

The use of systems development methodologies in the development of e-government systems

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PREFACE AND ACKNOWLEDGEMENTS

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Lastly, I give all my thanks to the Almighty, for the strength and the opportunity He has giving me.

DECLARATION

I, Lesego Tshgofatso Ditibane hereby declare that this mini-dissertation is my original work done under the supervision of the Faculty of Natural Science, Potchefstroom Campus and has not been written for or submitted to any other Institution of higher education. I further declare that all information provided and the data sources quoted have been indicated and acknowledged in a list of references.

Signature:

September 2014

ABSTRACT

The development of e-government systems in South Africa has raised major concerns when coming to the systems development methodology used. Through the literature review conducted and the data collected, the study has indicated that there is lack of uniformity, isolated cost, models for choosing project teams and the overall control of the whole process of e-government systems development. As a result, this research investigates the use of systems development methodologies in the development of e-government systems.

The study followed the qualitative research method; interviews were conducted in four case studies involved in the development of e-government systems. The collected data were then analysed using a software analytical tool called Atlas ti. 6.1.

Subsequently a cross-case analysis was performed on the four case studies. The research findings of this study indicated that the appropriate use of systems development methodologies in the development of e-government systems helps improve the quality of e-government systems, reduces development costs, and also makes the development process effective and efficient.

Based on the information gathered from the four case studies, developers in government find it difficult to select a suitable systems development methodology to use when developing e-government systems. Therefore the study proposes a conceptual framework that can be used to select the appropriate systems development methodology when developing e-government systems. This framework is made up of characteristics of e-government systems and different types of systems development methodologies.

Keywords: e-government systems, systems development methodology, developers, conceptual framework, theoretical framework.

OPSOMMING

Die ontwikkeling van e-regeringstelsels in Suid-Afrika het groot probleme opgelewer wanneer dit kom by die stelselontwikkelingsmetodologie wat gebruik word. Deur die literatuursoektog wat gedoen is en die data wat versamel is, het die studie uitgewys dat daar 'n gebrek aan uniformiteit is, 'n probleem met geïsoleerde koste, watter modelle om te gebruik om projekspanne saam te stel, sowel as die oorhoofse beheer van die hele proses van e-regeringstelselontwikkeling.

Hierdie studie het dus ten doel gehad om die gebruik van stelselontwikkelingsmetodologieë te ondersoek vir doeleindes van die ontwikkeling van e-regeringstelsels. Die studie is gedoen volgens die kwalitatiewe navorsingsmetode; onderhoude is gevoer in vier gevallestudies met mense wat betrokke is in die ontwikkeling van e-regeringstelsels. Die data wat versamel is, is daarna ontleed met die gebruik van 'n sagteware-ontledingsstelsel bekend as Atlas ti. 6.1.

Daarna is 'n kruisvalle-analise gedoen op die vier gevallestudies. Die navorsingsbevindinge van die studie het uitgewys dat die toepaslike gebruik van stelselontwikkelingsmetodologieë help om die kwaliteit van e-regeringstelsels te verbeter, om die ontwikkelingskoste te verlaag, en ook om die ontwikkelingsproses effektief en doelmatig te maak.

Op die basis van die inligting wat bekom is uit die vier gevallestudies kom dit voor dat ontwikkelaars in die regering dit moeilik vind om te besluit watter toepaslike stelselontwikkelingsmetodologie om te gebruik. Die studie beveel dus 'n konseptuele raamwerk aan wat gebruik kan word om die toepaslike stelselontwikkelingsmetodologie te kies waarbinne sodanige e-regeringstelsels ontwikkel moet word. Hierdie raamwerk bestaan uit kenmerke van e-regeringstelsels en verskillende soorte stelselontwikkelingsmetodologieë.

Sleutelwoorde: e-regeringstelsels, stelselontwikkelingsmetodologie, ontwikkelaars, konseptuele raamwerk, teoretiese raamwerk.

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LIST OF ACRONYMS

ACRONYMS	DESCRIPTION
ADAPT	Application Development and Processing Techniques
ALCM	Application life cycle management
CIO	Chief Information Officer
DBA	Database Administrator
DFD	Data-Flow Diagram
ERD	Entity Relationship Diagram
ERM	Enterprise Resource Management
ETHICS	Effective Technical and Human Implementation of Computer-based Systems.
G2B	Government to Business
G2C	Government-to-Citizen
G2E	Government to Employee
G2G	Government to Government
ICT	Information, Communication and Technology
IE	Information Engineering
ISD	Information Systems Development
IT	Information Technology
PERSAL	Personnel and Salary
PT1	Project type 1
RFI	Request for Information
RFP	Request for proposal
RUP	Rational Unified Processes
SAS	Statistical Analysis Software
SDLC	Systems Development Life Cycle
SDM	Systems development methodology
SSM	Soft systems methodology
STRDIS	Structured Analysis, Design and Implementation of Information Systems
UC	Unique characteristics
UML	Unified Modelling Languages
XP	Extreme Programming

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CHAPTER 1: INTRODUCTION AND MOTIVATION

1.1 Introduction

This Chapter presents the motivations of this study and the problem statement. The research aims and objectives are also discussed, as well as the methodology used to conduct this research and the significance of the study. The structural design that outlines what to expect from each Chapter of this dissertation is also provided. A brief summary of this Chapter is also provided at the end of this Chapter.

1.2 Motivation and problem statement of this study

e-Government systems are regarded as systems that allow public access, user interaction and also deliver electronic services and government information. The technologies associated with e-business have brought about changes not only in the private sector but also in the public sectors (Wimmer *et al.*, 2008). As a result, government in all divisions and at departmental levels are now using internet technologies to deliver information and services to the society, employees and businesses with which they work (Muir *et al.*, 2002). These systems have also improved government business processes in an effective and efficient manner whereby citizens can now interact with the system rather than going to government offices.

The development of e-government systems has brought about many challenges. Developers of e-government systems find it very difficult to plan and manage the e-government systems development process. In most cases, there have been problems of uniformity, isolated costs or costing of projects, models for choosing project teams and control of the whole process and the bigger picture (Heeks, 2004). At national and provincial delimitations, research has shown that there is no one accepted systems development methodology for developing e-government systems. Different ministries have different approaches and methods to e-government implementations (Wimmer *et al.*, 2008). According to Farelo and Morris (2006), the state of e-government in South Africa is considered to be in its rudimentary stages and they also indicated

that a lack of clear strategies to facilitate the uptake and adoption of e-government as well as the framework as one of the key factors which collectively contribute to such an assessment.

Systems development methodology, on the other hand, is a method that can be used to manage and control these problems. According to Al Ahmar (2010) and Avison and Fitzgerald (2003), systems development methodologies (SDMs) are promoted as a means of improving the management and control of the software development process. They are also important for standardizing the development process and the final product by specifying activities to be done and techniques to be used in a proper and chronological manner.

1.3 Justification of the problem statement

Research conducted by Sensuse and Ramadhan (2012) has indicated that the development process of e-government systems can be very complex and different when compared to the development of common information systems due to some aspects of management and policies that should be considered. The research results from interviews conducted on four companies that are involved in the development of e-government systems, has also indicated that developers of e-government systems especially in government have no knowledge of systems development methodologies. Most developers in government are still using systems development life cycle (SDLC) which is a step by step process of developing systems. Moise and Papo (2008) defined some of the challenges of e-government systems development as of political pressure, quality of information and data, agencies autonomy, inaccuracy, incompleteness and inconsistency. Due to lack of knowledge about systems development methodologies when developing e-government systems, it has been indicated that most e-government systems fail because of improper or poor planning, lack of systems development methodologies framework, lack of control and management procedures of such projects. This research will help in determining how e-government systems are developed and implemented, what systems development methodologies can be used in developing e-government systems and lastly propose a framework that can be used in selecting an appropriate methodology to use for a particular e-government system. The research would be more beneficial to the developers and project managers of e-government of systems and also help in improving the methods, procedures as well as the management thinking when coming to e-government systems development.

1.4 Research aims and objectives

This study focuses on the use of SDMs in the development of e-government systems and addresses the following research objectives:

- *to investigate the SDMs used in the development of e-government systems,*
- *to identify the challenges and problems that are encountered by the developers of e-government systems, and*
- *to determine suitable SDMs that address unique aspects of e-government systems.*

In order to address the above research objectives, a selection of SDMs and e-government systems were analysed, their suitability to the study was justified; their common and unique characteristics as well as their challenges are described. As a result, we wish in this study to develop a uniform framework to be used in the development of e-government systems in the Republic of South Africa.

1.5 Research methodology

This study used the case study approach as a research method. Therefore, four case studies were performed on companies that are involved in the development of e-government systems which are discussed later in this study. Unstructured interviews and literature analysis for data acquisition are applied in this study. The research outcomes are discussed later in Chapter four dealing with research analysis. Again in Chapter four content analysis and cross-case analysis are used as data analysis techniques and a computer programme called ATLAS.ti is used as the qualitative data analysis tool.

1.6 Significance of this study

The significance of this study is mainly located in trying to address the problems encountered in the development of e-government systems. The use of systems development methodologies in

the development of e-government systems is also addressed. According to the information gathered during the interviews, most government agencies involved in the development of e-government systems are still using the old traditional method of developing e-government systems called the systems development life cycle (SDLC) which is time-consuming, requires lots of documentation and filing. As a result, the author in this study saw fit to develop a uniform systems development methodologies framework for the development of e-government systems. The framework comprises the characteristics of the e-government systems being developed and different types of systems development methodologies that can be used. Using systems development methodology will help in solving most of the problems encountered by developers of e-government systems. These concepts of Systems development methodologies, e-government systems and the use of systems development methodology in the development of e-government systems as well as the proposed framework are discussed later in the study.

1.7 Structure of the dissertation

Chapter 1: Introduction

This Chapter discusses the research topic, motivation and problems statement of this study, the research aims and objectives, the research methodology, the significance of this study, the structural organization of this dissertation and the overall summary of this Chapter.

Chapter 2: Literature review

The Chapter provides a literature study of Systems development methodologies, the components of SDMs, background on the selected SDMs used for this study, the advantages and disadvantages of the selected SDMs and the comparison of SDMs based on the type, method, philosophy, process model and the tools and techniques. A background overview of e-government systems is also provided, together with the types of e-government system, the processes of developing e-government system. The challenges and the unique characteristics of e-government systems are also discussed. The use of SDMs in the development is also discussed as well as the proposed framework for selecting a system development methodology for the development of a particular e-government system.

Chapter 3: Research methodology

This Chapter discusses in detail the research methodology, the data-collection method, the research approach method and the method of analysis used to execute this research. The Chapter also includes the research design that gives a structural overview of this research.

Chapter 4: Data analysis

This Chapter focuses on the results analysis and discussions. In this Chapter the data collected from four different companies that are involved in the development of e-government system are critically analysed. Each company's interview results are discussed and propositions formulated thereafter. The interviews are also reported and lastly a *cross-case analysis* is performed in order to generate similar propositions between companies.

Chapter 5: Summary and recommendations

This is the last Chapter of this study. The main purpose of this research was to investigate the use of SDMs in the development of e-government systems. Therefore, this Chapter provides a summary of the findings of the investigation that was conducted, a conclusion of the whole study as well as the author's recommendations for future research.

1.8 Chapter summary

This Chapter dealt with the research topic, the motivation and problem statement which this research aimed to address, the main research aims and objectives, the research methodology, the significance of this study, and the structural organization of this dissertation. The next Chapter discusses in detail the literature study conducted on SDMs, e-government systems and the use of SDMs in the development of e-government systems.

CHAPTER 2: LITERATURE STUDY

2.1 Introduction

As discussed in Chapter 1, the concepts of systems development methodologies (SDMs), e-government systems and the use of SDMs in developing e-government systems are the most important topics that this literature study focused on. Research has indicated that when an information system is designed, there may be different types of SDMs that can be used (Avison & Fitzgerald, 2003, Mihailescu & Mihailescu, 2010).

Figure 2.1 below provides a brief structural overview of this Chapter based on systems development methodologies used in this study and e-government systems development and the use of systems development methodology in the development of e-government systems. Discussions on different components of systems development methodologies, advantages and disadvantages as well as comparisons of these SDMs used in this study based on the philosophy, model process, methods and, tools and techniques are provided. e-Government systems development, the characteristics, the stages of growth on e-government systems development as well as the challenges of e-government systems development are also discussed. The study later combines the two concepts of SDMs and e-government systems in order to determine the use of systems development methodologies in the development of e-government systems. The study also looks at how e-government systems are developed and deals with the notion as to whether SDMs are used in developing those e-government systems.

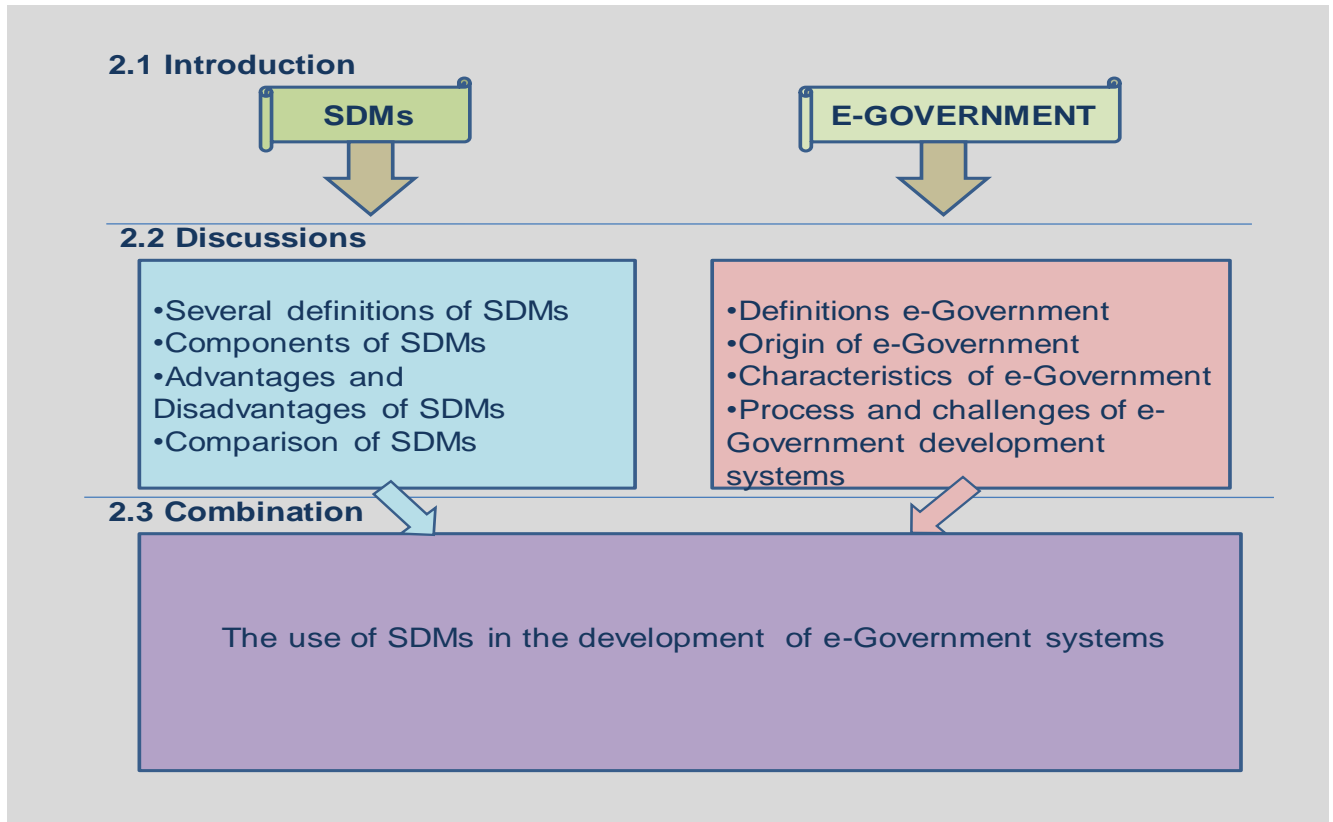


Figure 2. 1: Structure of Chapter 2

The next section of this study discusses the significance of this literature review chapter.

2.2 The significance of this chapter

In this chapter, the author intent to find out what has been written about systems development methodologies, e-Government systems and also identifies the relationship between these two concepts. The aim is for the author to be able to define the strength and weaknesses in the previous work of other researchers so that he/she does not repeat the same mistakes but rather eliminate the potential weaknesses whilst bringing to the front the potential strengths. This chapter of literature review will discusses in detail different systems development methodologies that were selected in this study, the type of e-government systems developed then later combine the two concepts and define how systems development methodologies are used in the development of e-government systems. At the end of this chapter the author should be able to identify the data sources using information gathered from other researchers work, define the research questions and also create ideas for further consideration.

The next section of this study provides a discussion on systems development methodologies selected for purposes of analysis in this dissertation.

2.3 Systems Development Methodologies (SDMs)

This section focuses on defining SDM is, the advantages and disadvantages of the selected SDMs, the components and comparisons of different types of selected SMDs relevant for this study.

2.3.1 Brief overview of SDMs

Systems development methodology (SDM) refers to the framework that is used to structure, plan and control the process of developing a system (Centres for Medicare and Medicaid Services (CMC), 2008). The SDMs are promoted as a means of improving the management and control of the software development process, structuring and simplifying the process, and standardizing the development process and product by specifying activities to be done and techniques to be used in a proper and chronological manner (Al Ahmar, 2010; Avison & Fitzgerald, 2003). In order for us to have a clear understanding of what SDMs are, a summary of different SDM definitions as understood by different researchers is provided in the next section.

2.3.2 Definitions of SDMs

According to Huisman and livari (2006), the term SDM is not easy to define. Avison and Fitzgerald (2006) argue that the term methodology is a much more extensive concept than the term method since there are certain characteristics such as the philosophies that are not implied by method. Table 2.1 consists of a summary of different definitions of SDMs as viewed by different researchers:

Table 2. 1: Selected definitions of SDMs

Researcher	SDMs Definitions
Huisman and livari (2006)	A combination of systems development approaches such as structured approach, object-oriented approach; process models such as linear cycle, spiral models; specific methods such as IE, OMT, UML and specific techniques such as ERD.
Avison and Fitzgerald (2006)	A recommended means to achieve the development, or part of the development, of information systems based on a set of rationales and an understanding of philosophy that supports, justifies and makes coherent such a recommendation of phases, procedures, tasks, techniques, guidelines, documentation and tools.
Centres for Medicare and Medicaid services (CMC), (2008).	The framework that is used for structuring, planning, and controlling the processes of systems development.
al Ahmar (2010)	A formalized approach that is used for planning and managing the processes of developing a software system.
Mihailescue and Mihailescue (2010)	An organized collection of concepts, methods or techniques, beliefs, values and normative principles supported by material resources and a codified set of goal-oriented procedures which are intended to guide the work and cooperation of various parties involved in the building of an information systems application.

Based on the above definitions of SDMs, we have defined SDMs using the definitions of Avison and Fitzgerald (2006) and Huisman and livari (2006), that SDM is a collection of *procedures*, including different *approaches, tools and techniques, methods, process models*, and *documentation aids* which can help the systems developers to implement new information systems.

This definition will assist the researcher in measuring the use of SDMs in the development of e-government systems and also to develop the framework that can be used for developing e-government systems. The next section discusses the components of SDMs as well as the advantages and disadvantages of SDMs.

