented in my department.					
27. There is clear definition, classification and security control of data assets in my department.					
28. There is a unique identification of users with their access levels in my department.					
29. Compliance guidelines are enforced with consultants and contractors dealing with departmental data					

Section 7- Expected results from the implementation of the DGMEM

1) Strongly Agree 2) Agree 3) Neither agree nor disagree 4) Strongly Disagree 5) Disagree						
30. The DGMEM will assist us in achieving better data quality.						
31. Issues of access rights and authentication will be better defined through the DGMEM.						
32. I believe the DGMEM will encourage the department to seek a higher maturity level						
33. The DGMEM will have no impact whatsoever on our data processes.						
34. Issues of data security and privacy will be resolved if the DGMEM is implemented						
35. Regulatory compliance will no longer be an audit problem if the DGMEM is implemented.						

36. Data management issues can be resolved with the DGMEM.						
37. The DGMEM will help to create the necessary buy-in for data governance in the department.						

Section 8- Missing Components of the DGMEM

	1) Strongly Agree 2) Agree 3) Neither agree nor disagree 4) Strongly Disagree 5) Disagree				
	1	**2**	**3**	**4**	**5**
38. There are data elements in my department which are not on this model.					
39. There are data elements on the model which are not relevant to my department.					
40. The DGMEM needs to be reconstructed to suit my department's needs.					
41. I believe the DGMEM, as it is, has all the data elements for a successful data governance maturity evaluation suitable for my department.					
42. The DGMEM process model is too complicated to work in my department.					

Thank you for your time.

Appendix E- enclosed CD Rom

Appendix F- Turnitin Report

Appendix G- Proofreading certificate