TOWARDS A CONCEPTUAL DECISION SUPPORT SYSTEMS FRAMEWORK AIMED AT NARROWING THE TAX GAP IN SOUTH AFRICA: A NARRATIVE CASE STUDY

by

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DECLARATION

I declare that this research entitled *Towards a conceptual decision support systems framework aimed at narrowing the tax gap in South Africa: A narrative case study* is my own work and that all the sources I have used or quoted have been indicated and acknowledged by means of complete references. I further declare that I have not previously submitted this work, or part of it, examination at Unisa or another qualification or at any higher education institution.

Eugene Wessels

ABSTRACT

Revenue collection agencies across the world aim to maximise revenue collection by minimising tax noncompliance. The different types of tax noncompliance are collectively referred to as the tax gap phenomenon, which revenue collection agencies address by means of various enforcement approaches and capabilities. Much like any organisation, the resources required to execute these capabilities are finite and require accurate organisational decision-making in order to make optimal use thereof. Information technology, and specifically decision support systems (DSS), is critical in enabling this decision-making process. Using the Structuration Model of Technology, the information needs, demand and offerings of revenue collection agencies are explored given their objective of narrowing the tax gap phenomenon using DSS. Emphasis is placed on the manner in which IT is used to address taxpayer noncompliance, the way in which IT supports knowledge creation and subsequently also facilitate the decision-making process of tax practitioners, and also the different types of IT offerings made available to decision-makers in the form of DSS. In doing so, this research presents the results of a case study on the South African Revenue Service in which a conceptual decision support system framework is developed aimed at minimising the tax gap phenomenon. The research is conducted as a qualitative single case study and presented through a narrative analysis. The framework is systematically constructed as the research findings emerge and concluded by means of a framework validation and transferability test. The research result is a conceptual DSS framework acting as a reference point to other revenue collection agencies with the objective of addressing taxpayer noncompliance through DSS.

Keywords: Revenue Collection Agency; Tax Gap; Decision Support Systems; Conceptual Framework; Case Study

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Figure 1-1: Chapter 1 Roadmap

1.1 Definition of Key Terms

- Revenue / tax collection industry and agency: The revenue collection industry describes the collection of taxes, duties and levies from financially active entities. A revenue collection agency is a non-profit public institution that represents government and has the responsibility of collecting a defined revenue target. The revenue collected is annually allocated by government to different public institutions. These allocations are aimed at improving the social environment of its citizens.

- Tax gap: The difference between the taxes due and taxes collected resulting from a financial entity's tax noncompliance (OECD[1], 2008:10).

- Conceptual framework: A topic of interest presented in a graphical or descriptive format. Such a framework presents 'key factors, constructs or variables' as well as the relevance or associations amongst them. A framework can take many forms and can be 'rudimentary or elaborate, theory-driven or commercial, descriptive or casual' (Miles & Huberman, 1994:18).

- Decision-making: This research limits decision-making to the cognitive human process of concluding decisions about corporate issues, such as tasks, policies, goals and objectives, in accordance with the mission and vision of an organisation (Sun & Liu, 2001:247).

- Technology: The concept of technology can vastly differ in definition and scope. This research defines technology as the 'material artefacts', specifically in the form of information technology, used to facilitate human action and specifically so from an organisational perspective.

- Decision support systems (DSS): Information systems that are used to support, facilitate and conduct problem solving and decision making (Shim et al., 2002:111).

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[1] The Organisation for Economic Co-operation and Development (OECD) is an organisation represented by 34 countries and is aimed at promoting economic activity amongst the countries in an attempt to improve the social state of its citizens. The OECD acts as an independent body and regularly publishes articles addressing critical issues, including those related to tax matters. See www.oecd.org.

1.2 Publications From This Research

The following publication has resulted from this research:

Wessels, E., Smit, M. & Kroeze, J.H. 2012. Social Network Analysis to optimize tax enforcement effort. *Proceedings of the 18th Americas Conference on Information Systems (AMCIS 2012 Proceedings)*, Seattle, Washington, USA, August 9-11, 2012, Paper 39, ISBN 978-0-615-66346-3. Available: http://aisel.aisnet.org/amcis2012/proceedings/DecisionSupport/39/ (August 2, 2012) or http://hdl.handle.net/10500/6985.

1.3 Introduction and Background

Revenue collection agencies world-wide have the responsibility of collecting taxes, duties and levies. The South African Revenue Service (SARS) performs this role in South Africa. Similar to other agencies, SARS experiences a phenomenon referred to as the tax gap which, in its simplest form, is described as the difference between the taxes due (as determined by legislation) and the actual taxes collected (OECD, 2008:10). The nature of the tax gap phenomenon causes it to be a widespread and continuous challenge for revenue collection agencies (Slemrod, 2007:45), and is the result of various factors related to the taxpayer such as those presented by the OECD (2010:5). Many of these factors are further discussed in Chapter 3.

Effective decision-making by revenue collection agencies is critical in their attempt to address the tax gap. The limited resource capacity of revenue collection agencies, much like other organisations, emphasises the critical role of decision-making to optimally support business operations. In the case of revenue collection agencies, one such example is the management of tax compliance, which aims to minimise the tax gap (OECD, 2004:6). Information systems facilitate decision-making, amongst others, by presenting decision-makers with relevant information. These IT implementations are referred to as decision support systems (DSS) and are specifically designed to facilitate and improve organisational decision-making (Sun & Liu, 2001:247).

A DSS is a technological implementation that is used in conjunction with the cognitive actions of humans and is aimed at facilitating the decision-making process. DSS utilise data that is stored in a database, processed in a modelling layer and

displayed as information through an interface (Shim et al., 2002:111), which is then consumed by the decision-maker. Although this historical perspective on DSS has remained fairly consistent, DSS have since advanced to a much more sophisticated form. In doing so, DSS has become an extensive topic and offers a wide range of value propositions to decision-makers and organisations. Many different instances of decision support systems have subsequently been defined, of which each can best be grouped according to the various categories defined by Power (2002:13-16), as further discussed in Chapter 6.

This research aims to develop a conceptual framework that focuses on how DSS can be used to enable decision-making that addresses the tax gap phenomenon. A conceptual framework is different from a theoretical framework. A theoretical framework aims to develop new theories based on generalisations related to a specific topic and serves as the basis for further research. A conceptual framework is developed from existing theory(s) (or theoretical frameworks) with the objective to discover subsequent detailed findings (Smyth, 2004:168). A conceptual framework can be seen as the 'operationalisation' of one or more theoretical frameworks. The research conducted in this study is based on various existing academic theories (to be introduced in subsequent chapters) from which the conceptual framework is developed. Schwarz et al. (2007:44) list different motivations that should be evaluated when considering the development of a framework. Most importantly, the proposed framework aims to generate a 'prospective focus' on the topic. In other words, the research aims to understand the relationships and further potential of certain concepts as defined by the problem statement presented in the subsequent section. The framework also aims to 'conceptualise and integrate' existing theories, providing an opportunity for new discoveries to be made. The motivation for generating the proposed framework is therefore to enhance the academic and practitioner perspectives on the chosen topic based on various existing academic theories. The main theories referenced in this research are Leviner's (2009:420) framework for tax compliance and risk management, Orlikowski's (1992:410) Structuration Model of Technology (SMT) model, Osmanagic-Bedenik & Varga (2006:141) Information Offer, Demand and Needs (INOD) model, as well as Power's (2002:13-16) categorisation of DSS.

1.4 Problem Statement

The problem statement addressed in this research is the lack of a conceptual DSS framework aimed at addressing the tax gap, a phenomenon which continues to be a critical challenge for revenue collection agencies across the world.

Limited publications focus on the tax gap and few of these quantify the value of the tax gaps in countries around the world. Where such publications do exist, they are usually outdated and should only be used as a reference point at the time. Tax noncompliance is widespread and will in all likelihood continue to be in future (Slemrod, 2007:45). This is because in general, noncompliant taxpayers are rarely prosecuted and mostly inadequately penalised for being noncompliant (Picur & Riahi-Belkaoui, 2006:175; Riahi-Belkaoui, 2004:141). The tax gap in the United States (US) is considerable and estimated at 16.3% of the total taxes collected, totalling $40.7 billion for the 2001 taxes. This amount has tripled in value over the past two decades (Leviner, 2009:382). The estimated tax gap of other countries (referred to as equivalent high-income countries) ranges between 4% and 17% of total taxes collected (Slemrod, 2007:33). South Africa's tax gap value for the same time period of 2001 is estimated at 13.9% of total taxes collected, which approximately equates to R30 billion (Oberholzer & Stack, 2009:738). One approach to address the tax gap is through the management of tax compliance and specifically by performing tax audits on noncompliant taxpayers (OECD, 2008:16). However, in reality the audit capacity of revenue collection agencies is fractional in comparison with the potential number of noncompliant taxpayers (i.e. all taxpayers registered). For example, the US Internal Revenue Service (IRS) covers a limited 1% to 2% of their tax register on an annual cycle (Akinboade et al., 2009:1129). This coverage is consistent with that of SARS. The Greece Revenue Authority's annual audit rate is estimated slightly higher at 5% of their total tax register, although one can safely agree that this remains a very low coverage of the tax register (Goumagias, et al., 2012:76). With the percentage of penalised taxes being very low – only 20% of the penalised taxes in the US (Torgler, 2006:82) – taxpayers are almost 'incentivised' for being noncompliant.

It is therefore evident that arguably the most important objective of revenue collection agencies is the effective application of their finite resources to combat the tax gap. In

doing so revenue collection agencies ultimately aim to achieve maximal taxpayer compliance with minimal intrusion and cost (OECD, 2004:6). The ability for revenue collections agencies to make accurate decisions in an attempt to minimise the tax gap, is 'fundamentally founded' on IT (OECD, 2004:15) and more specifically DSS.

Very little academic literature addresses IT's value proposition to minimise taxpayer noncompliance, this is despite the significant implication of the tax gap experienced by revenue collection agencies. In particular, hardly any literature exists that explores how DSS can facilitate the management of tax compliance. Numerous publications exist that propose DSS frameworks for the private sector. However, the distinct nature of the public sector and especially revenue collection agencies allows for only a limited amount of value to be derived from these publications. At best, value can be derived through the abstraction and generalisation of the theories presented. After all, more than two decades ago Henderson & Schilling (1985:157) referred to IT and specifically DSS when they stated "[d]esigning a solution to a public sector problem is largely an art". Without a conceptual decision support system framework aimed at addressing the tax gap revenue collection agencies will most likely find certain value propositions of IT to remain unexploited.

1.5 Research Questions

The main research question addressed in this study is:

How can a conceptual decision support systems framework be used to address the tax gap phenomenon experienced in a South African context?

The secondary research questions addressed in this study are:

- What is the nature of the tax gap phenomenon experienced by revenue collection agencies and why does it continue to exist?
- How does IT influence a revenue collection agency's ability to address the tax gap?
- How does IT support tax practitioners to reduce the tax gap?
- Which decision support systems enable IT's value proposition to minimise the tax gap phenomenon through enforcement capabilities?

1.6 Theoretical Framework

The development of a conceptual framework is based on 'general constructs' representing the grouping of detailed 'particulars', as well as the 'interrelationships' amongst them (Miles & Huberman, 1994:18). The purpose of this research is to develop an IT focused conceptual framework aimed at addressing the tax gap. More specifically, the conceptual framework will focus on DSS that could enable the management of tax compliance.

A comprehensive overview of DSS research over recent years is presented by Arnott & Pervan (2005:67). In this publication various key issues are identified and discussed, some which are now elaborated on. IS research (Benbasat & Zmud, 1999:3) and more recently DSS research (Arnott & Pervan, 2005:83) have been accused of lacking both relevancy and rigour. DSS research has been criticized for lacking professional relevance – perhaps with the exception of publications related to business intelligence, data analysis and data warehousing. It is additionally suggested that DSS research has been lacking case study research and that a strong theoretical foundational for DSS research has been absent. Arnott & Pervan (2005:83) propose specific recommendations for DSS research to be more relevant and rigorous. Many of these are incorporated in the research methodology followed in this research (see section 1.7). They make one specific and important recommendation for future DSS research, which is to ensure research rigour by means of a strong theoretical research foundation. Section 1.3 introduced the main theories serving as the foundation of this case study. The SMT and INOD theories are most important to this study as they define both the content and structure of this study. The remainder of this section discusses each of these theories.

SMT by Orlikowski (1992:410) presents a model detailing the role of IT in an organisation. The model is illustrated in Figure 1-2 and presented in Table 1-1. Using SMT as basis for the development of a DSS conceptual framework provides an opportunity for relevant research. Researching each of the SMT components provides for the theoretical rigour of this research. SMT explores key relationships and interactions related to the manner in which IT 'lives' in an organisation. SMT has since formed the basis of many studies such as Fang et al. (2007) and Heinze & Hu

(2005), of which others such as Wu & Fang (2007) have also proposed certain improvements to the model. SMT is based on the Theory of Structuration (Giddens 1976, 1979 & 1984) which, in summary, describes the world as consisting of many different social structures guided by unique principles. These existing social structures influence human behaviour, which in return adjust the social structure's principles and eventually cause the structure to evolve. SMT elaborates on this theory by specifically focusing on an organisational social structure. A study by Jones & Karsten (2008) provides for a comprehensive elaboration on how Gidden's theory of structuration relates to IS research. Their study evaluates the contributions of research dating between 1991 and 2004 and concludes by suggesting future research opportunities.
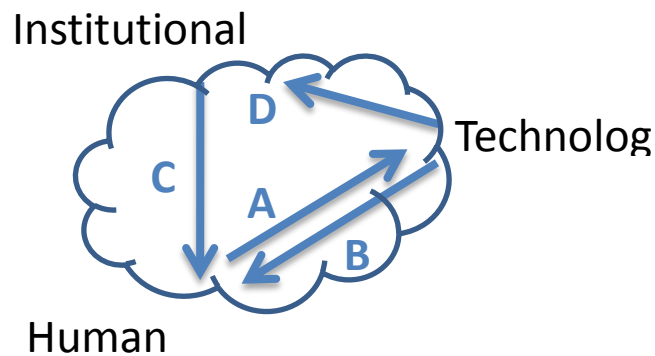
Figure 1-2: The Structuration Model of Technology (Orlikowski, 1992:410)

Activity	Type of Influence	Nature of Influence
A	Technology as a product of human action	Technology is an outcome of human action such as design, development, appropriation and modification.
B	Technology as a medium of human action	Technology facilitates and constrains human action through the provision of interpretive schemes, facilities and norms.
C	Institutional conditions of interaction with technology	Institutional properties influence humans in their interaction with technology, for example, intentions, professional norms, state of the art in materials and knowledge, design standards and available resources (time, money, skills).
D	Institutional consequences of interaction with technology	Interaction with technology influences the institutional properties of an organisation, through reinforcing or transforming structures of signification, domination and legitimation.

Table 1-1: The Structuration Model of Technology (Orlikowski, 1992:410)

SMT serves as the foundation of this research from which the conceptual framework is developed. The model comprises of three components, namely: institutional context and properties; human agents acting as decision-makers and technology that enables the tasks of human agents in support of the institution's objectives. Each of these areas contributes towards the conceptual DSS framework developed in this research and is briefly discussed in subsequent sections. Wu & Fang (2007:1772) list examples of each of these components: Human agents include technology designers, users and decision-makers. Technology refers to the 'material artefacts' used to facilitate action, which in the case of IT might be an operating system, an application and a web solution to name but a few. Lastly, internal institutional properties are typically aspects such as organisational structure and reporting hierarchies, strategies, culture and governance aspects. External institutional properties examples include government regulation, industry competitors and socio-economic conditions. For the purpose of this case study, 'institutional properties' refers to SARS and the tax gap phenomenon, 'human agents' refers to the decision-makers in SARS combating tax noncompliance and 'technology' refers to DSS.

The SMT model is a generic model that describes the impact of IT in an organisation. Although still valuable, the model does not explicitly address the role of IT in support of organisational decision-making. As a matter of fact, a limitation of SMT from an IT perspective has been pointed out stating that the original structuration work by Giddens makes very little reference to IT if any (Jones & Karsten, 2008: 129). A need therefore exists to deepen the theoretical basis of SMT with complementing theories that specifically address the role of IT as an enabler of organisational decision-making. For this reason, SMT is supplemented by the perspectives which Osmanagic-Bedenik & Varga (2006:141) have on IT's role to facilitate organisational decision-making, hereafter referred to as the Information Needs, Information Offer and Information Demand (INOD) model. The INOD model is an 'information-oriented controlling concept' aimed at aligning an organisation's information offerings with its information needs and demands. Information needs are determined by an organisation's requirements and are guided by the defined vision, mission and goals. The priorities of an organisation determine the information needs of the organisation and also distinguishes important information from unimportant information.

Information demand is determined by the user in accordance with his/her objectives and goals. Information demand is mostly based on what is controlled by the manager and based on past behaviour. Information offering is the ability to convert data to information with the aim of enhancing user knowledge. This aspect briefly touches on the Data, Information, Knowledge and Wisdom (DIKW) hierarchy which is comprehensively discussed in section 5.3.2. This is often done through IT tools, the transformation and process of data and the presentation of data. The relationship between information offer, demand and need is presented in Figure 1-3 and Table 1-2.
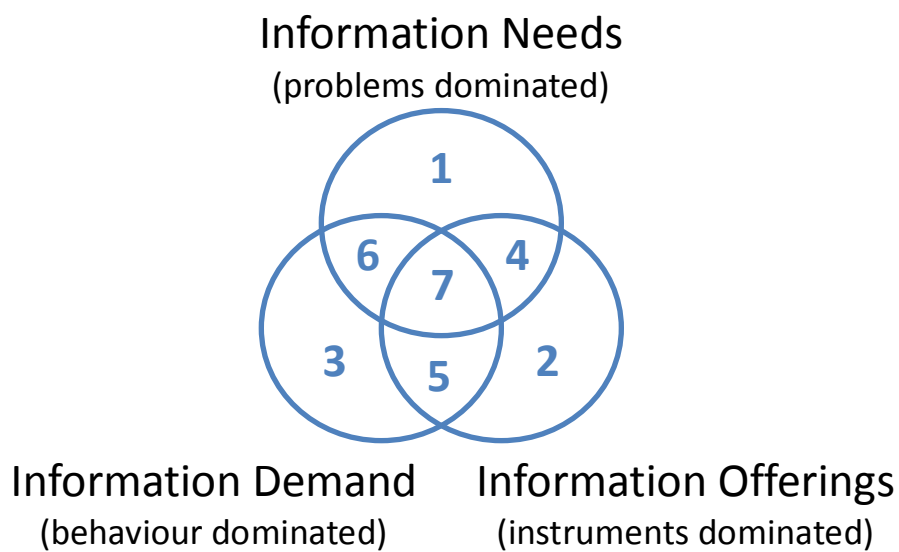
Figure 1-3: The Information Offer, Demand and Needs Model (Osmanagic-Bedenik & Varga, 2006:141)

Activity	Nature of Influence
1	Information that is not offered and for which there is no demand, but which is needed.
2	Information that is offered but has no demand, neither is needed.
3	Information for which there is demand but is not offered, neither is needed.
4	Information for which there are both needs and offer, but no demand.
5	Information that is offered and for which there is demand, but which is not needed.
6	Information that is needed and for which there is demand, but which is not offered.
7	Information that is needed, for which there is demand, and which is offered.

Table 1-2: Relationship Between Information Offer, Demand and Needs (Osmanagic-Bedenik & Varga, 2006:141)
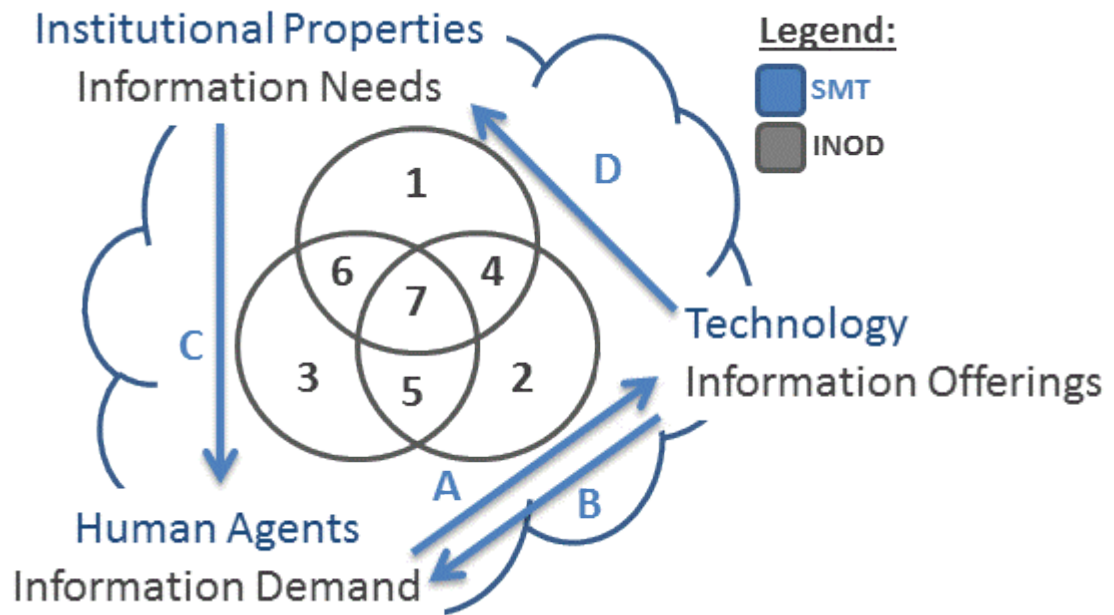
Figure 1-4: Relationship Between SMT and INOD

The relationship between SMT and INOD is surprisingly recognisable given the similarity of the three main components. These similarities are pointed out in Figure 1-4. Each of the SMT components is further elaborated on by INOD but from a decision support perspective. A particular emphasis is placed on how IT in the form of information supports decision-making. SMT's institutional properties component relates to the manner in which problems are defined and presented. This relates to the information needs by INOD. Similarly, the human agents component of SMT is further studied through their decision-making behaviour and the demands they have for information in an attempt to address the defined organisational problems. The technology component of SMT acts as enabler to these human agents to facilitate decision-making. This is done by presenting various instruments and tools that are ultimately grouped by INOD as information offerings. This relationship between SMT and INOD serves as the foundation for the rest of this study and in particular the manner in which the research questions are addressed according to each of the chapters. See section 1.11 for the research's chapter breakdown. Lastly, throughout the research the SMT and INOD models are further complemented by various other theories that have relevance to the specific topic under discussion.

1.7 Research Methodology

The research methodology framework followed in this research is adapted from Myers (2009:26) and consists of five areas of focus, as presented in Figure 1-5 and discussed in the subsequent sections:

- Field: The area in which the research is conducted, namely the Information Systems Discipline;

- Philosophy: Describing the philosophical underpinnings of the research which determines the manner in which the information obtained from the research methodology is interpreted;

- Method: The underlying model used to execute the data collection method;

- Data collection: The actions and practical techniques used to collect data; and

- Data analysis: The manner in which the collected data is processed.
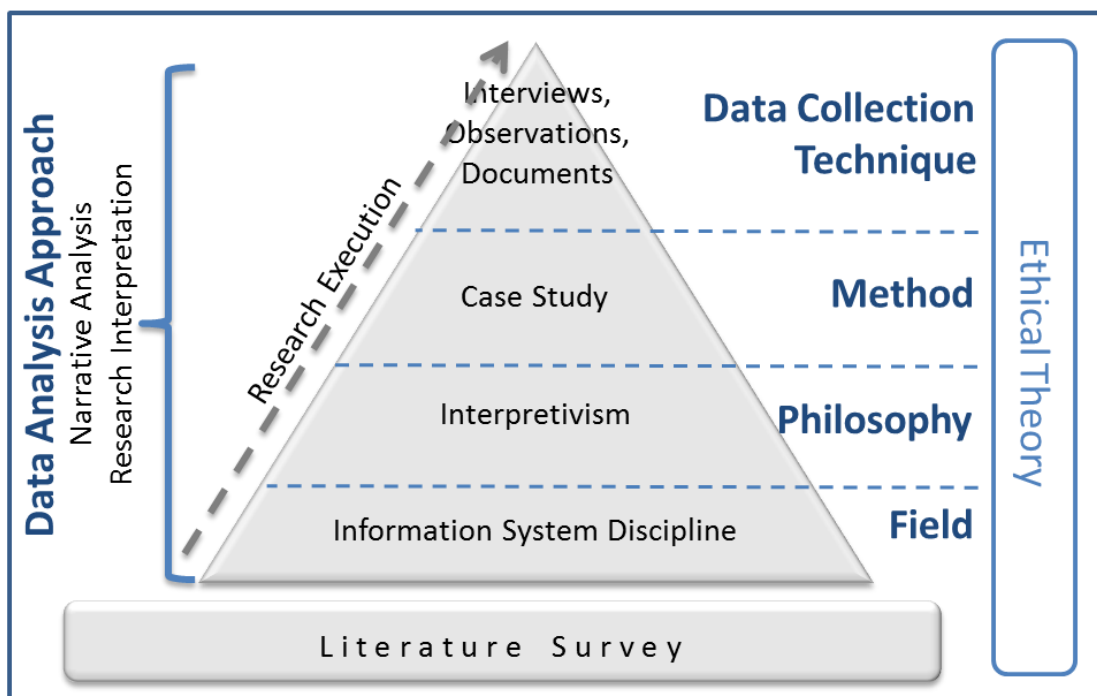
Figure 1-5: Research Methodology

Chapter 2 discusses the research methodology executed in this research in great detail and a summary thereof is now presented. The research topic is investigated within the field of IS and, specifically, IS as an applied discipline. Interpretivism is selected as the appropriate qualitative research philosophy, which is realised by case study research as the preferred research method for data collection. Empirical interviews

and document collection are used as data collection techniques, whereas a narrative analysis is used as the data analysis and interpretive approach. Whilst a single interpretive case study can be criticized for its lack of generalisation, a strong argument is made for such an approach in section 1.9 as well as section 2.4.

1.8 Research Execution

The execution of the research methodology is shown in Figure 1-6 and is an iterative process between the literature survey, case study execution and research verification process. However, the result of this process is sequentially presented as a narrative analysis between the literature survey and the empirical study. This narrative analysis starts by providing insights on the search problem, followed by the literature survey and empirical study and finally concludes by presenting the conceptual DSS framework derived from this research. The literature survey consists of published books, academic journals and practitioner journals. The empirical case study will consist of interviews and field documents. The interpretations and conclusions derived from the data collection process are evaluated through a verification process. This verification process includes data triangulation, reflexivity and verbatim quotations. The literature survey and case study execution will be aligned and unified through a common story line guided by a narrative analysis. The result of the narrative analysis is the proposal of a conceptual framework that enables decision-makers to address tax gaps.

1.9 Assumptions and Limitations

The most significant limitation of this study is the focus on a single case. Remenyi (2012:4,22) defends the validity of a case study and says that critique stating case studies to be of substandard quality are too simplistically argued. He explicitly argues for the usage of a single case study for doctoral degrees in the situation where access is only available to a single institution or one that is unique in nature. Both these conditions are met by this research. A similar motivation for in-depth single case studies is presented by Yin (2009:18).
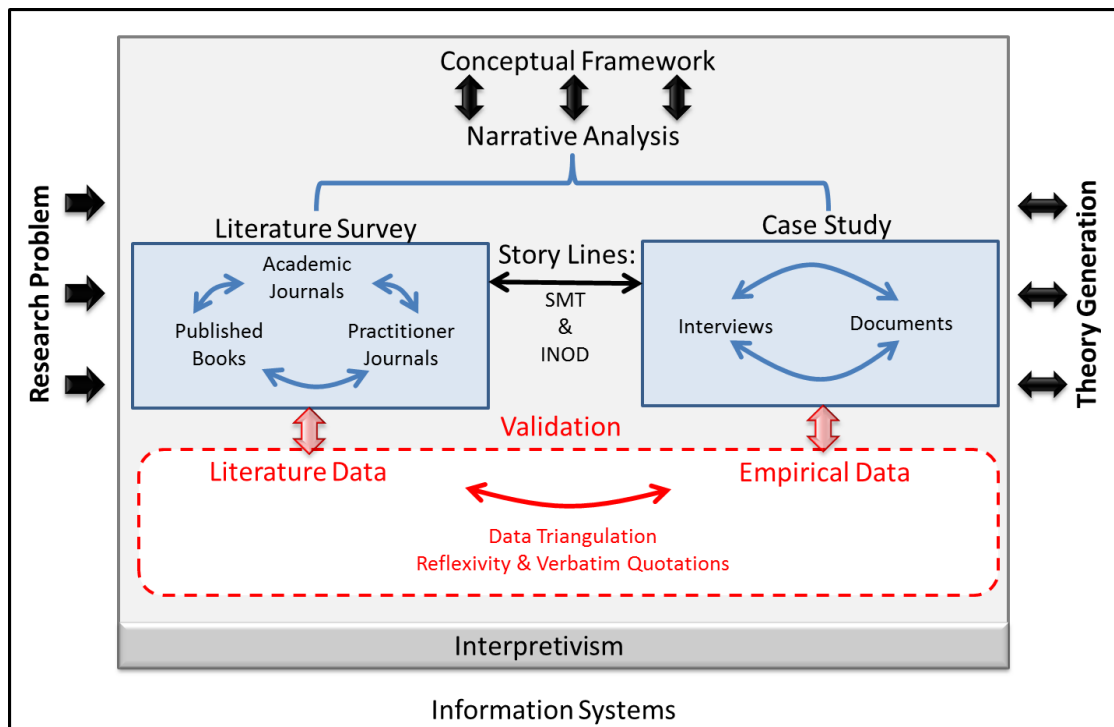
Figure 1-6: Research Execution Plan

The selected research topic is uniquely positioned in the sense that there is only one revenue collection agency in South Africa and therefore research on this topic from a South African context is limited to a single instance. In following this recommendation, it is acknowledged that although still valuable as a single case, the researcher must ensure that transferability (also discussed in section 2.4, the interpretivist version of what positivism describes as generalisations) can be derived based on the research conclusions (Oates, 2006:295). This limitation is addressed by conducting a critical explanatory case study, which uses established academic literature as well as practitioner literature for the study's basis. In doing so, the research therefore aims to address this limitation by providing a deep literature survey as well as a rich empirical study. It is consequently important to expect that such a literature survey be longer than usual. Examples of other single case studies successfully published in the IS research field include Markus et al. (2006), Khoumbati et al. (2006) and Martensson & Lee (2004), to name but a few. Although somewhat dated, an example of a single case study specifically focusing on a revenue collection agency (namely that of the Inland Revenue Authority of Singapore) is published by Sia & Neo (1997). Lastly, the research also includes a comprehensive

framework verification process in order to ensure both the validity and transferability of the derived conclusions, as further elaborated on in section 2.7.