2.3.3 Components of SDMs

Huisman and livani (2006) as well as Beynon-Davies and Williams (2003) defined several SDMs components; for the purposes of this research we are going to discuss only four of those components which are relevant to this study:

a) *Systems development approach(es)*

This component consists of a set of goals, fundamental concepts and principles that are used to guide the underlying beliefs and the development process model of sequence of phases through which the system evolves. For example: the structured approach, object-oriented approach, people-oriented approach, and many more.

b) *Systems development methodologies*

These are sets of guidelines, instances, techniques and tools that are based on the specific philosophy of system development and the intended system. Example includes soft systems methodology (SSM) and information engineering (IE).

c) *Systems development process model*

With these components of the process model there are sequences of stages through which the system is taken, for example, the spiral model and the linear life cycle model and each stage is designed for a specific purpose.

d) *Systems development tools and technique(s)*

Systems development techniques are seen as undertaken procedures consisting of possible notations to perform a development activity, for example, entity relationship diagrams (ERD) and use case diagrams.

2.3.4 Brief overview of the selected SDMs

Avison and Fitzgerald (2003) define different types of systems development methodologies that can be applied when developing a system and which can guarantee better planning, improved quality of systems, consistency and diligence. In this study, we discussed only six of the most commonly used and recent methodologies in systems development such as structured analysis, design, and implementation of information systems (STRADIS), information engineering (IE), extreme programming (XP), Soft Systems methodology (SSM), effective technical and human implementation of computer-based systems (ETHICS) and rationally unified processes (RUP).

STRADIS is a systems development methodology that adopts the science paradigm approach, which will be discussed later in Chapter 3 (on Research Method and Design). This systems development methodology is a type of process-oriented methodology and its main focus is on the development of any information systems designed for specific problem solving irrespective of the size and type of the systems (Avison & Fitzgerald, 2003). This systems development methodology is also seen as the relevant methodology to be used when there is a backlog of systems waiting to be developed and insufficient resources to devote to all the potential new systems.

IE is another type of blended systems development methodology that can be used in a wide range of industries and organizations. The blended systems development methodologies, as the name states, are combinations of other systems development methodologies, techniques and tools. These types of methodologies view data as the building blocks of systems and also recognize the impact of processes in the development of systems. IE also follows the science paradigm approach and is more appropriate for planning, strategizing and organizing. With IE, the focus is only on the development of computerized systems.

RUP is a type of object-oriented systems development methodology that focuses on the development of computerized systems and it also adopts the science paradigm approach. Object-oriented systems development methodologies are more oriented toward the substances of class. RUP emerged from unified modelling languages (UML) which only define what needed to be modelled (Jacobson, 2000). This systems development methodology can be used for general purposes and also for solving specific problems. The disadvantage of this methodology is that it cannot be used for simple or limited systems, as it is only appropriate for large systems in large organizations.

XP, is a type of rapid systems development methodology; it also follows the science paradigm approach and is appropriate for problem-solving systems. Rapid systems development methodologies are those that are oriented towards the speed of the systems development. XP emerged as one of the most popular and controversial agile systems development methodology and is defined as a lightweight systems development methodology with a series of principles for developing software more rapidly than a step-by-step methodology (Avison & Fitzgerald, 2003; Angioni *et al.*, 2006). The focus of this methodology is on the development of computerized systems and more appropriate for small and medium size application systems and organizations.

Other methodologies relevant to this study are ETHICS and SSM. ETHICS is a people-oriented systems development methodology that follows the scientific paradigm approach and it focuses on improving the quality of the work environment and on enhancing jobs. People-oriented systems development methodologies focus mainly on the skills and knowledge of people's in an organization. On the other hand, the SSM is an organizational-oriented systems development methodology and its purpose is to identify issues in order to understand the problem situations including the organizations itself. SSM follows the system paradigm approach as compared to other methodologies. The ETHICS systems development methodology is suitable for specific problem-solving and is much more appropriate for use in large organizations and SSM is applicable in human activity situations with existing complex problems. Both of these methodologies focus on the development of IT systems.

The next section of this study provides more detail about the advantages and disadvantages of the above-mentioned SDMs.

2.3.5 Advantages and disadvantages of SDMs

Since each systems development methodology has its own advantages and disadvantages, Table 2.2 in this section provides the advantages and disadvantages of the types of methodologies discussed in Section 2.2.4.

Table 2. 2: The advantages and disadvantages of the selected SDMs for this study.

Systems development methodology	Type of systems approach	Advantages	Disadvantages
Information Engineering (IE) (Avison & Fitzgerald, 2003)	<ul style="list-style-type: none"> • Soft Systems Approach 	<ul style="list-style-type: none"> • Focus is on a collection of systems operating within architecture and supporting the business as a whole. • With regard to development, the focus is on the front end of the life cycle ensuring that the systems build is the right solution for the business. • Based on the methodology, it focuses on the needs of the complete team, and it supports management as a structured method but also addresses the real work on the project through an elaborate collection of techniques. 	<ul style="list-style-type: none"> • Time-consuming due to lengthy documentation and it is cost consuming.

Systems development methodology	Type of systems approach	Advantages	Disadvantages
Rational Unified Processes (RUP) (Ambler, S.W., 2005, Jacobson, 2000 and Avison & Fitzgerald, 2003)	<ul style="list-style-type: none"> Agile approach 	<ul style="list-style-type: none"> There is improved governance: the delivery of high-quality working software meets the actual needs of stakeholders. Regular feedback to stakeholders: this allows stakeholders to see the portion of the system sooner and get the opportunity to make corrections at an early stage. There is improved risk management and focus is developed on what matters most. 	<ul style="list-style-type: none"> Not suitable for small-scale industry and safety critical projects. Time consuming due to lengthy documentation Cost-consuming.
Soft Systems Methodology (SSM) (Ambler, S.W., 2005 and Avison & Fitzgerald, 2003)	<ul style="list-style-type: none"> Interactive model 	<ul style="list-style-type: none"> Uses multidisciplinary team of analysts to understand the organization and suggest better solutions to problems. Uses a systems approach, which will help in preventing automatic assumptions. It focuses on both real world activities of problem situations and activities concerned with thinking 	<ul style="list-style-type: none"> Not appropriate in the study of large and complex problem situations.

Systems development methodology	Type of systems approach	Advantages	Disadvantages
		about problem situations.	
ETHICS (Avison & Fitzgerald, 2003)	• Parallel model	<ul style="list-style-type: none"> • Focuses more on the needs of the people and on improving the quality of work environment and job enhancement. 	<ul style="list-style-type: none"> • Not suitable for small and medium-sized systems.
Extreme Programming (XP) (Avison & Fitzgerald, 2003 and Angioni <i>et al.</i> , 2006)	• Agile approach	<ul style="list-style-type: none"> • Promotes teamwork and cross training • Suitable for both fixed and changing requirements. • Functionality can be developed rapidly and demonstrated. • There is less documentation required 	<ul style="list-style-type: none"> • Not suitable for handling complex dependencies. • More risk of sustainability, maintainability and extensibility.
STRADIS (Avison & Fitzgerald, 2003)	• Structured approach	<ul style="list-style-type: none"> • It is suitable for any type of information system irrespective of the size. • It only focuses on the needs of project managers; and uses data-flow diagrams. 	<ul style="list-style-type: none"> • Time-consuming due to lengthy documentation and it is cost-consuming.

Methodologies such as RUP, STRADIS and IE share the same disadvantage in that they are all costly and time-consuming due to lengthy documentations as compared to XP. XP and IE also share the same advantages since they are both promoting teamwork and on the other hand, RUP also share the same advantage with XP, they both provide regular feedback to stakeholders and have opportunities to make corrections at early stages of systems development. Only XP and SSM methodologies are appropriate for small and medium sized application systems whereas RUP, IE and ETHICS are appropriate for large systems and large organizations and STRADIS for any type of information system.

The next section of this study is a comparison of these methodologies according to their categories, which are:

- ❖ *philosophy,*
- ❖ *method,*
- ❖ *processes and*
- ❖ *tools and techniques.*

2.3.6 Comparison of SDMs

According to Avison and Fitzgerald (2003) SDMs can be categorized according to the philosophy, method, process model and the tools and techniques. For the purpose of this research, this section compares and discusses in detail only the most commonly used systems development methodology approaches in Table 2.3.

Table 2. 3: Comparison of SDMs

Types of SDMs	Philosophy	Method	Process model	Tools and techniques
<p>STRADIS</p> <p><i>This systems development methodology was proposed by Gane and Sarson (1979), and it reflects the process modelling theme, that is the structure of the process and the emphasis is more on the data.</i></p>	<p>Process oriented</p> <p><i>- According to Avison and Fitzgerald (2003) this type of methodology stresses the significance of the user and other strategic persons involved in the development systems.</i></p>	<ol style="list-style-type: none"> 1. Initial study 2. Detailed study 3. Defining & designing alternative solutions 4. Physical design 	<p>Linear processes</p>	<p>Functional decomposition</p> <p>Data-flow diagrams</p> <p>Decision trees</p> <p>Decision tables</p> <p>Structured English</p>
<p>IE</p> <p><i>This systems development methodology has process-oriented aspects embedded in it and is data-oriented meaning it has more emphasis on data, activity and the interaction of data and activities.</i></p>	<p>Blended</p> <p><i>- these methodologies focus not only on the data elements of systems development, but also on the processes involved (Avison & Fitzgerald, 2003). With these methodologies data are viewed as the building blocks of systems and one also recognizes the impact of processes in the development of systems.</i></p>	<ol style="list-style-type: none"> 1. Information strategy planning 2. Business analysis 3. Systems planning & design 4. Construction & cutover 	<p>Interaction model</p>	<p>Specific technique which is fundamental to the system development methodology and recommended use of tools (i.e. diagrams, simulation).</p>

<p>RUP</p> <p><i>This type of systems development methodology is an architecture-centric process and it uses an integration of both process and data orientation</i></p>	<p>Object-oriented</p> <p><i>These methodologies are based on the notion of class which is defined as a software element describing an abstract of data type and its partial or total implementations (Avison & Fitzgerald, 2003). Abstract data types can be classified as sets of objects defined by the list of operations, features, and applicability and properties of these objects and operations.</i></p>	<ol style="list-style-type: none"> 1. Business model 2. Requirements 3. Analysis and design 4. Implementation 5. Test 6. Deployment 7. Configuration & change management 8. Project management 9. Environment 	<p>Spiral model</p>	<p>Specific technique which is fundamental to the systems development methodology and recommended use of tools (i.e. use cases, architecture and iteration).</p>
<p>XP</p> <p><i>This systems development methodology is much appropriate for small and medium-sized applications and organizations. It uses user stories, prototypes or architectural spikes</i></p>	<p>Rapid development</p> <p><i>These types of methodologies are oriented towards the speed of the development. The development of Information systems is driven by the rapidly changing business requirements.</i></p>	<ol style="list-style-type: none"> 1. Planning 2. Design 3. Development 4. Productionalizing 	<p>Agile process</p>	<p>Specific technique which is fundamental to the system development methodology and recommended use of tools (i.e. prototyping).</p>

<p>ETHICS</p> <p><i>This type of systems development methodology uses a socio-technical model</i></p>	<p>People oriented</p> <p><i>These types of methodologies attempt to capture the expertise and knowledge of people in the organization.</i></p>	<ol style="list-style-type: none"> 1. Why change 2. System boundaries 3. Description of existing System 4. 5 and 6 Definition of key objectives and tasks 7. Diagnosis of the efficiency needs 8. Diagnosis of job satisfaction needs 9. Future analysis 10. Specifying and weighting efficiency and job satisfaction needs and objectives 11. Organizational design of the new system 12. Technical options 13. Preparation of a detailed work design 14. Implementation 15. Evaluation 	<p>Parallel Processing model</p>	<p>Specific technique which is fundamental to the system development methodology</p>
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<p>SSM</p> <p><i>This type of systems development methodology uses DFD and process-oriented approach</i></p>	<p>Organizational oriented</p> <p><i>This type of methodology is oriented toward the organization and its environment. It is more focused on understanding organizations as a whole including employees, divisions and the operations of that organization and suggests better solutions to the problems.</i></p>	<ol style="list-style-type: none"> 1. Unstructured problem situations 2. Expressed problem situation 3. Root definition of relevant systems 4. Building a conceptual models 5. Comparing conceptual models with reality 6. Assessing feasibility and desirable changes 7. Action to improve the problem situation 	<p>Interactive model</p>	<p>Specific technique which is fundamental to the systems development methodology.</p>
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The development of information systems requires both analysis and design, but a structured approach to design has limitations as it only addresses the selection and the organization of the program modules and interfaces that would solve a predefined problem and does not contribute to defining the problem (Avison & Fitzgerald, 2003).

As indicated in Table 2.3 systems development methodologies such as STRADIS, IE and XP, consist of four stages which are executed using different processes and techniques. STRADIS focuses more on linear process models, while IE uses an interactive process model and XP is more an agile process model. The first stages of these methodologies involve studying and analysing the objectives of an organization by reviewing the necessary documentation, which is later transformed into design. Both XP and IE have construction phase which include the development and production of the proposed information system or solution to the problem. RUP also have some similarities of both XP and IE, such as analysis and design. The disadvantage of these methodologies, except for XP and IE, is that a problem or mistakes that are identified during software testing, that is at the end of project life-cycle, can only be corrected after testing, unlike with XP or IE where changes can be made on a regular basis.

The following section discusses in detail what is meant by the term e-government systems, different selected definitions of e-government systems as defined by other researchers, types of e-Government systems currently in use and the agencies or institutions using these e-government systems, brief overview of these types of e-government systems, and the processes and challenges of e-government systems.

2.4 e-Government systems development

The purpose of this section is to provide a background and overview of e-government systems, different types of e-government systems, examples of e-government systems developed and also to provide the author definition of e-government systems as used in the context of this research.

2.4.1 Brief overview of e-government systems

The term electronic government, also known as e-government emerged from the term e-commerce which is defined as “the sharing of business information, maintaining business

relationships and conducting business transactions by means of telecommunications networks” (Molla, 2001). As a result, the development of e-government systems has made a breakthrough over the years whereby government agencies are transformed to be more citizen-centred by providing their services online (Heeks, 2004).

The concept of e-government focuses largely on electronic service delivery and some additional channels of interaction among governments, businesses, and citizens (McClure, 2000). According to West (2005) the service delivery of e-government systems developed mainly focuses on the number and the type of online services offered. These services can only be considered an online service only if the entire transaction can occur online and not have the citizens to print out the forms and fax or e-mail after completing them (West, 2005).

With regard to this proliferation of e-government systems, there have been problems of uniformity, isolated costs or costing of projects, models for choosing project teams and control of the whole process and the bigger picture (Heeks, 2004).

2.4.2 Definition of e-Government

Table 2.4 consists of different definitions of e-government systems as viewed by different researchers.

Table 2.4: Selected definitions of e-government

Researchers	e-Government definitions
Farelo and Morris (2006)	e-Government is the use of Information, Communication and Technology (ICT), particularly the internet, to promote more efficient and effective government, facilitate more accessible government services, and also to allow greater public access to information and also to make government more accountable to citizens.
Bonham, Seifert, & Thorson (2001)	e-Government involves using information technology (IT), specifically the internet, to deliver government information and in some cases, services, to citizens, businesses, and other government agencies.
Layne and Lee (2001)	e-Government is the use of technology by government particularly web-based internet applications that enhance the access to and delivery of government information and services to citizens, business partners, employees and government entities and other agencies.
Heeks (2004)	The use of information, communication and technology (ICT) to improve

Researchers	e-Government definitions
	the access to and delivery of government services with which citizens, business partners and employee benefit more.
Basu (2004)	e-Government involves the computerization of the existing paper-based procedures in order to prompt new style of leadership, new ways of debating and deciding strategies, new ways of transacting business, new ways of listening to citizens and communities and new ways of organizing and delivering information.
Ndou (2004)	The use if ICT tools to reinvent the public sector by transforming its internal and external ways of doing things and its interrelationships with customers, and the business community.

Table 2.4 above consists of the selected definition of e-government, and most of these definitions focus largely on the range of technologies that can be used, the use of internet, accessibility, service delivery as well as transformation of government services to be citizen-centred.

Service	- PERSAL	- Web-based application systems (<i>i.e. e-Filing</i>) - <i>e-Voting system</i>
	- Business transaction - Processing systems - Number crunching systems	-Web based information systems (<i>i.e. Website, Web pages</i>)
Core business		
	General ICT	Internet

Figure 2.2: Ditibane et al. (2013) Proposed theoretical framework for e-Government

The above Fig. 2.2 of the proposed theoretical framework for the development of e-government systems indicates that e-government systems can be defined as the use of information, communication and technology (ICT) and the internet to improve the core business operation and deliver government information and services faster and at a reasonable price to the public and also to the private sector, community members, consumers, employees as well as other government officials across the globe.

Farelo & Morris (2006).indicated that the successes of the development of e-government systems require changing the way:

- *government operates,*
- *information is handled,*
- *government officials view their jobs and*
- *communication is conducted with the public*

According to Farelo and Morris (2006) the development of e-government inside the South African context is divided into different sectors or department such as e-health, e-education, SMME (Small and Medium Enterprises) and local content. The next section discusses different examples of e-government systems that are used in some of South African governmental agencies and institutions.

2.4.3 Types of e-Government systems

According to Sharma & Gupta (2002) the purpose of e-government systems is to deliver information and services to four main government customers which are:

- *citizens,*
- *the business community,*
- *government employees and*
- *government agencies*

This section discusses the four types of e-government systems that are used by government department to provide information and services (Layne & Lee, 2001 and Sharma & Gupta, 2002). These are:

- Government-to-Citizen (G2C),*
- Government-to-Business (G2B),*
- Government-to-Employee (G2E) and*
- Government-to-Government (G2G).*

G2C is a type of e-government system that provides information dissemination like basic citizenry services such as licence renewals, ordering of birth/death/marriage certificates and filling in of income taxes, as well as citizen assistance such as basic services of education, health care and more, to the public (Sharma & Gupta, 2002).

G2B is a type of e-government system that provides various transaction services between government and the business community including dissemination of policies, memos, rule

and regulations. The services offered include support to business development (small and medium enterprises), obtaining current business information, downloading of applications forms, renewing licences, registering businesses, obtaining permits and payment of taxes.

G2E is another type of e-government system that provides specialized services that cover only government employees such as provision of human resources training and development. With this systems government employees can view their payroll and tax information records online through an integrated transversal system called Persal.

G2G is also another type of e-government system that can be used at two levels: local or domestic level and at the international level. The transaction of services is between governments - that is, central/national and local governments, as well as the department-level and attached agencies of bureaux

The next section provides different examples of e-government systems which were developed and are implemented in most of government agencies and departments.

2.4.4 Different examples of e-Government systems

Warkentin *et al.* (2002) stated that governments around the world are implementing a variety of e-government initiatives to improve the effectiveness and efficiency of the internal operations, communication with the public and engagement in transactional processes with consumers and government constituents. The table 2.5 shows different examples of e-government systems that were developed and implemented by the SA government and government departments or organizations.