1.10 Expected Findings

The expected outcome of this research is a conceptual framework that describes how DSS can facilitate the management of tax compliance through decision-making, which ultimately aims to minimise the tax gap phenomenon experienced by revenue collection agencies.

1.11 Chapter Divisions

The structure of this research is in accordance with Yin's (2009:176) theory-building structure for case studies and subscribes to Remenyi's (2012:136-140) suggestion pertaining to a case study write-up. The structure aims to address a new part of the theoretical argument in each chapter, allowing the research conclusions to slowly unfold though a narrative analysis. The structure is consequently different to that of a typical thesis which has the usual layout consisting of a literature review, method, findings, analysis and conclusion. A research roadmap is presented in Figure 1-7. The study consists of four parts. Part one elaborates on the research setting and consists of chapters one to three. Part two presents the literature findings through the theory-building chapters three to six. The empirical conclusions form part three of the research and comprise of chapters seven and eight. Finally, part four summarises the research in chapter nine and also includes a few appendixes, jointly referred to as supporting information.

Part 1 Chapter 1: Introduction and research methodology. This chapter serves as an introduction to the research. The chapter mainly presents details around the concepts covered in the research, the problem statement, research questions and objectives, the theoretical framework followed during the research, a summary of the research execution, research assumptions and limitations, the expected research outcomes and lastly, a structural overview of the thesis.

Part 1 Chapter 2: Research methodology and case study details. Chapter two elaborates on the research design by presenting the research field, philosophy

followed in the research, research method used, the selected data collection technique a well as the preferred data analysis technique, details on the research verification and also ethical theory. The chapter lastly provides details surrounding the case study and empirical participants.

Part 1: Research Setting	Part 2: Literature Findings
Chapter 1: Introduction	Chapter 4: IT and the revenue collection agency
Chapter 2: Research design	Chapter 5: IT and the tax practitioner
Chapter 3: Understanding the tax gap phenomenon	Chapter 6: DSS value propositions

Part 4: Research Summary	Part 3: Empirical Conclusions
Chapter 9: Conclusion	Chapter 7: Empirical findings on the tax gap and the role of IT
Supporting Information	Chapter 8: Empirical findings on DSS instances and framework confirmation

Figure 1-7: Research Roadmap

Part 1 Chapter 3: Understanding the tax gap phenomenon. In this chapter an overview of the tax gap is presented, approaches to address the tax gap are discussed, ethical stances on the tax gap are elaborated on, the implication of tax noncompliance is identified and so too the reasons for tax noncompliance and factors influencing it. This chapter also commences the construction of the conceptual DSS framework.

Part 2 Chapter 4: IT and the revenue collection agency. This chapter explores the influence that IT has on revenue collection agencies, given the objective of minimising the tax gap. This chapter addresses the institutional properties of the SMT and the information needs activity of INOD by discussing the institutional conditions and consequences of interaction with technology. This chapter continues the construction of the conceptual DSS framework.

Part 2 Chapter 5: IT and the tax practitioner. Chapter five explores IT's influence over tax practitioners. Specific focus is placed on the enforcement capabilities required to minimise the tax gap. The chapter focuses on the human agent component of the SMT and the information demand activity of INOD. This is done by elaborating on technology as both a product and medium of human action. This chapter also constructs the conceptual DSS framework.

Part 2 Chapter 6: DSS value propositions. The different DSS instances are explored in this chapter. The objective of this chapter is to identify the value proposition of each DSS instance. The technology component of the SMT and information offering activity of INOD is explored in this chapter. This chapter finalises the construction of the conceptual DSS framework.

Part 3 Chapter 7: The empirical findings on the tax gap and the role of IT. This chapter presents the empirical perspectives related to the associated literature chapters three to five. The chapter refines the conceptual DSS framework.

Part 3 Chapter 8: Empirical findings on DSS instances and framework confirmation. This chapter summarises the empirical findings related to DSS as supported by the literature study in chapter six. This chapter firstly refines the conceptual DSS framework, then validates the framework and finally tests the transferability of the framework.

Part 4 Chapter 9: Conclusion. The objective of this chapter is to reflect on the research conclusions and to present the conceptual DSS framework derived from this research. Insights pertaining to the future management of tax compliance through DSS are also discussed. The research limitations are explained in conjunction with future research opportunities. The chapter concludes with an elaboration on the researcher's contribution to the DSS body of knowledge.

Part 4 Supporting Information. This section presents the research abbreviations, empirical questions posted to the interviewees, the development lifecycle of the

conceptual DSS framework developed in this research, the interviewee participant form and lastly the references used throughout the research.

1.12 Conclusion

This study aims to develop a conceptual DSS framework with the focus of narrowing the tax gap by means of enabling effective and efficient organisational decision-making. Using the SMT and INOD as theoretical basis for the conceptual framework development, the value of information systems is explored by focusing on the IT interactions between an organisation, human agent and DSS. This conceptual framework can ultimately be referenced as a technology proposition to improve organisational decision-making aimed at managing tax compliance. The value of such a framework also has relevance to any other organisation, whether public or private, with a mandate to manage compliance in whatever form. This research is also expected to be valued by academics specialising in the field of DSS. This is because the proposed framework supplements the existing body of knowledge in addition to providing insights to those with academic interests in taxation. Lastly, practitioner journals such as Gartner and the OECD might also derive value from this research.

The subsequent chapter commences the research by firstly presenting an in-depth discussion on the research methodology. The chapter concludes with a discussion on the various characteristics of the case study, as this is required to appreciate the interpretations of the subsequent empirical chapters.

CHAPTER 2: RESEARCH DESIGN
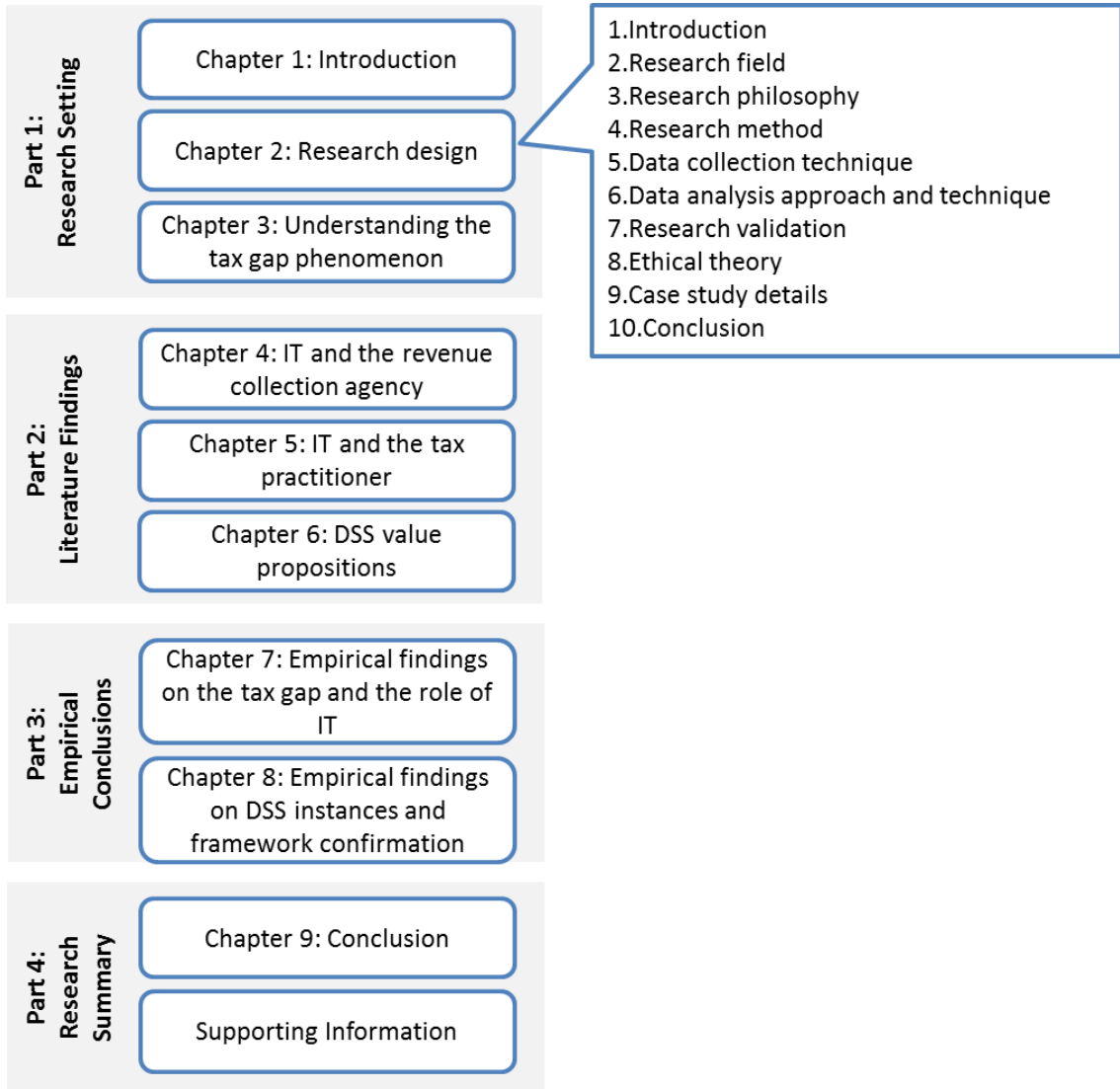
Figure 2-1: Chapter 2 Roadmap

2.1 Introduction

The research methodology was first introduced in section 1.7. Without a well-defined research methodology, the rigorousness of the research conducted will be doubted by fellow academics and may even be perceived as substandard. The success of any research execution is vitally dependent on the declaration and execution of a solid research methodology. Chapter 2 presents the research methodology framework used in this study. This framework stipulates the field of the research topic, the philosophical lens under which the research is observed, the theoretical approach selected and techniques used to conduct the research. The chapter concludes by providing details on the case study, which also includes an overview of the empirical study participants.

2.2 Research Field

IS has been described as a 'multi-perspective [disciplinary]' (De Villiers, 2005:143) or 'inter-disciplinary' (Pather & Remenyi, 2004:142; Ahituv & Neumann, 1986:4; Avison & Myers, 1995:44) discipline because of the strong influences by other disciplines. These disciplines are mainly the exact sciences, technology sciences and also social and behavioural sciences (Ahituv & Neumann, 1986:4). However, not all academics agree. Some academics refer to IS as an applied discipline (Szajna, 1994:49; Moody, 2000:351; Galliers & Land, 1987:901; Vessey et al., 2002:130) when others regard IS to be a pure discipline (Kaplan & Duchon, 1988:572). Although the last mentioned might have been the case in 1988, it would generally be disagreed with today. This study agrees with the suggestion by Oates (2009:2-3), which views IS as an applied discipline concerned with researching the 'real-world social and organisational context' in which IS exists.

Much debate has occurred over the disciplinary positioning of IS research. More than two decades ago, IS research was characterised by academics such as Galliers & Land (1987:901) as a set of uncontrollable and sometimes unforeseen 'real world' variables that cannot be reproduced or valued in laboratory conditions. This type of reasoning disqualified IS as a science, resulting in IS rather being classified as a discipline. Even more recently, the identity and positioning of IS research continues to be refined. IS is specifically characterised by its utilisation, refinement and sometimes the

redevelopment of theories from other pure disciplines (Vessey et al., 2002:130). Different concerns have also been raised around IS research. These concerns are mainly related to the various methodologies used to conduct IS research, as well as the lack of a distinct theoretical basis for IS research (Moody, 2000:352). IS research has at times even been accused of being 'fragmented and disjointed' (Bacon & Fitzgerald, 2001:48). The diverse scope of IS is also considered problematic because of the lack of well-defined boundaries in which academics perform research (Vessey et al., 2002:131). Despite these debates, the majority of academics continue to be of the opinion that IS research is an important academic pursuit (Pather & Remenyi, 2004:142). This is also generally evident in the number of IS related articles that are regularly published in a variety of respected journals.

The research topic of this thesis is studied as an applied discipline within the field of IS. The motivation for this selection is based on the main focus of the research namely DSS, which is a particular instance of IS. The selection is also substantiated because of the research topic's relevance to the industry and the practical relevance of the study's findings.

2.3 Research Philosophy

2.3.1 Past Reflections on the Paradigms of IS Research

The term paradigm has in the past been defined as the universal assumptions of theoretical philosophies that determine the manner in which research is conducted and concluded (Mingers & Brocklesby, 1997:490). This definition has remained consistent as is evident by subsequent publications such as De Villiers (2005:144), who states a paradigm to be the 'primary philosophical point of departure' for research. More recently, Kroeze (2010:154) also points to historical phases in science philosophy where different 'paradigms' were traditionally seen in isolated ways. However, he explains that many of these paradigms co-exist today in postmodern social sciences. The two main research paradigms traditionally referenced in IS are positivism and interpretivism (Mingers & Brocklesby, 1997:490; Parther & Remenyi, 2004:142; Fitzgerald & Howcroft, 1998:155; Moody, 2000:352; Goede & De Villiers, 2003:209; Bryant, 2002:3446). These are sometimes also respectively referred to as

hard and soft research paradigms (Fitzgerald & Howcroft, 1998:155). Academics had searched for a single all-inclusive IS research paradigm in the past, which subsequently resulted in rival debates between the positivist and interpretivist academics. Other researchers, such as Vessey et al. (2002:132), Kaplan & Duchon (1988:571) and Weber (2004:xii) suggest that IS research should be conducted by means of multiple paradigms in order for the discipline to mature. It is important to appreciate the philosophical dimensions associated with IS to better comprehend the conclusions derived at in this research. Some of these dimensions are now discussed.

A classic but still relevant publication by Burrell & Morgan (1979:1) states that social sciences, which includes IS, can best be conceptualised by four assumptions:

- Human nature describes the relationship between man and the surrounding environment. The one perspective presents humans as products of their surrounding environment and is described as responsive, mechanistic and deterministic. The contrasting perspective positions humans as the masters of their surrounding environment, and characterises them as being creative, controlling and influential. This point is especially relevant when exploring the relationship between humans, technology and the institution in which they operate. Such a focus is especially true for the theoretical departure points used in this research namely SMT and INOD (introduced in section 1.6).

- Epistemology explains how the researcher obtains knowledge of the world through observations. The researcher can, on the one hand, 'discover' knowledge that has always been in existence. On the other hand, knowledge is dynamically generated through the interpretation of the researcher's observations. The last-mentioned is of particular reference to this research, as motivated by the interpretivist approach selected for this research (see section 2.3.4).

- Methodology is related to the manner (tools and techniques) in which the research is conducted. The one extreme proposes that observations are scientifically measured with the purpose of deriving general conclusions. This is in contrast to the other extreme that attempts to describe general

- observations with the goal of obtaining an understanding thereof. The research method followed in this study is further elaborated on in section 2.4.

- Ontology focuses on how reality is perceived when conducting research. Reality can be described as an external force that is experienced by the researcher. Alternatively, reality can be considered as the product of the researcher's perceptions of the world. Ontology is relevant to this research by means of the manner in which the researcher interprets his findings, as well as how the empirical participants portray the reality they perceive. Section 2.6 elaborates on the manner in which the research findings are interpreted and presented.

Burrell & Morgan (1979:21) also reference these assumptions as part of their much cited 'four fundamental research paradigms'. These paradigms are shown in Figure 2-2 and discussed under the extremes of horizontal and vertical dimensions:

- Subjective vs. objective. The influence that society has within the research environment can either be recognised or ignored during the research observations; and

- Radical change vs. regulation. The research observations can either be viewed from a perspective that society promotes change within the research environment or that society promotes the establishment of regulation within the research environment.

THE SOCIOLOGY OF RADICAL CHANGE

	Anti-organisation theory	Radical organisation theory	
SUBJECTIVE	**Radical Humanism**	**Radical Structuralism**	**OBJECTIVE**
	Interpretive Sociology	**Functionalist Sociology**	
	Ethnomethodology & Phenomenological symbolic interactionism	Action frame of reference Theories of bureaucratic dysfunctions Social systems theory Objectivism	

THE SOCIOLOGY OF REGULATION

Figure 2-2: Paradigms for IS Research (Adapted from Burrell & Morgan, 1979:22)

The four quadrants defined by Burrel & Morgan (1979:23-35) can be discussed in great depth, but only a summary thereof is presented in this section. The radical humanist paradigm promotes the sociology of radical change from a subjectivist perspective. Radical humanists aim to improve the existing limitations of society (through consciousness) in order for man to truly fulfil his ideals. Man's ideological objectives continuously drive his actions but create a false consciousness which prevents man's true fulfilment. Radical humanism aims for man's consciousness to exceed the social constraints they are engaged in, in order to achieve their full potential. The radical structuralist paradigm advocates the sociology of radical change from an objectivist point of view. Similar to the radical humanists, radical structuralists aim to introduce change with the goal of improving man's state. However, this change is by means of structural relationships. The paradigm identifies structural conflicts that limit man's potential and aims to remove these conflicts in order for man to advance. The functionalist/positivist paradigm is grounded in the sociology of regulation from an objectivist standpoint and has traditionally been the dominant paradigm for most past research. The paradigm attempts to explain man's rational actions in a world of unified social facts that reside outside man's consciousness. Knowledge is obtained by following a problem-oriented approach to explain practical solutions through measurement and hypothesis testing. To the contrary, the interpretive paradigm is best described as the sociology of regulation by means of a subjective stance. Interpretivists aim to explain man's actions from his unique perspective, believing that multiple realities exist of the same social facts. Any reality beyond man consciousness is no more than mere assumptions. Knowledge is created by subjectively understanding the on-going social behaviour of man in relationship to those of others.

Of these four paradigms presented here, IS research has mainly focused on the positivistic and interpretive paradigms. The next section presents a comparison between these paradigms, as is summarised in Table 2-1.

2.3.2 Positivism and Interpretivism

The past rivalry between positivism and interpretivism is well acknowledged amongst IS researchers. An editorial comment by Weber (2004:iii-xii) questions this historical opposition between positivists and interpretivists. He elaborates on the fundamental assumptions related to these two categories and concludes that the differences, if any, are mostly related to the selected research methodology and not so much the research paradigm. Weber states that at most these differences should be considered 'shallow' and are therefore almost insignificant. Some academics even regard the positivism and interpretivism debate as irrelevant (Kroeze, 2012a:2). Remenyi (2012:1) also agrees with such a perspective when stating that the differences are overstated and similarities often ignored. However, the authors do support the historical importance of the debate by acknowledging that the rivalry was needed to introduce and establish interpretivism as an alternative to positivism. Weber also urges academics to withdraw these dividing 'labels' of positivism and interpretivism by suggesting that IS researchers should rather embrace the underlying unity shared by these two paradigms and in doing so, improve 'the metatheoretical assumptions that underlie [IS] research'. This research is somewhat sceptical of such a suggestion as it might lead to research lacking rigour. Having said this, one such undertaking is that by Kroeze (2012a:1) when he suggests that interpretivism could be a postmodern episistemology of postmodernism. It is not within the scope of this research to ignite the debate questioning the appropriateness of positivism versus interpretivism. Rather, the following sections discussing positivism and intepretivism aim to use the contributions of the past as a solid point of departure for this research.

Paradigm Level:	
A set of theories that is typical of a historical phase in the philosophy of science.	
Positivist	**Interpretivist**
A belief that the world conforms to fixed laws of causation and that complexity can be tackled by reductionism. Emphasis is placed on objectivity, measurement and repeatability.	A belief that there is no universal truth and that the 'truth' is understood and interpreted from the researcher's own frame of reference. This means that uncommitted neutrality is impossible.
Ontological Level:	
A theory which makes explicit underlying assumptions about reality and the nature of existence.	

Realist	Relativist
A belief that the external world consists of pre-existing hard and tangible structures that exist independently of an individual's cognition.	A belief that multiple realities exist as subjective constructions of the mind. Socially transmitted terms direct how reality is perceived and subsequently varies across different languages and cultures.
Epistemological Level: A theory which makes explicit the underlying assumptions about understanding and knowledge.	
Objectivist	**Subjectivist**
A belief that the researcher remains detached from the research situation. Neutral observation of reality takes place without the contaminating values or influences from the researcher.	There is no distinction between the researcher and research situation. Research findings emerge from the interaction between researcher and research situation. The values and beliefs of the researcher are therefore central mediators.
Etic/Outsider/Objective	**Emic/Insider/Subjective**
The research orientation is separate from the researcher, who is seen as being objective.	The research orientation is centred on researcher's view, with the latter viewed as the best to judge the adequacy of research.
Methodological Level: A set of methods and techniques that prescribe the type of research, as well as the associated data collection techniques.	
Quantitative	**Qualitative**
The use of mathematical and statistical techniques to identify facts and causal relationships. Samples can be larger and more representative. Results can be generalised to larger populations with known limits of error.	Focuses on determining what things exist rather than how many there are. Thick descriptions are given on the matter that is less structured and more responsive to needs and nature of research situation.
Confirmatory	**Exploratory**
Is concerned with hypothesis testing and theory verification and tends to follow positivist and quantitative research.	Is concerned with discovering patterns in research data and also to explain and understand them. Provides a basic descriptive foundation that may lead to generation of hypotheses.
Deduction	**Induction**
Uses general results to ascribe properties to specific instances. An argument is valid if it is impossible for the conclusions to be false if the premises are true. Also associated with theory verification/falsification and hypothesis testing.	Begins with specific instances that are used to arrive at overall generalisations which can be expected on the balance of probability. New evidence may cause conclusions to be revised. Criticised by many philosophers of science, but plays an important role in theory/hypothesis conception.

Laboratory	Field
Precisely measures and controls research variables. However, this is at the expense of naturalness of situation, since real world intensity and variation may not be achievable.	Emphasis is placed on the reality of context in natural situation, but precision in control of variables and behaviour measurement cannot be achieved.
Nomothetic	**Idiographic**
Group centred perspective using controlled environments and quantitative methods to establish general laws.	Individual-centred perspective that uses naturalistic context and qualitative methods to recognise unique experience of the subject.
Axiological Level: A pragmatic theory regarding the study of values in terms of morals and ethical stance.	
Rigor	**Relevance**
Research characterised by hypothetico-deductive testing according to the positivist paradigm. Emphasis is placed on internal validity through tight experimental control and quantitative techniques.	The external validity of actual question and its relevance to practice is vital, rather than constraining the focus to 'rigorous' methods.

Table 2-1: Summary of Soft vs. Hard Research Dichotomies (adapted from Fitzgerald & Howcroft, 1998:160; Kroeze 2012b:62)

A description and differentiation between positivism and interpretivism are given in the subsequent sections as well as the motivation for selecting interpretivism as being most relevant to this research.

2.3.3 Positivism

Positivism (hard research) is seen as the traditional paradigm in which most research (including IS) has been conducted (Pather & Remenyi, 2004:141 - 143; Burrel & Morgan, 1979:25; Kroeze, 2012b:47). Consequently, a study conducted by Vessey et al. (2002:166) identifies positivistic research as the most popular paradigm for IS research. One explanation for this research outcome might be because many IS academics converted from science/pure discipline fields where positivistic research was the norm.

The paradigm of positivistic research is characterised as quantitative and objective (Mingers & Brocklesby, 1997:490; Pather & Remeny, 2004:142; De Villiers, 2005:142), which is typically practised by functionalists (Mingers & Brocklesby,

1997:490). Results from this paradigm are usually quantifiable and repeatable (Fitzgerald & Howcroft, 1998:160; Goede & De Villiers, 2003:209) because positivism regards reality to be a single and universal version of the truth (Kroeze, 2012b:4). Through an ontological point of view, positivism is practised by realists for whom a unified reality exists that is external to human beings and that is exact, unbiased and value-free (De Villiers, 2005:142; Fitzgerald & Howcroft, 1998:160). Knowledge is therefore seen as being 'out there' pertaining to 'law-like generalisations' that can be discovered through structured research methods (Gonzalez & Sol, 2012:407). The epistemology of positivism describes the researcher as an objectivist, which should be isolated from the research environment in an attempt to be neutral and unbiased (Fitzgerald & Howcroft, 1998:160; Kroeze, 2012a:1). From an axiological perspective, positivism is focused on the rigorous simulation of real-world occurrences from where theories can be derived and proven (Fitzgerald & Howcroft, 1998:160; Kroeze, 2012a:4). Such a quantitative research approach forms the basis of the positivistic research methodology.

The positivism research method makes use of controlled experiments by examining well-defined and measurable environmental variables in a closed system. A researcher would typically declare a hypothesis and measure the identified variables in an attempt to satisfy each hypothesis. Research results are considered valid when the environmental variables can repeatedly and consistently emulate a hypothesis through scientific and statistical analyses (Kaplan & Duchon, 1988:572; Pather & Remeny, 2004:142; De Villiers, 2005:142; Fitzgerald & Howcroft, 1998:160; Klein & Myers, 1999:69; Goede & De Villiers, 2003:209).

Kaplan & Duchon (1988:572) motivate why the positivistic paradigm is not ideal for IS research: A typical IS research environment consists of complex social structures and influences which possibly contribute towards numerous uncontrolled, immeasurable and even unidentified environmental variables. A positivistic approach does not complement these characteristics and it is specifically these characteristics that are of importance to the IS researcher (Goede & De Villiers, 2003:209). This fact disfavours the positivistic paradigm for IS research as the paradigm prefers a closed research environment with clearly identified, quantifiable and controllable

environmental variables. Having said this, various IS research do exist that successfully applied positivistic research methodologies. If IS is researched by means of a positivist approach, the abstraction of environmental variables (used for hypothesis testing) might cause the researcher to fail in understanding the contextual occurrences within the environment. If anything, positivism originated from the natural sciences in which the world is physically studied and is therefore disconnected with human and social phenomena applicable in IS research (Kroeze, 2012b:47). Gonzalez & Sol (2012:407) further question the appropriateness of positivism for IS research because of various propositions: Positivism views technology as having a neutral influence over humans; positivism regards organisations as isolated entities that cannot be affected by external factors; and more importantly, positivism does not recognise the researcher's ability to influence the research process and the interpretation thereof. It becomes fairly clear that these propositions are not credible given the objective of this research and subsequently disqualifies positivism to be used in this particular research. This is because organisational decision-making is a social event in which external variables cannot be quantified.

2.3.4 Interpretivism

Interpretivism (soft research) has become an increasingly popular paradigm in IS research. Nevertheless, Vessey et al. (2002:166) state that in comparison with positivism, very few interpretive studies have been published. They also recognise the potential of this paradigm and expect a substantial increase in interpretive publications as IS research continues to mature. The below section argues that this is indeed the case.

The interpretivist paradigm is best described as qualitative and subjective (Mingers & Brocklesby, 1997:490; Pather & Remeny, 2004:143; De Villiers, 2005:143; Kroeze, 2012b:47) and is generally executed by constructivists (Mingers & Brocklesby, 1997:490). Research execution and interpretation are based on the researcher's frame of reference (Fitzgerald & Howcroft, 1998:160) and any research conclusions are therefore a product of the researcher's interpretation (Gonzalez & Sol, 2012:407). Ontologically speaking, interpretivist researchers are described as relativists who believe that multiple realities exist (that are time and context dependent) and that

interpretivist research is value-related because of its subjectivity (De Villiers, 2005:142; Fitzgerald & Howcroft, 1998:160; Klein & Myers, 1999:69). Consequently, the epistemology of interpretivism does not differentiate between the researcher as a subjectivist and the research environment. During interpretive research, an interactive network of social relationships exists between the researcher and the research environment (Goede & De Villiers, 2003:2009). This network is dominated by the researcher's believes and values (Fitzgerald & Howcroft, 1998:160; Klein & Myers, 1999:69). The axiological perspective of interpretivism is based on quality and relevance and forms the basis of its empirical research methodology (Fitzgerald & Howcroft, 1998:160). Klein & Myers (1999:72) and Bacon & Fitzgerald (2001:48) also explain the fundamental importance of hermeneutics in interpretive research: researchers must follow an iterative approach of understanding the interdependent parts that form the whole, as well as the whole itself. The principle of hermeneutics is characterised by the statement that the whole is greater than the sum of its parts.

Interpretivism is sensitive to social context and orientation, including those of the researcher. Oates (2009:292) explains that interpretivism in IS is concerned with the social context of technology, how IT is constructed by people and consequently also how IT influences people. This social lens acknowledges that all conclusions are epistemological by nature. In other words, the researcher obtains knowledge of the world through observations. On the one side, the researcher 'discovers' knowledge that has always been in existence. On the other side, knowledge is dynamically generated through the interpretation of observations by the researcher. Interpretivism is also derived through hermeneutics (Myers, 2009:181-190). Hermeneutic historicity implied that our current understanding of the topic is based on our past context and present ability to interpret the case in a given environment. The hermeneutic circle states that the whole is greater than the sum of the topic's parts and that the interpretation of the topic is a constant move between the whole and the parts. Hermeneutic prejudice explains that prior knowledge is critical to the interpretation of the case. This prior knowledge exists in the minds of interpretivist researchers. These researchers are described by Oates (2006:292) as relativists who believe in multiple realities, resulting in subjective and qualitative conclusions.

Oates (2006:292) lists different characteristics unique to interpretivism:

- Multiple subjective realities and interpretations: Results can be interpreted in different ways by different people, resulting in various versions of the truth. This point becomes evident in the empirical study (chapters 7 and 8) when the different perspectives that participants have on the same topic are interpreted.

- Socially constructed meaning: Reality in whatever form is created and transferred through social constructions. The awareness of these social constructions is important during the empirical study.

- Social settings: Interpretive research studies a 'real-world' phenomenon in its natural settings. The research method selected in this study as presented in section 2.4 supports the suggestion of exploring a topic in its natural setting.

- Researcher reflexivity: The researcher's history such as assumptions, beliefs and values cannot be separated from the research, which has an inevitable impact on the researcher's interpretations. This point is relevant to the empirical conclusions derived in this study.

- Qualitative data analysis: Interpretive research does not use the statistical methods applied to quantitative data. Instead, qualitative data is used to derive logical interpretations and conclusions. More on this point is discussed in sections 2.5 and 2.6.

Klein & Myers (1999:72) identified seven widely cited principles for interpretive research (specifically field studies) that can be used as guidelines to improve the quality and evaluation of interpretivist studies. These principles are also supported by Goede & De Villiers (2003:209) and listed in Table 2-2.