Table 2. 5: Examples of e-Government Systems Developed

Examples of e-Government systems	Organizations using the system
PERSAL	Local Government, Government departments and Municipality and Government institutions.
e-Filling or e@syFile	SARS
e-Voting	Independent Electoral Commission
Case Management System	SAPS
Motor Vehicle Registration System	Department of Transport

Pension and Unemployment Insurance Systems	Department of Welfare and Labour
Subsidy Management System	Department of Housing
Batho-Pele Gateway	South African Government

Personnel and Salary (PERSAL) is the most popular e-Government system developed by one of the biggest and dominant ICT Company in South Africa called Business Connexions and it was implemented by the National Treasury. This system is an Integrated Human Resource, Personnel and Salary system used by all the National and Provincial government departments in South Africa for the administration of human resource transactions and remuneration of public sector employees (Department of Public Service and Administration (DPSA), 2010).

Research conducted by Business Connexions has indicated that there are approximately 25 000 users who access the system through linked mainframes across South Africa, also there are some 32 million transactions which are processed each year and approximately 1,1 million government employees are paid via the system each month. According to the DPSA (2010), the information on the PERSAL system does not accurately reflect the actual situations within the public service. This inaccurate information is caused by lack of effective and efficient management of the systems and data within the Public Service which causes a problem of uniformity among departments. One department's information would be more accurate and complete than the other even though they are using the same system and the policies apply to all departments within the Public Service.

An e-Filing system called e@syFile Employer is an example of e-government systems developed for the South African Revenue Services (SARS). The e-Filing system is a free, secure electronic tax form and online payment submission service which is offered by SARS in order to eliminate the risks and hassles associated with the submission of manual tax forms and payments (SARS, 2012). This system offers the facility to submit a variety of tax returns such as VAT, PAYE, SDL, UIF, Income Tax, STC and Provisional Tax through an e-Filing website. The e-Filing systems affect two types of payment, the *credit push* which refers to payment transactions that are initiated on e-Filing and presented to the banking products as bill presentation and the *authorized debit pull* which refers to payment transactions that the payer has requested SARS to collect on their behalf at a specified date. With the debit push mechanism, payments may be reversed due to insufficient funds once the request is processed by the bank, whereas with the credit push, transactions are

irrevocable once approved by the user. These types of payment require the correct banking details to ensure the successful payment transaction (SARS, 2012).

Other e-government systems such as e-Venus, are fully integrated Enterprise Resource Management (ERM) solution, specifically developed for Local Government. This system addresses all aspects of Local Government management such as:

- *financial management,*
- *human resources management,*
- *salaries and wages,*
- *performance management,*
- *strategic sourcing,*
- *supply chain management, and many more.*

Another example of an e-government system is called the electronic voting system also known as the e-voting system, meaning using an electronic means to cast a vote. According to the articles written by Jones (2001) and Fisher, *et al.*, (2005), there are different types of e-Voting systems such as internet-web based voting systems and other online voting such as *punch cards, optical scan voting system, and direct record electronic voting system (DRE)*. The internet–web based voting system is defined as an election system that uses the Internet in order to ensure access to a website or domain where electronic ballots can be used. According to research conducted by Masuku (2006) e-Voting technologies are still under development in many countries, South Africa included.

Masuku (2006) defined different types of e-Voting systems, but for the purpose of this research we are only going to discuss three which are:

- *the telephone voting system,*
- *the mark-sense (optical scan) voting system and*
- *the direct recording electronic (DRE) voting machine.*

The telephone voting system is a system where a voter can call one number from anywhere to indicate a preference by pressing buttons on the menu systems, the only difficulty about the system is that one cannot verify the caller identity.

The mark-sense (optical scan) voting system is a system where the candidate's name is printed on the pre-printed ballot and the voter marks a ballot paper and feeds it into the box. A tabulating device is used to read and pick up the votes on the paper using dark mark logic

and a scanning machine is used to pick up the dark markers on the paper and tabulates the results.

The last of the three systems involves the ***direct recording electronic (DRE) voting system*** which is a system that uses a voting machine with candidate's name printed on the computer screen. With this system the voters directly enter their preferred choices into electronic storage. The only drawback about this system is that it is too expensive in terms of maintenance and it is also risky in a sense that a voter cannot verify that the vote has been recorded inside the machine (Coleman and Fisher, 2006). These types of e-Voting systems present some security challenges such as threats (viruses, worms, hackers, social engineering, physical tampering and many more) and security at large (Masuku, 2006).

2.4.5 Processes of e-government development systems

Layne and Lee (2001) developed and proposed a bottom-up approach, four stages of growth model for fully functional e-government systems based on the experience with e-government initiatives in the United States of America and are as follows:

Stage1: Cataloguing is a stage at which the state government establishes the presence of an online service for government such as creating a state website and at this stage there is a problem of limited functionality to online presentations of government information.

Stage 2: Transaction is the second stage in which efficiency and availability of information are demanded from the website. At this stage the focus is largely on establishing connection between the internal government systems and the online interface such as putting live database links to online interface in order to allow citizens to review their information and pay fines.

Stage3: Vertical integration which focuses mainly on the transformation of government services rather than automating and digitizing existing processes. Examples will be departments such as licence departmental systems and the e-voting system.

Stage 4: Horizontal integration is the last stage that involves the provision of services across different functional subdivisions. An example of this type of system would be the SARS and Labour and Welfare department. Fig 2.3 demonstrates the bottom-up approach four stage of growth model for e-government development systems as outlined by Layne and Lee (2001) in their study.

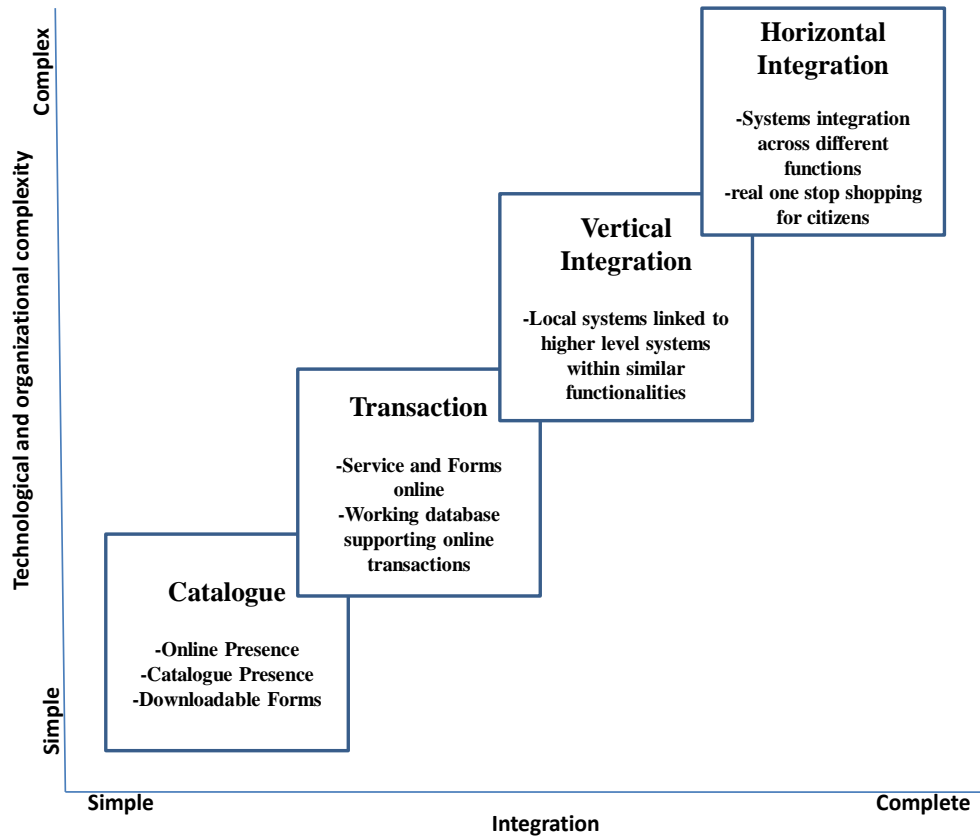


Figure 2.3: Bottom-up approach of four stages of e-government development (adapted from Layne & Lee, 2001).

Researchers such as Panagopoulos (2004), Moon (2002), Siau and Long (2005) describe different stages of e-government systems development which are provided in Table 2.6.

Table 2.6: Stages of e-Government systems development

Researchers	Number of Stages	Description of each stages	Focus
Layne and Lee (2001)	4	1.Cataloguing 2.Transaction 3.Vertical integration 4.Horizontal integration	Functionality
Moon (2002)	5	1.One-way communication 2.Two-way communication 3.Service and financial integration 4.Vertical and horizontal integration 5.Political participation	Information Flow Functionality Political process
United Nations (2003)	5	1. Emerging presence 2. Enhanced presence 3. Interactive presence 4. Transactional presence 5.Seamless/fully	Web-based
Panagopoulos (2004)	5	1. Emerging 2. Enhanced 3. Interactive 4. Transactional 5. Seamless	Functionality
Siau and Long (2005)	5	1. Web presence 2. Interaction 3. Transaction 4. Transformation 5. E-democracy	Customer-oriented democracy

In Table 2.6, researchers such as Layne and Lee (2001), Moon (2002) and Panagopoulos (2004) put similar emphasis on functionality, whereas Siau and Long (2005) focus more on customer satisfaction. There are also some similarities in most of the stages outlined, like the second stage defined by Moon (2002). The next sections discuss the challenges that are encountered in the development of e-Government systems.

2.4.6 The challenges of e-government development systems

Layne and Lee (2001) identified a number of challenges and problems encountered when developing e-government systems. McClure (2000) also defined some of those challenges as chaotic, meaning disorganized and unmanageable.

Some challenges of e-government systems include providing access to needed information, ensuring privacy and security, changing technology and maintenance, measuring customer satisfaction and many more.

For example, for the first stage of cataloguing, since government consists of different departments that require different amounts of on-line presence and demand resources allocated to them, the first challenge will be assigning responsibilities for the overall coordination and planning of the services on the state website. There is also the need for maintenance with regards to changes of the procedures and policies as well as information on the web. Because of that, the government is also faced with challenges assigning to each agency the responsibility for the maintenance of the web as it would be more problematic. The only solution would be outsourcing to a private vendor or state information technology agency for the development of the website, but the problem of maintenance would still not be solved. Another challenge would be assigning responsibility for answering e-mails since websites have a section where site user send their queries or comments.

Since South Africa is defined as a “rainbow nation”, meaning, it has many cultures and languages; therefore, the issues of socio-economy and service delivery are also other challenges when coming to e-government (Maumbe *et al.*, 2008).

According to Maumbe *et al.* (2008) it is very important that e-government initiatives should be context-specific without forgetting the unique obstacles they face. This includes the high cost of failure and the users’ access to different information technologies. The next section deals with the unique characteristics of e-government systems.

2.4.7 The unique characteristics of e-government development systems

This section defines the examples of the unique characteristics (UC) of e-government systems which were generated from the literatures study and the information collected from interviews conducted on four developing companies. The unique characteristics are defined based on the type and size of systems being developed and they are as follows:

a. *Unique characteristics 1 (UC1): Electronic service delivery*

This would offer the government a huge opportunity to improve on public services that would benefit the citizens in a more convenient, more joined-up and responsive way. All government documentation of all kinds would be accessed by anyone.

b. *Unique characteristics 2 (UC 2): Electronic workflow*

This is concerned with the automation of procedures where documents, information or tasks are passed between Interviewees according to defined sets of rules to achieve or even contribute to overall business goals. This may include business process management which is concerned with the assessment analysis, modelling, definition and the subsequent operational\implementation of the core business in an organization.

c. *Unique characteristics 3 (UC3): Electronic productivity*

The rationale of e-government systems is to provide better operations at lower cost. UC3 is the most cost-effective way to create wealth. Better processes and good management skills can ensure government productivity.

d. *Unique characteristics 4 (UC4): Electronic access to government information*

Access to government services will be available at any time to citizens, businesses and other government departments as well as government employees.

e. *Unique characteristics 5 (UC5): Convenience and satisfaction*

Services should be provided at any time, anyhow and anywhere. Business officials, citizens and other government agencies will have a choice of channels to government information and services that are convenient, easy to use and deliver what is needed.

f. *Unique characteristic 6 (UC6): Participation*

This involves participation in government service delivery. People will be better informed and be able to participate as they will be having easy access to government information and processes.

g. *Unique characteristic 7 (UC7): Integration and Efficiency*

This includes services that are integrated, customer-centric and efficient. Information and services provided will be integrated, packaged and presented to minimize the cost for people, business and government departments.

The following section discusses, in detail, SDMs that are used in developing e-government systems as well as the type of systems developed.

2.5 The use of SDMs on e-government development systems

e-Government is a complex phenomenon which involves technical, organizational, institutional and environmental aspects (Gil-Garcia & Pardo, 2006).

Research has indicated that there are some SDMs that are used in designing and developing information systems depending upon the actual requirements of the system. However, some systems groups recommend the centralized data processing system while others may go in for distributed data processing systems. Centralized data processing consists of one or more centralized computers that are used for the processing and the retrieval of information is done from them whereas the distributed processing systems involve number of computers located remotely in the branches/departments of the organization (Avison & Fitzgerald, 2006). Table 2.7 indicates the type of methodologies that were used to develop e-government systems.

Table 2. 7: SDM used in developing e-government system

Types of e-government systems	System development methodology used	References
PERSAL (Government-to-Government)	SDLC	Farrelo and Morris (2006)
e-Filing or e@syFile (Government-to-Business and Government-to-Citizens)	Not clear	www.sarsefiling.co.za Electronic Journal of e-government (2010)
e-Voting (Government-to-Citizens)	SDLC	Electronic Journal of e-government (2010)
Case Management System (Government-to-Citizens)	Not clear	
Motor Vehicle Registration System (Government-to-Citizens)	Not clear	
Pension and Unemployment Insurance Systems (Government-to-Business and Government-to-Citizens)	Not clear	
Subsidy Management System (Government-to-Business & Government-to-Government)	Not clear	
Batho-Pele Gateway (Government-to-Business & Government-to-Citizens)	Not clear	

As indicated in Table 2.7, some e-government systems such as e-voting systems and Persal, were developed using the most prominent systems development methodology, the systems development life-cycle (SDLC) approach such as the Waterfall (grand design) model which is one of the most widely used and accepted systems development methodologies. The model is based on scientific management theory, the spiral (incremental) model, which is based on human relations theory, evolutionary (participatory)

model that is also constructed on system approach, and others are also used (Davis-Roberts, 2007).

According to Davis-Roberts (2007) the waterfall system development methodology comes with disadvantages in such a way that it only permits a single pass through each phase of development without any room for iterative trial and error process, and the phase can only begin when the preceding phase is complete. Therefore the working version of a system can only be seen late in the life-cycle, and this may result in failure to detect problems until the systems testing phase. The next section provides a proposed conceptual framework by the researcher. The framework looks at the unique characteristics of e-government systems development and different types of SDMs that were discussed in this study, and the type of projects that can be developed.

Table 2.8 in this section provides the proposed conceptual framework for the development of e-government systems. This framework comprises some unique characteristics of e-government systems development and the selected SDMs which were discussed earlier in this Chapter. The keys used in Table 2.8 are presented in Table 2.9 below to further explain symbols.

Table 2. 8: Conceptual Framework

Unique characteristics of e-government	Systems Development Methodologies (SDMs)					
	STRADIS	IE	XP	RUP	ETHICS	SSM
UC1: Electronic Service delivery	Y	Y	Y	Y	Y	Y
UC2: Electronic Workflow	P	Y	Y	Y	Y	Y
UC3: Electronic productivity	N	Y	Y	Y	Y	Y
UC4: Electronic access to government information	N	Y	Y	Y	Y	Y
UC5: Convenience and Satisfaction	N	Y	Y	Y	Y	Y
UC6: Participation	N	P	Y	P	Y	Y
UC7: Integration and Efficiency	N	Y	Y	Y	Y	Y
Project Type	Any	PT1, PT3,PT5	PT1,PT3, PT6	PT2,PT4, PT5	PT1,PT4, PT5	PT1,PT4
Scale	1.5/7	6.5/7	7/7	6.5/7	7/7	7/7

Table 2. 9: Keys and descriptions

Keys	Description
Y (70%-100%)	means Yes
N (40%-69%)	means No
P (0%-39%)	means Partially
PT1	Project type 1 which is processing systems
PT2	Project type 2 which is web-based application systems
PT3	Project type 3 which is for number-crunching systems
PT4	Project type 4 for Website design
PT5	Project type 5 which is for big projects
PT6	Project type 6 which is for small projects

The proposed conceptual framework presented in Table 2.8 suggests that, for any type of project, there is a particular systems development methodology that can be adopted based on the characteristics of the required e-government systems development processes. There are different methodologies that can be used for different types of projects depending on the size of the organization, the size of the system being developed and how complex is the problem situations. As illustrated in Table 2.8, different types of SDMs discussed in this study are evaluated against the defined unique characteristics of e-government systems development in order to choose the relevant SDM to be used for a particular system.

2.6 The significance of Systems Development Methodologies in the development of e-government systems

Systems development methodologies are the very important because they can help e-government systems developers and top management to structure, plan and control the development process of e-government system. Research interviews conducted has also indicated that the development of e-government systems can be very complicated at the beginning due to government politics, management issues and policies set out to citizen. Therefore the use of systems development methodologies can help improve the management and control of the software development process and product by specifying activities to be performed and techniques to be utilized. Stanforth (2010) conducted a research on the *“Analysing e-government Project Failure: Comparing Factorial, Systems and Interpretive Approaches”* and discovered that most e-government systems fail because of poor reporting structures, lack of communication and poor consultation with regard to the e-

government systems being developed and this support the result obtained from the interviews. It was also highlighted from the interviews conducted that user involvement is one of the most important success factors of e-government system, therefore if user are not included in the planning and the development process of e-government system, such systems is guaranteed failure.

It is therefore important that systems development methodologies be used when developing e-government systems so that it helps reduce these problems of e-government systems development failures.

2.7 Chapter summary

This Chapter has dealt with different definitions and types of systems development methodologies (SDMs), the advantages and disadvantages as viewed by different researcher, e-government system, different types and examples of e-government systems developed, the processes followed and challenges faced when developing e-government and the methodologies that were used in developing such t e-government systems. A conceptual framework that can be used in the development of e-government system was proposed. The framework includes different types of SDMs which are evaluated against the unique characteristics that define a particular e-government system to be developed in order to select the SDM that meet the characteristics of such system.

CHAPTER 3: RESEARCH METHOD AND DESIGN

3.1 Introduction

In this Chapter, the research methods and design addressing certain topics will be discussed. These topics include, amongst other things, the research paradigm, research method, data collection (interview questions) and data analysis. Research studies have revealed many ways of research methods and design which can be used when conducting research (Mingers, 2003; Myers & Avison, 2002).

The research method used in this study is the case study, which is discussed later in this Chapter. Unstructured interviews as well as literature analysis for data acquisition were applied in this study. The research outcomes are discussed later in Chapter four dealing with the research analysis. Again in Chapter four content analysis and cross-case analysis are used as data-analysis techniques and a computer programme called ATLAS.ti 6.1 is used as the qualitative data-analysis tool.

The next section in this Chapter begins by defining the research problem, the philosophy behind research, the research approaches and the various research strategies in order to develop consistency on the selected research methods and design.

3.2 The research problem

The main aim of this study is to investigate the use of systems development methodologies in the development of e-government systems. The research started with the question “is there a system development methodology designed for the development of e-government systems”? The literature study in Chapter 2, illuminated our understanding of SDMs, different types of SDMs and how the SDMs can be used when developing an information system. Most importantly, we have also learned more about e-government systems, different types of e-government systems as well as examples of e-government systems and the processes used when developing e-government systems. The following section defines research and the purpose of research as understood by most researchers.

This study largely focuses on the use of systems development methodologies in the development of e-government systems. The following are our research objectives, which are to:

- *investigate the SDMs used in the development of e-government systems;*
- *identify the challenges and problems that are encountered by the developers of e-government systems; and*
- *determine the suitable SDMs that addresses unique aspects of e-government systems.*

The researcher in this study wishes to determine how e-government systems are developed and what methodologies are used when developing those systems. The last two objectives were addressed in Chapter 2 and in this Chapter (Chapter 3), the first objective is addressed by answering the following research questions:

- ***What SDMs are used when developing e-government systems?***
- ***Do the use of SDMs help create better quality e-government systems? and***
- ***Does it lead to better development processes?***

These questions are addressed by eliciting information from at four cases involved in the development of e-government systems. The type of research that will be conducted necessitates the use of the interpretive paradigm and follows the qualitative approach for studying e-government systems development.

In this study, research is defined as a systematic process of fact-finding with the aim of analysing collected data into meaningful and useful knowledge valuable to other people with the purpose of increasing our understanding of the phenomenon under study (Oates, 2006). According to researchers Giddens (2009) and Oates (2006), any research should follow a certain process and this process should be based on the philosophy underlying the researcher's research question and answers. Therefore, this research follows one of those philosophical epistemologies discussed in the next section.

There are three philosophical epistemologies called research paradigms that should be considered when conducting research and they are as follows: positivistic, interpretive and critical social research (Giddens, 2009). Philosophical epistemology in this study refers to the study of the fundamental knowledge, reality and existence and how we can go about differentiating truth from falsehood. The next section of this study discusses, in detail, the research paradigms and their purpose.

3.3 Research paradigms

According to Dash (2005), a paradigm determines the criteria for conducting research. Therefore, a research project is built upon the underlying paradigm which is a way of thinking about the world, how people view the world we live in and also different ways we choose to investigate it (Oates, 2006). Giddens (2009) defined a paradigm as a set of assumptions about the nature of social reality. The significance of paradigms is that they shape how we perceive the world and are strengthened by those around us, like the community of practitioners (Giddens, 2009; Oates, 2006). The following section discussed the three most common research paradigms that can be used when conducting research (Giddens, 2009; Oates, 2006; Lather, 2006).

3.3.1 The positivistic research paradigm

The positivistic research paradigm takes the scientific approach of doing research, and this scientific approach looks for standard laws in the universe (Oates, 2006). Lather (2006) defines positivism paradigm as a deterministic as well as an empiricist philosophy whereby the causes determine effects and aims to directly observe, quantitatively measure and objectively predict relationships between variables. Deterministic simply means that the events are caused by other circumstances whereas empiricism means collection of variables empirical evidences in support of theories or hypothesis.

According to Oates (2006), the scientific method of this research paradigm uses experiments and tests as the main methods of investigation. These are methods that can be controlled, measured and used to support a hypothesis. Another popular method that can be used to gather data for this research paradigm is that of questionnaires (Giddens, 2009). With both the scientific approach and questionnaires methods, data retrieved are of a quantitative nature since it consists of numerical values which are normally in the form of statistics and measurements (Creswell, 2008). Analysing the data collected using this paradigm requires the use of specific statistical software's such as the one commonly used by statisticians called SASSA as well as SPSS which is commonly used by researchers in computer sciences and mathematics (Mackenzie & Knipe, 2006).

3.3.2 The critical social research paradigm

According to Oats (2006), the critical social research paradigm assumes that people create and re-create the social reality. Critical researchers usually aim to transform the society in

order to address inequality, particularly in relation to ethnic, gender, sexual orientation, disability and other parts of society that are marginalized (Mackenzie & Knipe, 2006). The purpose of this paradigm is to understand the lived experience of real people in context, examine social conditions and uncover oppressive power arrangement (Elliott & Lukes, 2008). This research paradigm uses case studies as well as action research to gather data. The primary goal of this paradigm is an attempt to identify and differentiate the conditions of dominance and takes into considerations the assumptions, limitations and injustices of the norms that are normally taken for granted (Giddens, 2009; Oates, 2006).

3.3.3 Interpretive research paradigm

The interpretivist research paradigm focuses mainly on understanding the phenomena through the meaning people allocate to them (Giddens, 2009). According to Onweugbuzie (2000) this approach is appropriate when the subject matter investigated by the natural sciences is different from that of social sciences, where human beings as opposed to inanimate objects can interpret the environment they live or work in and themselves.

This type of research approach does not attempt to prove or disprove a theory, but rather studies an organization, and how it carries out its operations. The main purpose of this research approach is to create an understanding of distinct situations, and also to make controlled findings of people's perceptions and how those perceptions could change in the long run. With this paradigm, there is an acknowledgement that facts and values cannot be separated (Elliott & Lukes, 2008; Cousin, 2005). All Interviewees involved, including the researcher, brings their own unique view of the world to the research (Mackenzie & Knipe, 2006).

In order to best achieve the main aim of this research which was mentioned in section 3.2 of this study, the interpretive paradigm will be used. Table 3.1 outlines the advantages as well as disadvantages of the interpretive paradigm as a defined by other researchers.

Table 3.1: The Advantages and disadvantages of interpretive paradigm

<i>Advantages</i>	<i>Disadvantages</i>
Researchers obtain a more realistic feel of the world that cannot be improved in the numerical data and statistical analysis that is used in the positivistic paradigm.	It is time-consuming as patterns slowly emerge.
Research strategy is characterized by lower sample numbers compared to positivistic paradigm.	There is a high researcher involvement; the researcher becomes the main Interviewee during data-collection.
There is a descriptive capability based on the primary and unstructured data.	One content may not be true for another; therefore data need to be gathered in a variety of contexts.
There are flexible ways of performing data-collection, subsequent analysis and the interpretation of collected information.	There are some difficulties in explaining the difference in the quality and quantity of information obtained from different respondent and in arriving at non-consistency and different conclusion.
The researcher has the ability to interact with the research subjects in their own language and in their own terms.	Lack of consistence and reliability because the researcher can employ different probing techniques and the respondent can choose to tell some stories and ignore others.
The interpretive paradigm provides a holistic view of the phenomena under study.	Arriving at different conclusions based on the same information largely depends on the personal characteristics of the researcher.

Table 3.1 outlines, in details, some advantages and disadvantages of the interpretivist research paradigm as best understood by different researchers. The purpose of this table is to provide the reader with a clear summary of what the interpretive research paradigm is all about and the reasons why it was selected for this research. The next section provides a detailed discussion of how this paradigm is implemented in this research.

The research is done by studying the development of e-government systems within their natural environment. By choosing this paradigm, the government and government agencies are studied without the researcher's presence affecting the data gathered. The aim here is to gather data for objective analysis without affecting the organization. The next section deals with the research method chosen in this study in order to best achieve the primary objective of the research.

3.4 The research method

Research methods refer to the ways in which insightful information is gained from a particular phenomenon which is influenced by the underlying epistemological assumptions such as positivist, critical social and interpretive research (Elliott & Lukes, 2008). Therefore, the research methods that are associated with the interpretive paradigm include case studies and surveys (Oates, 2006). For the purposes of this study, the method used to conduct this research is that of case studies, which are discussed in detail in this section.

3.4.1 Case studies

A case study is an intensive analysis of an individual unit (such as an organization) stressing developmental factors in relation to context (Gillham, 2005). This research method involves focus groups, interviews, research diaries, and it allows as many variables to be recorded as possible (Elliott & Lukes, 2008; Lewin, 2005). The content within a case study may include information about organizations' objectives, strategies, challenges, results, recommendations, and many more (Denscombe, 2003). The aim of this research is to study three to four e-government systems developed for use by government and government departments.

Definition of a Case study

Gillham (2005) defined a case study as a research strategy which focuses on understanding the present dynamics within a single setting. When researchers focus on a single case, they can make detailed observations over a long period of time, something that cannot be done with large samples without costing a lot of money (Denscombe, 2003). Case studies are also useful in the early stages of research with the goal of exploring ideas, testing and perfecting on the measurement instruments, and also to prepare for a larger study (Gillham, 2005).

3.4.2 Types of Case Studies

Table 3.2 contains different types of case studies and a brief description of how they are used and when to use them (Denscombe, 2003).

Table 3.2: Types of Case studies

Types of Case Studies	Description
Explanatory	A case study that is used to do causal investigations.
Exploratory	A case study that is sometimes used as an introduction to further, more in-depth research. With this type of case study, researchers gather more information before developing their research questions and hypotheses.
Descriptive	This type of case study involves starting with a descriptive theory. The research subjects are observed and the information gathered is compared to the pre-existing theory
Intrinsic	This is a type of case study in which the researcher has a personal interest in the case.
Collective	This case study involves studying a group of individuals
Instrumental	This type of case study occurs when the individual or group allows researchers to understand more than what is initially obvious to observers.

Different types of case studies as described in Table 3.1, give us an insight into types of case studies that can be used to gather data. Since this study is based on the use of SMDs in the development of e-Government systems, the relevant and appropriate type of case study would be that of an exploratory case study. This type of case study will give the researcher insight into the research problem. With this type of case study, there are varieties of methods such as interviews, group discussions and observations that can be used to gain information. The next section addresses the case study method that is used to gather data.

3.4.3 Case Study methods

Case studies can be carried out using different kinds of methods, but for the purposes of this research, we will only address two kinds of case studies which are:

The prospective method which is a type of case study in which an individual or group of people is observed for a certain period in order to determine outcomes (Denscombe, 2003).

The retrospective method which is a type of case study that involves looking at historical information. With this method, researchers might start first by defining an outcome, such as

system malfunction, and then looking backwards at information about the planning and the development processes of such systems to determine risk factors that may have contributed to the onset of the malfunctioning (Denscombe, 2003).

3.5 Sources of information used in a Case study

Different sources and methods can be used to gather information about an individual or group. The following are the six major sources that have been identified by researchers (Myers & Avison, 2002).

Direct observation - this strategy involves observing the subject, often in a natural setting. While an individual observer is sometimes used, it is more common to utilize a group of observers.

Documentation - this includes the organization's letters, newspaper articles, administrative records, and other documented reports relevant for the study.

Archival records - this includes the census records, survey records, name lists and more.

Physical artefacts - this method includes using the tools, objects, instruments and other artefacts often observed during a direct observation of the subject.

Participant observation - involves the researcher actually serving as a participant in events and observing the actions and outcomes.

Interviews - this is one of the most important methods for gathering information in case studies. Interviews are a widely used tool to access people's experiences and their inner perceptions, attitudes, and feelings of reality (Fontana & Frey, 2005). An interview can involve structured survey-type questions, or unstructured types, which are more open-ended questions. For the purposes of this research we used both structured and unstructured questions to best achieve our research results.

- **Structured interviews-**

A structured interview is sometimes called a standardised interview and it is a quantitative research method commonly used in survey research (Bless, Smith & Kagee, 2006). The purpose of this approach is to confirm that each interview is offered with exactly the same

questions in the same order. This type of interview questions will guarantee that answers can be reliably collected and that comparisons can be made with confidence between sample sub-groups or between different survey periods. Table 3.3 in this section provides some of the strength and weaknesses of using structured interviews.

Table 3.3: Some of the Strength and Weaknesses of Structured interviews

Strengths of structured interviews	Weaknesses of a structured interview
Enables the researcher to examine the level of understanding a respondent has about a specific topic - usually a lot more depth than with a postal questionnaire.	Can be time-consuming if a sample group is very large (this is because the researcher or their representative needs to be present for each structured interview).
All respondents are asked the same questions in the same manner and order. This makes it easy to replicate the discussion. In other words, this type of research method is easy to regulate or standardize.	The quality and convenience of the information is vastly dependent on the quality of the questions asked. The interviewer cannot change the interview questions; they must all stay the same.

- **Unstructured interviews**

Unstructured interviews are usually formulated around open-ended interview questions (Oates, 2006; Bless *et al.*, 2006). These open-ended questions may give more valid data as the respondents can say what is important to them and express it in their own words. Table 3.4 addresses the strengths and weaknesses of using unstructured interviews.

Table 3.4: Strength and weaknesses of unstructured interviews

Strengths of unstructured interviews	Weaknesses of a unstructured interview
The respondent can answer in any way they wish which may result in them leading the interview.	Interpreting the respondent's response to the questions may require more thought and time
The research focuses more on the respondents' talk on a particular topic of interest, which gives the researcher the opportunity to test his or her preliminary understanding.	The coding cost of open questions may be high

3.6 Data-collection methods

The method and the source of information that this research is based on are those of the prospective method and the interviews. To best achieve our research objectives, a group of selected e-government systems developers were interviewed. The following section outlines the research questions used for both structured and unstructured interview questions in order to achieve the research objectives.

3.6.1 Research questions

The research questions are sub-divided into general questions which will help the researcher to establish the professional life of the interviewee in relation to the study, and questions based on SDMs and e-government systems to get the interviewee's knowledge of both terms and on the relationship between them.

3.6.2 General questions

Table 3.4 consists of a list of general question that will assist the researcher to get to know the interviewee's professional life in relation to the information necessary for the study.

Table 3.5: General research questions

Questions	Purpose
What is your position in the organization, your job specification and your duties?	The purpose of this question is to give the interviewees the opportunity of introducing themselves. On the other hand the researcher gets to familiarise herself/himself with the interviewee and also know how to initiate the conversation and to address them
Are you involved in decisions concerning e-government systems development?	The aim is to help the researcher know whether the interviewee was the right candidate to present the necessary answers with regards to the development of e-government systems.
Are you involved with information systems development?	The aim is to help the researcher to understand whether the interviewee was the right candidate to give the necessary information with regards to SDMs.
How many years of experience do you have as systems development or e-government systems development.	This question will help the researcher to have knowledge about the interviewee's level of experience in the field as a systems developer

3.6.3 e-Government systems development

Table 3.6 outlines the interview questions intended to help the researcher understand more about e-government systems development.

Table 3. 6: Question in relation with development of e-Government systems

Questions	Purpose
1. How would you describe an e-government system?	This questions aims at assisting the researcher to acquire the interviewee's knowledge of e-government systems
2. How many e-government systems did your organization or department developed?	The question aims at giving the researcher knowledge about e-government systems developed by the organization of company, the successful or unsuccessful of e-government systems.
3. How do you plan and manage your e-government projects?	The question assists the researcher to achieve more information on how the plan manage the development of e-government systems.
4. What tools or techniques do you use when developing e-government systems?	The researcher is helped to acquire more information about the tools and the techniques used when developing e-government systems.
5. What are the challenges of developing an e-government system and how do you address those challenges?	The question aims at assisting the researcher understand the problems and challenges of developing e-government systems
6. Based on your experience as a developer, what are the key factors affecting the development of e-government system?	The question aims at helping the researcher with understanding the factors affecting the development of e-government systems which might result in the success or failure of these systems.

3.6.4 Systems Development Methodologies (SDMs)

The questions in Table 3.7 will assist the researcher to acquire more information about SDMs.

Table 3.7: Questions in relation to SDMs

Questions	Purpose
1. What do you understand about SDMs?	The researcher tried to understand the candidates' level of understanding on SDMs.
2. How would you rate your knowledge of SDMs?	This question shows the respondent's level of expertise.
3. What systems development methodology do you use when developing e-government systems?	The questions helped the researcher to establish the system development methodology that is used when developing e-government systems
4. Which systems development methodology do you think is suitable for the development of e-government systems and why?	The question assisted the researcher in acquiring knowledge about the systems development methodology that the organization or department are using to develop e-government systems.

3.7 Research approach

Leedy and Ormond (2005) define the two basic approaches for social research that are governed by either quantitative (positivist) or qualitative (interpretive). In this research, the anti-positivist research approach is that of the interpretive research approach. This section provides an in-depth discussion of both the quantitative research and the qualitative research approaches.

3.7.1 Quantitative approach

The quantitative research approach is a research method that relies less on interviews, observations, and small numbers of questionnaires, focus groups, subjective reports and case studies, but is much more focused on the collection and analysis of numerical data and statistics (Bless *et al.*, 2006). This research approach is normally associated with statistical analysis, the systematic measurement, and mathematical models (Wan, 2003). The goal of

the quantitative approach is to determine whether the predictive generalizations of a hypothesis hold true.

As a result, this research approach aims at testing the theoretically conceived null hypothesis against the facts of reality and the result is represented in numerical values (Wan, 2003). In addition to this, according to Mingers (2003), the data collected must be quantified in order to increase the reliability, comparability, and the accurateness of theoretical propositions. Quantitative researches consist of general examples such as *experiments* and *surveys* (Denscombe, 2003).

3.7.2 Qualitative approach

The qualitative research approach is a research method that relies less on numbers and statistics but more on interviews, observations, small numbers of questionnaires, focus groups, subjective reports and case studies (Bless *et al.*, 2006). Fitzgerald and Howcroft (2000) and Wan (2003) define qualitative research as the methodology of study that produces descriptive data, determines what things exist, and also the observable behaviour of people's written or spoken words. According to Denscombe (2003), spoken words and written sentences used to qualify and record information about the world, can be considered as a qualitative approach. The qualitative research approach is a less structured approach and it was developed in social sciences to enable researchers to study social and cultural phenomena (Olivier, 2004).

The use of qualitative research approach gives the interviewee the opportunity to express words and feelings when responding to the interview questions. Qualitative findings grow out of three types of data collection which are in-depth, open-ended interviews, direct observations as well as written documents. In this study the method used was interviews. According to Olivier (2004) the researcher gets involved with the actors and tries to understand their perspective in detail through careful interviews. Interviews yield direct quotations from people about their experiences, feelings, opinions and knowledge. Olivier (2004) states that qualitative research methods include grounded theory, action research, case studies and ethnography. The next section discusses in detail the preferred approach for this study.

3.7.3 Preferred research approach

The study aims at understanding the use of systems development methodologies in the development of e-government systems. In this study, the method of data gathering is of interpretive nature, as a result qualitative approach is used. A Case study from a qualitative perspective is used as a research methodology. Case studies are discussed more fully in section 3.4.1 of this study. The data gathered from unstructured interviews and written literature on the phenomena under study are used to complement the interviews. The use of the interpretive approach as discussed earlier in section 3.7.2 which is also of a qualitative nature is productive in order to best achieve the research objectives.

3.8 Data-analysis method

Data analysis is the most complex and mysterious of all phases of research (Elloitt & Lukes, 2008; Oates, 2006). This study is based on the qualitative data method. This qualitative data method constitutes all non-numeric data, which are words, images and/or sounds found on interview tapes, researcher's diaries, written documents or websites as discussed in earlier sections. Oates (2006) defines the qualitative data approach as the main type of data or evidence generated by using case studies and analysed by interpretive researchers. As a result, the qualitative data-analysis methods used in this study include cross-case analysis and content-analysis techniques as well as the data-analysis tool called ATLAS.ti 6.1.

3.8.1 Content analysis

Content analysis, as the name states, is based on analysis and interpretation of written text, verbal or communicated messages. It is a method used for summarizing any form of content by counting various aspects of the content. The purpose of this analysis is to enable a more objective evaluation than merely comparing content based on the impressions of a listener (Denscombe 2003).

This type of analysis enables the researcher to test theoretical issues in order to enhance understanding of collected data. According to Denscombe (2003) content analysis enables the researcher to clarify words into fewer content-related categories with the assumption that words and phrases used share the same meaning when they are classified under the same categories.