The interpretive research method is executed by means of detailed observations of the research object in its natural environment, without the influence of theoretical constructs or preconceived conclusions (Kaplan & Duchon, 1988:572). Research data is usually generated by means of empirical studies that are guided by specific research questions. Research is executed and interpreted in the context of social constructs (Pather & Remeny, 2004:143; Klein & Myers, 1999:67). These social constructs could be events, concepts and categories that consist of numerous uncontrolled,

immeasurable and even unidentified environmental variables (Kaplan & Duchon, 1988:572). The research aims to interpret the data and understand the information derived, in order to provide an explanation of the phenomena. At last, the reliability of interpretive research is measured by the natural occurrences of the research findings (De Villiers, 2005:142; Fitzgerald & Howcroft, 1998:160).

1	**The Hermeneutic Circle** This principle suggests that all human understanding is achieved by iterating between considering the interdependent meaning of parts and the whole that they form. This principle of human understanding is fundamental to all the other principles.
2	**Contextualisation** Requires critical reflection of the social and historical background of the research setting, so that the intended audience can see how the current situation under investigation emerged.
3	**The Interaction Between the Researchers and the Subjects** Requires critical reflection on how the research materials (or 'data') were socially constructed through the interaction between the researchers and participants.
4	**Abstraction and Generalisation** Requires relating the idiographic details revealed by the data interpretation through the application of principles one and two to theoretical, general concepts that describe the nature of human understanding and social action.
5	**Dialogical Reasoning** Requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research design and actual findings ('the story told by the data') with subsequent cycles of revision.
6	**Multiple Interpretations** Requires sensitivity to possible differences in interpretations among the participants as are typically expressed in multiple narratives or stories of the same sequence of events under study. Similar to multiple witness accounts even if all tell it as they saw it.
7	**Suspicion** Requires sensitivity to possible 'biases' and systematic 'distortions' in the narratives collected from the participants.

Table 2-2: Summary of Principles for Interpretive Field Research (Adapted from Klein & Myers,1999:72 and Kroeze,2012b:49)

Fitzgerald & Howcroft (1998:163) and Klein & Myers (1999:67) motivate why interpretive research is the paradigm of choice for IS research. Interpretive (qualitative) research is sensitive to the social context and time in which the research is conducted. External influences (such as physical, social and historical factors) are typically ignored by positivists but are recognised by interpretivists. Interpretivism is

not only relevant when referencing a particular phenomenon, but is also applicable when concluding the results of the research. As an applied discipline, IS also recognises the existence of complex and perhaps hidden structures within the research environment. It therefore becomes important for the research object and activities to be socially conceptualised in an attempt to obtain insight and understanding of the phenomena. The human usage of IS and in particular DSS is a prime example. For this reason, the soft approach of the interpretivism paradigm is selected as most appropriate for this study. Also, when exploring the relationship between human agents and technology in an institutional setting (as per SMT and INOD theoretical foundation of this study), a positivistic approach is of less relevance as the knowledge discovery process is not about scientific repetition. Rather, the process is about gaining insights regarding how the usage of IS - in particular DSS - can be used to address the tax gap phenomenon by enabling effective and efficient decision-making. Interpretivism supports such an approach because it views organisations as social entities that have a dynamic relationship with DSS users (Gonzalez & Sol, 2012:407).

DSS has the ability to create knowledge and in doing so create authority structures within an organisation. These authority structures control organisational knowledge as it enables individuals in these structures to become influential decision-makers in an organisation. In doing so, the 'true' reality of events can be overwritten because of the influential nature of these decision-makers. For this reason, the creation of an empirical 'universal perspective' on DSS is at risk. Positivism would not recognise these factors and the researcher prefers interpretivism as the research paradigm of choice.

2.4 Research Method

Arnott & Pervan (2008:657) indicate that case study research on DSS is vastly 'under represented' in comparison to other research methods focussing on DSS. Perhaps this is related to the general critique that case studies are too simplistic and therefore considered to be a substandard research method. However, Remenyi (2012:4) argues strongly for this not to be the case. Additionally, Gonzalez & Sol (2012:415) state that case study is a valid research method for interpretivism. Case study research through the interpretive research paradigm provides detailed insights and in-depth social

explanations on the case being researched. Social explanations are of particular importance when humans are involved, as is the situation for this research because of its focus on decision-making. It is often the case that such richness of understanding cannot be derived from any other research method and especially not when using the positivistic research paradigm. Case study research is described by Oates (2006:141) as a comprehensive and concentrated evaluation of a very specific phenomenon as it occurs, in an attempt to generate new knowledge on the subject. However, this description is too vague and it is effective to list the case study characteristics defined by experts such as Yin[1] (2009:18) and Remenyi (2012:3):

- Case study is the research of a relevant phenomenon in great detail and focus as it exists in its natural environment and setting. Two points are of importance in this regard. First is the in-depth focus on the topic that must be supported by a comprehensive literature survey and wide-ranging empirical participation. This study aims to do both. As a result, the literature survey and empirical study are more extensive than what would be expected from alternative research methods. Second is the study of the topic in its natural state. This research aims to do so by studying decision-making related to managing the tax gap phenomenon within SARS as an organisation. More on the case study particulars is presented in 2.9.

- The case study phenomenon is influenced by many more factors than data points. Whilst recognising this, the researcher has limited the scope of this research by only exploring data points related to the relationship between human agents and technology in an institutional context, as predefined by SMT and INOD.

- Well-recognised existing theories are referenced in case studies and serve as guidance for data collection and analysis. This is an important characteristic and substantiates the previous two points. Many existing theories are referenced and integrated throughout this research. The literature survey is consequently much richer and longer than that of other typical theses.

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[1] Robert K. Yin has various publications related to case studies, focusing on both qualitative and quantitative research. Some of his most respected work includes Yin (2003) that presents various applications of case studies, and also Yin (2009) that offers guidance on the execution of case study research.

- Case study requires multiple data sources to be used and there is consequently a need for continuous theory verification. This is accommodated by using two data collection techniques namely interviews and document collection. The researcher can continuously triangulate the data collection points by using these independent techniques. The literature survey is used as another triangulation point. Section 2.7 elaborates on this point.

Based on the above mentioned, the characteristics of the proposed case study is now presented in accordance with Yin's (2009:47-53) and Remenyi (2012:19, 20) recommendations[2]. This study follows a *single-case* design consisting of SARS as the sole *research case*. The case is made up of a single unit of analysis, which is the technology associated to support the decision-making processes involved in addressing the tax noncompliance. The selection of a single-case research study is best motivated because of the fact that there is only one revenue collection agency in South Africa. Credibility is given to this selection through the comprehensive usage of well-established theories as part of the literature survey, in addition to a very comprehensive empirical study. A research case uses a strict methodological process to study the particular problem at hand. The research is considered a *critical explanatory* case. This is because well-formulated theories from the existing body of knowledge are referenced to generate new knowledge in a domain with limited existing publications. The generalisations derived from this research aim to be rich in insight as the study references established existing theories in order to discover new knowledge. The practical implications of the conclusions derived are also presented as generalisations. The case study is considered to be a *unique opportunity* or potentially even a *revelatory* instance. This is because the researcher is uniquely positioned to explore a topic with limited accessibility to others. The researcher also has access to a variety of resources in the organisation, which would otherwise be challenging for an external researcher to obtain. Although unique by nature, the study aims to generate theories *representative* of revenue collection agencies in general. The case study characteristics selected in the above-mentioned are mainly motivated by the fact that there is only one revenue collection agency in South Africa. However,

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[2] These characteristics are presented in bold-italics for ease of reference and are limited to section 2.4.

the research must ensure 'transferability' (this concept is elaborated on in the next paragraph) to other revenue collection agencies for the research to be meaningful. Section 2.7 elaborates on this point. Although different frameworks suggest the manner in which noncompliance should be combatted, hardly any of these frameworks have a DSS perspective. Additionally, few if any of the frameworks focus on the management of tax noncompliance in developing countries. One can also expect a developing country's approach to managing tax noncompliance (e.g. South Africa) to differ from that of a developed country. Hence the motivation for selecting a single-research-case study of critical explanatory nature to study how DSS can address the tax gap phenomenon in South Africa.

Traditional critique against the case study research method, although mostly positivistic by nature, is addressed by Yin (2009:15). Two points in particular are of interest to this study, namely that a) case study research lacks rigorous research execution and b) case study findings can't be generalised. The lack of rigorous research execution has been a past concern raised against interpretive research in general. The researcher attempts to address this concern by not executing a teaching case study, but rather a research case study. Stated differently, this means that the case study is not simply the presentation of a particular case aimed at stimulating discussion. Instead this research is the documentation of a knowledge discovery journey related to a uniquely positioned research topic (Remenyi, 2012:15). This process execution is supported by a theoretically sound research methodology, as presented in this chapter. The critique that case study research lacks generalisation is also addressed. However, Oates (2006:295) refers to 'transferability' as the interpretive alternative to generalisation, as the concept of 'generalisation' is more relevant to positivism. Transferability is addressed by means of a rich and comprehensive theoretical foundation used in this research as well as a comprehensive empirical study. The theoretical foundation guides both the direction and findings of the case study and is also the reason for the case study to be critically explanatory by nature. The main theories creating the theoretical foundation of this research are Leviner's (2009:420) framework for tax compliance and risk management, Orlikowski's (1992:410) Structuration Model of Technology (SMT)

model, Osmanagic-Bedenik & Varga's (2006:141) Information Offer, Demand and Needs (INOD) model, as well as Power's (2002:13-16) categorisation of DSS.

2.5 Data Collection Technique

The case study research method consists of both primary and secondary data. Myers (2009:122) differentiates between primary data, which is unpublished data, and secondary data. Primary data in this research is generated through different empirical data collection techniques, namely interviews and practitioner documents, and are typical instances of qualitative data collection according to Remenyi (2012: 38). Remenyi (2012:3) also emphasises the importance of primary data by criticising case study research that only reference secondary data. Secondary data is theoretical by nature and is sourced from practitioner journals, academic journals as well as published books.

The interviews used in this study are semi-structured by nature, consisting of a few pre-formulated questions. Oates (2009:188) and Myers (2009:124) explain that semi-structured interviews are aimed at stimulating the conversation towards the defined research objectives, yet also allowing opportunity for the natural discovery of information (as opposed to checking, which is the case for structured interviews). Yin (2009:107) elaborates by promoting 'in-depth' interviews for longitudinal case studies. These interviews occur over an extended period in time and also identify further sources of evidence by means of empirical documents. The pre-formulated questions discussed in the interviews are presented in Appendix B.

The final data collection technique is that of empirical documents. These documents consist of published and unpublished/internal documents. Yin (2009:103) explains the importance of documents for case study research, especially as a method of theory triangulation. Examples of such documents include reports; publications; formal statistics; business documents; communications and presentations, to name but a few. The analysing of data commences once the data collection has been completed.

It is important to recognise the researcher's position in relation to the case study when collecting data. The researcher is classified as a practitioner-researcher because of his

relationship to the case study. This opportunity presents the researcher with the practical knowledge together with the required credentials and approval to explore the research topic in great detail - as prescribed by single case study requirements. However, this advantage so poses a risk as the researcher's preconceived conceptualisations and perceptions can influence the research interpretations and derived conclusions. The study will counter this by executing the validity checks discussed in section 2.7.

2.6 Data Analysis Approach and Technique

Kroeze (2012b:47) explains data to be intertwined with theory and that it is the purpose of the interpretivist to derive conclusions from the data. For this reason, a well-defined data analysis approach is critical to any case study research.

The data analysis approach selected in this research is narrative analysis, whereas the data analysis technique is that of explanation building. The objective of explanation building is to use a theoretical basis to interpret the phenomenon studied by understanding why or how something occurred, or understanding the presumed set of causal links related to it. Explanation building as defined by Yin (2009:141) complements the critical explanatory nature of the case study. Narrative analysis is the process of writing an account of past events or occurrences, mostly in a linear story-like fashion (Myers, 2009:211). Remenyi (2012:7) approves of a narrative analysis for case study research. He motivates this by stating that the most insightful knowledge held by society is captured in the insights they have into past occurrences. The narrative analysis will follow a bottom-up approach by generating the narrative structure from the literature survey, interviews and documents collected. The bottom-up approach is typically used by interpretive studies to create the structure of the thesis according to continuous research findings. This is opposed to the top-down approach mostly used in positivistic studies in which the research structure and execution is pre-defined. The researcher will generate constructivist narratives typical to interpretivism, or in other words, the researcher (or narrator) constructs meaning through the interpretation of the data collected. The narrative analysis storyline is based on the three main components prescribed by SMT which are institutional properties; human agents and technological artefacts. Additionally, the storyline is

made relevant to IS by making specific reference to DSS. More specifically, particular focus is placed on DSS through the usage of INOD's position on information requirement, information demand and information offerings.

2.7 Research Verification

Verification checks are mechanisms used to increase the credibility and authenticity of the interpretations. Oates (2006:211, 212) describes different verification types and those types relevant to this study are presented below:

- Verbatim quotations from the case study are presented to reassure the reader about the conclusions derived.

- Triangulation uses multiple data collection methods and compares the results to complement theory discovery and validation. Triangulation is the ability to approach the research question from different angles, with the objective of ensuring consistent and valid interpretations. Yin (2009:116) suggests different types of triangulations of which data triangulation has been selected for this study. Data triangulation can validate the construction of theory using multiple data sources aimed at converging the case study's lines of inquiry. This study uses the convergence of data that occurs when multiple sources of data have been explored in a single study with the goal of cohesively concluding certain facts or events. The literature survey acts as the first triangulation point. Interviews and practitioner documents are used as the other two empirical triangulation points, as suggested by Remenyi (2012:95).

- Reflexivity is the ability for the researcher to inner-reflect on his/her presence in the research situation, as well as the epistemological assumptions made by the researcher. This is also in support of the interpretivist research paradigm. As previously also mentioned, reflexivity is critically important as the researcher and the case study function inseparably in the same environment.
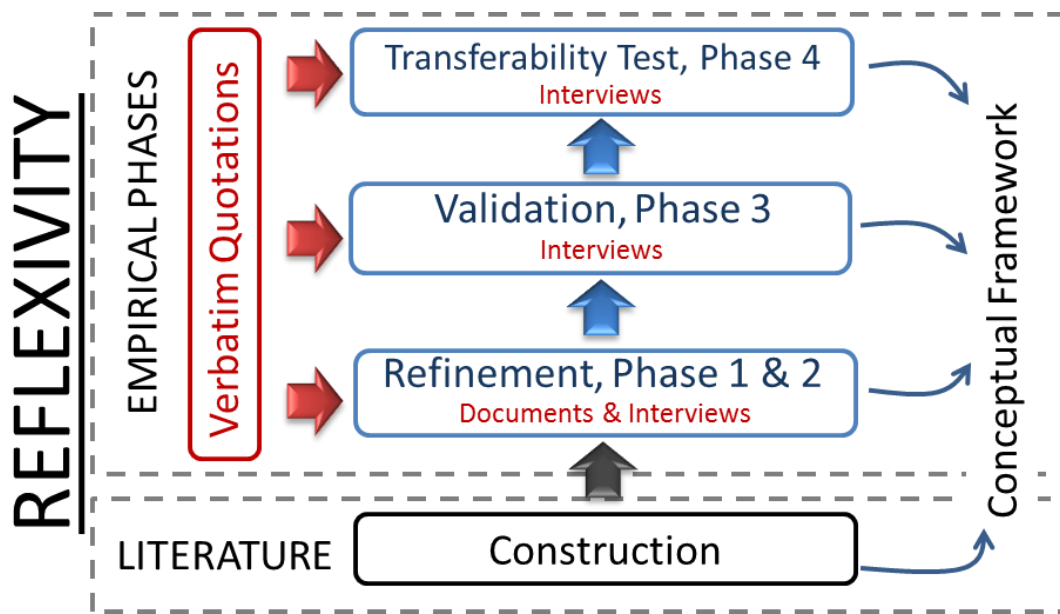
Figure 2-3: Research Verification Triangulation Points

The study verification is performed using all three prescriptions, as shown in Figure 2-3. Verbatim quotations are continuously presented throughout the empirical study. The challenge in this regard is the fact that English is not the first language of most empirical participants and that the verbatim quotations therefore might prove to be difficult. The empirical study consists of four phases. The first two phases are labelled the refinement phase during which the framework construction from the literature survey is empirically enhanced. The subsequent phase three of the empirical study is aimed at validating the conclusions derived from the literature survey construction and empirical refinement phases. The fourth and final empirical phase is that of transferability testing. The transferability testing phase aims to evaluate whether the derived framework is relevant to other revenue collection agencies.

2.8 Ethical Theory

The ethical theory selected in this research has a particular impact on the manner in which the empirical research component is executed. Gordon (2004:176-179) defines eight ethical theories on which society is based, of which a short overview is follows below:

- Egoism: The main purpose is to succeed in one's desires. The challenge is that humans are often not sure themselves what these desires are, or what they should be, and consequently happiness cannot be guaranteed.

- Hedonism: Promoting own interest in an attempt to maximise pleasure and minimise pain. However, critics of hedonism state that there is more to life than simply pleasure. Also, pursuing pleasure alone eventually leads to the creation of pain in one form or another. The intentional noncompliance of taxpayers can be related to hedonism as the financial gain of taxpayers equates to their 'pleasure'.

- Naturalism and Virtue Theory: The being of one is based on the flourishing of its existence and well-being, which is different for each individual. One has to accept that these preferences are often based on what is regarded as acceptable norms by society. This theory touches on the social development responsibility of SARS. An objective of collecting taxes is to enable government to distribute wealth amongst citizens with the goal of cultivating an equal society.

- Existentialism: Focuses on an individual's freedom to choose the best life based on the subjective interpretation of the world. However, this perspective often challenges the moral stance of individuals. This is because the best life of one individual might mean the worst life of another. This theory touches on the choice an individual has in terms of paying taxes or not. This choice is often based on the individual's perception of how government spends these taxes. Section 3.3.2.3 elaborates on this point.

- Kantianism: Moral duty is the main driver of human behaviour, although the reasoning for selecting moral behaviour above one's own preference is not addressed. An example of this theory is when taxpayers pay taxes because it is the 'right thing to do'.

- Utilitarianism: Actions should be judged according to the impact it has on the happiness of the majority. The payment of taxes to support the greater good of society is an example of the utilitarianism theory.

- Contractualism: An agreed upon set of social obligations forms the basis of all behaviour and intent, thereby balancing the importance of freedom and happiness. Contractualism is similar to Kantianism, but from a social perspective. It therefore focuses on the moral duty of society, where the

payment of taxes is a behaviour prescribed by society and the failure thereof would be socially unacceptable.

- Religion: One's being is guided by a religious obligation and desire. The topic of religion is much debated in many different forms and it is not within the scope of this research to revisit these debates.

It is reasonable to state that Gordon's discussion of these theories is successive by nature. In other words, starting at Egoism each subsequent theory addresses (to a certain degree) the limitations of the previous theory, ending at Religion. Although these theories are successive in nature, it is important to note that no single theory is considered insignificant or more significant than others, nor that the impact of one theory exceeds that of others. The uniqueness of individuals causes them to appreciate different aspects of life and how they perceive their role in society, resulting in the significance and impact of ethical theories to be at most questionable. Gordon (2004:205) summarises this when stating: 'They [referring to humans in general] pay most attention to personal concerns and some attention to what they perceive as moral demands'.

It is the purpose of this section to provide a limited awareness of how ethical theory touches on certain aspects covered throughout this study. Additional reference is made to some of these ethical theories in section 3.4, in which the ethical perspectives related to the tax gap and in particular taxpayer noncompliance are discussed.

2.9 Case Study Details

The purpose of this section is to present a high level overview of the single case study, namely SARS. The section commences with a discussion of the general role of revenue collection in South Africa. An institutional overview of SARS then follows after which the section concludes by providing details on the interviewees selected as empirical participants.

2.9.1 Simplified Overview of Revenue Collection within South Africa

SARS forms an integral part of the economic services delivered by the South African government. The taxes collected enables government to facilitate economic growth and distribution, as well as to improve the social development of its citizens.

According to SARS's official website[3], it has been appointed as the agency responsible for the collection of revenue as well as the enforcement of tax regulation and compliance. In addition to this primary role, SARS is also tasked to facilitate economic trade by means of its customs divisions, which is done through the governing of cross-border economic activities. In summary, the main functions of SARS as determined by the South African Revenue Service Act 34 of 1997 are:

- The collection and administration of revenue consisting of taxes, duties and levies;
- Ensure tax compliance; and
- Provide customs service to facilitate cross-border trade.

SARS is mandated to collect taxes, duties and levies. The taxes collected consist of Air Passenger Tax, Capital Gains Tax, Donations Tax, Income Tax, Pay As You Earn Tax, Provisional Tax, Retirement Funds Tax, Uncertificated Securities Tax and Value Added Tax. The duties revenue is collected from Customs Duty, Estates Duty, Excise Duty, Stamps Duty and Transfer Duty. Lastly, the levy revenue is gathered from Environmental Levy, Fuel levy, Skills Development Levy and Unemployment Insurance Fund. It is beyond the scope of this research to elaborate on each of these taxes as these have little relevance to the remainder of the research.

The positioning of SARS within the South African economy cannot be viewed in isolation. Yet, because of the research scope and complexity, it is quite challenging to provide a comprehensive description thereof. Figure 2-4 attempts to provide an accurate yet simplified summary of SARS's positioning in the South African economy.

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[3] URL is www.sars.gov.za, cited 10 November 2011.
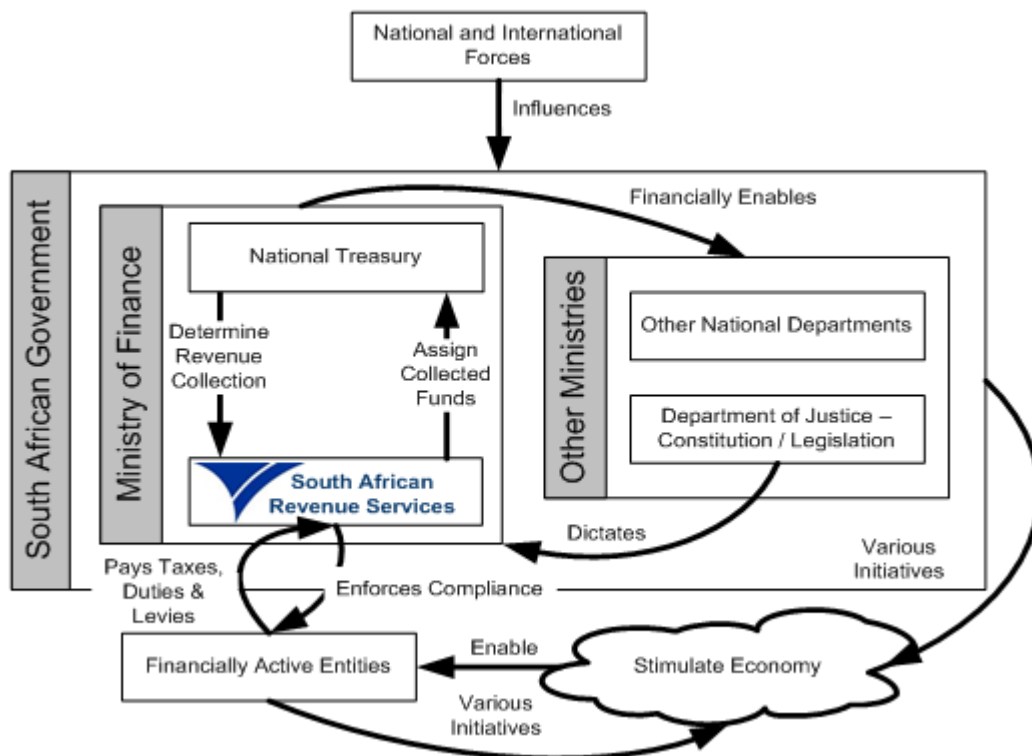
Figure 2-4: Simplified Positioning of SARS in the South African Economy

The South African government comprises of different ministries dedicated to the governing of specific domains. The Ministry of Finance is an example of such, and focuses specifically on South Africa's monetary affairs. SARS forms part of the Ministry of Finance and works closely with National Treasury. National Treasury has the responsibility of managing the finances of the South African government through the coordination of monetary policies, as well as the preparation and implementation of the annual budget. This national department provides input to SARS's revenue collection, more specifically relating to revenue collection forecasts and targets. The revenue collected by SARS is transferred to National Treasury from where it is allocated according to the defined budget. Despite National Treasury's governance of revenue, SARS administers and conducts the collection of revenue. Both National Treasury and SARS are dictated by the South African constitution and legislation, as prescribed by the Department of Justice. The Ministry of Finance funds the activities of other South African ministries. These different ministries stimulate the South African economy through various initiatives. Recent examples of these initiatives include the expansion of national infrastructure, industrial capital, education and skills development, income support and service delivery, just to name a few. Through the

stimulation of the South African economy, financially active entities are enabled which mostly includes companies and individuals. By law these entities are obliged to pay taxes, duties and levies to SARS in accordance with their financial activities. SARS also has the mandate to enforce the compliance of non-cooperative entities.

Based on this overview, the critical role SARS plays within the context of the South African economy is evident. The tax gap, and in particular tax evasion, has a critical impact on the budgetary income of government and is therefore an important challenge for any revenue collection agency (Wu et al., 2012:8769). Without effective revenue collection by SARS, the South African economy is likely to disintegrate, mostly likely resulting in catastrophic consequences for South Africa.

2.9.2 An Institutional Overview of SARS

The collection of revenue by SARS is driven by a target set by National Treasury. The revenue collection targets defined for recent financial years have mostly been achieved by SARS, despite the economic turmoil. Consequently, it is reasonable to conclude that SARS has historically performed exceptionally well. The revenue collected for financial years 2006 to 2013 increased from R417.6 to R813.8 billion, with an estimated revenue growth of around 10% per annum as shown in Figure 2-5.
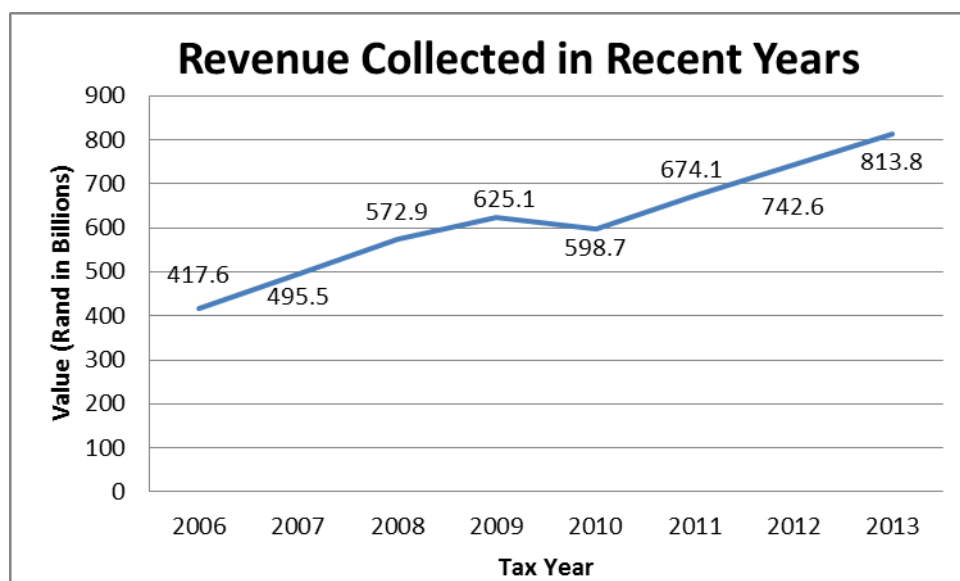
Figure 2-5: Revenue Collected by SARS in Recent Years

As a result of South Africa's strong economic growth over recent years, the workforce employed by SARS has grown significantly. By April 2013, SARS had 14,701 employees, each categorised in one of six career levels. Government has also directed South African organisations to rectify the politically-driven employment injustices of the past by prescribing employment equity guidelines. Consequently, the cultural profile of SARS is very diverse by nature. This has a significant influence on the research interpretations as the perspective these individuals have might differ significantly because of their diverse backgrounds. More on this topic is also presented in section 5.4.2. A detailed description of SARS's workforce profile is presented in Table 2-3.

SARS embarked on a modernisation programme (SARS, 20013a:30) in 2007. The modernisation programme is aimed at automating the high volumes of manual processing in order to free up human capacity that will instead focus on providing improved services to taxpayers. By the end of 2013, most of the original modernisation objectives were completed, with only a handful of important projects remaining. The modernisation programme has made significant improvements specifically related to personal income tax, the eFiling web system and the introduction of electronic channels supporting Customs and Excise transactions. The modernisation programme also touched on the revamp of SARS's DSS capabilities, which includes many of the instances discussed in chapters 6 and 8. For this reason, the acknowledgement of the SARS modernisation programme is important, also because reference is made to it throughout the rest of the study. SARS subsequently also introduced a new operating model as a result of the modernisation programme, of which an overview is presented in Figure 2-6. The next section provides a brief description thereof. An understanding thereof is important as it illustrates the manner in which DSS are deployed in SARS, both in terms of creation and in support of organisational decision-making.

Occupational Levels	Male				Female				Foreigners	Total
	African	Coloured	Indian	White	African	Coloured	Indian	White		
Top Management	8	5	4	14	3	2	1	3	2	42
Senior Management	342	71	112	330	229	44	82	264	14	1,488
Professional	485	97	89	300	439	93	85	340	10	1,938
Skilled, Junior	2,109	342	186	511	2,944	604	292	1,848	15	8,851
Semi-Skilled	342	69	15	56	861	232	48	542	4	2,169
Unskilled	62	12		6	118	14		1	6	213
Total	3,348	596	409	1,217	4,594	989	508	2,998	45	14,701

Table 2-3: Organisational Workforce Profile of SARS
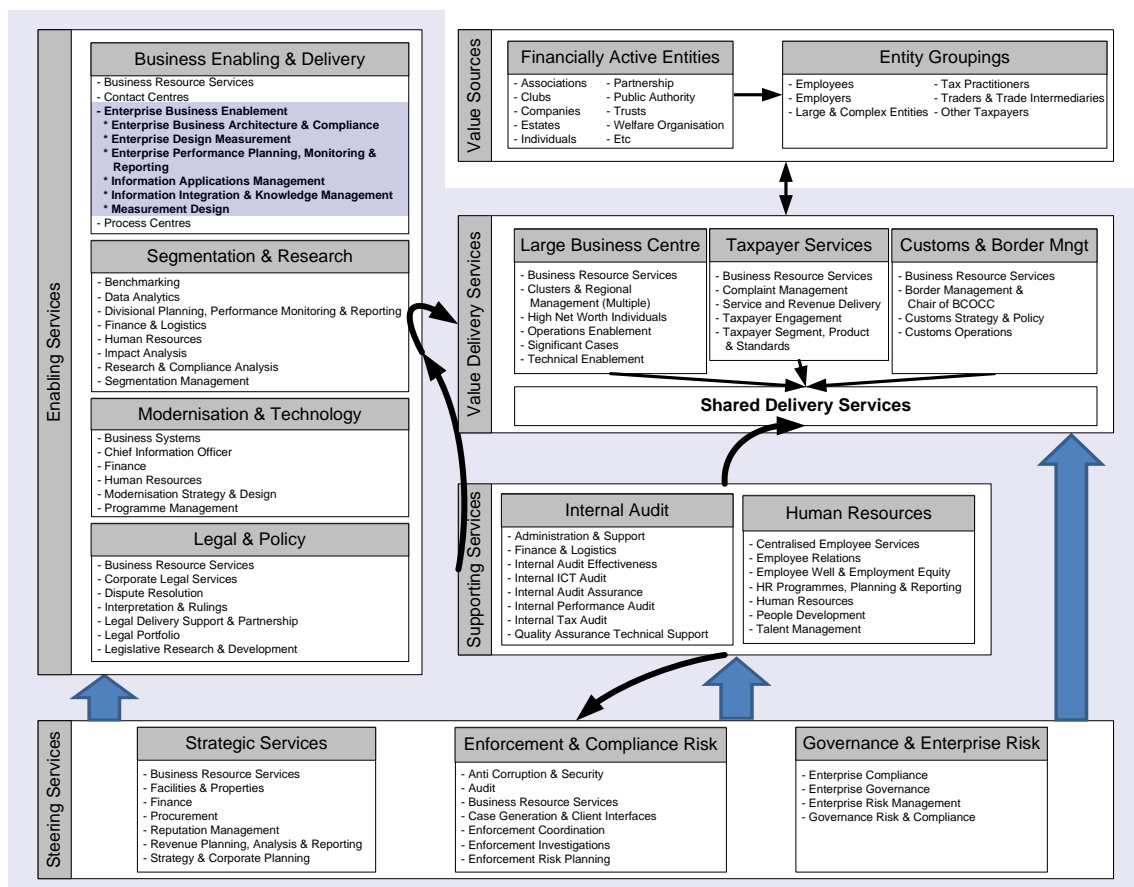
Figure 2-6: Organisational Overview of SARS

The South African taxpayers are classified in one of six groupings, namely employees, employers, large & complex entities, tax practitioners, traders & trade intermediaries and other taxpayers. Based on these groupings, SARS facilitates revenue collection through their Value Delivery Services. This department consists of three business units that share different organisational delivery services such as infrastructure, IT, employees, etc. The Large Business Centre is dedicated to large & complex entities, the Taxpayer Services unit focuses on the employees, employers, tax practitioners and other taxpayer entities, whereas the Customs & Border Management unit handles the traders & trade intermediaries entities. The Value Delivery Services department is supported by the Supporting Services Department, which consists of the Internal Audit and Human Resources business units. Internal Audit conducts the actions related to the assessment of operational activities. The Human Resources unit is dedicated to all aspects related to SARS's employees. Supporting Services also supports the Steering Services and Enabling Services department. The purpose of Enabling Services is to facilitate and assist the Value Delivery Services with operational activities by means of four business units, namely: Business Enabling & Delivery, Segmentation & Research, Modernisation & Technology and Legal & Policy. Business Enabling & Delivery focuses on definition, design, implementation and evaluation of organisational resources. Segmentation & Research explores the nature of the business activities conducted by SARS with the goal of proposing new approaches to better serve taxpayers. Modernisation & Technology aims to sustain all IT-related activities within SARS and also has the agenda of introducing business improvements through IT. Legal & Policy ensures the alignment of SARS's business activities with what is defined in the South African constitution and also the creation of business policies to ensure the continuous alignment. Lastly, the Steering Services department has the objective of driving and governing the rest of the organisation. This department consists of the Strategic Services, Enforcement & Compliance Risk and Governance & Enterprise Risk business units. The Strategic Services business unit defines and drives the strategic direction of SARS. Enforcement & Compliance Risk aims to improve taxpayer compliance and conduct prosecutions where citizen's tax related affairs are identified as unlawful. Lastly, the Governance & Enterprise Risk business unit practises corporate governance with the goal of ensuring compliance and alignment in SARS,

while ensuring risks are kept to a minimum. Lastly, it is important to note that the creation of DSS in SARS is done through the Enterprise Business Enablement as well as the Modernisation & Technology divisions.

The previous paragraph briefly explains the operating model of SARS. The purpose of this section is for it to form part of a comprehensive description of the single case study being researched.

2.9.3 The Empirical Case Study Participants

A comprehensive empirical study is required to ensure the credibility of the single case study research method selected. Section 2.7 explained the empirical study to consist of four phases. The interviewee participants of these four phases differed significantly in terms of their role and responsibilities, and are consequently selectively chosen from different managerial levels. The identity of these participants was kept anonymous at all times and never recorded (with the exception of engagements prior to the actual interview). In doing so, the empirical participants are simply referred to as the employment title they hold. Furthermore, the participants were interviewed over a long period in time, thereby making it unlikely for them to recognise the identities of other participants. A summary of these participants is presented in Table 2-4 and listed below in alphabetical order according to the title they hold in SARS.

Occupational Levels	Male				Female				Foreigners	Total
	African	Coloured	Indian	White	African	Coloured	Indian	White		
Top Management				1						
Senior Management	2			7				2		
Professional								2		
Total	2			8				4		14

Table 2-4: Empirical Participants

Empirical phase one: refining the perspectives on the tax gap

- Executive: Enforcement Strategy (Senior management)
- Executive: Tax Research (Senior management)
- Senior Manager: Tax Enforcement Planning (Senior management)

Empirical phase two: refinement of conceptual DSS framework

- Manager: Enterprise Measurement (Senior management)
- Manager: Information Integration, (Senior management)
- Manager: Knowledge Management (KM) (Senior management)
- Manager: Monitoring and Analysis (Senior management)
- Senior BI Developer (Senior management)
- Senior Enforcement Data Analyst (Professional)
- Senior Geographical Information Systems (GIS) Developer (Senior management)
- Senior Manager: Case Selection (Senior management)
- Senior Social Network Analysis (SNA) Developer (Professional)

Empirical phase three: validating the conceptual DSS framework

- Chief Officer: Strategy, Enablement and Enforcement (SEE) (Top management)
- Senior Manager: Data Analytics (Senior management)
- Senior Manager: Information Management (Senior management)

Empirical phase four: testing the framework's transferability. The empirical participants of this phase are not part of the single case study. Instead, this phase validates and tests the transferability of the conceptual DSS framework developed in the preceding phases. Section 8.6 presents more information on the two institutions that took part in this empirical phase. At this stage it is sufficient to mention that the two empirical participants are the Namibian Inland Revenue and the Botswana United Revenue Service.

2.10 Conclusion

Chapter 2 defines the research methodology followed in this study. The methodology consists of a research field, philosophy, approach and method. The topic is studied within the research field of IS. Interpretivism is chosen as the most relevant research philosophy whereas the case study research method is selected as most appropriate to address the research problem. The data collection consists of three activities, namely interviews, empirical documentation and a literature survey. These three activities also serve as triangulation points to validate the research findings. Lastly, the narrative analysis approach has been selected for the data analysis approach. Chapter 2 also introduced the case study, namely SARS. The relationships between public sector and revenue collection industry as well as the revenue collection agency were discussed, followed by a discussion on certain organisational attributes of the SARS. Finally, an overview of the empirical study participants was presented.

The following chapter commences the research by presenting a detailed overview of the research problem together with the different facets it consists of. In doing so the chapter answers the first research question pertaining to details surrounding the tax gap phenomenon. The development of the conceptual DSS framework also commences based on these findings.

CHAPTER 3: UNDERSTANDING THE TAX GAP PHENOMENON

Chapter 1: Introduction

Chapter 2: Research design

Chapter 3: Understanding the tax gap phenomenon

Chapter 4: IT and the revenue collection agency

Chapter 5: IT and the tax practitioner

Chapter 6: DSS value propositions

Chapter 7: Empirical findings on the tax gap and the role of IT

Chapter 8: Empirical findings on DSS instances and framework confirmation

Chapter 9: Conclusion

Supporting Information

Part 1: Research Setting

Part 2: Literature Findings

Part 3: Empirical Conclusions

Part 4: Research Summary

1. Introduction
2. Differentiating tax non-compliance, tax evasion and tax avoidance
3. Approaching tax noncompliance
4. Ethical perspectives of the tax gap
5. Implications of tax noncompliance
6. Reasons for tax noncompliance
7. Factors influencing taxpayer compliance
8. Understanding the tax gap
9. Constructing the conceptual DSS framework
10. Conclusion

Figure 3-1: Chapter 3 Roadmap

3.1 Introduction

A comprehensive understanding of the tax gap phenomenon is critical to formulate a conceptual DSS framework that aims to address the tax gap phenomenon. This chapter commences the case study by starting at the very core of the research, namely the problem itself. In doing so the chapter focuses on the research question asking: "What is the nature of the tax gap phenomenon experienced by revenue collection agencies and why does it continue to exist?"

Evidently there is more to the tax compliance of citizens than simply a revenue agency's ability to execute enforcement capabilities. The various literatures presented in this chapter suggest that psychological influences, social interactions and economic dynamics, amongst others, influence the noncompliance of taxpayers and that many of these factors do not have a permanent remedy. Most of these influences have received limited attention in the past but are now increasingly being recognised by academics.

The relevance of certain sections of this chapter might be questioned from an IS perspective. However, these sections are required to support the larger purpose of this research and the development of the conceptual DSS framework. The chapter aims to comprehensively explore the research problem by consolidating the fragmented body of knowledge on the topic of tax noncompliance. The chapter also supports the usage of a single case study because an in-depth perspective is given on the defined research problem. The usage of a single case study to explore the tax gap topic is important because the topic has limited availability to other academics. Also and perhaps more importantly, this chapter puts the research topic in perspective to the reader as there is a high likelihood of the reader being unfamiliar with the research topic. Lastly, the chapter commences the development of a conceptual DSS framework aimed at minimising the tax gap. Although limited reference is made to technology itself, future chapters focusing on technology build on the conclusions derived in this chapter.

3.2 Differentiating Tax , Tax Evasion and Tax Avoidance

Chapter 1 introduced the fact that the tax gap is a phenomenon resulting from taxpayer noncompliance. Whilst this is generally accepted, much confusion exists regarding the differentiation between tax evasion, tax avoidance, unintentional errors made by taxpayers (ignorance) and intentional 'errors' made by taxpayers (Braithwaite, 2003:69). In some cases the literature references terminologies such as tax evasion, tax avoidance, noncompliance and tax gap interchangeably despite their significant differences (Slemrod, 2007:26). This confusion is even more significant amongst taxpayers, as identified through an empirical study by Wallschutzky (1985:1-63). In particular, Wallschutzky's empirical study's participants viewed tax avoidance and tax evasion as similar. Even with a clear understanding of these terminologies, the practical differentiation thereof can at times be quite challenging. Subsequently, this is also the case when considering how DSS can be used to address the tax gap. The remainder of this section differentiates between these concepts.

Tax Noncompliance

Intentional   Unintentional

Tax Evasion   **Tax Avoidance**

Without Fraud   With Fraud
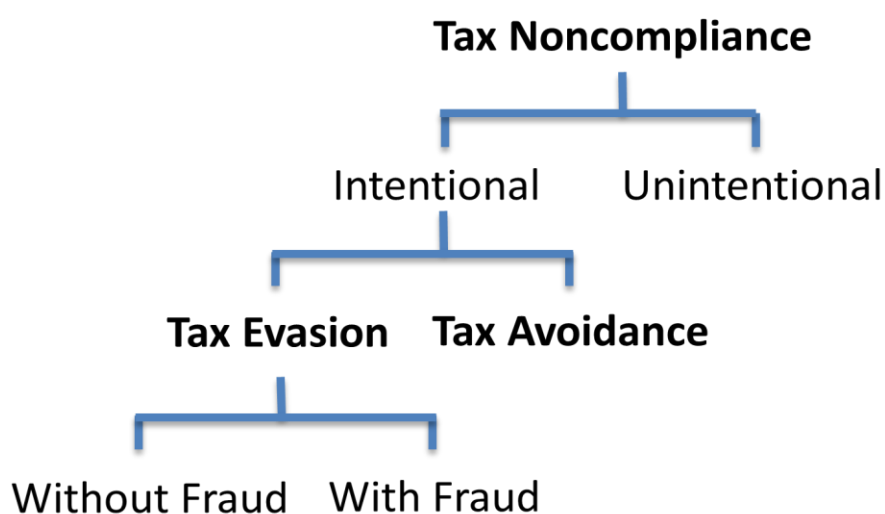
Figure 3-2: Differentiating Noncompliance, Tax Evasion and Tax Avoidance

3.2.1 Tax Noncompliance

Tax noncompliance is the all-inclusive failure by financial entities to meet their tax obligations as defined by legislation (McKerchar & Walpole, 2006:185; Kirchler, 2007:21). This failure can be a result of intentional and unintentional errors made by taxpayers, of which the last mentioned is often because of ignorance, negligence and

recklessness (OECD, 2004:7). Unintentional errors are typically made by honest taxpayers attempting to be compliant but who do not understand tax legislation, disagree with the interpretation of the tax legislation or who simply make mistakes when declaring their taxes. Intentional errors subsequently consist of tax avoidance and tax evasion.

3.2.2 Tax Evasion

Tax evasion is summarised as the intentional act of non-disclosing information related to the accurate declaration of all taxable incomes as stipulated by tax legislation (Tsakumis et al., 2007:131; Gcabo & Robinson, 2007:361; Pyle, 1989:4; Kirchler, 2007:22). Tax evasion is most commonly manifested in three scenarios namely the excessive claiming of tax deductions; the failure to declare occasional earnings (Vihanto, 2003:113) and perhaps most frequently the underreporting of any form of income (Gcabo & Robinson, 2007:362). Many of these scenarios can be managed to a certain degree by DSS, some of which are discussed in the latter parts of the study.

An empirical study by Kirchler et al. (2003:545) explored the attitude of taxpayers towards tax evasion and concluded that tax evasion is generally considered illegal, immoral and therefore not an acceptable practise by society. This conclusion is somewhat expected given the fact that tax evasion equates to the failure of complying with the law, which essentially equates to criminal behaviour (Slemrod, 2007:26). Supporting this perspective is McKerchar & Walpole (2006:185), who consider this act to be a 'white-collar crime' and differentiate between fraudulent and non-fraudulent tax evasion. Non-fraudulent tax evasion constitutes to the failure of a taxpayer to submit a tax declaration. Fraudulent tax evasion constitutes to the under declaration of taxable income and/or the over declaration of deductions, but also more complex examples such as the falsifying of an identity used for a second income not declared (Wallschutzky, 1985:40). In fact, not everyone considers tax evasion to be that serious. Such a perspective is mentioned by Kirchler (2007:53), who states that tax evasion is a clever act and not a crime. The researcher disagrees with this statement as such an act is intentional while within the law. For this reason, such an act should rather be classified as tax avoidance, as is elaborated on in the next paragraph.

3.2.3 Tax Avoidance

Tax avoidance is the legitimate use of tax loopholes to minimize a taxpayer's tax liability (Pyle, 1989:4; Kirchler et al., 2003:536; Kirchler, 2007:22). Gcabo & Robinson (2007:361) regard tax avoidance as a method in which taxpayers exploit the tax law to their benefit despite its negative impact on others. Such a perspective touches on the ethical perspectives associated with tax avoidance, as is presented in section 3.4. Tsakumis et al. (2007:131) take a more positive perspective on the matter when describing tax avoidance as a taxpayer's ability to take advantage of tax interpretations in an attempt to minimise tax liability within the legal tax framework. This is perhaps why Braithwaite (2003:229) refers to tax avoidance as 'creative compliance'. Such a position is also supported by Kirchler et al.'s (2003:536) empirical study which concludes that taxpayers regard tax avoidance as legal and moral and it is consequently regarded as an acceptable practice. It is also suggested that taxpayers promote tax avoidance amongst each other in an attempt to 'save' on taxes paid to revenue collection agencies in an attempt to object to government. More on such a collective stance against tax compliance is discussed in section 3.3.2.3.

The researcher supports the stance considering tax avoidance to be unethical. However, the ethical validity of tax avoidance is less important as the act is considered legal. Additionally, it is challenging for DSS to counter tax avoidance as such behaviour is legitimate. Instead, DSS can be used to inform revenue collection agencies of occurrences in which tax avoidance becomes tax evasion.

3.3 Approaching Tax Noncompliance

3.3.1 Traditional Perspectives on Tax Noncompliance

Ensuring taxpayer compliance is considered one of the most challenging tasks of revenue collection agencies. Traditional approaches aimed at countering taxpayer noncompliance were based on naïve and even idealistic assumptions. Amongst others, taxpayers were considered to have a moral responsibility towards paying taxes. It was expected that the failure in doing so would result in an overwhelming guilt experienced by these noncompliant taxpayers. It was also assumed that taxpayers would perceive the government and tax regime as being fair (Vihanto, 2003:112) and

that this would prompt taxpayer participation. Recent studies have suggested these assumptions to be inaccurate and even simplistic. Instead, taxpayer noncompliance should be explored from different hierarchical levels, collectively referred to as motivational postures. Taxpayer motivational postures form part of the tax compliance pyramid, which section 4.3.1 discusses in greater detail. These motivational postures also dictate the manner in which DSS are used to combat the tax gap phenomenon.

Tax noncompliance has traditionally been managed from two perspectives. The first perspective has been shared by various academics in the past and again more recently stated by Alm et al. (2005:120), who explain that the continuous monitoring of taxpayer compliance supported by rigorous enforcement is the only manner in which tax noncompliance can be minimised. The second perspective argues that taxpayer noncompliance is mostly driven by a taxpayer's decision to maximise personal financial interest against the probability of being detected (Dell'Anno, 2009:995; Leviner, 2009:389). The last mentioned perspective is often referred to as the deterrence model and is based on the theory of utility originally published by Allingham & Sandmo (1972). The model has since gained acceptance and popularity, most recently also from Slemrod (2007:35) and Gcabo & Robinson (2007:362).

The deterrence model describes a taxpayer's decision to be noncompliant as a product of the taxpayer's perceived likelihood of being caught. Taxpayers also consider the cost of the consequent penalties raised if caught versus the financial benefit resulting from the opportunity of not being caught. However, contrasting perspectives exist such as those of Vihanto (2003:112) describing the deterrence model as 'rudimentary' and states that the psychology of tax evasion has largely been ignored in the past. This has caused revenue collection agencies to only address the symptoms of tax noncompliance. Kirchler (2007:xiii) goes as far as stating that despite an immense growth in tax publications, only 10% of these publications focus on the psychology of tax evasion. The shift from the traditional economic perspective to tax noncompliance to that of a psychological perspective is also emphasised by Gcabo & Robinson (2007:362). However, this shift implies a change regarding the manner in which the

enforcement activities of revenue collection agencies are performed and consequently how DSS support these activities.

3.3.2 Modern Perspectives on Tax Noncompliance

The past perspectives on tax noncompliance are revised from three angles, namely the revenue collection agency's enforcement effort, the taxpayer's attempt to maximise his position and the contractual social agreement between the wider government and its citizens. Each of these aspects is important as they determine the manner in which DSS should be designed to support the organisation's attempt to minimise the tax gap.

3.3.2.1 The Enforcement Perspective

The traditional approach to tax noncompliance cannot be limited to that of a monetary perspective (Kirchler et al., 2003:537; Torgler, 2007:65). The enforcement capacity of most revenue collection agencies can at best be described as limited and therefore the 'opportunity' to combat tax noncompliance is also limited. An example of how limited enforcement capacity offers an opportunity for increased noncompliance is presented by Pyle (1989:86). Pyle explains that the general public justifies their tax noncompliance because they are unlikely to be caught. Even if they get caught, the imposed penalties are minimal in comparison to the potential benefit the taxpayer can achieve. Such a perspective implies that increased audits and penalties will increase taxpayer compliance as more instances of tax noncompliance are acted upon. Although having been true in the past (Cummings et al., 2009:447), this perspective has become outdated.

Academics such as Kirchler (2007:107) illustrates that an intensified enforcement capacity can have undesired effects and at times even contrasting consequences. For example, the introduction of excessive penalties is likely to result in taxpayer resistance and could even promote bribery and corruption. The result will be lower taxes collected and ultimately lead to distrust regarding the revenue collection agency. Borck (2004:725) agrees that excessive enforcement might actually increase tax noncompliance. This is partly because more labour is needed for tax enforcement, which implies increased government expenditure. Increased government expenditure requires higher tax rates, inevitably leading to the dissatisfaction of taxpayers.

Therefore, excessive enforcement capabilities are likely to prompt taxpayer resistance. An exception to this is the usage of DSS to combat tax noncompliance. The expenditure associated with DSS is minimal compared to that of labour costs and its coverage in terms of detecting noncompliance far exceeds that of labour. The challenge of course is the accuracy of the DSS, especially when compared to that of humans detecting noncompliance.

Recent approaches to tax noncompliance have seen revenue collection agencies differentiate between compliance efforts such as audits and penalties, and cooperation efforts. The last-mentioned focuses on the education, persuasion and encouragement of taxpayers to cooperate and be self-compliant (Braithwaite, 2003:15). This has become increasingly popular as revenue collection agencies have come to the realisation that their enforcement capabilities are limited and that they consequently need to promote the self-compliancy of taxpayers. In order to instil this trust in taxpayers, Cummings et al. (2009:447) and Kirchler et al. (2003:537) suggest that tax noncompliance should rather be perceived as a complex behavioural issue and revenue collection agencies should therefore rather consider the psychological factors influencing taxpayer behaviour. Needless to say, such a change in perspective suggests that DSS should also include these psychological variables that have historically been omitted.

3.3.2.2 The Taxpayer's Maximisation Perspective

The ability for revenue agencies to decrease tax noncompliance has a much greater impact on society than simply an increase in taxes collected (Cummings et al., 2009:447). Tax enforcement promotes a sense of civil order in society and consequently promotes good citizenship in general. The social dimension of tax noncompliance has been neglected in the past but has gained significant emphasis in recent years.

Tax noncompliance has traditionally been approached from an individual perspective that assumed taxpayer noncompliance to be financially motivated. However, recent perspectives on the matter have evolved to a multi-level perspective in which taxpayers are considered to be part of a greater 'whole' (Torgler, 2007:5). From this

perspective, the influences and consequences of tax noncompliance have a much larger impact than previously considered. In particular, Braithwaite (2003:49) describes 'the whole' to consist of multiple levels ranging from an individual level (focusing on the taxpayer), a group level (segments such as financial turnover, geographical segments and tax type, to name but a few) and society (the all-inclusive collective). It must also be acknowledged that taxpayer noncompliance has a 'social multiplier effect' when considering that a taxpayer forms part of the greater whole (Fortin et al., 2007: 2090). This implies that the successful tax noncompliance of one taxpayer is likely to also prompt other taxpayers to be noncompliant.

The social dimension of tax noncompliance presents a 'social dilemma' for taxpayers (Braithwaite, 2003:42): Taxpayers consider whether the taxes they pay are a fair reflection of government services received. The revenue available to government for the delivery of these services is directly related to the taxes collected and consequently also the collective compliance of taxpayers. Taxpayers are constantly presented with opportunities to minimise their tax implication (through tax noncompliance) in order to maximise their personal financial outcome. The single noncompliance of an average taxpayer will not result in a significant reduction of taxes collected and consequently not the ability for government to deliver services. One can therefore argue that taxpayers can maximise their personal financial position whilst still sharing the benefit of the public services made available from the greater society. Such an argument would of course be short sighted: Government's ability to deliver such services is merely a result of taxes collected and this will be severely impacted if the majority of taxpayers choose to maximize their personal financial position by minimising their tax liabilities. The result of such a scenario would be the personal gain of individuals, but the greater loss to society. This dilemma illustrates the interconnectivity as well as interdependence of taxpayers.

DSS have traditionally been designed to mainly focus on the single instances of tax noncompliance as this was prescribed by the maximisation theory of taxpayer noncompliance (refer to previous section). This has subsequently resulted in a very narrow enforcement attempt. Modern perspectives suggest that one must appreciate the social setting of a taxpayer, as this setting influences his tax behaviour. It is

therefore proposed that DSS incorporate social attributes when presenting enforcement opportunities. This is not only because tax compliance is socially constructed, but also because the enforcement effort on a single taxpayer will ripple over to the remainder of his social setting. In doing so revenue collection agencies receive a higher return on their effort spent. An example of such DSS instance is presented by Wessels et al. (2012) who illustrate how a single enforcement effort applied to the wife of a noncompliant married couple automatically results in the compliance of her husband.

3.3.2.3 The Social Contract between Government and Taxpayers

The relationship between a revenue collection agency and its taxpayer forms part of a much greater relationship between government and its citizens. This relationship can be perceived as a 'social contract' between government and citizens (Picur & Riahi-Belkaoui, 2006:174; Torgler, 2007:74) and has mostly been neglected in the past when considering the motivations for tax noncompliance.

Vihanto (2003:112, 160, 120) explains that taxpayers are more likely to be compliant when they consider themselves to 'approve' of the tax regime prescribed by government. Taxpayers have a sense of resistance towards tax compliance when the respective government leadership is not their democratic choice. Riahi-Belkaoui (2004:141) considers a different perspective when stating that taxpayers will only honour their obligations of the social contract (such as taxes) if government successfully delivers on its mandate – regardless of whether the respective government leadership was their selection. A similar social contract exists between a revenue collection agency and its taxpayers. The challenge that government faces is that a breach in this social contract has limited implications, as government cannot deny a taxpayer rights to basic services such as public infrastructure, sanitation and health. In fact, taxpayers can also purposely dishonour their part of the contract because of government's inability to deliver on their responsibilities. For example, tax noncompliance need not be limited to the negative portrayal of the taxpayer. Instead taxpayers can deliberately use noncompliance as a method to object to government's irresponsible expenditures. Such taxpayer actions can become an effective mechanism

to restore government's responsibilities. This approach can also be referred to as negative reciprocity (Torgler, 2007:74).

Although interesting, the concept of a social contract between government and taxpayers has limited practical value – especially on the topic of DSS. The concept however substantiates that there is much more to tax noncompliance than the efficiency of revenue collection agencies' enforcement effort. Also, the concept can be included in the conceptual DSS framework as a factor influencing the noncompliance of taxpayers, although these factors are to be introduced in section 3.7.

3.4 Ethical Perspectives of the Tax Gap

Section 2.8 presented eight ethical theories, as defined by Gordon (2004), which at that time were related to the research methodology under discussion. Unfortunately very few publications exist that focus on both tax compliance and ethical behaviour McGee (2006:15-16). Furthermore, the distinction between ethics and morals, together with their psychological and philosophical underpinnings, can often be perceived as being unclear. Ethics in the context of this research is aligned with that of Gordon (2004:8). The author differentiates ethics and morals by explaining that ethics relate to 'action', whereas morals are determined by the 'properties' of an individual. Therefore, morals are the intentional act of taxpayers choosing to be compliant or noncompliant, whereas morals are the attitude of taxpayers towards being compliant or noncompliant. Kirchler (2007:59) elaborates on the concept of ethical theory by specifically focusing on the topic of tax compliance. It is explained that an individual's ethical stance is a strong influencer of his/her tax compliance. For this reason the topic of ethical behaviour very relevant to this research. The ethical theories of egoism and hedonism promote tax evasion and avoidance, whereas utilitarianism and religion promotes tax compliance. The researcher disagrees with these rigid classifications and supports the less philosophical position taken by McGee (2006:17-31). Three views on the ethical perspective of tax noncompliance exist, namely that noncompliance is never ethical; noncompliance is always ethical; and noncompliance is sometimes ethical.

It is argued that noncompliance is never ethical in democratic societies because citizens elect the government which in return institutionalises tax regimes aimed at serving the general public's interests. These tax regimes might include the very same things a taxpayer becomes resistant to, such as penalties and excessive tax rates. However, critics state that government does not represent the interests of all people, perhaps not even the people who voted for the government, and that the alteration of the tax regime is not just a simple matter of replacing government. The tax laws institutionalised are also the moral obligation of taxpayers to follow which, amongst others, prevents taxpayers from under-declaring their income. A counter argument should also be considered when considering that government often 'under-declare' to taxpayers, perhaps most importantly about the irresponsible spending of taxes collected. Tax noncompliance is also never ethical from the religious perspective in the sense that it is the moral obligation of taxpayers to distribute wealth in society and that noncompliance is effectively an instance of theft. A contrasting viewpoint might also state that many of government's actions are considered sinful and should not be supported through paying taxes. An example of such is the legalisation of abortion which is condemned by certain religions.

Noncompliance is always ethical when viewed from the perspective that government is acting like a thief in the sense that they are stealing from citizens by means of institutionalised taxes. One might argue that a government only exists because of its citizens, who consequently also determine government's mandate. Such a position is only considered accurate when assuming the democratic election of government. This is not to mention the unique perspectives which individuals have on a government's mandate, which might not necessarily include the presence of a tax regime. Even if one considers the presence of the elected government as acceptable, the occurrence of corruption, operational inefficiencies and wasteful expenditures can justify tax noncompliance as one method of protesting against unwanted government behaviour. Furthermore, even if the payment of taxes is considered an ethical duty, does it not remain unethical for compliant taxpayers to be taxed higher based on the noncompliance of other taxpayers?

Tax noncompliance is sometimes considered ethical when acknowledging that each individual has a unique perspective on the matter and that no one perspective is more correct than another. For instance, government could use the taxes collected to support state welfare functions that are ethical to taxpayer A but unethical to taxpayer B, whereas government's support of defence functions might be considered unethical to taxpayer A but ethical to taxpayer B. Another example is the scenario when government uses the taxes collected to fund a war. If such a war is unjust and innocent lives are lost it would certainly be unethical to be a compliant taxpayer. However, if the same war ensures the safety of society's future generations it would be unethical to be noncompliant.

Regardless of the ethical stance on the tax gap, the occurrence of tax noncompliance does have significant implications. Some of these implications are discussed in the subsequent section.