Content analysis offers the researcher major benefits since it is a content-sensitive method and it has an established position in research (Neuendorf, 2002). This method is also flexible when coming to research design. Furthermore, content analysis can be used as a development tool in order to develop an understanding of the meaning of communication as well as to identify critical processes (Olivier, 2004).

3.8.2 Cross-case analysis

According to Denscombe (2003) cross-case analysis is a method that examines themes, similarities, and differences across cases. This method aims at revealing related patterns among cases with an attempt of assisting the researcher to identify areas where respondents agree as coherent. Olivier (2004) describes this method as an effective way of analysing data from multiple-case studies and thereafter generates theory about particular phenomena.

For the purposes of this study, the cross-case analysis method was identified as the preferred method of data analysis, mainly for its capability of searching for factors from a stack of literature that may possibly influence changes of particular phenomena, especially in those areas identified as burdensome (Denscombe, 2003; Olivier, 2004). In this study, a stack of transcribed interviews from four case studies and literature documents was used. The researcher wanted to determine the use of SDMs in the development of e-government systems and also to determine their success rate and failure rate in addressing strategic issues.

Data were analysed using codes whereby the propositions were matched to their supporting data-collection instruments. In this study the codes used are as follows:

- For instance in this study we have four case studies, the code that is used for case study 1 would be Company A which is represented by letter **A** and case study 2 which is Company B is represented by letter **B** , this would apply to any other companies visited
- For interviews, we used the code I and if there is more than one, it would be 1IA, 2IA, 3IA, meaning 1 Interview from Company A, or 2 interviewees from Company A.
- For literature documents we used the code L

For example, if a proposition is supported by both interviews and the literature documents then the code would be [1A, L], whereby the “A” represents the company A or case study 1 which would be the different companies that were visited, ‘1’ represents interviewee number 1 while ‘L’ represents literature documents. Each company’s propositions were formulated and combined propositions formulated thereafter. This combined proposition consists of data gathered from each of the company’s. All of these formulated propositions will be discussed in detail later in Chapter 4. The data analysis tool that was used is that of a qualitative data analysis tool called ATLAS.ti 6.1. The next section provides a detailed discussion of qualitative data analysis tool as used in this study.

3.8.3 ATLAS.ti. 6.1

ATLAS.ti. 6.1 is a software programme that is used to analyse qualitative data, management and building models. It is a powerful workbench tool used mainly for the qualitative analysis of large bodies of textual (literature), graphics, audio (interviews), or any other data that captures the opinions and perceptions of the respondents (Olivier, 2004). This software offers a variety of tools for accomplishing the tasks associated with any systematic approach, and it is important, especially, when theory from cases is expected to be generated. Furthermore, this analysis tool helps the researcher to explore the complex phenomena that is hidden in the data collected.

This study consists of six separate interviews that were conducted at three government agencies including the government agencies involved in the development of e-government systems. Firstly, the interviews were transcribed from audio to textual data then, secondly, they were stored inside a hermeneutic unit (HU) created in ATLAS.ti. As a result, these interviews are known as primary documents (PD). These PDs were then read into this software in order for the codes to be assigned to the relevant parts of the interview that can be applied to the subsequent PDs. These assigned codes are then formed and used as a guide to compare the PDs in order to have easily identifiable perceptions or a general view on particular issues.

For the purposes of this study, the researcher used the assigned codes to formulate propositions from each interview conducted on e-government development systems. These propositions then formed the initial propositions which were later revised when data from the literature analysis were presented. Furthermore, an iterative process was used in order to formulate propositions for all the cases being presented until the final propositions which

encompasses the results from all e-government systems presented. After all these processes, the researcher then had to interpret the qualitative data in a way deemed suitable. The major disadvantage of ATLAS.ti is that it does not assist in establishing the meanings of constructs (Denscombe, 2003).

3.9 Chapter summary

This Chapter first started by defining the purpose of research and secondly it continued to discuss the philosophical assumptions behind research, the research method and design underlying this research study. Common philosophical assumptions of research such as the positivist paradigm, critical social research paradigm and the interpretive research paradigm, were reviewed and presented. Furthermore, the interpretive research paradigm was identified as suitable for the framework of this study. The research questions are also discussed as well as the rationale behind these questions. The research interviewees were also identified and the strategy on how data would be sourced out from these interviewees was also put in place.

CHAPTER 4: RESULTS AND DISCUSSIONS

4.1 Introduction

This Chapter discusses the results obtained from the interviews conducted in four companies involved in the development of e-government systems. The results obtained from each company are first discussed individually; thereafter the summaries of the company's results are presented in each question. After reporting the interviews, a cross-case analysis is performed in order to generate common propositions among the four companies. The study enables the researcher to generate theory on the use of SDMs in the development of e-government systems in the Republic of South Africa. A qualitative analysis tool called ATLAS.ti.6.1 was used to analyse the transcribed interviews.

4.2 Research aims and objectives

The main aims and objectives of this research were to determine whether SDMs are used in the development of e-Government systems and also to develop a uniform framework for the use of SDMs in the development of e-government systems in the Republic of South Africa. The main research questions of this study were based on:

- *investigating the SDMs used in the development of e-government systems.*
- *identifying the challenges and problems that are encountered by the developers of e-government systems.*
- *determining the suitable SDMs that addresses unique aspects of e-government systems.*

The last two objectives were addressed in the literature review conducted in Chapter 2 of this study. As a result a set of research questions were formulated from the literature review in order to address the first objective as well as the main research aim of this study. These research questions were grouped into two main research questions and they were used to represent the research questions used in this study. Eight sub-research questions were also formulated from the two main questions as follows:

First main question: What SDMs are used when developing e-government systems?

The first semi research questions used to answer the first main research question are:

- Are you involved in the development of e-Government systems?
- What type of e-government systems do you develop?
- What are the challenges and benefits of e-government systems?
- What types of SDMs are currently being used in the organization?
- If SDMs are not used, how do you plan and develop and e-government systems?
- What are factors affecting the development of e-government systems?

Second main question: Does the use of SDMs help create better quality e-government systems, and does it lead to better developmental process?

The second sub-research questions used to answer the first main research question are as follows:

- Are the SDMs used in the organization improving the quality of e-government systems?
- Do they also lead to better development processes? Please elaborate.

The purpose behind the formulated research questions in this Chapter was to help the researcher address the first objectives as defined in the study. In the section below, a brief description is provided of how interviews were arranged and the challenges encountered in the whole process.

4.3 How interviews were arranged

A clear letter of permission, signed by both the researcher and the supervisor was sent to quite a number of government agencies and organisations in the North West Province and Gauteng Province. This letter explained clearly the main purpose of the research. Copies of possible research questions were also sent to the organizations concerned. Telephone calls were also made, emails were sent in order to ensure that all interviewees knew what was expected of them. All the interviews were conducted in the air-conditioned and very clean boardroom of the organization in question. The interviewees were comfortable and were able to answer all the questions asked during the interviews.

4.4 Challenges encountered

Gathering data and getting the relevant individuals to interview for this study, was not very pleasing. There were so many obstacles that could make one think again about doing research. Some of the challenges included, amongst other things, not having cooperative departments, especially in government. A visit was also made to those agencies and still there was no one who could assist or even answer one question with regard to e-government systems that their organization was using.

Although it was very difficult and challenging to find the relevant people to interview and gather data from for this research, I managed to interview at least three representatives from four companies who responded positively to my letters of request. One of the organisations that participated was from Mafikeng and the others from the city of Johannesburg. All of these companies that were interviewed are involved in the development e-government systems. The next section discusses the research findings and responses from the four case studies conducted.

4.5 Research findings

The following section provides a brief summary of the collected interview data as well as background overviews of all case studies and the candidates who were participating in the interviews.

4.5.1 Collected data on case studies

As mentioned in the previous Chapter, Research methodology, the interviews used to collect data from four companies that are involved in the development of e-government systems were unstructured. Therefore, the interview questions were formulated in a way that enabled the researcher to have the benefits of controlling and leading the interviewee to answer questions that were prepared for this study. The next section of this study provides brief background information on the participating companies.

4.5.1.1 Background Information on participating companies

This section provides background information on case studies that were conducted in four different companies that are involved in the development of e-government systems. The

medium for the communication language used in all companies was English. The project managers and Information systems developers were interviewed individually in all four companies. For confidentiality purposes, the names of all participating companies are provided with the name Company A, Company B, Company C and Company D. The section below provides a brief overview of all participating companies.

Company A which forms case 1 of this study; is well-known as a company that provides clients with sophisticated and diverse service delivery options in systems integration and networking areas as well as in infrastructure solutions. The company is unparalleled in the local market and is a proudly empowered SA IT company which is listed on the Johannesburg Stock Exchange (JSE). Through the years of excellent and satisfying service delivery, this company has gained recognition as the complete IT partners to a considerable client-base of large technology users in both the private and the public sectors. Company A has specialised business knowledge and it consists of structures called Chief Client Officer Structures, which are industry verticals. These structures consist of five industries, amongst others financial industries such as banks, the mining and manufacturing industries such as Anglo-American, the telecommunications industry and government agencies.

Company B is a global management consulting technology services and outsourcing company with over 250 000 employees serving clients in more than 120 countries world-wide. This company forms case study 2 of this study, and it collaborates with clients in order to help them become high-performance businesses and Government. The company is also known for its excellence of combining unparalleled experience, comprehensive capabilities across all business functions and industries and performing extensive research on the world's most successful companies. Company B has an extensive relationship with the world's leading companies and government and it can work with organizations of all sizes. This company also helps its clients identify new business and technology trends and also develops solutions to their clients all over the world in order to allow them to enter new markets, increase revenue, improve on operational performance and also deliver products and services in the most efficient and effective way.

Company C is one of the government agencies in the North West Province that aims at providing quality education for higher learner achievement through outstanding teaching and support. This company forms case study 3 of this study, and is known for its excellence in providing higher education, innovation, communication, integrity and honesty and also for being people-centric, meaning that whatever the department does is based on the needs and requirements of the people. Within this company there are divisions such as

administration, finance, human resources and also the IT divisions that are responsible for the planning, development, maintenance and provision of support to any systems or software used in the department.

Company D forms case study 4 of this study and it is one of the leading data-banking companies in South Africa. This company mainly focuses on the collection, organization, analysis, interpretation as well as the presentation on the data that are accurate and on time. This company is also responsible for monitoring the quality of the information made available to the public and also for the updating of such information on a regular basis.

The next section in this study discusses in detail the responses from the interviews conducted from four companies involved in the development of e-government systems.

4.5.1.2 Overview of the Interviewees

The Interviewees that were interviewed in all four companies are employees and members of the e-governments systems development teams in their companies. Three of the companies participating in this study were from the Gauteng Province and the other company from North West Province which are both in South Africa. From each company at least three Interviewees who are from different cultural backgrounds were interviewed. The interviews conducted lasted for about 30 to 45 minutes for each individual.

The interviewed Interviewees had different roles in terms of job descriptions, responsibilities and working experience which are discussed in Category I of General questions in Table 4.2 of section 4.5.1.3. Table 4.1 below provides the characteristics of each participant based on their age, gender and job description and assigned identification (ID) codes used to identify individuals during analysis.

Table 4.1 The Characteristics and Interviewees Code ID matrix

Company	Participant ID code	Job Description	Gender	Age
A	1A	Sales Person/Project manager	F	> 40
A	2A	Developer	M	30 - 40
A	3A	Developer	M	30 – 40
B	1B	Systems Analyst	F	< 30
B	2B	Developer	M	30 – 40
B	3B	Developer	M	30 – 40
C	1C	Systems Analyst	M	30 – 40
C	2C	Developer	M	30 – 40
D	1D	Systems Analyst	M	30 – 40
D	2D	DBA	M	30 - 40
D	3D	Systems Analyst/Project manager	M	> 40

As indicated in Table 4.1, from the 11 Interviewees in different companies, five developers involved in the development of e-government systems with ages ranging from 30 – 40 were interviewed; four Interviewees who also took part in the interviews were Systems Analysts. They also play a big role in the development of e-government systems. Furthermore, one DBA and a Salesperson of above forty (>40) had other responsibilities than being the project manager of the e-government systems being developed. The next section below provides a summary of how research questions were categorized, as well as the responses from the different Interviewees who were interviewed.

4.5.2 Interview questions

The interview questions as grouped from the previous chapter are arranged into three categories. These categories were created in such a way that the research questions set for this study are well addressed. The categories of the research questions are as follows:

- **Category I: General questions**

The discussion under this category was mainly focused on the interviewee’s historical background based on:

- job position, description as well as the responsibilities,
- involvement in information systems development;

- involvement in decision-making and
- work experience.

- **Category II: e-Government systems**

The discussion in this category was based more on the type of e-government systems that the organisation is developing, the factors affecting the development process and the process they follow to ensure the uptake of the e-government system developed.

- **Category III: SDMs**

The discussion under this category was mainly focused on:

- the SDMs used in the development of e-government systems,
- the tools and techniques used to plan, analyse and design, develop and implement the e-government systems developed.

4.5.3 Documentations of the interview

For quality purposes and consistency, the interviews were recorded using a microphone and saved as audio format, then later transcribed into text format. Windows media player was used to play and listen to the audio files which were then transcribed into a text format using a Microsoft Word document. The text format was later used in an analytical software tool called ATLAS ti 6.1. The next section discusses data analysis and interpretation of the results that was analysed using ATLAS ti 6.1.

4.5.4 Data analysis and interpretation

The data analysis in this study went through several stages of iteration of codes and it was presented using ATLAS ti 6.1.

Stage 1: Data were coded for each participant in order to isolate the themes and categories using ATLAS ti 6.1 as indicated in Figure 4.1 below.

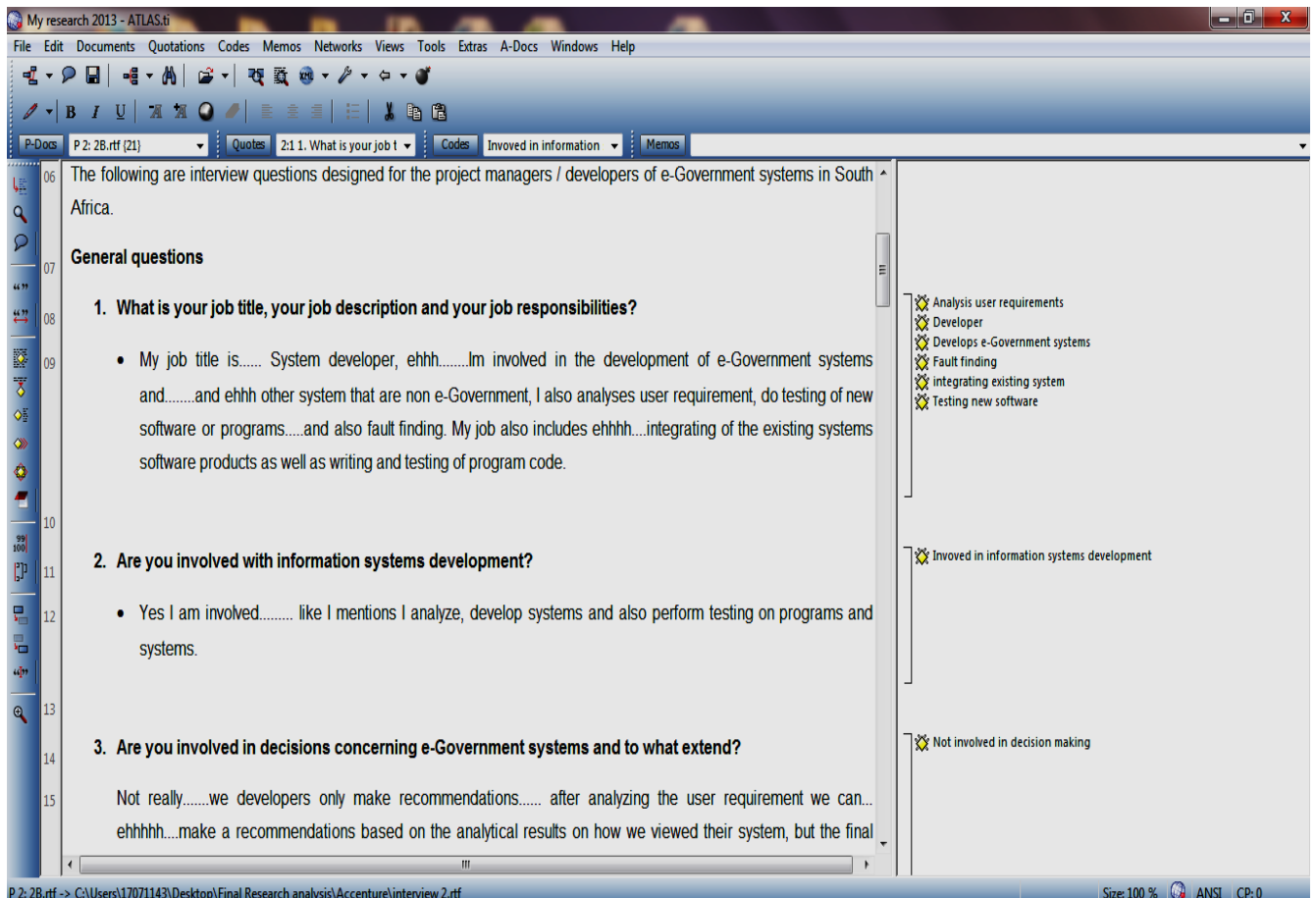


Figure 4.1: Sample Analysis in ATLAS ti 6.1.

Figure 4.1 provides an example of the iteration of codes with the corresponding interview questions as well as the responses from the interviewee using ATLAS ti. 6.1 Software. The data were coded for each interviewee in order to find the themes and categories as well as the core of the data. The process of transcribing data from audio to text message and then uploaded in the ATLA ti software for coding purposes. This process was performed on each interviewee's responses from four companies that were participating and it lasted for almost three months.

An excerpt summary of the interview questions and responses received in Category I, General Question from different interviewees using Microsoft excel (spreadsheet) document presents Table 4.2 (see Annexure C, Table C 1). The responses of each interviewee are grouped together according to their respective company.

Table 4.2: Sample responses under Category I: General Questions (An excerpt analysis in spread-sheet)

INTERVIEW QUESTIONS	COMPANY A		
	1A	2A	3A
1.1 What is your job title, your job description and your job responsibilities?	<ul style="list-style-type: none"> - Business Delivery Executive Public Sector - Work in sale environment - Sell solution to government. - Look after contracts - Ensure good interaction with sale 	<ul style="list-style-type: none"> - Systems developer and an analyst - Systems planning, - Systems analysis, - Develop systems, and do systems testing 	<ul style="list-style-type: none"> - Developer, - Develop systems, - Do testing like unit testing as well as system testing. - Provide training of users
1.2. Are you involved with information systems development?	<ul style="list-style-type: none"> - Not directly - Work closely with developers and clients 	<ul style="list-style-type: none"> - Yes I am involved in information systems development 	<ul style="list-style-type: none"> - Yes I am in systems development
INTERVIEW QUESTIONS	COMPANY B		
	1B	2B	3B
1.1 What are your job title, your job description and your job responsibilities?	<ul style="list-style-type: none"> - Systems developer and programmer - Develop systems 	<ul style="list-style-type: none"> - Systems developer - develop e-government systems and other systems that are non e-government, - Analyses user requirements, - do testing of new software or programmes and also fault-finding - Integrating the existing systems software products as well as writing and testing of programme codes. 	<ul style="list-style-type: none"> - Systems analyst - Work closely with clients - Making sure that the systems requirements are set forth by the business
1.2. Are you involved with information systems	<ul style="list-style-type: none"> - Yes < only the senior manager decides on what methodology to use and what process 	<ul style="list-style-type: none"> - Yes I am involved, like I mentions I analyse, develop systems and also 	<ul style="list-style-type: none"> Yes, normally when the user comes to us to request the

development?	to be followed. - Once the deal is been signed off no changes can be made on the system. - Only sale representatives of the company make some decisions.	perform testing on programmes and systems	system we sit and then discuss the processes and then we decide and then we go on with the development and everything
INTERVIEW QUESTIONS	COMPANY C		
	1C	2C	
1.1 What is your job title, your job description and your job responsibilities?	- Senior data analyst - Develops systems and draws up reports	- Systems / Software developer - Develop systems	
1.2. Are you involved with information systems development?	- Yes I am involved in almost every system that we design or implement.	- Yes, we wait for people to come and make request to us and then we go on with the development of the systems	
INTERVIEW QUESTIONS	COMPANY D		
	1D	2D	3D
1.1 What is your job title, your job description and your job responsibilities?	- Systems analyst - Analyse user requirements - Translate user requirements into technical specification - Design databases and systems documentation - Do systems testing like sound systems testing, quality assurance testing and user acceptance testing.	- Database administrator (DBA) - Administer the databases, the database servers - Make data available for developers and systems users - Do user acceptance testing (UAT) on the database	- Systems Senior Specialist Analyst - Involved in Skills Management Staff (SMS) which entails management of staff, manage skills, manage resources, manage infrastructure
1.2. Are you involved with information systems	- Not directly, I am just managing and overseeing the whole process and analysis.	-Yes, I am involved, like I said I am a DBA and I work very closely with	- Yes I take part heavily in the initial stages of

development?		developers, thought I am in database management	elaboration, implementation, and testing
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In stage 2, a table with questions, category, codes and count was produced based on the responses given by Interviewees in Table 4.2 of this section. The responses provided are listed under the name codes, whereas the respondents are listed under the name count, so to count numbers of respondent whose answers were in correspondence to a specific code for a particular question. Count was represented in such a way that it indicates the number of participant(s) who responded in correspondence to the specific code of a particular question as well as the company name.

For example, in Table 4.3 in Question 1, 2IA would mean two Interviewees from Company A responded to a similar code, which is Developer, and 1IC means one Interviewee from Company C responded to code: Analyst.

Table 4.3: Extract responses under Category II from Annexure C, Table C 1

Question	Category, codes and count	
1. What are your job title, your job description and your job responsibilities?	Category 1-1: developer	
	Codes	Count
	• Developer	2IA, 2IB,1IC
	• DBA	1ID
	• Analyst	1IB, 1IC,2ID
	Category 1-3:Sales person	
Codes	Count	
• Business Delivery Executive Public Sector	1IA	
2. Are you involved with information systems development?	Category 2-1: Involved in ISD	
	Codes	Count
	• Involved in ISD	2IA,3IB,2IC,2ID
	Category 2-2: Not involved in ISD	
	Codes	Count
	• Not directly involved in ISD	1IA,1ID

In category I: General questions, the interviewee were asked the same questions so as to ensure quality and fairness at the same time trying to minimize inconsistency. This also helped with the management of time and also to ensure that interviewees do not repeat themselves more often.

The response for the main research question “*What SDMs are used when developing e-government systems*” is addressed in Table 4.4 and Table 4.5. Table 4.4 presents a summary of the interview questions discussed in Category II of e-government systems developed and responses received from different interviewees. The responses provided are listed under the name codes whereas the respondents are listed under the name counts in order to count number of responses to a particular question.

Table 4.4: Excerpt responses from Annexure C table 2 under Category III: e-Government systems developed

Question	Category, codes and count	
3. How do you plan and manage e-government	Category 9-1: Planning and managing of e-government projects	
	Code	Count
	<ul style="list-style-type: none"> First the user sent an RFP, meeting with stakeholders is arranged to discuss user requirements and sign off on the systems. 	3IA,2IB, 1IC, 2ID
	Category 9-2: No planning	
	Code	Count
	<ul style="list-style-type: none"> No planning and manage e-government 	1IB,1IC,1ID
4. What strategies do you use to facilitate the uptake and adoption of e-government systems?	Category 9: Strategies used in e-Government systems	
	Codes	Count
	<ul style="list-style-type: none"> Approach method 	2IB
	<ul style="list-style-type: none"> User training 	3IA,1IB,3ID, 2IC
	<ul style="list-style-type: none"> Allocate internal people for systems delivery Sign users' acceptance form 	3ID 3ID
5. Please describe the process that you follow while developing e-government systems?	Category 10-1: Development processes followed	
	Codes	Count
	<ul style="list-style-type: none"> Follow SDLC processes 	3IA, 2IC,3ID
	Category 10-2: No development process followed	
	Codes	Count
	<ul style="list-style-type: none"> No development process followed 	3IB,
6. What tools /	Category 11: Tools/Techniques used	

Question	Category, codes and count	
techniques do you use when developing e-government systems?	Codes	Count
	<ul style="list-style-type: none"> • ERD • DFD • Data Dictionaries • Use-case diagram • Prototyping • Flow-chart diagram • Decision table • Ms. Visio • Structure English • Visual Studio • SQL, Wed, Excel and power design 	11A, 21B,11C 31A, 21B,11C 21D, 11C 11A, 11D, 11B 31B 21B 11C 11A 21B 11C 11D
7. Based on your experience as developer, what are the key factors affecting the development of e-government systems?	Category 14: Factors affecting development of e-Government systems	
	Codes	Count
	<ul style="list-style-type: none"> • Communication between developer and user • Political factor • Economic factors • Technological factors • Social factors 	21A,21B,11D 11C,21D 11A,21B,11C 11A,11B, 21C,31D

Finding 1:

According to the interviewees in Company C, there is no planning and management strategy for the development of e-government systems. A request for a proposal is first received from the users for a particular system to be developed. The following is an example of what the interviewee said:

Interviewer: How do you plan and manage your e-Government projects?

11A: “Planning the system, we don’t have such a methodology or anything like that but what usually happens is that we have a request, maybe initial the request from our users to say we need such a system and then from there on we discuss it with the business processes and all those processes that need to happen for that system. And then from there on to decoding the system itself, we do the documentation and then from there on implement to

users and then makes some testing before if the system was correct with few clusters maybe in particular we run a prototype with a small unit first, so that they can use the system, get the feeling of the system and then from there on if there we need be where we can correct then we can correct. And then from there on after the training is the full implementation then and then there on the user they will give us the feedback as after implementation if any problems.”

All interviewees from Company A, B, C and D explained that communication between developers and users, political, economic, social and technological factors was a factor affecting the development of e-government systems. To ensure the uptake and adoption of e-government systems² interviewees from company B use the approach method, 3 interviewees from company A, 1 in company B, 2 in company C and 3 in company D conduct user training. All participants in company D allocate internal people for systems delivery and sign users’ acceptance forms.

Table 4.5 presents a summary of the interview questions under category III of Systems Development Methodologies used and responses received from different interviewees. The responses provided are listed under the name codes whereas the respondents are listed under the name counts. This would allow us to count numbers of respondents from a particular question.

Table 4. 5: Responses under Category III: SDMs

Question	Category, codes and count	
8. Do you use SDM when developing e-Government systems? If so please name it. If not, explain reasons why?	Category 16-1: SDM used to develop e-Government systems	
	Codes	Count
	SDM used to develop e-government systems	3IA,3IB
	Category 16-3: No SDM used to develop e-Government system	
	Codes	Count
	No SDM used to develop e-government system	2IC,3ID
9. What are the challenges of selecting SDMs and how do you deal with them?	Category 18-1: Challenges of selecting SDM	
	Codes	Count
	Using one systems development methodology	1IA,1IB, 1ID
	Category 18-2: No challenges of selection SDM	

Question	Category, codes and count	
	Codes	Count
	No challenges	2IA,2IB,2IC,2ID
10. What processes or frameworks do you use when developing an e-government system and why?	Category 19-1: Framework used	
	Codes	Count
	Frameworks are used	1IA,1IB,2ID
	Category 19-2: No Frameworks used	
	Codes	Count
	No frameworks used	2IA,2IB,2IC,1ID
11. What are the advantages and disadvantages of SDMs when developing e-government systems?	Category 20-1: Advantages of SDM	
	Codes	Count
	Proper planning and management	3IA,1IB,2IC,3ID
	Category 20-2: Disadvantages of SDM	
	Codes	Count
	Lack of knowledge, understanding and wrongly implemented	3IA,3IB,2IC,3ID
12. Does the use of SDMs lead to a better quality e-government system?	Category 21: Using SDM leads to better quality	
	Codes	Count
	• Leads to a better quality	3IA,2IB,1IC,2ID
	• Not leading to a better quality	2IB,1IC,1ID
13. Does the use of SDMs lead to a better development process?	Category 22: Using SDM leads to better development process	
	Codes	Count
	• Leads to better development process	3IA,2IB,1IC, 2ID
	• Not leading to better development process.	1IB,1IC,1ID

Finding 2:

All participants in company A, 2 in company B and D and 1 in company C are exposed to SDMs and they believe that SDMs lead to better quality of e-government systems development whereas 2 interviewees in company B, 1 in C and 1 in D have no knowledge of how SDMs work since they do not use or apply them when developing e-government systems. Developers in most of the companies developing e-government systems still lack

knowledge of SDM and how they are used when developing e-government systems. The next section provides examples of e-government systems developed.

Types of e-Government systems

The Figure 4.1 below illustrates a tree diagram of the types of e-government systems developed.

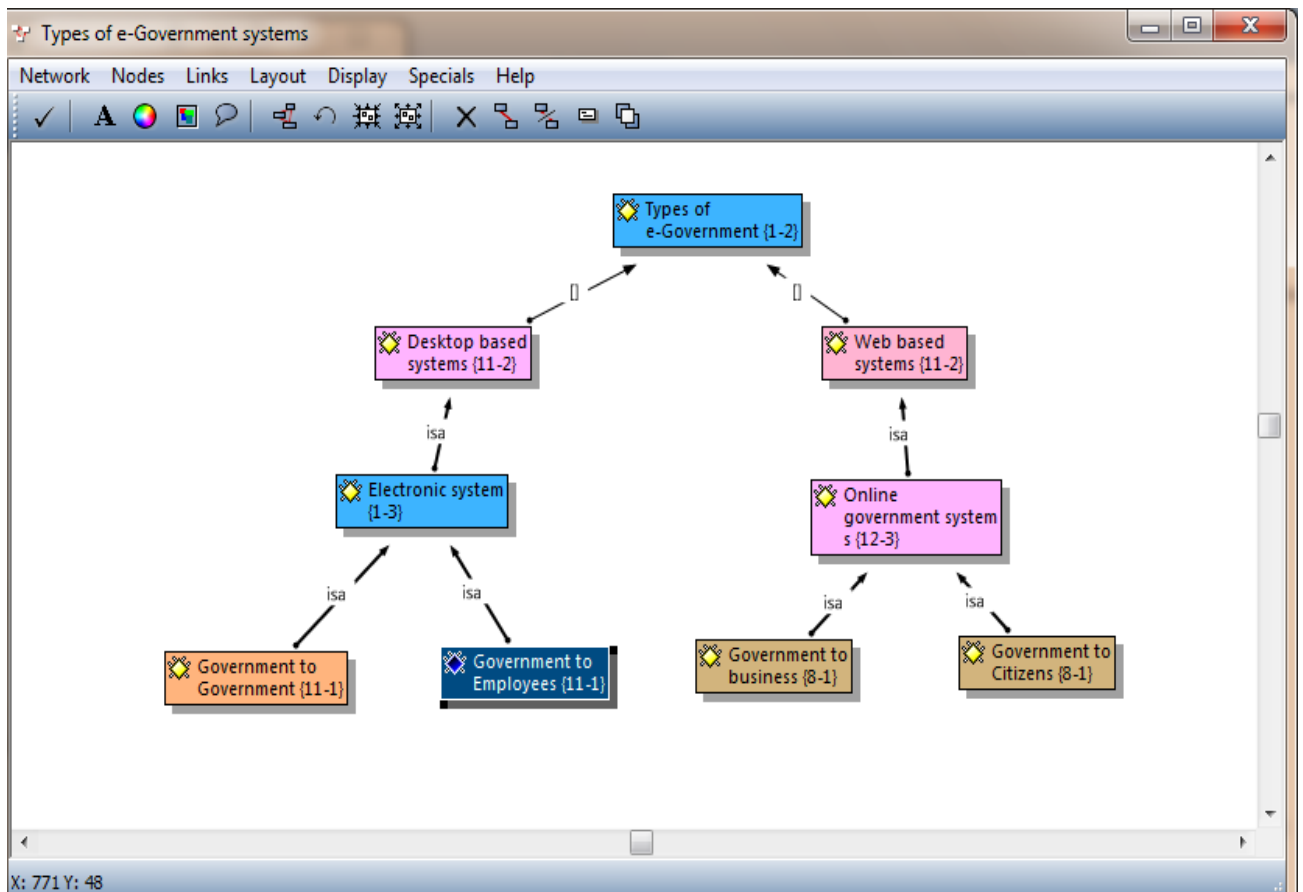


Figure 4. 2: Types of e-Government Systems

This tree diagram was designed using ATLAS ti. 6.1. It shows that there are two types of e-government systems, web-based and desktop-based ones. The figure also demonstrates the relationship between two nodes, for example, it shows the relationship between G2G system and Electronic system as well as the relationship between electronic systems and desktop-based systems. It also indicates how many interviewees are developing either desktop-based systems or windows-based systems. The next section illustrates the SDMs used to develop the e-government systems in Figure 4.1.

The SDMs used in the development of e-Government systems

Figure 4.2 of the SDMs tree diagram below illustrates different types of SDMs used by different organizations when developing e-government systems.

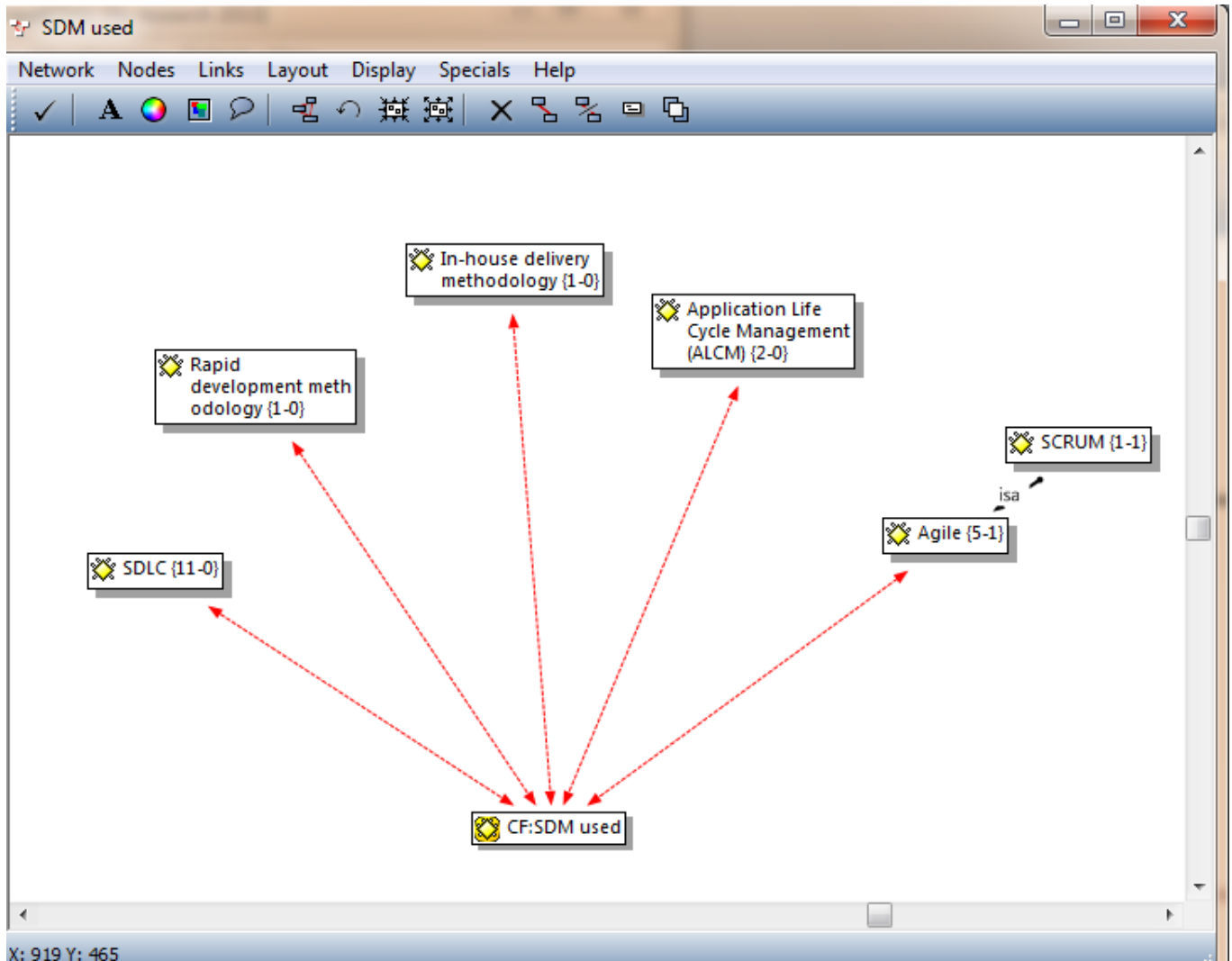


Figure 4. 3: Tree of SDMs used

According to this figure, almost all interviewees mentioned that they used the SDLC approach; only five who were interviewed were familiar with agile methodology.