3.5 Implications of Tax Noncompliance

South Africa is used as an example by Oberholzer & Stack (2009:738) when stating that most developing countries' expenditure is predominantly funded by the taxes collected. The importance of tax compliance is therefore critical to South Africa's future economic growth and such economic development can be drastically hampered if SARS fails to collect the adequate taxes (Picur & Riahi-Belkaoui, 2006:174). The biggest single risk to such a failure is the noncompliance of taxpayers. If unmanaged, this risk can eventually result in a tax system becoming paralysed in its objective to raise the taxes required to implement government objectives (Leviner, 2009:383, Wu et al, 2012:8769). For this reason, government should use capability, including DSS, to address tax noncompliance.

The impact of large scale tax noncompliance is widespread and its consequences are severe. Tax noncompliance leads to government experiencing a loss in revenue collected, which will subsequently decrease government expenditures to ultimately result in fewer government services provided (Pyle, 1989:145; Braithwaite, 2003:41; Kirchler et al., 2003:536). Such a state of affairs will also make it difficult for government to monitor and ultimately govern the economy through effective policies

(Pyle, 1989:145), which will in return discourage further investment and growth. Furthermore, a failure to collect taxes prevents the effective distribution of income amongst society (Pyle, 1989:145; Leviner, 2009:383) and subsequently also the social upliftment required for a sustainable future society. If anything, tax noncompliance forces government to devote scarce resources to enforcement capabilities that would otherwise not have been required. These enforcement capabilities come at an additional cost paid by society themselves (Pyle, 1989:130). The development costs of DSS are included in this – a cost which is generally regarded as being quite significant given the expensive nature of DSS (Shin, 2002: 581; Wixom & Watson: 2001:18). Watson & Carte (2000:374) argue that these costs are even harder to justify in public institutions than private institutions because it represents the money of taxpayers. The implications of tax noncompliance are severe, which is why the next section elaborates on the reasons for its existence.

3.6 Reasons for Tax Noncompliance

The reasons for tax noncompliance are difficult to understand at the best of times. This is even more the case for a developing country such as South Africa because of its multiple cultures and religions; complex political background and important social traditions (Gcabo & Robinson, 2007:357). These factors, amongst others, introduce various challenges for SARS to successfully manage taxpayer compliance and even more challenges to develop DSS aimed at enabling the management thereof.

More than two decades ago, Wallschutzky (1985:1-63) published one of the first empirical studies aimed at identifying the reasons why taxpayers become noncompliant. These reasons stipulated that taxpayers generally regarded taxes to be unaffordable as it was perceived to be too high, unevenly distributed amongst taxpayers and that government's service delivery was regarded as poor value for money. In some cases tax noncompliance was also directed to professional tax advisers who would influence taxpayers to manipulate taxes to their advantage and thereby offering a 'good service' to them. Once can argue that most of these reasons still remain valid today. McKerchar & Walpole (2006:185-187) attempt to revise the reasons for noncompliance by comparing those identified by revenue collection agencies against those listed by taxpayers, as illustrated in Table 3-1. The study

concludes that the revenue collection agency's reasons for noncompliance mostly place the fault on the taxpayer, whereas taxpayers mostly plead ignorance as their reason. This is an interesting but somewhat expected observation. However, Pyle (1989:111) is critical towards any conclusions made regarding the reasons for tax noncompliance, and rightfully so. Unlike a crime, there is hardly any reason or benefit gained from explaining the reasons for noncompliance to revenue collection agencies. This makes it difficult to truly state the reasons for tax noncompliance.

Importance	Revenue Collection Agency	Taxpayer
1	Intentional evasion by taxpayer	No reason given
2	Tax advisor influencing taxpayer	Unintentional error
3	Tax avoidance	Lack of education
4	Lack of education	Mistake by tax advisor

Table 3-1: Reasons for Noncompliance (McKerchar & Walpole, 2006:185-187)

The complexity of taxpayer noncompliance and the reasons influencing such behaviour becomes evident when exploring specific taxpayer segments. A recent study by Richardson (2006:151) considers 45 countries in an attempt to identify the typical taxpayer attributes that influence tax compliance. Many of the findings remain consistent with those in previous historical publications like Wallschutzky (1985:38) and Pyle's (1989: 129) and even more recently Alm et al. (2005:339). These studies and others, such as Richardson (2006:151) and Alm et al. (2005:339), list very specific attributes contributing towards tax noncompliance. These include general attributes such as the complexity of the tax regime and the perceptions taxpayers have about government, but more importantly detailed attributes related to taxpayers. Examples are taxpayer age; gender; geographical location; education; industry of income and the monetary size thereof; products being traded; and whether the taxpayer is self-employed or informally employed, to name but a few. Although interesting to explore, it is not within the scope of this study to discuss these attributes in greater detail as they have little relevance to the development of DSS. It is, however, important that one acknowledges that these attributes and their specific instances should be recognised in the detailed and practical designs of DSS – especially knowledge-driven DSS. Sections 6.6 and 8.3.5 elaborate on such instances

and quote example publications in which detailed taxpayer attributes are used to develop specific DSS aimed at minimising the tax gap.

3.7 Factors Influencing Taxpayer Compliance

A good understanding of the reasons why taxpayers are compliant and noncompliant will result in an improved perspective on how to combat tax noncompliance, which will ultimately minimise the tax gap (Braithwaite, 2003:69). One cannot introduce DSS aimed at minimising the tax gap either, if there is no understanding of the factors influencing a taxpayer's decision to be noncompliant. Although a vast amount of research discussing this topic is available, no conclusive results have been agreed upon. Whilst acknowledging this, the subsequent sections aim to present some insights related to the motivation behind taxpayer behaviour.

There exist a number of different models aimed at describing the factors influencing tax noncompliance. The scope of this study does not allow for a detailed elaboration on these models, which is why only two models are presented in this section. These two models are selected based on the relevance of their multi-dimensional content. The first approach is the Classification of Determinants of Tax Compliance model by Kirchler (2007:3), as shown in Figure 3-3. This model consists of five 'perspectives' influencing tax compliance. Political perspective comprises of fiscal policy, tax systems and tax law, amongst others. Social psychological perspective covers taxpayer attitudes, norms, motivations, perceived opportunity to evade and perceived fairness of tax system. Decision-making perspective relates to the probability of audits and penalties as well as the psychological aspects of decision-making. Tax interactions perspective covers the aspects related to the interactions between taxpayer and revenue collection agency. Lastly, the self-employment perspective explains aspects unique to small business, such as the impact of compliance cost.
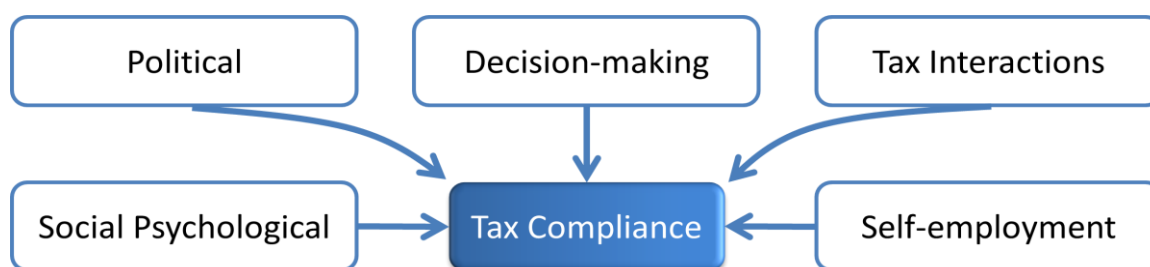
Figure 3-3: Model of Tax Compliance Determinants Classification (Adapted from Kirchler 2007:3)

The second perspective on tax noncompliance is by Oberholzer & Stack (2009:741), who define the Taxpayer Compliance Perception model. This model consists of three groupings influencing perception, namely factors in perceiver, factors in environment and factors in target. The authors apply this model to the perception of taxpayer compliance with specific reference to South Africa. In doing so, the factors in perceiver grouping refers to the taxpayer, the factors in situation grouping describes the aspects originating from the taxpayer's surrounding environment, and lastly the factors in target grouping is derived from the revenue collection agency itself. McKerchar & Walpole (2006:186) describe a similar model but refer to factors in perceiver grouping as micro factors and factors in situation and target as macro factors. Each of these perception groupings consists of some or other tax compliance influence category, as defined by the OECD (2004:40), namely sociological, psychological, business, economic and industry factors.
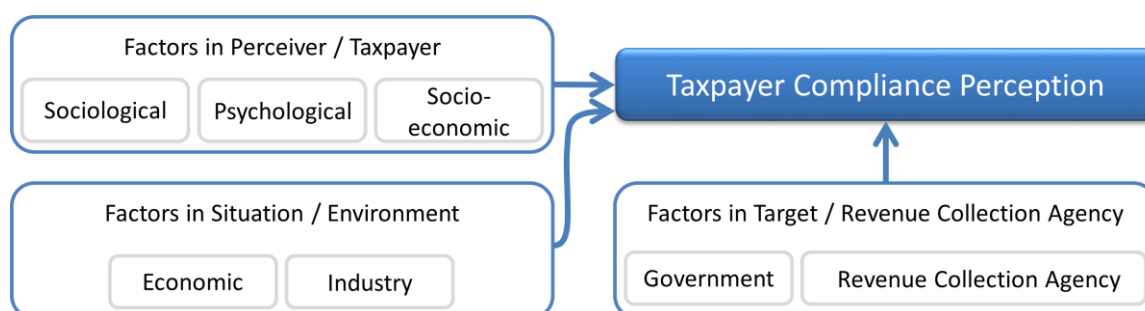
Figure 3-4: Model of Taxpayer Compliance Perception (Adapted from Oberholzer & Stack, 2009:741)

It is noticeable how both models presented in this section correspond and to some degree even overlap. Oberholzer & Stack (2009:741)'s Taxpayer Compliance Perception model supplemented by the OECD's (2004:40) tax compliance influence

categories is preferred to Kirchler's (2007:3) Classification of Determinants of Tax Compliance. The motivation for this is because all aspects of the last mentioned can be incorporated in the first mentioned. The subsequent sections briefly explain the three dimensions influencing taxpayer compliance, namely factors in perceiver; factors in situation; and factors in target. These three dimensions subsequently also form part of the conceptual DSS framework presented in section 3.9.

3.7.1 Factors in Perceiver / Taxpayer

The factors influencing taxpayer compliance from a perceiver perspective, namely the taxpayer, are discussed under three headings, namely sociological factors, psychological factors and socio-economic factors. These factors are recognised by the literature as the main influencers of tax compliance (Torgler, 2007:5), of which a few examples are now presented.

3.7.1.1 Sociological Factors

True to the interpretivist philosophy, the behaviour of taxpayers is best described as being unique to the norms of the taxpayers. Section 2.3.4 presents more information on interpretivism as a research philosophy. Interpretivism states that reality is subjective and norms are consequently very specific to the environmental context or social setting of the taxpayer (Leviner, 2009:406-407).

Taxpayer norms have been identified as an important factor influencing taxpayer compliance. Taxpayer norms range from personal norms, to social norms and societal norms (Kirchler, 2007:3). Personal norms are typically associated with an individual's ethical perspective on tax compliance. Personal norms do not contribute towards the sociological factors influencing tax compliance and are consequently rather discussed in section 3.4. Social norms refer to the reference group of the taxpayer such as friends and acquaintances. Torgler (2007:66) elaborates on this description by stating that social norms determine the compliance behaviour of a taxpayer based on the approval and disapproval shared by the taxpayer's reference group. Lastly, societal norms are best described as the taxpayer norms conditioned by cultural preferences.

The social setting of a taxpayer is not only an important factor influencing the tax compliance of the taxpayer. Perhaps more importantly, the social setting of a taxpayer

also allows the taxpayer to act as an influencer of the social norms. Taxpayer behaviour can therefore be considered as dynamic, which consequently increases the complexity of tax compliance management (Oberholzer & Stack, 2009:741). This is especially true for South Africa because of the diverse social and cultural norms shared by its citizens, as well as the strong political history (Cummings et al., 2009:447). Section 3.3.2.2 briefly touches on the importance of recognising the social dimension of a taxpayer when designing DSS aimed at addressing tax noncompliance. It is therefore important to understand the various aspects associated with the social setting of a taxpayer. Fortin et al. (2007:2090) and Gcabo & Robinson (2007:362) explain the social setting of a taxpayer to consist of a few facets, some of which are now discussed.

Social conformity is when taxpayers are compliant simply because such behaviour is generally prescribed and accepted by society. This behaviour includes the taxpayer's social orientation, as well as the taxpayer's orientation with government. In its simplest form, social orientation relates to a taxpayer's culture. McKerchar & Walpole (2006:186) agree when stating that diverse cultural differences are critical to improving taxpayer compliance, as is the case in South Africa. The OECD (2010:5) explains that social conformity is arguably the most important factor influencing taxpayer compliance. Social conformity is evident to such an extent that taxpayers are compliant only to prevent the negative social stigma associated with the dishonesty of tax compliance (Pyle, 1989:104; Dell'Anno, 2009:990). This negative social stigma results in dishonest taxpayers experiencing 'guilt' and 'shame' and in some cases even 'public disgrace' (Fortin et al., 2007:2090; Dell'Anno, 2009:990; Kirchler, 2007:3). However, Torgler (2007:69) explains that guilt and shame are not directly observable and any conclusions suggesting that guilt and shame influence tax compliance are merely assumptions.

The phenomenon of 'social learning' is complementary to social conformity - it is when a taxpayer references his peers to successfully evade or avoid taxes. Vihanto (2003:114) elaborates in much detail on this topic and comes to the conclusion that in general, people follow the same behaviour as their affiliated groups in a particular social setting. This explains why social structures do influence the tax compliance

behaviour of taxpayers. The OECD (2010:5) adds to this by explaining that revenue collection agencies should stimulate social learning by proactively acting on tax noncompliance. An example is when the revenue collection agency proactively detects and acts on a negative deviation in taxpayer behaviour based on past behaviour.

Lastly, social equity and tax fairness is when a taxpayer chooses his compliancy based on the perception of how revenue authorities treat his peers. A few other but less significant sociological factors influencing taxpayer compliance are listed by Dell'Anno (2009:990), OECD (2004:40), McKerchar & Walpole (2006:186) and Torgler (2007:20-31). These include aspects such as national pride and civil duty experienced by taxpayers; law abidance expected by taxpayers; the cultural norms and ethnic background of taxpayers; the age, gender, occupation/employment, education and the marital status of taxpayers.

3.7.1.2 Psychological Factors

In addition to understanding the social setting of a taxpayer, revenue collection agencies can also strengthen its tax administration by better understanding taxpayer behaviour and more specifically, the psychological factors motivating tax compliance behaviour (OECD, 2010:5). An example is when the psychology of a taxpayer is positive towards tax compliance, which will result in an increased probability of that taxpayer actually being compliant (Kirchler's, 2007:49). The concepts presented in this section overlaps with the ethical theories presented in sections 2.8 and 3.4

The psychological factors influencing compliance behaviour of taxpayers are often referred to as tax morale or taxpayer norms (OECD, 2010: 20; Dell'Anno, 2009:989). Kirchler (2007:50) differs slightly by suggesting that tax morale refers to the collective stance of many taxpayers and not that of an individual. Regardless of this minor difference, tax morale is defined as the intrinsic motivation of a taxpayer to pay taxes (Torgler, 2006:81; Torgler 2007:4). This motivation is strongly determined by a taxpayer's historical upbringing, which itself is strongly influenced by the sociological factors presented in the previous section. A different perspective to tax morale is presented by Dell'Anno (2009:990), who states that tax morale is strongly

influenced by the 'psychic cost' of being noncompliant. Psychic cost describes a situation where a taxpayer is successfully noncompliant (such as under reporting income) but in doing so, experience an on-going sense of guilt afterwards.

A taxpayer's ethical attitude towards a revenue collection agency is instrumental in understanding taxpayer behaviour towards tax compliance (Leviner, 2009:405). It is quite common for taxpayers in certain societies to be compliant simply because they perceive it as a moral obligation (McKerchar & Walpole, 2006:186). If taxpayer compliance is a simple matter of moral obligation, what influences moral obligation? Religion is identified by Riahi-Belkaoui (2004:141) as arguably the strongest influence over tax morale and moral obligation. The impact of religiosity on tax compliance has received limited attention by academics. This limitation has been acknowledged and consequently addressed by Torgler (2006:81) and Torgler (2007:114), who confirms that religiosity has a major impact on taxpayer morale and consequently also taxpayer compliance. General conclusions suggest that religious taxpayers are more likely to be compliant than less or non-religious taxpayers. Religiosity is defined by Torgler as upheld by an individual who is active in a religious organisation by living according to religious guidelines, attending church and this individual also has a religious education. It is also interesting that Kirchler (2007:63) states that a taxpayer's political preference is closely related to his/her religion. So perhaps this too has an impact on taxpayers' sense of moral obligation towards being tax compliant.

McKerchar & Walpole (2006:185) suggest a much simpler psychological reason for noncompliance, namely the failure of taxpayers to understand and consequently comply with tax laws. An empirical study in 2003 on 2,000 Australian income tax taxpayers (Kirchler, 2007:32) indicated that only 12.4% of taxpayers feel truly competent about their taxes, whereas 36% feel completely incompetent. Three-quarters of these taxpayers rather rely on tax agents to handle their tax affairs. In another study referenced by Torgler (2007:75), only 60% of the interviewed IRS taxpayers believe that the tax officials are competent in handling their tax affairs. These statistics suggest that in general, taxpayers feel relatively uncertain about taxes. This is an interesting observation and certainly a value proposition for DSS. Section

7.3.1 briefly touches on the usage of DSS to pre-populate tax returns in order to make it simpler for taxpayers to be compliant.

3.7.1.3 Socio-economic Factors

The final component of the factors in perceiver grouping that influences tax compliance is the socio-economic characteristics of the taxpayer (Dell'Anno, 2009:990). The OECD (2004:40) lists a few example factors. The structure of the taxpayer is important, such as sole trader, partnership, company or trust. The size and age of the business, the type of activities it carries out; the taxpayer's market focus whether local or international and whether the taxpayer trades as a business intermediary are but a few business factors influencing tax compliance.

3.7.2 Factors in Situation / Environment

It is generally accepted that the state of the economy influences taxpayer compliance (McKerchar & Walpole, 2006:186). Evidence suggests that economic growth promotes tax compliance, whereas economic contraction decreases tax compliance (OECD, 2010:5). Economic and industry factors are jointly referred to as environmental factors, which also impact taxpayer compliance. The economic factors influencing taxpayer compliance are listed by Riahi-Belkaoui (2004:141) as the promotion of economic freedom, important equity market, effective competition laws and a low crime rate. These factors are complemented by the OECD (2010:5) and McKerchar & Walpole (2006:186): availability of investments; demographic interest rates; state of the tax system; government policies; international influences; inflation and the state of local plus international markets. The OECD (2010:5) lists different industry factors impacting taxpayer compliance. The definition/size of the industry; behaviour of major participants in the industry; profit margins; cost structures; industry regulation; working patterns and seasonality of the industry and industry issues such as competition levels are but a few such examples.

3.7.3 Factors in Target / Revenue Collection Agency

Factors in target refer to the factors related to the revenue collection agency which influences taxpayer compliance behaviour. These factors are discussed in two

sections, namely government in general and also those specific to a revenue collection agency.

3.7.3.1 Government in General

As previously discussed, the social contract between government and its citizens is an important factor influencing the relationship between taxpayers and revenue collection agencies. Government's responsiveness to address the needs of its citizens influences taxpayer compliance (Dell'Anno, 2009:989). Taxpayers continuously evaluate government's performance, products and services against their tax contribution. In doing so these taxpayers attempt to measure the perceived 'value for tax money' or whether their taxes are a 'fair exchange' for government's delivery (Leviner, 2009:405). Although much can be said about this topic, this section only summarises two contradictory views in this regard.

The first view explains that tax noncompliance results because of a failed relationship between government and its citizens. Tax compliance will increase if the political system facilitates a close exchange relationship between citizens and government and more specifically, between taxpayers and tax authorities (Dell'Anno, 2009:990). This relationship can easily be negatively influenced by typical government inefficiencies such as corruption and bloated bureaucracies (Picur & Riahi-Belkaoui, 2006:174).

The second view focuses on a taxpayer's satisfaction with government, regardless of government's performance. This satisfaction is relative to soft factors such as the taxpayer's perspectives and experiences, but also hard factors such as the supporting institutional structures. Examples of last mentioned are listed by Leviner (2009:405), namely tax administrators, tax courts and tax advisors, to name but a few. Citizens will not be empowered to become compliant taxpayers without sufficient supporting structures. An example of this is when a citizen must register for income tax but fails to do doing so because the taxpayer is too far from the nearest tax office.

3.7.3.2 The Revenue Collection Agency

The perception which taxpayers have about revenue collection agencies has an important influence on taxpayer behaviour. Tax rates, taxpayer interaction and tax fairness are considered some of the more important factors.

The main stance by revenue collection agencies has always been to 'punish' tax noncompliance with excessive tax and penalty rates. However, section 3.3.2.1 indicated that this approach has, in many cases, led to increased taxpayer noncompliance. A different stance is taken by Pyle (1989:104) who focuses on the responsiveness of taxpayers as opposed to revenue collection agencies. Tax noncompliance is explained as a result of 'information uncertainty' by the taxpayer. Information uncertainty in this context is when taxpayers are uncertain about particular tax affairs. Their uncertainty subsequently results in static and nonresponsive taxpayer behaviour. An example is when a taxpayer is aware of a tax rate increase but fails to submit their tax returns because he is uncertain about the exact tax rate and how the tax alteration impacts them. For this reason effective and efficient communication between taxpayer and revenue collection agency is critical.

The OECD (2010:5) prescribes the interaction (communication being one instance) between taxpayer and revenue collection agency to be frequent, consistent and clear. This approach is likely to foster a trusted relationship between the agency and taxpayer, which in return will promote tax compliance. Communication is also a very effective manner to influence the social norms of society, as well as the psychology of taxpayers. In particular, communication by revenue collection agencies mostly influences two psychological factors, namely duty and fear, in an attempt to proactively manage taxpayer behaviour (Torgler, 2007:69). Duty refers to the moral obligation of taxpayers. An example of fear is when a taxpayer's perceived probability of being audited is much higher than the actual probability, consequently resulting in 'automatic' compliance (Dell'Anno, 2009:988; Kirchler, 2007:108; Torgler, 2007:69). The perceptions of duty and fear are typically driven through the effective communication tactics of revenue collection agencies. This tactic also explains why revenue collection agencies at times publicly communicate high profile enforcement cases. As Alm et al. (2009:392) point out, the taxpayer's perception of a high audit probability is crucial to driving voluntary compliance. Such an audit probability should be perceived to be equal amongst all taxpayers in order for the tax regime to be considered fair.

The perception of tax equity combined with the fairness and trustworthiness of tax officials, are important influencers of taxpayer compliance (Dell'Anno, 2009:990; Torgler, 2007:73). The perception of a fair and legitimate tax system will impose a general trust in government, consequently increasing taxpayer morale and taxpayer compliance. Kirchler (2007:51) states that taxpayers are more likely to be compliant if they perceive the tax system to be fair. A failure of such will result in taxpayer resentment towards government and a reduced sense of moral obligation to comply with tax laws. The trust which taxpayers have in public officials also influences their willingness to be compliant. Tax morale is uplifted when tax officials are considered trustworthy and when they treat taxpayers with respect. In contrast, tax morale reduces when taxpayers feel that they are forced to pay taxes which they might not necessarily comprehend or agree with.

3.8 Understanding the Tax Gap

The preceding sections of this chapter presented a comprehensive overview of the tax noncompliance. Such insights are needed to better understand the factors causing taxpayers to be noncompliant, which in return contributes towards the effective and efficient design of DSS to combat tax noncompliance. The result of tax noncompliance is referred to as the tax gap and was originally introduced in Chapter 1. Simply put, the tax gap refers to the difference in taxes owed and taxes collected (Leviner, 2009:382; Gcabo & Robinson, 2007:358; OECD, 2008:10). The tax gap is an ever changing and continuous phenomenon (Slemrod, 2007:45), most importantly because its existence is determined by the dynamic and social behaviour of taxpayers. Various factors such as those discussed in preceding sections of this chapter prevent a tax system from achieving perfect tax compliancy. However, the magnitude of the tax gap phenomenon is so significant that even a seemingly insignificant reduction in the tax gap will result in substantial tax gains (Leviner, 2009:382).

Much like in the past, monetary approaches continue to be the preferred manner in which the tax gap is measured for two reasons (Pyle, 1989:12). Firstly, it makes sense for the tax gap to also be measured in currency because taxes are related to economic transactions. Secondly, monetary approaches are reasonably measureable partly because various economic statistics are obtainable. Having said this, the very nature

of the tax gap is for taxpayers to 'successfully' be noncompliant and one should therefore acknowledge that any statistics are at best estimations. However, Leviner (2009:408) presents an alternative perspective by stating that the inclusion of nonmonetary factors can result in a more comprehensive conceptualisation of the tax gap phenomenon. Many such nonmonetary factors have been listed in the preceding sections of this chapter.
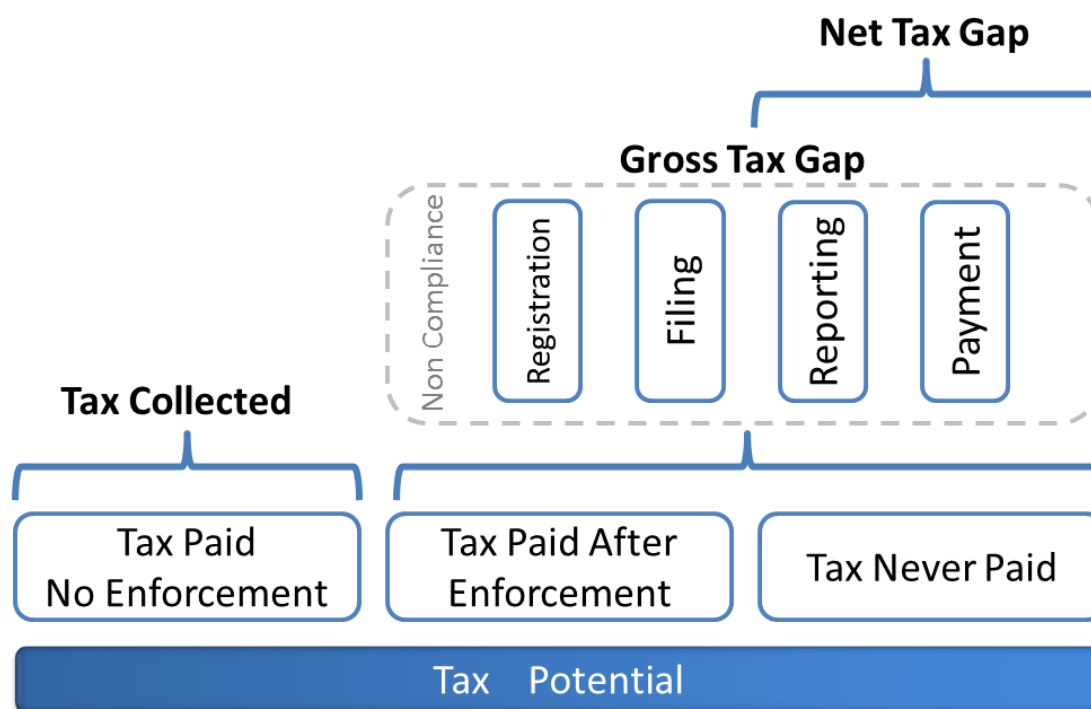
Figure 3-5: Understanding the Tax Gap (Adapted from OECD, 2008:16)

The OECD (2008:15) explains that the tax gap consists of two components, namely the gross tax gap and net tax gap (see Figure 3-5). The gross tax gap not only refers to taxes collected after a successful enforcement action, but also the taxes that remain uncollected despite intervention. The gross tax gap is the total amount of tax not paid voluntarily by taxpayers. The net tax gap is limited to taxes that remain unpaid despite various enforcement actions aimed at collecting these taxes. Examples of such enforcement actions aimed at minimising the tax gap are communications with the taxpayer; auditing of tax declarations; taxpayer prosecutions; etc. The tax gap is usually measured using four perspectives that are listed below. These measurements are important as they influence the focus and design of DSS.

- Registration: Whether a taxpayer is registered for taxes or not: Is the entity registered as a taxpayer? Is the taxpayer active? How long has the taxpayer been on register?

- Filing: The tax amount associated with the late submission of a tax return, but also the failure to submit a tax return. Are there any tax returns outstanding? Does this taxpayer usually submit returns late? Are the returns submitted manually or electronically?

- Reporting: The income tax amount under declared or deductions amount over claimed. The under declaration amount is based on what should have been declared on the tax return minus the actual tax declaration on the returns submitted. How many revised assessments do the taxpayer have? How accurate are the taxpayer's declarations? Does the declaration raise suspicion?

- Payment: The failure to fully pay taxes declared, which includes insufficient partial payments as well as the complete failure to pay the reported taxes owed. Does the taxpayer have any outstanding debt? Are the taxpayer's banking details invalid? Is the taxpayer constantly claiming tax refunds?

It is clear that these tax compliance pillars follow a sequential order in terms of taxpayer behaviour: A taxpayer is first registered; then files a tax return; the tax return contains the financial declarations of the taxpayer; and depending on the declaration assessment, the taxpayer must either make a payment to the revenue collection agency or receive a refund.

It is important that the tax gap is placed in context to much larger and severe forms of criminal behaviour. Hidden economic activities also form part of the tax gap, although these are not within the scope of this research to explore. The hidden economy refers to financial transactions that are in contrast with prescribed legislation. Hidden economic activities can be explored using two dimensions, namely type of activity and type of transactions, as described by Alm et al. (2005:16) and illustrated in Table 3-2. The activity type can be either legal or illegal activities. Transaction types can be monetary or non-monetary transactions, which for legal activities can be further grouped as tax evasion and tax avoidance transactions. Examples indicating the severity of the hidden economy are listed by Kirchler (2007:13-17) and includes the

illegal production of trademarked goods, commercial vice and prostitution, loan sharking and employment of illegal aliens to the list of shadow activities. Just for reference, Kirchler's study also examined the size of the shadow economy around the world and identified Africa to have a significant shadow economy averaging of 41% of the year 2000's gross net product (GNP). However, of these African countries South Africa has the smallest shadow economy totalling an estimated 28.4% of GNP, whereas Zimbabwe has the largest at 59.1%. The monetary value of the tax gap is included in this percentage and it can therefore be seen that the tax gap potential is quite significant.