The Tools and Techniques used

Figure 4.3 below illustrates the tools and techniques that are used in the development of e-government systems

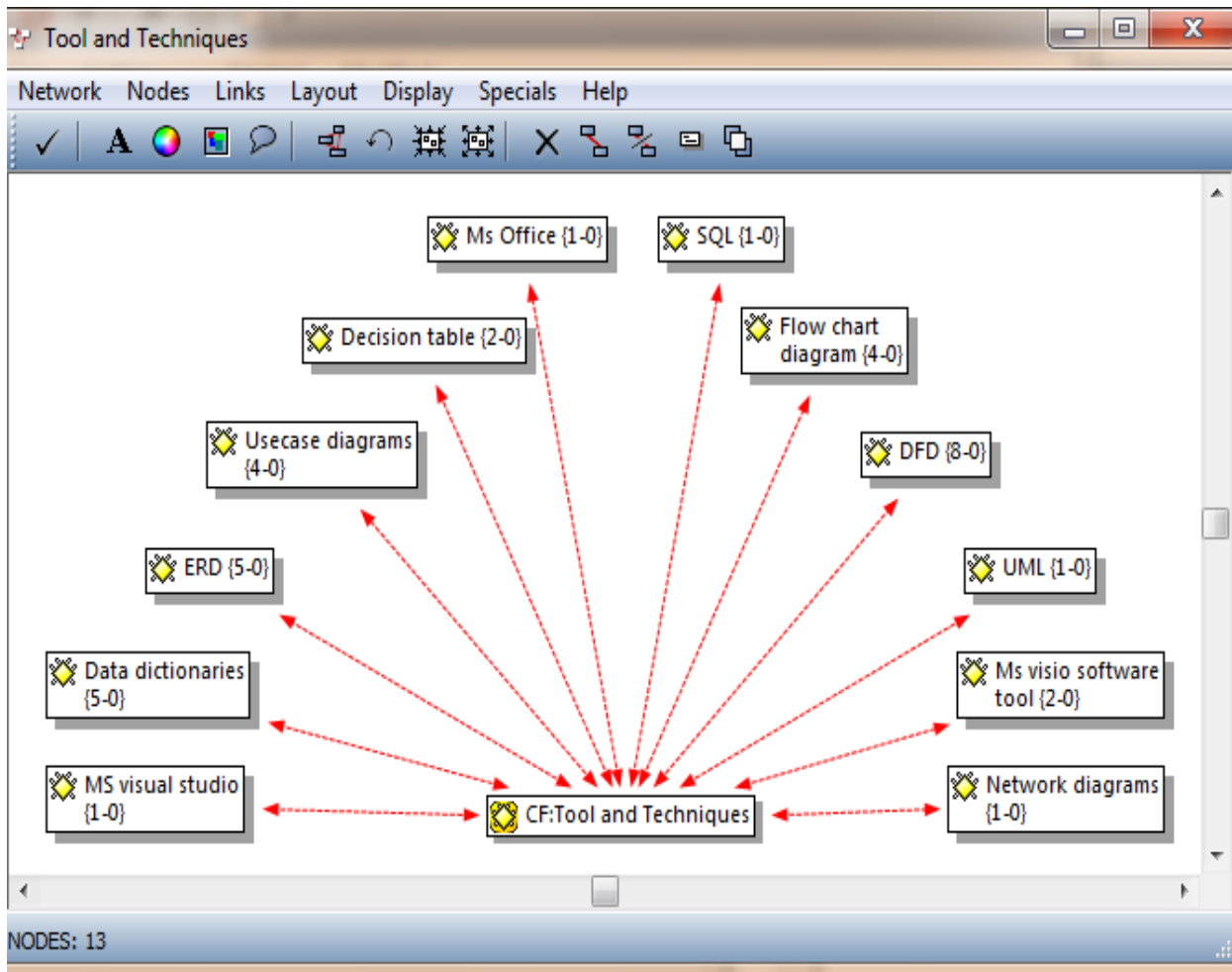


Figure 4.4: Tools and techniques used

Figure 4.4 above demonstrates the tools and techniques that the organizations interviewed are most familiar with. ATLAS ti was used to design the tree and it also indicates how many people are familiar with what tools. The following section discusses the research propositions extracted from the research interview in different companies.

4.6 Research propositions

In this section research propositions are formulated from each participating case study about what is currently happening when e-government systems are developed. The purpose of formulating these propositions is mainly to generate theory about what is being done regarding the use of SDMs in the development of e-government systems by using the information derived from the interviews.

4.6.1 Propositions from Company A

- ***Proposition 1***

A successful e-Government system should be well planned and analysed and users of such systems should be involved from the initial stage of the development phase till the implementation stage [3IA].

- ***Proposition 2***

Agile methodology is the most common methodology that developers of e-government systems are most familiar with. This shows that SDMs are used in the development of e-government systems. [3IA].

- ***Proposition 3***

Using SDMs leads to a better quality and development processes of e-government system [3IA]

- ***Proposition 4***

A request for proposal (RFP) or request for information (RFI) outlining the scope of the proposed system with clear specifications should be provided before the development of such systems commences [3IA].

- ***Proposition 5***

There is awareness that factors affecting the development of e-government systems include lack of understanding of the system requirements, failure to ensure that users of the e-government system being developed are trained and poor development strategies [3IA].

- **Proposition 6**

There is a need for a framework that should be used when selecting the appropriate methodology to use when developing e-government systems. Developers find it very challenging when selecting a systems development methodology to use since there is no framework for selecting an SDM when developing systems [2IA].

4.6.2 Propositions from Company B

The following propositions are formulated in order to generate theory about the use of systems development methodologies in the development of e-government systems from company B based on the interview data. In these sections the researcher decided to include propositions formulated around Company A so that propositions made in section 4.6.1 are revised and the findings from interview data in Company B are included. The researcher used this strategy in order to perform a cross-case analysis method of the cases under study.

- **Proposition 1**

[A successful e-government system should be well planned and analysed. Users of such systems should be involved from the initial stage of development phase till the implementation stage.]

Proposition 1 from section 4.6.1 is supported by the findings from interview data in Company B. As mentioned by the interviewees in Company B, there should be a strategy in place for the planning of e-government systems. One of the interviewees in Company B mentioned that developers are experiencing problems when planning for e-government systems. The Company's in-house systems development methodology puts emphasis on planning and design of information systems. Therefore the proposition 1 from section 4.6.1 is supported by the interview findings in Company B and it can be applied to Company B [3IA, 2IB].

- **Proposition 2**

[SDMs are used in the development of e-government systems. Agile methodology is the only methodology that developers of e-government systems are most familiar with.]

It was identified from the interview data that developers from Company B are more familiar with an agile methodology called SCRUM and their own in-house development

methodology. Therefore this proposition is supported by the findings from the interview data in Company B and it will remain unchanged [3IA, 3IB].

- **Proposition 3**

[Using SDMs leads to a better quality and development processes of e-government system.]

This proposition is supported by the findings from the interview data. Interviewees from company B indicated that SDMs give a guideline as to how systems should be developed by defining the process that should be followed as well as the tools that should be used [3IA, 3IB].

- **Proposition 4**

[A request for proposal (RFP) or request for information (RFI) outlining the scope of the proposed system with clear specification should be provided before the development of such systems commences]

During the interviews, it was clear that developers find it very difficult and challenging to develop e-government systems because government officials are not always clear about their systems specification. There should be clear systems specification documents when developing e-government systems. Therefore proposition 4 from section 3.6.1 will remain unchanged [3IA, 3IB].

- **Proposition 5**

[There is awareness that factors affecting the development of e-government systems include a lack of understanding of the system requirements, failure to ensure that users of the e-government system being developed are trained and poor development strategies.]

Proposition 5 from section 4.6.1 is supported by the findings from the interview data in Company B. The interviewees indicated that internal politics can affect the development of e-government systems [3IA, 3IB].

- **Proposition 6**

[There is a need for a framework that should be used when selecting the appropriate methodology to use when developing e-government systems. Developers find it very challenging when selecting a systems development methodology to use since there is no framework for selecting an SDM when developing systems.]

This proposition from section 4.6.1 is supported by the findings from the interview data in Company B. The interviewees mentioned that using one methodology to develop types of e-government systems can sometimes create backlogs as the scope of each individual system differs [2IA, 3IB].

4.6.3 Propositions from Company C

- **Proposition 1**

[A successful e-government system should be well planned and analysed. Users of such systems should be involved from the initial stage of the development phase till the implementation stage.]

The findings from the interview data in Company C indicated that this proposition will remain unchanged. It was identified that developers should be responsible for the planning of e-government systems, analysing user requirements and maintaining and testing of the e-government systems [3IA, 2IB, 2IC].

- **Proposition 2**

[SDMs are used in the development of e-government systems. Agile methodology is the only methodology that the Company A is most familiar with.]

Most companies involved in the development of e-government system are still using the old traditional approach called SDLC. It was indicated during the interview that developers in Company C are not familiar with any other systems development methodology other than the step-by-step process approach called SDLC. Therefore proposition 3 from section 4.6.1 will change slightly to indicate interview data from Company C.

- **Revised Proposition 2**

SDMs are used in the development of e-government systems. Agile methodology is the commonly used methodology that some developing companies are most familiar with. On the other hand, other developing companies are still using the old approach of systems development called SDLC, a framework that developers can use to select the appropriate SDM to use should be developed [3IA, 3IB, 2IC].

It was indicated in the interviews that when the SDLC approach is used to plan and manage the development of e-government system, developers are experiencing delays in the development process and the unnecessary increase in the cost of the systems [2IC].

- **Proposition 3**

[Using SDMs leads to a better quality and development processes of e-government system.]

This proposition is supported by the findings from the interview data. Interviewees from Company C indicated that SDMs help in defining the processes that should be followed as well as the tools that should be used **[3IA, 3IB, 2IC]**.

- **Proposition 4**

[A request for proposal (RFP) or request for information (RFI) outlining the scope of the proposed system with clear specifications should be provided before the development of such systems commences.]

It was indicated during the interview that government officials are not always clear about their systems specifications. A clear systems specification document should be provided beforehand when developing e-government systems. Therefore proposition 4 from section 3.6.1 will remain unchanged **[3IA, 3IB, 2IC]**.

- **Proposition 5**

[There is awareness that factors affecting the development of e-government systems include a lack of understanding of the systems requirements, failure to ensure that users of the e-government systems being developed are trained and poor development strategies.]

Proposition 5 from section 4.6.1 is supported by the findings from the interview data in Company C. The interviewees indicated that politics, both internally and externally, can affect the development of e-government systems. Therefore it will remain unchanged **[3IA, 3IB, 2IC]**.

- **Proposition 6**

There is a need for a framework that should be used when selecting the appropriate methodology to use when developing e-government systems. Developers find it very challenging when selecting a systems development methodology to use since there is no framework for selecting an SDM when developing systems]

This proposition from section 4.6.1 is supported by the findings from the interview data in Company C. The interviewee in Company C indicated that there is no framework in place for developing e-government systems **[2IA, 3IB, 2IC]**.

4.6.4 Propositions from Company D

- **Proposition 1**

[e-Government systems are regarded as a web-based service delivery solution that is an integration of voice and data on telecommunication infrastructure. A successful e-government system should be well-planned and analysed. Users of such systems should be involved from the initial stage of development phase till the implementation stage.]

The findings from the interview data in Company D indicated that this proposition will remain unchanged. It was identified that a specific process should be followed in order to have a proper planning strategy. The users log a request for a new system and after a log is received, the process of analysis begins; the project is then scheduled on the project management schedule to check how long it will take **[3IA, 2IB, 2IC, 3ID]**.

- **Proposition 2**

[SDMs are used in the development of e-government systems. Agile methodology is the only methodology that some developing companies are most familiar with. On the other hand, other companies in the development of e-government systems are still using the old approach of systems development called SDLC, a framework that developers can use to select the appropriate SDM to use should be developed].

The results from the interview data support the revised proposition in section 4.6.2. During the interview, it was indicated that the systems development life-cycle (SDLC) and rapid development approach are the only methodology approaches that developers in Company D are familiar with. Developers find these approaches time-consuming because the development of the proposed system cannot start while they are still gathering data. They also believe that SDLC has a lot of red-tape applications when coming to quality. Therefore the proposition made in section 4.6.2 will remain unchanged **[3IA, 3IB, 2IC, 3D]**.

- **Proposition 3**

[Using SDMs leads to a better quality and development processes of e-government system.]

This Proposition was not supported by the findings from the interview data in Company D. The interviewee indicated that the current methodology they are using does not lead to better quality and development processes of e-government systems. The interviewee in the

Company indicates that they have no methodology in place and that they are still using the old SDLC approach when developing e-government systems [3D].

- **Proposition 4**

[A request for proposal (RFP) or request for information (RFI) outlining the scope of the proposed system with clear specification should be provided before the development of such systems commences.]

Proposition 4 from section 4.6.1 is supported by the findings from the interview data in Company D. It was indicated that clear system specification documents should be presented to the developers when developing e-government systems. To ensure the uptake of the implemented systems, user acceptance should be signed by users of such system to certify that they are satisfied with the system Therefore the proposition will remain unchanged [3IA, 3IB, 2IC, 3ID].

- **Proposition 5**

[There is awareness that factors affecting the development of e-government systems include a lack of understanding of the system requirements, failure to ensure that users of the e-government system being developed are trained and poor development strategies.]

The Proposition from section 4.6.1 is supported by the interview data from Company D. Interviewees indicated that in order to have a smooth development process, top management should be involved in the development of e-government systems. Internal politics and lack of support from top management may affect the development process of a new e-government system. This proposition will remain unchanged as it is supported by the findings from the interview data in Company D [3IA, 3IB, 2IC, 3ID].

- **Proposition 6**

[There is a need for a framework that should be used when selecting the appropriate methodology to use when developing e-government systems. Developers find it very challenging when selecting a system development methodology to use since there is no framework for selecting an SDM when developing systems]

This proposition from section 4.6.1 is supported by the findings from the interview data in Company D. The interviewee in Company D indicated that there is no framework in place for

developing e-government systems. The company is using the old SDLC approach when developing e-government systems [2IA, 3IB, 2IC, 2ID].

4.7 Chapter summary

This Chapter reported the research findings from the interviews conducted with four companies that are developing e-government systems. Four case studies were performed whereby three participants from each case study were interviewed. The results obtained from the case studies were presented and interpreted using Atlas ti. Propositions were also formulated for each and every interviewee and a summarized proposition which is a combination of all individual propositions was also formulated in order to produce common answers to all the results found. A theory on the use of SDMs in the development of e-government systems was also generated. Proof that indicates that the interview questions as well as the aims and the objectives of this research study were addressed was shown by presenting the research findings in accordance with the research questions. The next Chapter in this study presents the research conclusions and recommendations.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This Chapter presents the author's conclusions and recommendations with regard to the use of SDMs in the development of e-government systems. The development of e-government systems has been nothing but challenging to systems developers. There is no one systems development methodology that can be used when developing e-government systems. According to Achimugu *et al.* (2010) the choice of information systems development methodology affects the way systems developments and evaluations are conducted. Therefore, the whole process of system planning and analysis of user requirement as well as system specification is the most important part of information systems development. If planning is not done properly and systems specifications or user requirement is not clearly defined, then the whole process of systems development will be a disaster. The current SDM that most developers interviewed seemed to be familiar with had fewer advantages and more disadvantages.

As a result, this study showed its importance as it addressed most of the challenges system developers are facing. The researcher in this research believes that SDMs are the most important weapon in systems development and should be applied correctly and in line with the systems specifications and user requirements. Systems developers should be involved in decision-making with regards to the development of new systems and selection of what SDMs should be used when developing information systems, either e-government or non e-government systems.

The concept of e-government systems is categorized into two types of systems, the first one being *windows/desktop-based system*, which is an electronic system that only assists with the business operations of a particular organization or government department. This type of system can only be accessed or used by internal users of a particular organization. The second one is the *web-based system* which are online government systems that deliver government solutions online, and also allow external users to access and interact with the system.

This study was more focused on how e-government systems are developed and the SDMs used in the development of e-government systems. For this to be achieved, a literature study was conducted in Chapter 2 of this study. The Chapter discusses in details the selected SDMs used in this study, the advantages and disadvantages of those SDMs, the type of e-

government systems developed, the challenges of developing such e-government systems and lastly the SDMs that were used in the development of such e-government systems. Moreover, case studies were performed on four organizations or companies involved in the development of e-government systems. From each case study three interviewees were interviewed in order to acquire more data on how e-government systems are developed. From those interviews propositions were also made on each interviewee and thereafter combined in order to find common ground among the collected sets of data. The results obtained from all case studies were used to determine whether SDMs are used when developing e-government systems. The results indicated that there is still a huge gap between SDMs and e-government systems. e-Government systems developers, especially in government, are still using the old traditional method of developing systems, called SDLC.

5.2 Research contribution

SDMs are the backbone of information systems development, whether it is e-government systems or non e-government systems. This research aimed to evaluate the SDMs used in the development of e-government systems, the challenges that are encountered by developers of e-government systems and the suitable SDMs that address the unique aspects of e-government systems. The challenges encountered by developers as well as the suitable SDMs that addresses the unique aspects of e-government systems development were addressed in Chapter 2 of this study under section 2.3.6, 2.3.7 and 2.4. With regard to whether SDMs are used in the development of e-government systems, the following research questions were formulated and grouped in the following manner:

First main question: What SDMs are used when developing e-government systems?

The first sub-research questions used to answer the first main research question are:

- Are you involved in the development of e-government systems?
- What type of e-government systems do you develop?
- What are the challenges and benefits of e-government systems?
- What types of SDMs are currently being used in the organization?
- If SDMs are not used, how do you plan and develop and e-government systems?
- What are factors affecting the development of e-government systems?

Second main question: Does the use of SDMs help create better quality e-government systems and does it lead to better development process?

The second sub-research questions used to answer the first main research question are as follows:

- Are the SDMs used in the organization leading to bettering the quality of e-government systems?
- Do they also lead to better development processes? Please elaborate.

The purpose of grouping these questions was to ensure that the most important facts about the current SDMs used are covered and that the first objective is answered. This research study aims to create a uniform framework that developers can use when developing e-government systems. The next section of this study discussed the research results of the three objectives of this study.

5.3 Research results

This section presents the research results of this study by addressing the main research objectives. The main objectives of this research were to determine whether SDMs are used in the development of e-government systems and also to develop a uniform framework for the use of SDMs in the development of e-government systems in the Republic of South Africa. The next section provides a summary of the revised interview propositions. The interview propositions are combined in order to formulate a common ground among the responses from the different companies that participated in the interviews.

Objective I: To investigate the SDMs used in the development of e-government systems.

Revised Proposition 1

Interview findings have confirmed that SDMs are being used when developing e-government systems **[3IA, 2IC, 3IB]**.

Revised Proposition 2

Most companies involved in developing e-government systems are still using the old traditional methodology approach called SDLC which makes the development process difficult to manage and also compromises the quality of the new system. There is a need for a framework that can be used to select the appropriate system development methodology when developing e-government systems [2IC, 3ID].

Revised Proposition 3

SDMs are generic tools or methods that are used in the development of e-government system. They can be used as guidelines on how systems should be developed by defining the development processes that should be followed [3IA, 2IC, 3IB].

Revised Proposition 4

The Interview findings indicated that developers in government are mostly still using the old traditional method called SDLC. [3ID, 2IC, 1IA]

Using the SDLC approach brings lots of red tape applications to the approach and it does not lead to better quality and development processes of e-government systems development. [3ID]

On the other hand, other developers, as indicated in the previous Chapter 4, are more familiar with the agile methodology like SCRUM and the company's in-house delivery systems development methodology. [3IA, 3IB]

Revised Proposition 5

The use of SDMs does lead to better development processes and produce good quality systems [3IA, 3IB, 2IC].

Objective II: To identify the challenges and problems encountered by the developers of e-government systems.

Revised Proposition 6

The result found in section 2.3.6 of Chapter 2 confirmed that developers of e-government systems are facing challenges when developing e-government systems. Some of those challenges include providing access to needed information, ensuring privacy and security, changing technology and maintenance, measuring customer satisfaction and many more. The challenges of developing e-government systems include selecting the appropriate systems development methodology when developing e-government systems, budget red tape, no clear specifications or user requirements are defined **[11B, 21D, 11B]**.

Revised Proposition 7

Interview results show that factors affecting the development of e-government systems include amongst other things: political factors, social factors, technological factors, they do not have a clear strategy in place or user requirements, lack of budget, and being given limited time to develop e-government systems **[11A, 31D, 11B]**

Objective III: To determine the suitable SDMs that address unique aspects of e-government systems.

The evaluations in Chapter 2, section 2.3.7 of this study addressed the unique characteristics of e-government systems. The interview findings also confirmed the characteristics of e-government systems. The study also found out that there is no one systems development methodology that is used to develop e-government systems.

Revised Proposition 8

Developers view e-government systems as an electronic system that delivers online services to the citizens and also allows them to interact with the system **[11A, 21B, 11C, 31D]**.