	Monetary Transactions		Non-monetary Transactions	
Income from Illegal Activities	Trade with stolen goods; drug dealing and manufacturing; prostitution; gambling; smuggling and fraud		Barter of drugs, stolen goods, smuggling, etc. Produce or grow drugs for own use. Theft for own use	
	Tax Evasion	**Tax Avoidance**	**Tax Evasion**	**Tax Avoidance**
Income from Legal Activities	Unreported income from self-employment. Wages, salaries, and assets from unreported work related to legal services and goods	Employee discounts, fringe benefits	Barter of legal services and goods	Do-it-yourself work and neighbour help

Table 3-2: A Taxonomy of Types of Hidden Economic Activities (Adapted from Alm et al., 2005:16)

Combating the tax gap phenomenon is not a trivial task. The subsequent chapters detail how IS and in particular DSS can be used from a practical perspective to do just that. This chapter, however, takes a more abstract stance on the matter. Vihanto (2003:112) explains that tax laws should be unambiguous in an attempt to eliminate any opportunity for misinterpretations by individuals. Taxation should then be transparent allowing individuals to continuously evaluate their tax contribution against government performance. The collection of these taxes should subsequently

occur in a manner decentralised from the broader government. This is required to not only allow for agile responsiveness to local influences causing tax noncompliance but also to ensure sustainability and continuity with the current government regime changes. More practical and reactive measures aimed at addressing the tax gap are prescribed by Akinboade et al. (2009:1126) in which South Africa is explicitly referenced: These measures commence with reactive actions such as the criminalisation of tax evasion through policies and legislation combined with the abilities for revenue collection agencies to punish tax noncompliance through audits; penalties, impositions and also taxpayer prosecution. Proactive measures are also prescribed such as forgiving noncompliant taxpayers and providing them with reacceptance into the economy through negotiations; settlements and amnesties, and also by promoting good citizenship; appealing to taxpayer ethics and to publically condemn taxpayer noncompliance through 'name and shame' techniques.

3.9 Constructing the Conceptual DSS Framework

This section commences the building of a conceptual DSS framework aimed at addressing the tax gap phenomenon experienced by revenue collection agencies. This is done by presenting the relevant conclusions derived in this chapter as building blocks of the conceptual DSS framework. The subsequent chapters continue this construction with their respective contributions focusing specifically on IT. A summary of the framework's development lifecycle is presented in Appendix C.

The framework commences with the three role players influencing noncompliance, namely the taxpayer, the environment in which they operate and the revenue collection agency. Details regarding these role players and the influences they have on noncompliance are respectively discussed in sections 3.7.1, 3.7.2 and 3.7.3. These influences determine the compliance behaviour of the taxpayer and are shown as the 'behaviour' arrow pointing from the taxpayer back to the revenue collection agency. The different types of behaviour is introduced in section 3.8 and further elaborated on in the subsequent chapter.
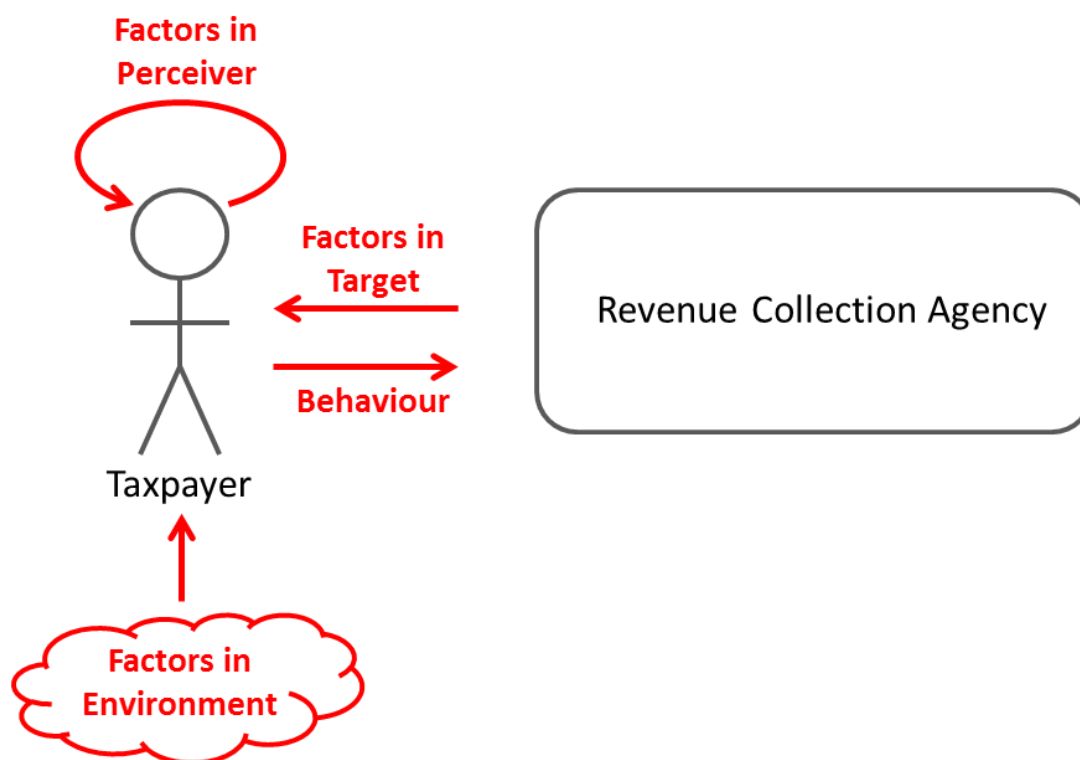
Figure 3-6: Framework Construction - Incorporating the Problem

3.10 Conclusion

The purpose of Chapter 2 was to provide a comprehensive overview of the research topic and problem. Its focus was less on IS and more on the institutional matters related to the research problem. This stance was taken in support of the selected research methodology, namely that of a single case study, in which a detailed literature survey on a research problem is required.

Chapter 3 aimed to address the research question asking what the tax gap phenomenon is and why it continues to exist. The chapter concludes that the tax gap phenomenon is the result of tax noncompliance which consists of many facets, many which are outside the control of revenue collection agencies. The tax gap is considered to be the difference between the true total taxes due to the revenue collection agency and the subset thereof paid by taxpayers. This difference can be in the form of tax avoidance which has legal grounds or tax evasion which is considered a criminal offence. The existence of the tax gap phenomenon continues to be a result of social behaviour. Such behaviour is unpredictable and ever changing because it is

continuously influenced by factors internal and external to the taxpayer. This chapter aimed to identify many of these factors, of which some can be embedded into DSS.

The chapter concluded by identifying the first components of the conceptual DSS framework, namely the taxpayer and the revenue collection agency together with the factors influencing taxpayer noncompliance. The details of these factors are also included in the final conceptual DSS framework presented in Chapter 9. The next chapter enhances the framework by focusing on the institutional properties associated with the revenue collection agency.

The remainder of chapters build on the conclusions derived from this chapter, but with a strong emphasis on IS and specifically how DSS can address the tax gap phenomenon. This is done by exploring each of the three SMT components, starting with the information demands determined by the institutional properties.

PART 2: LITERATURE FINDINGS

CHAPTER 4: IT AND THE REVENUE COLLECTION AGENCY
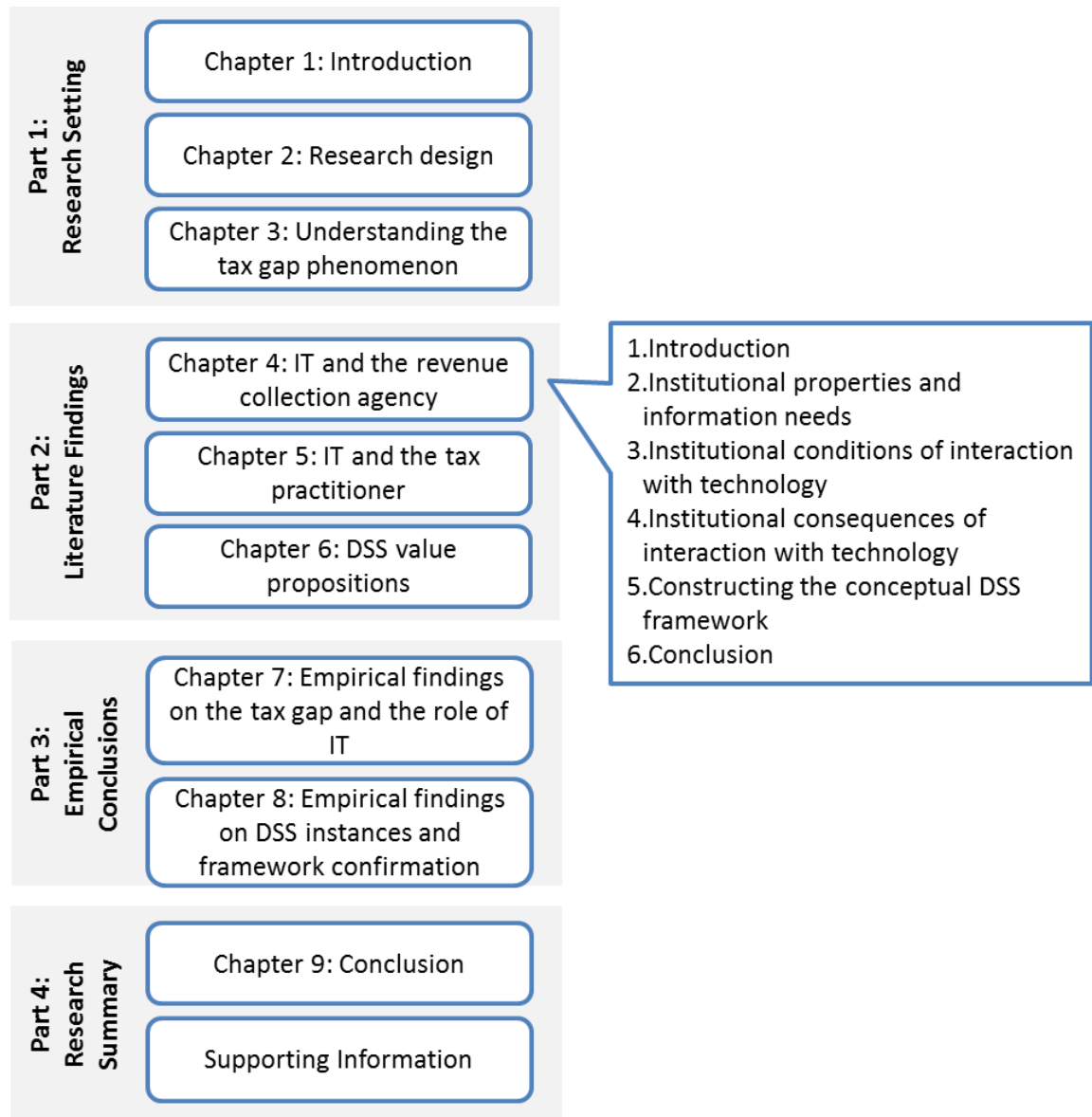
Figure 4-1: Chapter 4 Roadmap

4.1 Introduction

Part two of the research consists of three chapters and present the conclusion derived from the literature. Chapter 1 indicated the research to follow SMT as the base theory in which the research problem is addressed. This chapter commences this journey by discussing the first of the three prescribed components, namely that of institutional properties. More specifically, the chapter explores the influence that IT has on revenue collection agencies given the objective of minimising the tax gap. In doing so this chapter aims to address the research question stating:

"How does IT influence a revenue collection agency's ability to address the tax gap?"

Two influences are prescribed by SMT to guide such exploration. The first influence is that of the institutional conditions of integration with technology. This influence explains the conditions under which technology is used by human agents to perform institutional objectives. The second influence is that of the institutional consequences of interaction with technology, which explains the manner in which technology shapes the institution. However, prior to these discussions the chapter commences by elaborating on what constitutes institutional properties as well as the information needs originating these institutional properties.

4.2 Institutional Properties and Information Needs

SMT was first introduced in Chapter 1, in which it was described as a model that explains the role and relationship between IT, an organisation's institutional properties and the decision-making human agents. This chapter focuses on how IT influences the institutional properties of an organisation as well as the manner in which these institutional properties influence the decision-makers in an organisation. These institutional properties ultimately define and even characterise an organisation's 'business problems' from a decision-making perspective, therefore resulting in decision-makers having various information needs. For this reason, the INOD model has been selected to supplement SMT. This is because INOD provides a basis for describing the manner in which information flows through an organisation in support of decision-making. In addition to information needs, the INOD model also considers information offerings and information demand although these are only discussed in Chapters 5 and 6 respectively. The remainder of this chapter discusses

the organisational aspects of decision-making through the theoretical foundations prescribed by SMT's institutional properties and INOD's information needs.

4.2.1 Institutional Properties

Orlikowski (1992:410) defines the institutional properties of SMT as follows: "Institutional properties of organizations include organizational dimensions such as structural arrangements, business strategies, ideology, culture, control mechanisms, standard operating procedures, division of labour, expertise, communication patterns, as well as environmental pressures such as government regulation, competitive forces, vendor strategies, professional norms, state of knowledge about technology, and socio-economic conditions." Figure 4-2 presents the relationship that institutional properties have with human agents and technology and is explicitly illustrated through influences C and D. This presentation is a sub-selection of the full SMT model presented in section 1.6 and only considers the components related to this chapter, namely institutional properties.
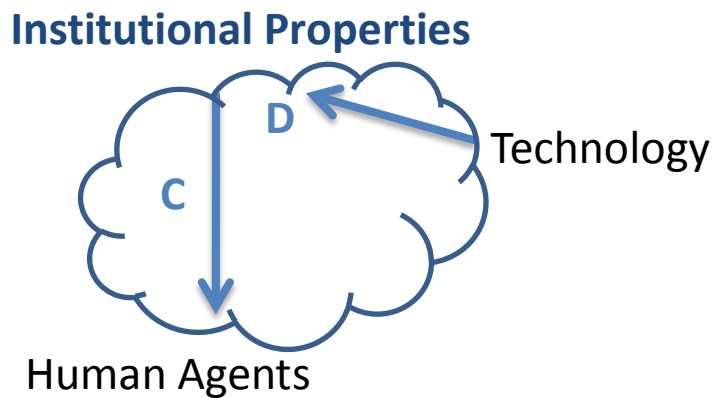
Figure 4-2: The Structuration Model of Technology (Adapted from Orlikowski, 1992:410)

Influence C describes the influence that institutional properties have on human agents. The characteristics and attributes of an organisation influence the manner in which human agents perform decision-making. This influence is often based on the decision-maker's perception of the organisation's institutional properties, as determined by his social setting in the organisation. These institutional properties might typically

include a body of knowledge; organisational resources; professional norms; and standard operating procedures, to name but a few.

The focus on organisational decision-making, as per this chapter, is very different from individual decision-making discussed in Chapter 5. Individual decision-making typically focuses on the physiological, cognitive and narrative aspects of a human agent during a problem solving process. However, much like individual decision-making, organisational decision-making occurs in many different forms – each unique to the particular institution. Despite this, various academics have attempted to define general decision-making categories against which such organisational characteristics can be matched. Most of these publications are dated prior to 2000, at the time when research on organisational and management theories peaked. Three of these examples are mentioned. Shrivastava & Grant's (1985:103) categorisation consists of four groupings: managerial autocracy, systematic bureaucracy, adaptive planning, and political expediency. Martinsons (2001:2) defines four different categories, namely analytical, conceptual, directive, and behavioural, but more importantly, he identifies the nationality of decision-making executives as a key influencer of the organisation's decision-making style. Sun & Liu. (2001:247) define the different decision-making categories as strategic, tactical and operational. The last mentioned is chosen for this study and further elaborated on in section 4.3.2. A different perspective is taken by Eisenhardt & Zbaracki (1992:35) who explain that in most cases the actual decision-making characteristics of an organisation are hidden behind what they describe as complex political systems. These political systems often have conflicting objectives combined with limited cognitive capabilities, resulting in the most influential and powerful decision-maker(s) to determine the decision's outcome regardless of whether it is the 'best' outcome. Section 4.4 elaborates on these types of indirect influences and their impact on DSS. Although most of the previous research related to the decision-making characteristics of an organisation remains valuable, very few of these publications make explicit reference to DSS. This is despite evidence stating that DSS significantly improves organisational decision-making in terms of problem formulation; decision-making speed and also knowledge on the matter (O'Donnell & David, 2000: 189). Not discarding other perspectives, the decision-making categorisation by Courtney (2001:25) is perhaps most relevant to this study: The

categorisation makes specific reference to the SECI knowledge creation process through the utilisation of IT in the form of DSS. This knowledge creation process through DSS is comprehensively discussed in section 5.4.2.

Courtney's (2001:25) categorisation of organisational decision-making describes five types of decision-making organisations together with the different institutional properties unique to each (summarised in Table 4-1). These types of organisations are Leibniz, Locke, Kant, Hegel and Singer, each of which will now be briefly discussed. Most organisations are not expected to fit in only one of these categories. The researcher furthermore cannot prescribe a single category of preference, as all five instances have positive and negative aspects associated with them. However, at this stage the researcher can mention that the Leibniz, Locke, and Kant organisations have a stronger emphasis on DSS, whereas the Hegel and Singer organisations have a weaker focus on DSS.

	Leibniz	**Locke**	**Kant**	**Hegel**	**Singer**
Decision-making style	Formal Analytical; Bureaucratic; Functional	Open Communicative; Consensual; Interpretive	Open Analytical; Multi-model; Functional	Conflictual Critical	Teleological Cooperative; Ethical; Interpretive; Critical
Information Technology	Models; DSS; Expert Systems; Document Management	Communication Repositories; Groupware; Networks	Databases; DSS Models; Management Systems	Repositories; Negotiation Systems	Groupware; Networks; Repositories; Document Management
Knowledge Perspective	Combination	Socialisation	Combination	Socialisation; Externalisation	Socialisation; Externalisation
Knowledge Creation	Induction Mathematical Analysis; Formal Logic	Deduction Observation; Classification	Mathematical Analysis Choose best	Construct Thesis & Antithesis Dialectic; Synthesis	Strategy of Disagreement Sweeping in; Multiple Perspectives

Table 4-1: Organisations' Decision-Making Characteristics (Adapted from Courtney, 2001:25)[1]

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[1] The five decision-making philosophies in their original form do not make specific reference to DSS. However, Courtney (2001) does reference these philosophies from a DSS perspective.

The Leibnizian organisation makes use of formalised analytical functions to generate facts in the organisation. The facts go through an induction process in which hypotheses are defined and tested, before the facts are built into an IT system that produces the results. Knowledge is created through various mathematical analytics in which the formal logic available within the defined boundaries of the organisation is concluded in a strict and bureaucratic manner. Discoveries are formal and easily reproduced, which is why DSS are typically chosen as the preferred IT implementations to support decision-making. The Lockean organisation uses a deductive approach in which empirical observations, internal and external to the organisation, are stored as facts in large organisational repositories. These repositories are interrogated in a transparent and interpretive manner, from which consensual conclusions are derived. The conclusions are continuously reflected upon in a social manner, using various group decision support system (GDSS) tools. Section 6.7 elaborates on GDSS. The Kantian organisation explores many different analytical and mathematical approaches to generate facts in the organisation. At the very least, this organisation develops multiple perspectives of the same approach to evaluate the 'goodness-of-fit' for each approach. The approach makes use of a strong IT foundation consisting of comprehensive repositories that supply a variety of DSS models with data. The discovery of facts is mostly driven from a pure technology perspective, with very little human interpretation applied. A different and contrasting approach is followed by the Hegelian organisation. In essence, these organisations make use of human conflict to debate contrasting perspectives of a problem. Opinions, contrasting viewpoints and the debate thereof are encouraged in the organisation's perusal to generate facts. An independent and neutral observer captures the contradictory interactions to derive a comprehensive viewpoint of the topic. This process is repetitive, social by nature and uses limited IT, mostly in the form of negotiation support systems (also see section 9.4) and GDSS. The Singerian organisation follows the principle that general facts should be created to support the decision-making of a broad audience. Only then should these facts evolve into an in-depth state appreciated by a limited and specialised audience. The process is ethical and holistic by nature, appealing to a broad spectrum of society and accommodating human, organisational and environmental factors. Social discussions are used to explore multiple perspectives and debate disagreements. This process is supported by

IT through GDSS and document-driven DSS (section 6.8 discusses the last mentioned in greater detail). Although the empirical study only commences later in this research, it is applicable to mention at this stage that the case study has shown strong characteristics of the Leibniz organisational decision-making type. Chapters 7 and 8 elaborate on many of these characteristics, together with practical illustrations thereof.

Influence D of SMT, as discussed in the previous section, addresses the institutional consequences of interaction with technology and essentially explores the impact that technology has on an organisation. Technology can reinforce or transform certain aspects in an organisation. SMT consequently discusses these aspects under the three perspectives referred to as structures of signification; structures of domination; and structures of legitimation. Signification structures broadly refer to the manner in which IT defines and influences organisational interaction through various means. Structures of domination discusses IT's role as that of an authoritative position that focuses on human agents and also an allocative position which focuses on objects and materials in the form of IT. The manner in which IT dictates organisational norms, including social practices and traditions, constitutes the structures of legitimation. These three 'structures' form part of the institutional consequences of interaction with technology and is further discussed in section 4.4.

4.2.2 Information Needs

The INOD model was first presented in section 1.6 and is further elaborated on in this section. Specific reference is made to the institutional aspects of the model, namely information needs. INOD's information needs category directly corresponds with SMT's institutional properties from a decision-making perspective. This is because the respective category addresses the manner in which an organisation's 'problems' define the institution's information needs. 'Problems' as referred to by INOD is perhaps loosely used to describe a variety of challenges experienced by an organisation.

An organisation's information needs are dominated by its objectives and therefore arise from the business challenges they experience. Figure 4-3 illustrates INOD's information needs, as well as the component's relationship with the remainder of the

model consisting of the information demand and information offerings components (these are further discussed in Chapters 5 and 6 respectively). More particularly, the relationship consists of three activities which the figure indicates by means of labels 1, 4 and 6.
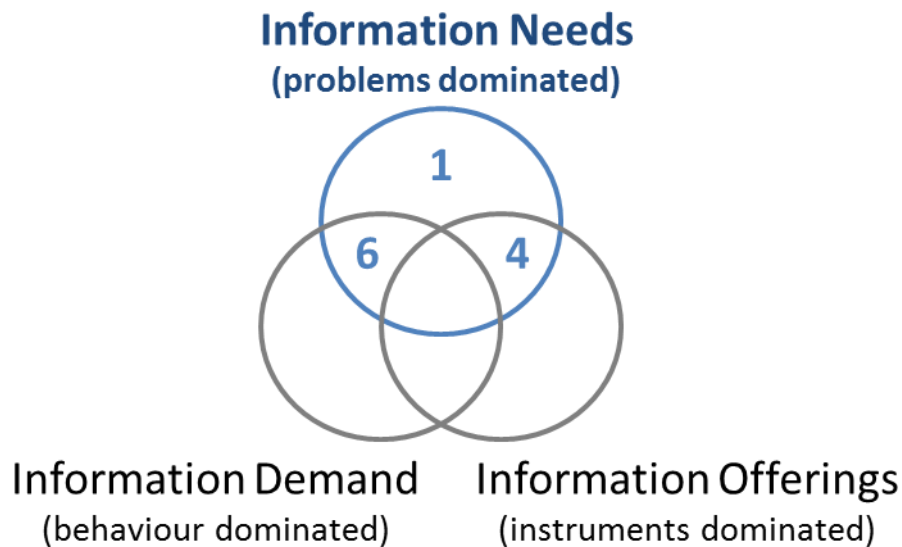
Figure 4-3: Relationship Between Information Offer, Demand and Needs (Adapted from Osmanagic-Bedenik & Varga, 2006:141)

Activity 1 details information needs for which there is neither an information offering nor information demand. These are situations where a particular business problem exists without it being recognised by the business stakeholders and consequently for which IT does not provide information. Typically these business problems are of less importance which is why they are either overlooked or ignored by the business stakeholders. It would therefore make sense for these stakeholders to have no demand for the associated information offering from IT. Activity 4 describes a situation with an information need and an information offering, but for which no information demand exists. A typical instance is the existence of a particular business problem that is supported by the required IT offerings, but for which there is no demand from the business stakeholders. Similar to activity 1, a lack of demand could be a result of business prioritisation or perhaps even the failure to acknowledge/address the particular business problem. It can even be suggested that such information offerings are wasteful and a result of misalignment between business and IT strategy. In contrast to this, activity 6 illustrates the scenario when information is needed by the

institution and demanded by decision-makers, but for which the information is not offered by IT. In these scenarios, business stakeholders aim to address business problems of importance to the organisation, but IT does not provide the necessary information offerings. This misalignment is typical because of IT's failure to adequately support the organisation's strategy.

The ability for IT to satisfy the information needs of decision-makers is identified by Neilson et al. (2008:63 – 68) as the most important factor influencing the ability for large organisations to deliver on its strategy. In the past, organisations often restructured their management structures to address the failure of business value delivery. Although this traditional approach of restructuring ineffective management still holds true, the authors argue that the failure to deliver strategic business objectives is often related to the misalignment between business and IT, and not because of managerial incompetency. This misalignment is normally when an information need exists that is not addressed by an information offering. The authors address this when they not only promote organisations to respect the mandates of their decision-makers, but also IT's role to distribute information timeously and consistently across the organisation. Despite the general consensus that an alignment between IT's information offerings and the organisation's information needs is critical to the institution, Peak et al. (2005:635) state that this remains a serious challenge for large organisations. They promote the 'deregulation' of IT which would allow business units to define their own IT requirements and allow information offerings to be reactive towards their information needs. It is suggested that these information needs are defined through the organisation's critical success factors; the defined business processes and the management thereof; as well as the IT solutions required to support these processes. However, the deregulation of IT aimed at addressing the misalignment between information offerings and information needs is in contrast with the proposition by Shih et al. (2012:525). They state that the institutional leadership should predefine an information needs framework which covers all aspects of strategic importance to the organisation. The information offerings should be aligned with this framework and must cater for all reporting levels in the organisation, i.e. operational, tactical and strategic.

The unique setting in which revenue collection agencies operate calls for specific emphasis on the organisational needs of SARS. Expert knowledge on tax matters are scarce, even in SARS, which is why the clear and consistent specification of information needs are critical. DSS should ideally consolidate and integrate these information needs to enable relevant and accurate decision-making.

The remainder of this chapter discusses the manner in which decision-making occurs from an institutional perspective and consequently also how an institution's information needs arise. Unlike the human agent and technology component of SMT, the institutional properties component is strongly associated with the related organisation being studied, namely SARS. Focus is placed on the type of information needs unique to revenue collection agencies as well as the type of decision-making DSS should support to enable decision-makers in minimising the tax gap.

4.3 Institutional Conditions of Interaction with Technology (SMT's Influence C and INOD's Activity 6)

This section discusses SMT's influence C, namely 'institutional conditions of interaction with technology' and INODS's activity 6 specifying that information is required and is demanded, but for which an IT solution is yet to exist. The section commences with a description of the institutional conditions required by revenue collection agencies to successfully address the tax gap and is concluded with an introductory overview of the type of DSS required to address the subsequent information needs and demands. Chapter 6 continues this discussion with a more comprehensive presentation of specific DSS instances.

For this case study, the SMT's institutional properties component is in its simplest form a referral to the public sector and specifically SARS as the only South African revenue collection agency. When considering the main research question presented in Chapter 1, a deeper perspective of SARS's institutional properties can be obtained based on the manner in which revenue collection agencies approach the tax gap. One such approach is the proposal by the OECD (2008:16). This proposition disseminates the tax gap into a gross tax gap (taxes not paid voluntary) and net tax gap (taxes remaining uncollected even after enforcement action) as presented in section 3.8.

Leviner (2009:420) proposes a pyramid model aimed at minimising the tax gap in its various forms through different enforcement strategies in Figure 4-4. The model is a pyramid based on a taxpayer's attitude towards tax compliance and is also referred to as motivational postures (discussed in the next section). Motivational postures influence the regulatory styles of the revenue collection agency and are ultimately aimed at defining different enforcement strategies. This is important as it dictates the manner in which DSS are used to combat the tax gap phenomenon. This model is supplemented by the OECD's (2008:8) compliance risk management process detailing the activities related to the management of tax compliance. The different enforcement strategies equate to the institution's IT requirements through their information needs. In return this should determine the information demands of human agents (tax practitioners), as further discussed in Chapter 5.

4.3.1 Enforcement Strategies

The tax compliance pyramid (see Figure 4-4) receives a taxpayer's motivational postures and the different regulatory styles of the revenue collection agency as input to the manner in which the tax gap is addressed. Four enforcement strategies are derived from these inputs, as defined by the OECD (2004:41) and supported by Leviner (2009:410,418) and Kirchler (2007:22).
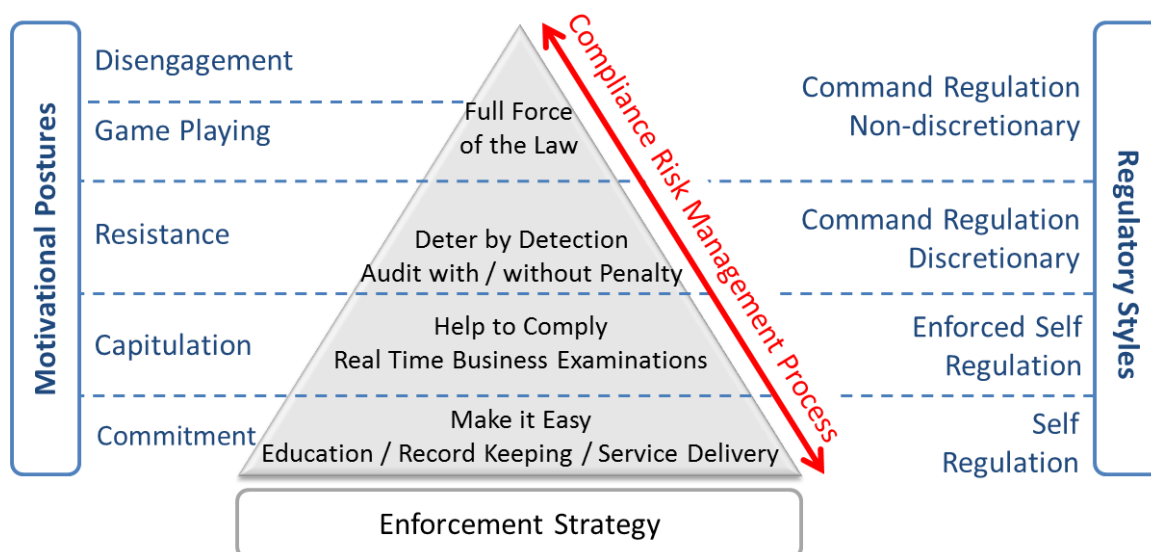
Figure 4-4: Tax Compliance Pyramid (Leviner, 2009:420)

The motivational postures describe the relationship that the taxpayer has with the revenue collection agency. Leviner (2009:410) describes taxpayer motivational postures as the beliefs, values and attitudes which taxpayers have towards revenue collection agencies. The manner in which revenue collection agencies counter tax noncompliance is defined by means of these taxpayer motivational postures. In particular, if a taxpayer perceives to foster a close and committed relationship with the revenue collection agency, the agency is expected to have a much stronger influence over the taxpayer. This influence will in all likelihood positively influence the taxpayer's attitude towards tax compliance and therefore also improve taxpayer compliance. Quite the opposite is true for a distanced or disengaged relationship between the taxpayer and revenue collection agency. In these cases revenue collection agencies have little influence over taxpayer behaviour and therefore also taxpayer compliance, which ultimately results in increased tax noncompliance. The motivational postures are defined according to the hierarchical nature of the tax compliance pyramid, consisting of five levels ranging from a committed taxpayer to a disconnected taxpayer. Regulatory styles are explained by Leviner (2009:418) as the different approaches in which taxpayer compliance is managed. Regulatory styles describe the relationship that the revenue collection agency has with the taxpayer whereas taxpayer motivational postures explain the relationship that the taxpayer has with the revenue collection agency. The regulatory styles also conform to the hierarchical nature of the tax compliance pyramid by means of four levels, ranging from limited involvement by the revenue collection agency to complete involvement. Limited involvement by the revenue collection agency is typical for engaged taxpayers that are self-regulated. The complete involvement of revenue collection agencies is also known as command regulation and is only pursued when taxpayers are fully disengaged.