5.4 Summary of measured aspects

This section presents a summary of the results findings of this study in Table 5.1 below. The purpose is to give the reader a clear understanding of the research findings for this study. The major aspects of this study are defined in Table 5.1 and the responses of each and every interviewee are also recorded in line with the interview questions asked.

Table 5. 1: Summary of Measured Aspect

MEASURED ASPECTS	COMPANY A			COMPANY B			COMPANY C		COMPANY D		
	1A	2A	3A	1B	2B	3B	1C	2C	1D	2D	3D
Interviewees											
Experience on e-government systems (years)	More than 10 yrs.	> 5	> 5	> 5	> 5	> 10	> 5	> 5	> 5	> 5	> 10
e-government system developed	50 systems	50 systems	25 systems	50 systems	25 systems	25 systems	< 25 systems	< 25 systems	25 Systems	25 Systems	25 Systems
SDMs used	a) Agile b) ALCM c) SDLC	a) Agile b) SDLC c) ALCM	a) Agile b) SDLC	a) In-house delivery system development methodology b) Agile (Scrum) c) SDLC	a) Agile b) SDLC	a) SDLC b) Agile	a) Rapid development b) SDLC.	a) SDLC	a) SDLC	a) SDLC	a) SDLC
Challenges of developing e-government system	Developing strategy	a) Given limited time frame b) Technological factor c) Developing strategy.	a) Working overtime b) Limited time frame,	a) Planning is poor b) limited time frame c) Delivering on time d) Working overtime to meet deadline	a) Delivering on time b) Limited time frame c) Working overtime to meet deadlines.	a) No space b) Delivering on time c) Limited time frame d) User requirements not define.	a) User requirements not define	a) User requirements not define b) Limited time frame	a) Limited Time frame, b) Working overtime to reach deadline c) Working under pressure.	a) No specification b) Budget allocation c) User requirements not define d) Time frame limited	a) Allocation of budget b) No infrastructure c) Political factor.
Factors affecting development system	a) Gathering of proper requirements b) Reaching agreements	a) Time factor b) Political factor c) Technological factor d) Economic	a) Time b) Technological c) Economic d) Social e) Gathering of	a) No specification b) Technological c) Time d) Economic factor	a) Allocation of funds b) Political c) Poor planning d) Social factors e) technological	a) Allocation of budget b) Economic c) Political factors d) Social factors	a) Time frame limited b) Political factors c) Technological factor	a) Social b) Time frame limited c) Political factors d) Technological	a) Lack of support from management b) Political c) Social d) Technological	a) Political factor b) Lack of support c) Economic factor d) Technological	a) Budget allocation b) No infrastructure c) Political.

	t on proper system c) Ensuring user aligned factor.	e) Social factor	proper requirements f) Lack of communication factor.		factor	e) Technological factor		al factor	factor	factor e) No infrastructure	
Processes followed to ensure the uptake of e-government System developed	a) Appoint internal people for system delivery b) Provide user training.	a) Appoint internal people for system delivery b) Provide use training.	a) Appoint internal people for system delivery b) Provide use training.	a) Development process followed	a) Kick of meeting b) Development Process followed	a) Development process followed	a) Feedback report training users b) Approach methods c) Provide user training.	a) Feedback from users, Provide user b) Training, Maintenance support.	a) Development process followed.	a) Uses SDLC process.	a) Uses SDLC process.
Method use to choose SDMs	a) No selection method used	a) No selection method used	a) Looks at past system development	a) No selection method used	b) No selection method used	a) No selection method used	a) No selection method used	a) No selection method used	a) No selection method used.	a) Consider size of system.	a) No selection method used.
Tools and Techniques	a) Corbet tool	a) DFD b) ERD c) Data dictionary d) MS vision software e) use case diagram tool	a) DFD b) Use case diagram c) Flow chart diagram d) SE data dictionary	DFD, Structured English, Use-case diagram	Data diagram, SE, DFD, ERD, Network D, Prototype UCD.	Data dictionary, Decision table DFD, ERD.	DFD, Structured English, Flow chart	Flow chart, DFD, ERD, Data dictionary, Decision table	MS visual studio, SQL, MS office	DFD, ERD, Flow chart diagram	MS Visio UML
Advantage and Disadvantage	Appropriate planning, Easier development process.	ADV: a) Appropriate planning b) Easier development process. DISAVD: a) Wrong SDM leads to system	ADV: a) Appropriate planning b) Easier development process. DIS: a) Wrong SDM leads to	a) Not sure of Advantage and Disadvantage	a) Advantage and disadvantage defined	a) No Advantage and disadvantage	a) Advantage and disadvantage defined	a) Advantage and Disadvantage defined	a) Advantage and Disadvantage defined	a) Advantage and Disadvantage of system defined	a) Advantage and Disadvantage define

		failure	system failure.								
Use of SDMs leads to better quality	Using SDM leads to better quality system.	Using SDM leads to better quality system.	Using SDM leads to better quality system	Using SDM leads to better quality system	Not sure	Using SDM leads to better quality system.	Using SDM leads to better quality system.	Using SDM leads to better quality system.	SDM used does not lead to better quality of system	SDM used does not lead to better quality of system	Using used SDM does leads to better quality.
SDMs for e-government system	SDM leads to better development process.	SDM leads to better development process.	SDM leads to better development process.	SDM leads to better development.	SDM leads to better development.	SDM leads to better development.	SDM does not lead to better development process.	SDM does not lead to better development process.	SDM used does not lead to better development process.	SDM used leads to development process.	SDM used leads to better development process.

5.5 Recommendations

This section of the study the author presents the recommendations which are influenced by the research findings of this study as discussed in section 5.4 of this Chapter.

SDMs in e-Government

Most developers of e-government systems in government department are only familiar with one systems development methodology called SDLC. Section 2.4 of this study confirmed that e-government systems developed within government departments used the SDLC approach as a systems development methodology. The research result has shown that this approach they are using created problems to the developers, whereby the development process took longer than planned and again users were not able to make contributions during the development of a new system until the end product is presented. So user involvement is very limited when using SDLC as a system development methodology.

Other recommendations which should be considered in the development of e-government system include:

- ❖ User involvement: users of e-government system are the core successes of the system developed. Without user support and contributions towards the development of new proposed systems, such systems are bound to be unsuccessful. As a result RFP that outlines the user requirements and systems specification is the most important tool to acquire from the clients before anything can be done on the new proposed e-government system.
- ❖ *e-Government systems developers*: when coming to decide what systems development methodology to use when developing e-government systems, systems developers should also be part of such decisions as they know and understand all the challenges and risks involved in using a particular systems development methodology when developing a system.

Conceptual framework of SDMs

This study proposes that a conceptual framework with the most current SDMs of developing information systems be developed. This framework can be used from e-government systems developers to project managers as well as top management to select the appropriate systems development methodology for the development of e-government systems with regard to the type and size of the project. The frameworks allow the stakeholders to list all the characteristics of the newly-proposed system to be developed after which the suitable systems development methodology can be selected and used without any challenges. This framework is presented in Chapter 2, Table 2.8 of this study.

5.6 Limitations and future work

The major objectives of this study were accomplished but there are some limitations that bring along opportunities for future work. The research has shown that there is a need for development of a new system development methodology that can be used in the development of e-government systems. Developers in government department are still left behind when compared to those in private companies.

This study also presents a conceptual framework which also creates more room for further research to be conducted and tests to be performed in order to have a validated and working framework for the development of e-government systems.

5.7 Conclusions of the study

This section presents the overall conclusions of this study. The literature review was conducted in Chapter 2 in order to have a clear background on e-government systems, SDMs, and the uses of SDMs in the development of e-government systems. The methods and design of this study were also covered in Chapter 3 of this study. The author described how data were collected and analysed. The research findings of this study indicated that SDMs are being used when developing e-government systems from the outsourced companies. Internally, e-government systems developers are only familiar with the old traditional step-by-step processes of developing systems called SDLC. This approach is used by mostly government departments that are involved in developing systems. The interview results also confirmed that government departments are still using this systems development methodology approach when developing systems. As a result the development processes of such e-government systems will take longer

than expected and users can only make changes to the final product which also extends the duration of the project. The study recommends that a framework should be implemented when e-government systems are developed and all stakeholders, including developers of the systems, should be involved in the decision-making about the selection for a new systems development methodology.

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ANNEXURE A: LETTER OF PERMISSION



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28 September 2012

To Whom It May Concern

Dear Sir/Madam

REQUEST FOR PERMISSION TO CONDUCT INTERVIEWS

I, Ms Ditibane Lesego Tshegofatso, am a Masters student at North West University (NWU), doing a research on **systems development methodologies and the development of e-government systems**. As a result I hereby request for permission to conduct interviews on the above mentioned topic with the relevant departments involved in developing systems.

The purpose of this study is to explore the use of systems development methodologies in the development of e-government systems. This research adheres to all ethical requirements. Permission to this study was granted by Prof. Magda Huisman and the research committee in the Faculty of Natural Science at NWU. The company name as well as the interviewee's identification will be treated as strictly confidential. The information gathered and the results of the study will be used for academic purposes only and may be published in an academic journal. A summary of our findings can be provided only on request.

For any questions or comments regarding this study, please contact my supervisors, Prof Magda Huisman, magda.huisman@nwu.ac.za or Dr. Nehemiah Maveterea at nehemiah.maveterea@nwu.ac.za.

Your participation in this study is very important to us.

Yours sincerely

Ms L.T Ditibane (Student number 17071143)

ANNEXURE B: INTERVIEW QUESTIONS

Topic: The use of Systems Development Methodologies in the development of e-government systems.

Systems Development Methodology (SDM) refers to the framework that is used to structure, plan and control the process of developing a system. The term **framework** refers to the **procedures**, including different **approaches, tools and techniques, methods, process models**, and **documentation aids** which can help the systems developers to develop and implement new information systems.

Objective

The objective of the interview is to assess the current state of the use of SDM's in the development of e-government systems, e-government as-is and the challenges faced in the development of e-government systems.

The following are interview questions designed for the project managers/developers of e-government systems in South Africa.

1 General questions

What is your job title, your job description and your job responsibilities?

Are you involved with information systems development?

Are you involved in decisions concerning e-government systems and to what extend?

How many years of experience do you have in systems development and e-government systems?

2 e-Government systems

How would you define e-government systems?

What type of e-government systems do you develop?

How many e-government systems have you developed, and how many were implemented?

How successful were the e-government systems that were implemented?

How do you plan and manage your e-government projects?

What strategies do you use to facilitation the uptake and adoption of e-government system?

Please describe the process that you follow while developing e-government systems?

What tools/techniques do you use when developing e-government systems?

What are the challenges of developing an e-government system and how do you address those challenges?

Who are the users of your e-government systems?

Based on your experience as a developer, what are the key factors affecting the development of e-government systems?

3 Systems Development Methodologies

What do you understand under Systems Development methodology?

Do you use an SDM when developing e-government systems? If so please name it. If not, explain reasons why?

How do you select a methodology for developing an e-government system?

What are the challenges of selecting SDMs and how do you deal with them?

What processes or framework do you use when developing an e-government system and why?

What are the advantages and disadvantages of SDMs when developing e-government systems?

Does the use of SDMs lead to a better quality e-government system?

Does the use of SDMs lead to a better development process?

ANNEXURE C: RESPONSES FROM INTERVIEWS

Table C 1. Responses to interview questions under Category I - General Questions: Job role, description and responsibilities

Question	Category, codes and count	
1. What is your job title, your job description and your job responsibilities?	Category 1-1: developer	
	Codes	Count
	• Developer	2IA, 2IB,1IC
	• DBA	1ID
	• Analyst	1IB, 1IC,2ID
	Category 1-3:Salesperson	
Codes	Count	
• Business Delivery Executive Public Sector	1IA	
2. Are you involved with information systems development?	Category 2-1: Involved in ISD	
	Codes	Count
	• Involved in ISD	2IA,3IB,2IC,2ID
	Category 2-2: Not involved in ISD	
	Codes	Count
	• Not involved in ISD	1IA,1ID
3. Are you involved in decisions concerning e-government systems and to what extent?	Category 3-1: Involved in decision-making	
	Codes	Count
	• Involved in decision making	1IA,1IB,2IC,3ID
	Category 3-2: Not Involved in decision-making	
	Codes	Count
	• Not involved	2IA,2IB
4. How many years of experience do you have in systems development and e-government systems?	Category 4-1: < 5 years' work experience	
	Codes	Count
	• Less than 5 years	1IB,1ID
	Category 4-2: Between 5 years' and 10 years' work experience	
	Codes	Count
	• Between 5 and 10 years	1IA,1IB,1IC,1ID
	Category 4-3: > 10 years' work experience	
	Codes	Count
	More than 10 years	1IA, 1IC,1ID

Table C 2. Responses to interview questions under Category II - e-Government systems developed

Question	Category, codes and count		
1. How would you define e-government systems?	Category 5: e-Government defined		
	Code	Count	
	<ul style="list-style-type: none"> • Electronic Systems 	3IA, 3IB, 2IC,3ID	
	<ul style="list-style-type: none"> • Online government systems that deliver service solutions to the public 	3IA, 3IB, 2IC,3ID	
<ul style="list-style-type: none"> • Solutions that users can interact with online 	3IA, 3IB, 2IC,3ID		
2. What type of e-government systems do you develop?	Category 6-1: Web-based e-government system		
	Code	Count	
	<ul style="list-style-type: none"> • Web-based systems 	3IA,3IB,2IC	
	Category 6-2: Windows/Desktop-based e-government system		
	Code	Count	
<ul style="list-style-type: none"> • Desktop-based systems 	3IA,3IB, 2IC,3ID		
3. How many e-government systems have you developed, and how many were implemented?	Category 7-1: All e-government systems developed are implemented		
	Codes	Count	
	- All e-government systems developed are implemented	2ID	
	Category 7-2: Some e-government systems developed are implemented		
	Codes	Count	
	Some e-government systems developed are implemented	3IA,3IB,2IC, 1ID	
4. How successful were the e-government systems that were implemented?	Category 8-1: Success of e-government systems		
	Codes	Count	
	<ul style="list-style-type: none"> • Success of e-government systems 	3IA,3IB,2ID	
	Category 8-2: Some e-government systems unsuccessful		
	Codes	Count	
<ul style="list-style-type: none"> • Some e-government systems are unsuccessful 	2IC, 1ID		
5. How do you plan and manage e-government	Category 9-1: Planning and managing of e-government project		
	Code	Count	
	<ul style="list-style-type: none"> • First the user sent an RFP, meeting with stakeholders is arranged to discuss user requirements and sign off on the systems. 	3IA,2IB,2ID	
	Category 9-2: No planning		
	<ul style="list-style-type: none"> • Code 	Count	

Question	Category, codes and count	
	<ul style="list-style-type: none"> No planning and manage e-government 	1B,1C,2C,2D
6. What strategies do you use to facilitate the uptake and adoption of e-government systems?	Category 9: Strategies used in e-government systems	
	Codes	Count
	<ul style="list-style-type: none"> Approachment method User Training Allocate internal people for systems delivery Sign users' acceptance forms 	2IB 3IA, 1IB, 2IC, 3ID, 3IA, 2IB, 2IC 3ID
7. Please describe the process that you follow while developing e-government systems?	Category 10-1: Development processes followed	
	Codes	Count
	<ul style="list-style-type: none"> Follow SDLC processes 	3IA, 2IC, 3ID
	Category 10-2: No development process followed	
	Codes	Count
	<ul style="list-style-type: none"> No development process followed 	3IB,
8. What tools / techniques do you use when developing e-government systems?	Category 11: Tools/Techniques used	
	Codes	Count
	ERD	11A, 2IB, 1IC,
	DFD	2IA, 2IB,1IC,
	Data Dictionaries	2ID, 1IC
	Use case diagram	1IA, 1ID, 1IB
	Prototyping	1IA, 2IB,
	Flow-Chart diagram	2IB,
	Decision table	1IC
	Ms Visio	1IA
	Structure English	2IB
	Visual Studio	1IC
SQL, Wed, Excel and power design	1ID	
9. What are the challenges of developing an e-government system and how do you address those challenges?	Category 12-1: Challenges in developing e-government systems	
	Codes	Count
	Challenges in developing e-government systems	3IA, 3IB, 2IC,3ID
	Category 12-2: Resolving challenges in developing e-government systems	
	Codes	Count
	Resolving challenges in developing e-government systems	3IA, 3IB, 2IC,3ID
10. Who are the users of your e-government	Category 13: Users of e-government systems	
	Codes	Count

Question	Category, codes and count	
systems?	<ul style="list-style-type: none"> • Internal users • External users 	3IA, 3IB, ,2IC, 3ID, 3IA,3IB,3ID,
11. Based on your experience as developer, what are the key factors affecting the development of e-government systems?	Category 14: Factors affecting development of e-government systems	
	Codes	Count
	<ul style="list-style-type: none"> • Communication between developer and user • Political factor • Economic factors • Technological factors • Social factors 	2IA, 2IB,1ID, 1IC,2ID 3IA,2IB,2IC 1IA,1IB, 1IC,2ID 1IC,2ID

Table C 3 Responses to interview questions under Category III – SDMs used

Question	Category, codes and count	
12. What do you understand under Systems Development Methodology?	Category 15-1: SDM defined	
	Codes	Count
	SDM define: - A method that can be used to plan, analyse, design, develop information systems	3IA, 3IB, 2IC,3ID
13. Do you use SDM when developing e-government systems? If so please name it. If not, explain reasons why?	Category 16-1: SDM used to develop e-government system	
	Codes	Count
	SDM used to develop e-government system	3IA, 3IB
	Category 16-3: No SDM used to develop e-government system	
	Codes	Count
	No SDM used to develop e-government system	2IC, 3ID
14. How do you select a methodology for developing e-government system?	Category 17-1: Selection method used on SDM	
	Codes	Count
	Selection methodology not used	2IB
	Category 17-2: No selection method used on SDM	
	Codes	Count
	No selection	3IA,1IB,2IC,3ID
15. What are the challenges of selecting SDMs and how do you deal with them?	Category 18-1: Challenges of selecting SDM	
	Codes	Count
	Using one methodology	1IA,1IB,1ID

Question	Category, codes and count	
	Category 18-2: No challenges of selection SDM	
	Codes	Count
	No challenges	3IA,2IB,2IC,2ID
16. What processes or framework do you use when developing an e-government system and why?	Category 19-1: Framework used	
	Codes	Count
	Framework are used	1IA,1IB,2ID
	Category 19-2: No Framework used	
	Codes	Count
	No framework used	2IA,2IB,2IC,2ID
17. What are the advantages and disadvantages of SDMs when developing e-government systems?	Category 20-1: Advantages and Disadvantages of SDM	
	Codes	Count
	Proper planning and management	3IA,1IB,2IC,3ID
	Category 20-2: Disadvantages of SDM	
	Codes	Count
	Lack of knowledge, understanding and wrongly implemented	3IA,3IB,2IC,3ID
18. Does the use of SDMs lead to a better quality e-government system?	Category 21: Using SDM leads to better quality	
	Codes	Count
	Leads to a better quality	3IA,2IB,2IC,2ID
	Not leading to a better quality	2IB,1IC,1ID
19. Does the use of SDMs lead to a better development process?	Category 22: Using SDM leads to better development process	
	Codes	Count
	Leads to better development	3IA,2IB,2IC,2ID
	Not leading to better development.	1IB,1IC,1ID