The combination of taxpayer motivational postures and the revenue collection agency's regulatory styles define the manner in which tax compliance is managed, or differently stated, the enforcement strategies of the revenue collection agency. The proposed enforcement strategies consist of four sub strategies, each which is now discussed in greater detail. It is important to understand these enforcement strategies as they define the manner in which IT is used to enable revenue collection agencies in

their pursuit to address the tax gap. Although the different instances of DSS are only presented in Chapters 6 and 8, this section lists specific examples pertaining to each of the enforcement strategies.

4.3.1.1 Make it Easy

The 'Make it Easy' enforcement strategy consists of the commitment motivational postures and self-regulation regulatory style. Commitment motivational posture entails taxpayers who regard the paying of taxes as a moral obligation and commitment necessary to distribute wealth in society (also refer to section 3.4 for the ethical perspectives of paying taxes). The self-regulation regulatory style describes taxpayers who are compliant without any interference by the revenue collection agency. Examples are when taxpayers submit tax returns prior to the submission deadline and taxpayers who settle their taxes due before their tax accounts are in arrears. The 'Make it Easy' enforcement strategy attempts to provide a simplistic tax regime supported by effective and efficient service delivery, thereby presenting taxpayers with the opportunity to be compliant at their own will.

This enforcement strategy is enabled through IT by means of operational systems supporting the everyday processing taxpayer affairs as stipulated by legislation. The 'Make it Easy' enforcement strategy in its purest form is supported by IT systems that simply conduct the processing of tax declarations as if all taxpayers make honest and accurate declarations. No additional intervention by the revenue collection agency is required. DSS systems are referenced by this enforcement strategy in a limited form. Document-driven DSS are perhaps most relevant as they enable taxpayers to search and subscribe to content (typically unstructured by nature) that will assist them in being tax compliant. Data-driven DSS ensures the storage of transactional information from which a variety of intelligence can be derived. Its value proposition becomes increasingly sophisticated as the levels of hierarchical enforcement strategies continue. Data-driven DSS are used as the foundation for the advanced DSS required by subsequent enforcement strategies. Perhaps most importantly, data-driven DSS conducts the pre-population of tax returns using third party data, which plays a significant role in helping taxpayers to be self-compliant. For the 'Make it Easy' enforcement strategy, data-driven DSS are also used to understand the volumetric of

tax administration, such as how many returns have been submitted; value of assessments processed; and number of taxpayers refunded. Model-driven DSS are used for examples such as optimising organisational capacity management and performance; and forecasting revenue collections and tax submissions cycles, to name but a few.

4.3.1.2 Help to Comply

The 'Help to Comply' enforcement strategy comprises of the capitulation motivational posture and enforced self-regulation regulatory style. Capitulation motivational posture describes taxpayers that respect revenue collection agencies and its mandate to collect taxes. These taxpayers typically attempt to be compliant, but fail at times to do so. The enforced self-regulation regulatory style is when the revenue collection agency instils self-regulation through limited and often automated enforcement practices. The automatic allocation of tax penalties for outstanding returns and/or outstanding debt are examples of enforced self-regulation. The 'Help to Comply' enforcement strategy is aimed at providing assistance and support, sometimes through partial enforcement actions, to taxpayers that are in the early stages of noncompliance.

The 'Help to Comply' enforcement strategy expands on the operational IT systems and in particular the data-driven DSS defined in the 'Make it Easy' enforcement strategy. Data-driven DSS are used to conduct various analytical exercises aimed at obtaining insights related to the challenges taxpayers face when trying to be compliant. An example is the incorrect tax declaration of certain deductions based on the misunderstanding of the deduction's intent. Additionally, this enforcement strategy also makes use of basic knowledge-driven DSS (such as rule based systems) to detect the partial noncompliance of taxpayers. This form of noncompliance is often a result of taxpayer ignorance and is therefore quite easily identified by basic knowledge-driven DSS. Following on the previous example, an example of a rule-based knowledge-driven DSS is when the tax declaration is rejected because of the invalidity of the deduction declared.

4.3.1.3 Deter by Detection

The 'Deter by Detection' enforcement strategy results from the resistance motivational posture and command regulation discretionary regulatory style. The resistant motivational posture describes taxpayers that are dissatisfied with the revenue collection agency or other facets of government, often leading to non-cooperative taxpayers and ultimately tax noncompliance. The taxpayers are typically confrontational because of their dissatisfaction with the tax system, but can at times still be persuaded to become compliant. Some reasons for tax noncompliance were discussed in section 3.6. Command regulation discretion entails the explicit detection of taxpayer noncompliance by the revenue collection agency followed by limited enforcement actions aimed at ensuring taxpayer compliance. One such example is when an official communication of enforcement intent is issued to a taxpayer, but only after the tax penalties raised did not result in taxpayer compliance. The 'Deter by Detection' enforcement strategy detects taxpayers with a resistance towards being compliant and executes a variety of enforcement actions as determined by the revenue collection agency's discretion.

Building on the DSS referenced in the previous enforcement strategies, the 'Deter by Detection' strategy makes use of advanced knowledge-driven DSS that detects tax noncompliance in a variety of ways, but especially through data-mining techniques. Data-driven DSS are also used to support these knowledge-driven DSS through complex data structures, in addition to providing reporting and analytical insights related to the detection of tax noncompliance.

4.3.1.4 Full Force of the Law

The 'Full Force of the Law' enforcement strategy references two motivational postures namely game playing and disengagement, in conjunction with the command regulation nondiscretionary regulatory style. Disengagement describes taxpayers that are disconnected with the tax regime and in doing so withdraw from any interaction with the respective revenue collection agency. The disengagement posture equates to tax evasion because of these taxpayers' general dissatisfaction with government. Game playing usually depicts taxpayers who aim to avoid tax and, in attempting to do so, manipulate the tax system to their advantage. Command regulation non-discretion

is the final avenue followed by revenue collection agencies in an attempt to address taxpayer noncompliance. Formal legal communication and prosecution is typical of this regulatory style. The jail sentencing of a taxpayer for outstanding debt or fraudulent declarations is one such example. The 'Full Force of the Law' enforcement strategy is therefore aimed at pursuing deliberately noncompliant taxpayers through a series of formal proceedings utilising whatever legal channels and resources are at the revenue collection agency's disposal.

The 'Full force of the Law' enforcements strategy uses DSS similar to that of the 'Deter by Detection' strategy with the exception that the first mentioned is more focused on perusal of the taxpayer than detection of the taxpayer. The continuous interactions associated with this strategy, whether verbally or through documents, emphasises the value of communications-driven and document-driven DSS. This is particularly true for large and complex organisations such as revenue collection agencies that have multiple people involved in the same process and who are often geographically dispersed.

4.3.2 The Compliance Risk Management Process

Most successful organisations have the ability to effectively execute decision-making at different levels in an organisation. This is enabled through free flowing information across the organisation (Neilson et al., 2008:61) and is no different for revenue collection agencies. The previous section described the types of enforcement strategies executed by revenue collection agencies to combat the tax gap as well as the associated DSS required to do so. This section focuses on the manner in which these enforcement strategies are managed and how this can be enabled through IT. It is important to obtain an understanding of the compliance risk management process as it defines the institutional properties in which human agents operate technology. This is even more important from a DSS point of view as this management process defines the information needs of the institution.

Academics have generally agreed that organisational decision-making is recognised in three groupings, namely operational, tactical and strategic decision-making (Sun & Liu., 2001:247). This is also the case for revenue collection agencies. Operational

decision-making is based on everyday working activities, executed by staff and lower management. These decision-making actions are frequent and focus on the immediate / short term objectives typically associated with administrative functions. Operational decision-making subsequently poses very little long term risk to an organisation. Tactical decision-making is required to drive the operational implementation of the defined organisational strategy. These decisions are executed by middle management and are usually medium term focused. The impact of tactical decisions are more significant than operational decisions, but less critical than strategic decisions. Strategic decision-making focuses on the corporate issues at hand, is practised by top management such as executives and is typically long term focused. These decisions are in most cases risky by nature, but very rewarding when successfully implemented. It is important to note that organisational decision-making can be explored from multiple dimensions, of which the decision-making category recently discussed is one example. Another dimension is the classification of decisions in terms of it being structured or unstructured (Ahituv & Neumann, 1986:43), and in some cases even semi-structured. Structured decisions are frequent by nature and consequently quantitative, repetitive and programmable in most cases. Structured decisions are associated with well-defined problems of which the variables influencing the decision are understood and accommodated for. Unstructured decisions are in contrast to structured decisions because they occur less frequently and are qualitative, occasional and unique by nature. An accurate perspective of organisational decision-making is obtained when combining the decision-making category and classification dimensions. Operational decision-making is mostly structured, whereas strategic decision-making is typically unstructured. Tactical decision-making is usually a combination of structured and unstructured decision-making, but perhaps biased towards the first mentioned. To supplement the categorical and classification dimensions of decision-making, Power (2002:39) suggests a final dimension namely that of frequency. The decision-making frequency dimension distinguishes between routine and non-routine decision-making. Routine decision-making refers to recurring decisions that can largely be automated by DSS. These decisions are structured by nature, well defined and understood. Operational and tactical decision-making mostly tends to be routine-like by nature. Strategic decision-making is mostly on an ad hoc basis, poorly defined and unstructured by nature. For this reason it is challenging to

support these decisions through DSS. These three dimensions of organisational decision-making is not only fundamental to the relationships that SMT's institutional properties share with human agents and technology, but also the manner in which INOD's information needs are defined and presented.

Power (2002:38) agrees with the hierarchical nature of organisational decision-making but proposes a slightly different perspective. Operational decision-making is split into two, namely operational control and operational performance. Operational control places emphasis on the detailed management of operational activities and aims to ensure organisational efficiency. Operational performance decision-making is related to everyday tasks associated with running operational activities. Tactical decision-making continues to form part of the hierarchy's middle layer, which Power (2002:38) instead refers to as management control. Management control is aimed at the decision-making required to ensure the operational activities are executed according to the strategic planning objectives set by executives. In other words, management control has to do with organisational effectiveness. Last is strategic decision-making which forms the top level of the decision-making hierarchy and is more related to pro-active planning than responsive decision-making.
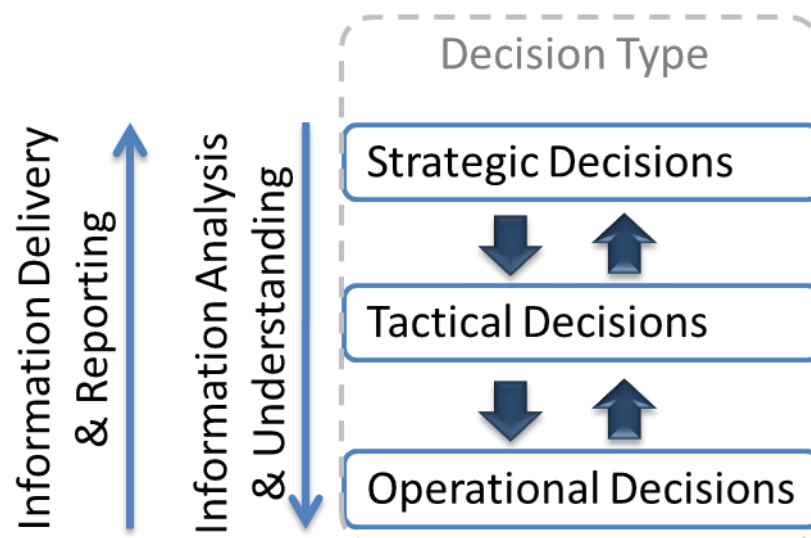
Figure 4-5: Data Processing for Decision Support - Derived from Varga (2005:21, 27)

The study by Bernroider & Schmollerl (2013:141) substantiates the fact that technological artefacts and in particular DSS positively affect decision-making satisfaction, a statement that is supported by March & Hevner (2007:1031). Even though a detailed discussion on DSS is only presented in Chapter 6, it is important to understand the manner in which DSS relate to organisational decision-making. Figure 4-5 illustrates how Varga (2005:21) elaborates on the hierarchical types of organisational decision-making by elaborating on its relationships with technological artefacts and, more specifically, DSS. Information delivery and reporting commences from operational decision-making and concludes with strategic decision-making. This makes sense considering that information is generated at an operational level and packaged for consumption at higher management levels. Put differently, information delivery and reporting follows a bottom-up approach where the reporting at a higher organisational level is typically determined by the aggregation of the supporting lower levels. Information delivery and reporting is more about measuring performance than driving innovation and change. This is in contrast to information analysis and understanding, which originates at a strategic decision-making level and terminates at an operational decision-making level. Information analysis and understanding is about deriving new value from existing information with the goal of introducing new business insights which might prompt organisational change. Information analysis and understanding follows a top-down approach. This is because the high level interrogation of information usually requires further analysis on the supporting detailed information. Section 5.4.3 elaborates on this model by relating it to different types of decision-makers, but more importantly also the IT 'facilities' they require to execute each of these decision-making types.

Management Level	Compliance Monitoring Focus	Provides Feedback on
Strategic	Whole of tax system	Overall tax system health, standard of administration
	Whole of tax product	Overall health & administration of each tax
Operational	Whole of taxpayer segment	Overall impact of risk treatment strategies & program management for segment
	Targeted compliance risk issues	Impacts of specific risk treatments on targeted compliance risk issues
Tactical	Targeted individuals / groups	Insights into individual / group behavioural responses

Figure 4-6: Managing Levels of Tax Compliance (OECD, 2008:10)

Effective and efficient decision-making in revenue collection agencies is critical to support the mandate of ensuring good tax compliance, which in return results in increased revenue collection (OECD, 2004:6). Much like other organisations, the limited resource capacity of revenue collection agencies emphasises the critical role of decision-making to optimally support business operations such as tax compliance risk management (OECD, 2004:16). Revenue collection agencies therefore also manage the risk of tax compliance from an operational, tactical and strategic manner (see Figure 4-6). An operational perspective of compliance risk management focuses on the lowest level of tax noncompliance. This is usually in the form of individual taxpayers that are targeted because of tax evasion / tax avoidance behaviour, or it can be the countering of specific tax risks such as auditing all tax returns containing a particular refund declaration. The institutional information needs of the operational instances regarding compliance risk management process are typically short lived and change frequently. It is also often the case that operational information needs result in information offerings that far exceed the information demand. This is because information demand is mostly limited by the cognitive capabilities of humans. Differently stated, the compliance risk management volumes generated by IT based on certain criteria defined by the organisation by far exceeds the human capacity to action the risk. Operational compliance risk management provides feedback on the actual result of risk treatment strategies and the impact of the strategic programmes introduced to combat noncompliance. Compliance risk management at a tactical level focuses on segments of non-compliant taxpayers or groupings of tax risks in general. An example of the first mentioned is when the revenue collection agency identifies non-compliant taxpayer industries such as the construction, financial and retail industries and then evaluates the tax compliance of all taxpayers in this industry regardless of compliance status. Tactical compliance risk management provides revenue collection agencies with insights related to taxpayer behaviour and emerging patterns of tax compliance. Strategic compliance risk management takes an umbrella view of tax compliance by considering the whole tax system and the general risks associated with it. It considers the general health of the tax administration by addressing the risks that are generally a challenge to resolve and that are focussed on the long term. An example is the improvement of IT systems hosting the accounts of taxpayers with the goal of ultimately reducing the amount of revenue owed by these

taxpayers because their accounts are more accurate. Another example might be to introduce more electronic communication channels to taxpayers to make it easier for them to be compliant and thereby eventually decreasing the number of outstanding tax returns. IT changes related to strategic compliance risk management are long term by nature as are the information needs required to measure the impact of strategic IT improvements.

Compliance risk management can be practised following a top-down approach or bottom-up approach. In a top-down approach tax compliance risks are strategically considered before filtering down to tactical and operational information needs. The result is a preventative approach to compliance risk management, where more emphasis is placed on building a sustainable tax system than addressing the current risks and limitations. To the contrary, a bottom-up approach to tax compliance places more focus on current operational tax compliance issues which consequently determines the strategic information needs of the revenue collection agency. It goes without saying that this approach is re-active by nature. However, in reality the institutional properties of organisations are probably a hybrid between the top-down and bottom-up approach. This is because revenue collection agencies, much like any other organisation, aim to find a balance between addressing current operational issues whilst modernising its systems for future sustainability.

The different enforcement strategies presented in section 4.3.1 are best implemented by the tax compliance risk management process proposed by the OECD (2008:8) as illustrated in Figure 4-7. This process prescribes the SMT's institutional properties that are associated with the management of tax compliance, as well as the INODS' information needs that drives organisational decision-making. The institutional properties of revenue collection agencies are prescribed through the compliance risk management process consisting of six steps. These steps are as follows: identify risks; assess and prioritise risk; analyse compliance risks and behaviour; determine treatment strategies followed by the planning and implementation of these strategies. The compliance risk management process explores various 'tax compliance pillars' as discussed in section 3.8. These pillars are critical from a DSS perspective as they form the basis of all information needs defined by the institution in support of the

management of tax compliance risk. Each pillar contains various 'compliance indicators' which essentially describes the tax compliance of each taxpayer. These indicators are aggregated in various forms to subsequently provide the different tax compliance levels to appropriate decision-makers.
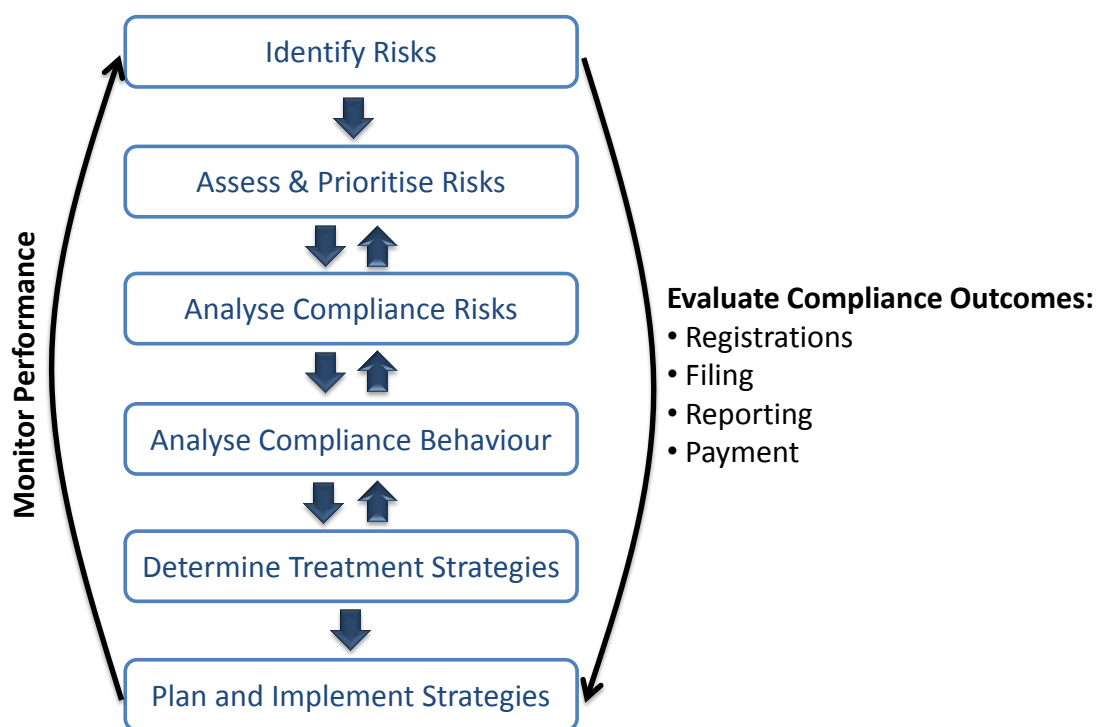
Figure 4-7: The Compliance Risk Management Process (OECD, 2008:8)

The institutional conditions for interacting with technology is therefore well defined considering the preceding sections, namely the different types of enforcement strategies; the different management levels of tax compliance in support of these strategies; the process involved in managing tax compliance and lastly, the compliance pillars measuring the levels of tax compliance. These aspects essentially define the institution's information needs. This section elaborated on the manner in which an institution creates the conditions that determine how human agents operate with technology and in particular DSS. The next section presents the manner in which technology influences the institutional properties of an organisation and consequently also the impact that technology ultimately has on human agents.

4.4 Institutional Consequences of Interaction with Technology (SMT's Influence D and INOD's Activity 4)

The Theory of Structuration by Giddens was first mentioned in section 1.6 when it was explained that the world consists of many different social structures connected through multiple relationships that allow them to influence one another. SMT has been selected to explore the influence of technology in an institution. Using similar principles, INOD determines the manner in which technology enables decision-making in the organisational structure. SMT and INOD both highlight the fact that technology and specifically DSS do not function in isolation. Both models illustrate the influential nature of technology over an organisation's institutional properties and human agents.

It is not within the scope of this research to comprehensively discuss the Theory of Structuration, but rather to provide an overview that will serve as reference to the rest of the study. Hossain et al. (2011:579) provides such an overview by describing structuration as a social process in which human agents and institutional properties interact. These interactions are determined through the meaning that human agents attach to it, the power or lack thereof associated with it and also the moral framework in which the human agent operates. Technology is introduced is a product of human agents with the objective of enabling them to efficiently function according to the defined institutional properties. In return, the presence and utilisation of technology influence the institution itself, as well the manner in which human agents function in the institution. The presence of technology therefore acts as a force of change for both the institution and human agents. This change is often more significant than the original intent and in doing so, technology evolves to become a force in its own right. This concept is defined by Giddens (1984) as the 'Duality of Structure' and has since been used by many studies such as Hossain et al. (2011) and Josef (2006). The SMT's institutional consequences of interaction with technology lead to the establishment of various informal structures in an organisation, namely signification, domination and legitimation. Each of these structures is enabled through different modalities that enable them to influence one another through different forms of interactions. These influences over one another are recursive by nature, as illustrated in Figure 4-8. Hossain et al. (2011:577) also emphasise the recursive nature of the structuration

theory stating that it is a result of human involvement. Josef (2006:323) explains this recursive relationship as a necessity required to ensure the security and trust between the different structures. This eventually leads to the 'institutionalisation' of the structures. It is this institutionalisation that allows the structures to become a force of their own, which in return introduces unintentional influences over the institution and human agents. Orlikowski (2000:406) elaborates on Gidden's 'Duality of Structure' with specific reference to taxes. He states that human agents recursively create interpretive schemes through the usage of the facilities available to them and that these are according to the norms in which they function. Differently stated, tax practitioners derive different meaning and value from organisational facilities -such as IT - and that this meaning and value is determined by the past social experiences. They act on these meanings and values to reaffirm the social structures they regard as relevant to them. Although this concept is further explored in section 5.4, the acknowledgement thereof is important. This is because the influence that technology has over human agents is greatly influenced by the structures of signification; domination and legitimation.
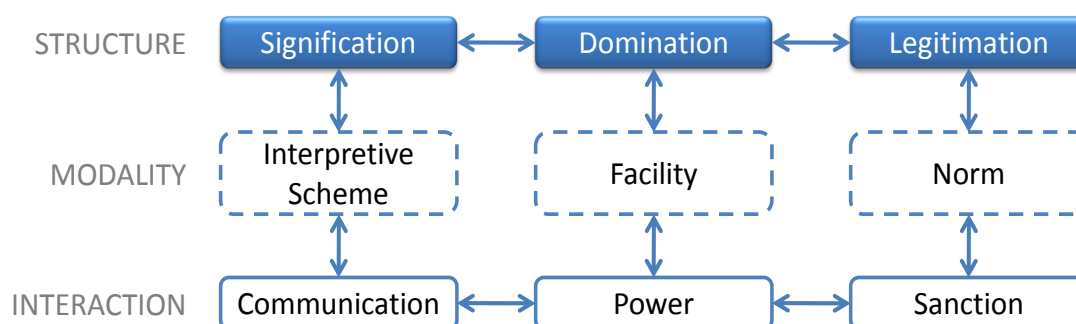
Figure 4-8: Dimensions of the Duality of Structure (Giddens, 1984:29)

The OECD (2004:21, 22) recommends a tax compliance risk identification model (refer to Figure 4-9) that summarises the institutional consequences of interaction with technology. It references the three components of SMT, namely the decision-maker as human agent, the management levels as institution and technology and decision enabler. These references not only explain how technology is used to influence and serve the properties of the institution, but also to determine additional institutional properties based on the theory of structuration. This equilibrium between the institution and technology is aligned with INOD's activity 4 where information is offered by technology and needed for organisational decision-making.

Risk Identification and Analyses Management Levels		
Operational	**Tactical**	**Strategic**
• Individual social/psychological behaviour profile including client relationship Management information • Intelligence gathering tools – local knowledge • Rated using future probability of noncompliance	• Behaviour based Industry social/psychological profiles • Business intelligence - categorisation and synthesis • Monitoring risk populations • Feedback from audit programs • Knowledge based risk rules • Moderator/Analyst Capability	• Compliance context - strategic intelligence from environmental scans and scenarios • Senior executive consideration • Risk impacts measured using – reputation, costs of compliance and revenue
• Integrated databases – centralised case selection • Taxpayer profiles of tax obligations • Success criteria – e.g. previous audit results, risk indicators/ratios etc • Public information • Rated using weighted attributes	• Whole of tax population profile including views by segment • Tax issue profiles • Third party information used • Technology tools enabling data matching • Resources allocated by risk • Trend analysis • Confidence ranges/ reliability indicators attached to risk ratings	• Macro economic information, economic time series • Effective average tax rates • Multiple taxes profile • Corporate risk culture
• Single case by case selection using tax return data • Processing checks (e.g. high risk refunds) • Paper-based selection	• Industry tax profile • Technology tools enabling case selection based on tax data (e.g. data warehouse) • Comprehensive risk coverage (incl. register, file, report & pay) • Deviation/s from population norms	• Data Mining • Automated exception cases • Macro level statistical analysis • Neural networks

Decision-making

Knowledge

Information

Data

Technology

Advanced

Inter-mediate

Basic

■ Indirectly IT Enabled   ■ Directly IT Enabled

Figure 4-9: Risk Identification Model (Adapted from OECD, 2004:21, 22)

The tax compliance risk identification model is in the form of a matrix and prescribes the manner in which revenue collection agencies should align their management levels, decision-making inputs and technology investments as first introduced in section 4.3. It is important to understand the relationship between these topics as they influence the institutional consequences of interaction with technology as depicted in each of the matrix's blocks. The tax compliance risk identification model references the tax compliance management levels (introduced in Figure 4-6) and lists enforcement strategy instances of the tax compliance pyramid (originally introduced in Figure 4-4). As previously explained, these management levels are operational; tactical and strategic and each of the matrix blocks contains practical examples of the different enforcement strategies. Linked to this matrix are two dimensions: the different decision-making inputs and the type of technology investment. Data, information and knowledge make up the different decision-making inputs. Section 5.3.2 discusses the instances and relationships between data; information and knowledge in much greater detail by referencing the Data, Information, Knowledge and Wisdom hierarchy. At this stage it is sufficient to have a brief understanding of each. Data is the representation of objects using symbols in whatever format or differently stated, data is information in a raw and unprocessed format. Information is data to which meaning has been attached, whereas knowledge is derived from information over time and essentially considered as the expertise of individuals. The second dimension associated with the matrix is the type of technology investment, specifically in the form of DSS. These investments range from basic, intermediate and advanced. The enforcement strategy instances depicted in the matrix is classified as not being IT enabled (in black) and being IT enabled (in red). Each of the points marked in red are practical instances of institutional consequences of interaction with technology. These consequences are categorised by different management levels and levels of technological sophistication.

4.4.1 Structures of Signification

Structures of signification refer to that which informs, defines and gives meaning to any type of interaction in the organisation. Hossain et al. (2011:580) explain structures of signification to be the 'strategic, relational and technological contexts' in

which IT systems are 'interpreted and used'. This study limits these interactions to that of technology.

From a technology perspective, structures of signification suggest that IT creates and controls the manner in which communication, action and decisions are performed by human agents in an institution. These structures are often embedded in IT itself by means of simulating intelligent human cognition; business processes guided by IT systems; as well as the presentation of business reports to enable decision-making, to name but a few examples. One specific example is presented by Spies (2010:404) in which the ontology of business reporting using specific IT standards are discussed. In particular, the eXtensible business reporting language (XBRL) has emerged as the de facto IT standard for business reporting. The standard consists of predefined data taxonomies that define the manner in which business reporting is exchanged. XBRL therefore acts as a structure of signification with regards to the manner in which DSS enable decision-making. A more general example is listed by Park (2006: 51), who suggests that IT in the form of DSS expands the 'bounded reality' of organisational decision-makers by reducing their uncertainty. IT becomes a structure of signification in the sense that decision-makers first consult with DSS to become 'aware' of certain realities prior to the actual decision-making function. The 'realities' portrayed in these DSS are of course also a questionable structure itself. This is because a DSS only presents the information deemed relevant by the DSS designer. What these designers regard as relevant can be quite different to that of the decision-maker. A simple example is the design of DSS as determined by the DSS designer. A design that makes perfect sense to the DSS designer can be flawed to the actual decision-maker. IT as a structure of signification can therefore also result in poorer decision-making. A study illustrating this is that of Jaing & Klein (2000:469). They show that end users are extremely sensitive to the dialogue design of DSS and that the impact of these designs can influence the decision-making quality positively or negatively. Power (2002:34) also confirms the poor design of DSS as a reason for business managers not to use DSS to their full potential. DSS designs are not the only factor influencing the manner in which organisations conduct decision-making. This is why Lee et al. (2008:350) place more emphasis on DSS functionality than any another factor

influencing organisational decision-making. Their study illustrates that restrictive and ambiguous DSS functionality ultimately results in a decrease of decision-making quality. A different example of IT as a structure of signification is presented by Jankowski & Nyerges (2001:52). They focus on the electronic interaction between human agents in an organisation and illustrate that the composition of social structures in an organisation is greatly influenced by communications-driven DSS (the authors specifically refer to a communications-driven DSS integrated with a data-driven DSS in the form of GIS, which is comprehensively explained in Chapter 6). Differently stated, technology has the ability to informally redefine the official reporting structures of an organisation by means of enabling human agents to communicate and collaborate through technology. These informal organisational structures are often more influential than the official organisational structures.

The examples listed in this section support the perspective of O'Donnell & David (2000:180), namely that IT has the ability to become a vehicle for driving what is perceived as reality by the decision-maker, regardless to what degree this perception is an actual representation of reality. These perceptions are influenced by many factors but perhaps most importantly the past experiences of the decision-maker. In doing so, IT becomes a structure of signification that is not only influenced by human agents but also influences the behaviour of human agents.

4.4.2 Structures of Domination

Structures of domination constitute to any resource that is used to achieve a certain business objective and/or through which power is exercised in order for it to become authoritative over human actions (Orlikowski, 1992:405). Structures of domination can be either allocative by nature, which focuses on the usage of objects and materials, or authoritative by nature, which focuses on the domination of human agents. The usage of organisational IT resources such as DSS reaffirms its role as an allocative structure of domination. Differently stated, this means that human agents control the resource to achieve a desired result, such as decision-making. Chapter 6 is dedicated to discussing examples of DSS in the form of allocative structures of domination. The alternative to this is its reverse, when the IT resource dictates the

manner in which the human agent operates. This is referred to as an authoritative structure of domination. Structures of authoritative domination are instances when technology acts as the external dominator that influences human agents and consequently human behaviour, including decision-making. An example of where technology acts as an authoritative influence is mentioned by Abdelaziz et al. (2004:465). The authors conclude that technology can change the social dynamics of decision-making which would otherwise not have been the case. An organisational resource remains an authoritative structure until change is introduced, at which time their authoritative position becomes undermined and challenged. The authoritative structures become absolute if its undermining is not challenged, and consequently leads to the establishment of new structures of domination. Authoritative structures are often explicit although many instances exist where this influence is subtle. An example of an implicit structure of domination is when IT unintentionally stimulates a decision-maker's cognition based on the manner in which it has been designed (O'Donnel & David, 2000:189). An explicit example is when an IT system alerts an organisational decision-maker of a particular problem, which forces the human agent to act in one of a few predefined manners, whether it is intentional or unintentional.

Perhaps the most obvious structure of domination is a concept labelled technocracy. Technocracy is a term referenced by various academics such as Haque (2001:260) that refers to a 'system of governance' in which knowledgeable experts become influential figures in a social structure based on the manner in which IT enables them to become knowledgeable. Furthermore, the knowledge of these decision-makers is often influenced by organisational politics (Walsham, 2001:603). Decision-makers are aware of their 'importance' in the organisation and consequently also the influence they have on other decision-makers and organisational matters. For this reason individuals may choose when and to what degree they participate in organisational decision-making. The simplest example is when an individual is reluctant to share views contradicting his/her manager or when an executive decision-maker overrides his subordinates by explicitly selecting a less favourable decision alternative that will promote his agenda. A similar perspective is presented by Hossain et al. (2011:580), who list IT competence and IT sophistication as critical examples of structures of

domination. A lack thereof will result in these human agents to be disadvantaged from an institutional perspective. This is in contrast to their peers who embrace technology, ultimately resulting in increased productivity amongst many things. Power (2002:34) also recognises IT literacy, with specific reference to DSS, as a factor influencing the acceptance of DSS. A failure to adopt DSS technology and the associated skills can ultimately lead to the rejection of any other decision-making mechanisms and their results, regardless of how accurate these results may be. This is also referred to as a 'decision aids impediment', which is explained by Power (2002:49) as the situation when IT becomes a dominator of human decision-making. Although mostly positive, decision aids impediments can at times be counterproductive and actually hinder good decision-making as it does not accommodate human intuition. Rose (2002:148) expresses a similar point but specifically from a tax perspective. The author explains that taxpayers are guided by tax submissions channels and, in doing so, are inadvertently using a DSS. The DSS significantly improves the quality of tax declarations and consequently also have an indirect influence over the compliance of a taxpayer. This conclusion suggests that a taxpayer's competence in IT influences his/her tax compliance levels, whereas a taxpayer's incompetence in IT might result in unintentional noncompliance. From this perspective IT therefore becomes an indirect structure of domination influencing taxpayer compliance. More examples of DSS acting as a structure of domination is mentioned by Ramaurthy et al. (2008:817), with specific reference to data warehousing as a data-driven DSS (further discussed in Chapter 6). The intent of data warehousing is, amongst others, to integrate multiple data sources across different business divisions with the goal of creating an all-inclusive perspective of the organisation. In doing so, technology influence organisational boundaries and political agendas and can subsequently shift data ownership, alter the manner in which decision-makers execute decision-making, modify flawed business processes through comprehensive reporting and data analyses and often even trigger large organisational change. A final example illustrating the dominant effect of DSS is presented by Liu & Lin (2003:815) with specific reference to the generation of INOD's information needs. Using text mining (further discussed in sections 6.8 and 8.3.6), technology can influence and potentially dictate the information needs of institutions. This dictation of technology is welcomed in certain

cases, especially when human agents experience an information overload. In other cases this domination over human agents is regarded as being intrusive and even restrictive.

This section provided an overview together with examples of how technology acts as a structure of domination in an institutional setting. The final institutional consequence of interaction with technology is that of legitimation, as discussed in the next section.

4.4.3 Structures of Legitimation

Structures of legitimation are at times also referred to as normative sanction. Normative sanction is best described as the norms that govern the actions of human agents. Norms are fundamentally influenced by the knowledge of human agents, explicit or implicit, and set the content and conditions in which they operate. From an organisational perspective, the structures of legitimation constitute the social practices typical to the organisation. These practices are often a result of historical traditions engrained in the organisation over long periods of time. Practices like these often remain unquestioned by human agents and are accepted simply because 'it is the way it has always been'. Such traditions regard any variation thereof as illegitimate and thereby reaffirm the existing structures of legitimation in the organisation. Technology in particular has created many organisational structures of legitimation. IT influences the 'acceptability' of organisational activities, such as the manner in which the work is completed. The simplest example is perhaps the manner in which employees are forced to schedule meetings in their colleague's calendars in order for them to have formal discussions. The method in which an institution's management structures embrace IT is arguably the most prominent structure of legitimation (Hossain et al., 2011:580). This argument holds especially true given the influential nature that managers have on the rest of the organisation. This is because their IT structures of legitimation will cascade to their employees and in most cases be accepted without objection.

The organisational IT structures of legitimation are very much present in the form of DSS. DSS act as the determinant of how organisational decision-managers conduct their activities. Managers are increasingly moving away from intuitive decision-making towards embracing fact-based decision-making (Power, 2002:34), as enabled by DSS. This is especially true for Leibniz, Locke and Kant decision-making (see Table 4-1). Fuglseth & Gronhaug (2003: 503) support this perspective by stating that DSS instil 'rational' decision-making and, in doing so, 'prescribes legitimate' variables influencing the decisions to be made. The consistency and alignment of these variables are perhaps one of the reasons why organisations have attempted to centralise organisation decision-making. However, this perspective has been reconsidered in the recent past: An interesting concept is presented by Massa & Testa (2005:710) in which they question the forced centralisation of DSS, information flow and decision-making. Although often considered best practice, they criticise this approach as an authoritative structure of legitimation that acts as the sole legitimiser of information dispersal in an organisation. An alternative approach is what they label as 'information democracy'. Information democracy is promoting the decentralisation of information and supporting decision-making enablers. Bolloju et al. (2002:163) agree with the concept of decentralised decision-making by explaining that DSS would then offer employees the ability to execute strategically aligned decision-making at different levels in the organisation. DSS therefore becomes a structure of legitimation when it assures aligned decision-making across the organisation. A warning is however given by Ramaurthy et al. (2008:817) with regard to the decentralisation of DSS: The decentralisation of organisational decision-making will in all likelihood challenge existing data ownerships in the organisation as well as the decisions concluded from this ownership and in doing so will impact political structures of legitimation. The dynamics around this once again instil the structures of signification regarding the data ownership and this ownership will only change if the signification of the previous ownership has become obsolete. Although the researcher agrees with the decentralisation of decision-making, he disagrees with the decentralisation of DSS. The researcher shares the concerns raised by Ramaurthy et al. (2008:817) with regard to the last mentioned, as is also evident in the empirical study findings presented in section 7.4.1.

These are but a few examples of the manner in which IT and in particular DSS, act as a force dominating the cognitive process of decision-makers in an organisational setting and thereby acting as a structure of legitimation.

4.5 Constructing the Conceptual DSS Framework

Section 3.9 commenced the development of the conceptual DSS framework aimed at addressing the tax gap. At that stage the framework only included the aspects contributing towards the research problem. This chapter continues the construction of the framework by also including the institutional aspects dictating the information needs required to minimise the tax gap. The enhanced conceptual framework derived in this chapter is again referenced in Appendix C where the development of the framework development is summarised.
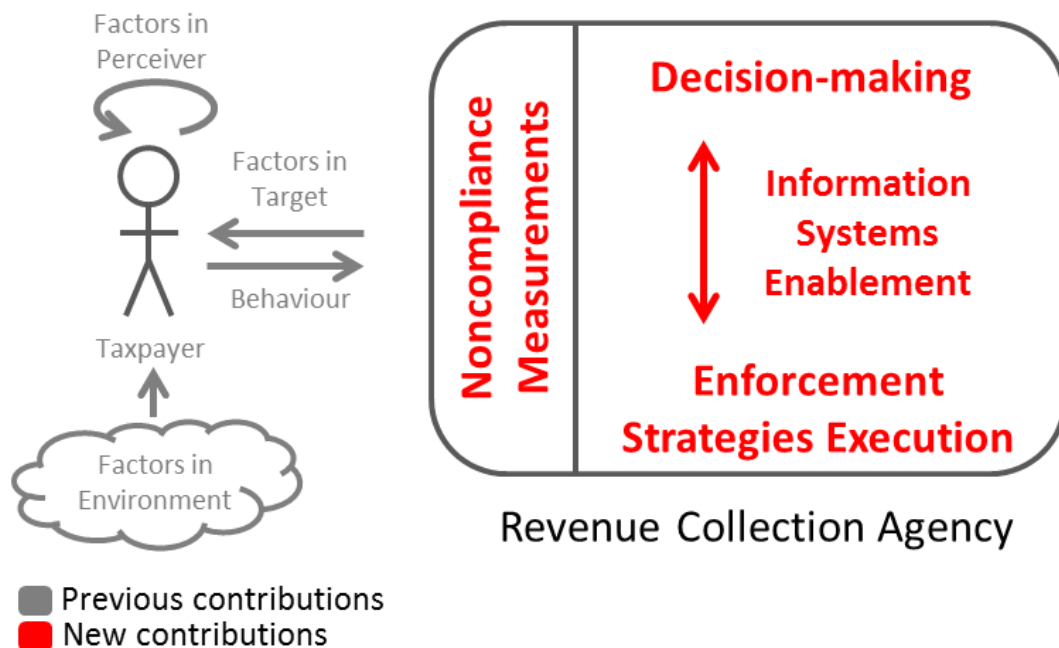
Figure 4-10: Framework Construction – Incorporating Institutional Properties

The previous chapter commenced the building of the conceptual DSS framework by defining three role players making up the framework, namely the taxpayer, the taxpayer's operating environment and the revenue collection agency. This chapter also builds on the framework by defining the noncompliance measurements that

evaluate the tax compliance behaviour of taxpayers. The measurements are defined as the four tax compliance pillars – namely registration, filing, declaration and payment – that are managed according to the tax compliance management process shown in Figure 4-7. These measurements are evaluated against different enforcement strategies, as comprehensively elaborated on in section 4.3.1. The organisational decision-making consists of operational, tactical and strategic decision-making which were discussed in section 4.3.2, as well as a high level overview of the manner in which DSS supports these types of decision-making. Section 4.4 introduced IS in the form of DSS, which enables the execution of the different enforcement strategies by means of effective decision-making. The following chapter explores the role that human agents play in organisational decision-making and elaborates on the manner in which DSS facilitates this process.

4.6 Conclusion

It was previously stated that this study references SMT and INOD as the theoretical bases of the single case study. In doing so, this chapter discussed the first of the three SMT components, namely institution properties and the information needs that arise from these institutions as prescribed by INOD. The institution referenced in this study is that of a revenue collection agency, more particularly, SARS. The institutional properties are specifically researched from an IT perspective by means of identifying how their information needs are generally addressed using DSS. This is done by considering two influences: the institutional conditions of interaction with technology and the institutional consequences of interaction with technology.

The institutional conditions of interaction with technology influence responds to this chapter's research question by elaborating on the manner in which technology facilitates the institutional objectives of narrowing the tax gap. This discussion builds on the conclusions derived in Chapter 3 by explaining how the different enforcement strategies aim to address tax noncompliance. Specific reference is made to the operational process of managing tax compliance. More importantly, the chapter highlights how IT in the form of DSS can satisfy the institutional information needs required to facilitate the respective decision-making processes. The second SMT

influence, namely the institutional consequences when interacting with technology, is also explored in this chapter by illustrating the institutional impact of technology. The chapter shows how technology emerges to have meaning and value; how it dominates institutional properties and human behaviour; and how technology eventually dictates the legality of human actions.

The conceptual DSS framework continued to be enhanced in this chapter with specific focus placed on the revenue collection agency. The framework starts off by including the manner in which taxpayer noncompliance is measured. Based on these measurements, different enforcement strategies are defined and managed through various forms of decision-making. It is the purpose of various DSS instances to enable and facilitate this decision-making proses.

The succeeding chapter develops on the conclusions derived in this chapter. The chapter focuses on the second component of SMT, namely that of human agents and the information demands they have to support of their objective of minimising the tax gap. In doing so, the chapter also identifies the technological artefacts created by these human agents. These artefacts subsequently elaborate on the different DSS making up the IS enablement component of the conceptual DSS framework.

CHAPTER 5: IT AND THE TAX PRACTITIONER
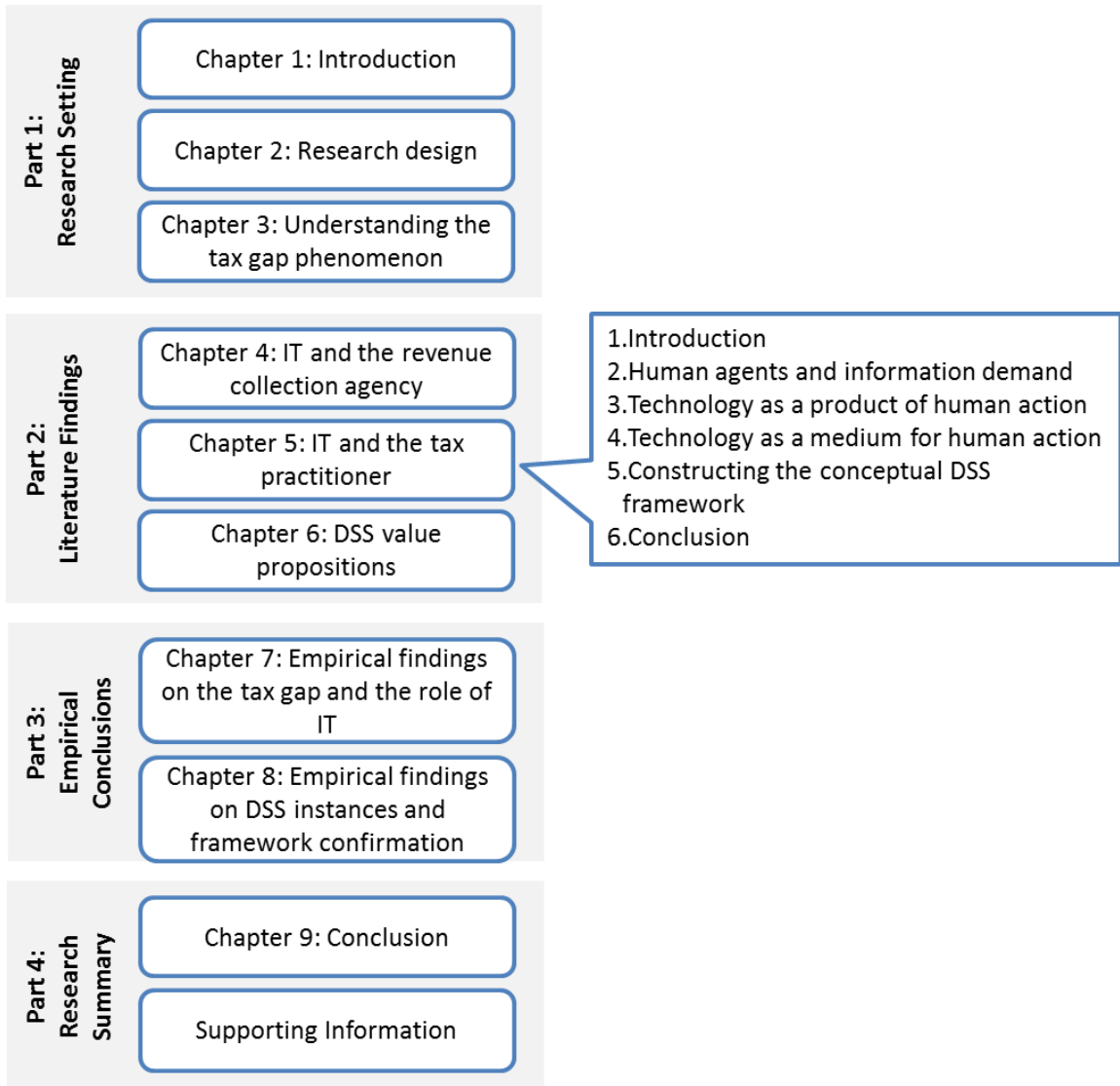
Figure 5-1: Chapter 5 Roadmap

5.1 Introduction

The previous chapter explored how institutional properties, the first of three SMT components forming the basis of this study, references technology to facilitate the narrowing of the tax gap phenomenon. This chapter continues by focusing on the second component of SMT, namely human agents, and the manner in which tax practitioners use technology to manage the tax gap phenomenon. Specific reference is made to the technology structures required to support the information demand of these human agents. This chapter aims to address the following research question:

"How does IT support tax practitioners to reduce the tax gap?"

The relationship between human agents and technology is recursive, meaning that technology is both a product of human action and also a medium for human action. Each of these influences is separately explored in an attempt to address the research question applicable to this chapter.

5.2 Human Agents and Information Demand

Chapter 5 continues the discussion on the SMT model originally introduced in Chapter 1 of which the first component, namely institutional properties are presented in Chapter 4. Focus is now placed on the next component of SMT namely human agents, with specific emphasis placed on the relationship between human agents and technology from an organisational context. In particular, the manner in which technology is a product of human action as well as how technology serves as a medium of human action are topics explored in this chapter. The relationship between human agents and technology is not one-directional. Human agents influence the creation of technology after which this technology becomes a medium that not only facilitates their organisational objectives, but at times also constrains their actions to do so. In doing so, these human agents instil a sense of demand with regard to what technology should offer. This chapter therefore also discusses the information demand activity of INOD. The demand of human agents is very much related to the manner in which technology is prescribed to them through their institutional setting. However, way in which humans experience technology is based on their past interactions. This

chapter discusses the different facets related to SMT's human agent component as well as INOD's information demand activity.

5.2.1 Human Agents

Orlikowski (1992:410) describes the human agent component of the SMT as technology designers, system users, and organisational decision-makers. Figure 5-2 illustrates the relationship that human agents have with institutional properties and technology, grouped into three influences labelled A, B and C. Influence C describes the institutional conditions of interaction with technology and was concluded in section 4.3. This chapter is dedicated to exploring the relationship between technology and human agents and the subsequent influences of technology as being both a product and influencer of human action.
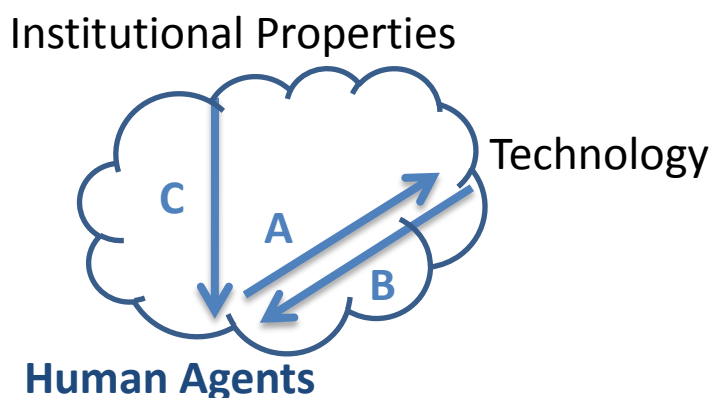
Figure 5-2: The Structuration Model of Technology (Adapted from Orlikowski, 1992:410)

Influence A indicates that technology is a product of human action from the perspectives of design, development, appropriation and modification. Technology only comes into existence through innovative creation and continuous maintenance through human action. This creation is based on a certain human need that technology can address. The technology of particular interest in this study is that of DSS. Although this chapter elaborates on the theoretical aspects associated with this, the empirical study illustrates actual examples of these products. The fact that technology is valued by humans does introduce technology's counter influence over humans. SMT prescribes technology to be valued by humans through interpretive schemes,

facilities and norms. Influence B describes technology to be a medium of human action and an enabler of decision-making. Such facilitation not only increases but also limits the performance of human agents and therefore has both positive and negative effects. Technology's influence is greater than merely that of an individual human agent. Technology can influence social practices but cannot determine them. This is because human agents remain the decider of how technology influences social practices. However, the mere existence of technology does not constitute any value or meaning. Technology has to be deployed into an institutional context for it to be meaningful; utilised and consequently valued by human agents. The usage of technology enables human agents to derive and share its meaning. Human agents control technology through this meaning and in return technology controls human agents.

Even though the discussions on DSS are generally technical by nature, the importance of human agents in the decision-making process should not be overlooked. After all, the successful utilisation of a DSS is determined by human emotions as well as any cognitive influences (Djamasbi, 2007:1707) experienced by the humans. Within the context of this research, human agents act as organisational decision-makers driven by various information demands.

5.2.2 Information Demand

Chapter 4 elaborated on the first activity of INOD namely the information needs of an institution. Chapter 5 now places emphasis on human agents as organisational decision-makers and consequently the information demands they have. These information demands are behaviour-dominated and determined by the institutional needs of the organisation. The information demands are addressed by information offerings through technological artefacts. These artefacts are typically designed to cater for the highest degree of participation by users (i.e. presenting the most content available), many of which are ignored by users with a lower degree of participation (Shih et al., 2012:525). INOD's activity 6 was concluded in Chapter 4 and was explained as the situation where information is needed by the institution and demanded by human agents but for which there is no such offering. Activity 5 is a

slight variation thereof in the sense that information is still in demand by human agents and is now offered by technology, but is not needed by the institution. Such a scenario typically occurs when an individual has identified a specific business opportunity using the technology available, but which has not yet become a regular need of the institution. Activity 3 sketches the scenario of information being demanded by human agents but for which the institution does not have a business need and is consequently also not an offering by technology. This scenario can either mean an individual's personal pursuit of matters is not prioritised by the institution or it could be valuable matters not yet recognised by the institution.
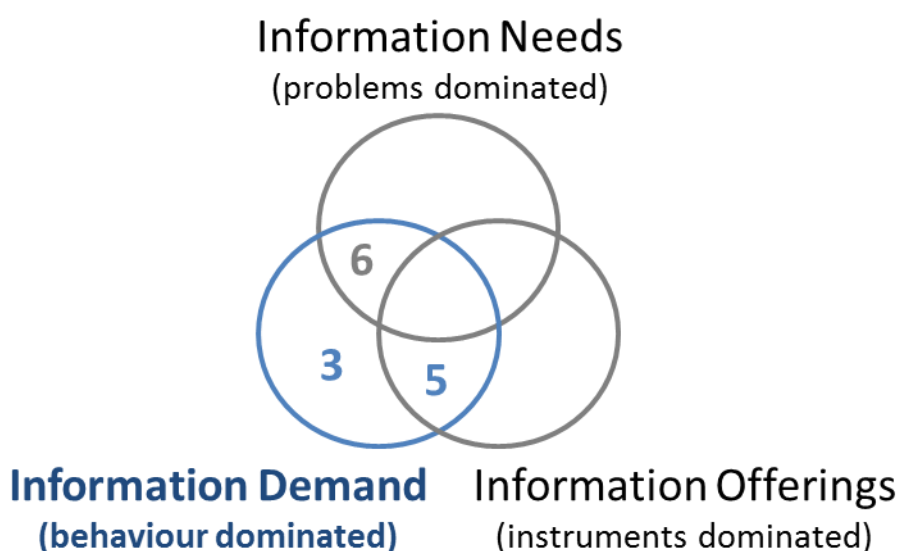
Figure 5-3: Relationship Between Information Offer, Demand and Needs (Adapted from Osmanagic-Bedenik & Varga, 2006:141)

A study discussing the behavioural information needs of individuals in specifically African developing countries is presented by Dutta (2009:44). The author introduces a concept labelled 'information divide' which explains the distinction between human agents whose decisions are highly information driven as opposed to those that are less information driven. The finding of their study indicates that this information divide between human agents is more associated with the level of education than it is with economic status and geographic location. It therefore comes as no surprise that decision-makers will have less information demands if they have not been exposed to certain information needs through an education. This finding is aligned with section

4.2.2 that advocates an institutional information needs framework to guide organisational decision-makers. Such a framework will prescribe the information demands of human agents based on industry best practice and, in doing so, place less reliance on the decision-makers' education as determining their information demands.

It is generally agreed that the cognitive process of fact driven decision-making starts with data collection and the evaluation of information by the human agent (Ahituv & Neumann, 1986:25). Decision-making in an organisational context is very similar in the sense that it is fundamentally dependent on data that is presented as information to which certain knowledge is applied in order to resolve a particular business problem (Sun & Liu, 2001:248). The next section discusses this relationship between data, information and knowledge from the perspective that technology is a product of human action aimed at facilitating organisational decision-making.

5.3 Technology as a Product of Human Action (SMT's Influence A and INOD's Activity 5)

The manner in which technology becomes a product of human action can be discussed from many different perspectives. SMT's description of how technology is an outcome of human action is mainly from an IS perspective. In particular, SMT focuses on the design, development, appropriation and modification of information systems such as DSS. This section commences the discussion by exploring what types of DSS can originate from human action. Further focus is then placed on the Data, Information, Knowledge and Wisdom (DIKW) hierarchy and the manner in which it supports decision-making through DSS. The section concludes by discussing the managerial activities associated with humans to successfully manage the different DIKW layers as to ensure the sustainability of DSS.

5.3.1 Decision Support Systems

The purpose of technology in a general institution setting is prevalent to such a degree that most institutions are not sustainable without it. Technology can, amongst others, facilitate decision-making by presenting human agents with information that is relevant to specific organisational problems. Technology implementations that

perform these functions are referred to as DSS and are specifically designed to facilitate and improve decision-making in organisations (Ahituv & Neumann, 1986:165; Sun & Liu, 2001:247; Bolloju et al., 2002:163). However, the term DSS is not the only reference to such technology artefacts. Academics have defined and termed many other concepts aimed at performing similar functions, such as management information systems, expert systems, executive information systems, knowledge systems, enterprise decision support systems, intelligent systems, management support systems, to name but a few. Critique can be expressed on the various overlaps, inconsistencies and contradictions that are apparent when considering these terminologies and their scope, as is also evident from the publications by Rowley (2007:163) and Power (2002:13-16).

A DSS is a technological implementation created by humans that is used in conjunction with the cognitive actions of human agents with the aim of resolving a particular organisational problem that is present in an institutional setting. Such business problems include structured, semi- and ill-structured problems (Nemati et al., 2002:144). DSS facilitate decision-making by converting data into actionable information (Millet & Gogan, 2006: 440), which ultimately contributes towards the knowledge of the decision-maker (more on the relationship between data, information and knowledge is presented in the subsequent section). DSS traditionally did this by utilising data that is stored in a database and processed in a modelling layer, to eventually be displayed through a decision-making interface (Shim et al., 2002:111). This somewhat dated state of DSS has since matured into a much more sophisticated state, as further elaborated on in section 6.3.3. From a revenue collection agency perspective, it is widely accepted that managing compliance risk is an impossible task without technology (OECD, 2008:15, 22) – a concept comprehensively discussed in section 4.3.2. Despite this, publications related to DSS in the context of revenue collection agencies – and especially related to compliance risk management – are limited in the literature. This once again touches on the importance of this single case study aimed at addressing this limitation. Prior to further discussions on the topic, the research scope of DSS must be defined. One of the most popular DSS taxonomies of recent times is that of Power (2002:13 - 16). The taxonomy is now briefly discussed

and further elaborated on by the literature in sections 6.4 to 6.8 and the empirical study in section 8.3:

- Data-driven DSS use sophisticated databases to manipulate large volumes of data. The data manipulation is typically executed by means of queries against an on-line analytical processing (OLAP) database specifically designed to enable efficient decision-making. Data-driven DSS also includes business intelligence (BI) reporting and geographical information systems (GIS).

- Model-driven DSS apply advanced algorithms and parameters to data with the objective of analysing a particular situation. These algorithms can simulate situations, predict behaviour, forecast values or even suggest optimisations.

- Knowledge-driven DSS have the ability to act intelligently by making interpretations or even recommendations based on known expertise captured in the system. In some cases knowledge-driven DSS are also referred to as expert systems, artificial intelligence systems and data mining solutions.

- Communications-driven DSS enables collaborative interaction between multiple decision-makers. In its simplest form, communication-driven DSS include tools such as groupware, messaging, conferencing software and even discussion forums.

- Document-driven DSS are content storage solutions that host a variety of files such as MS Office documents, images, scanned files, recordings, etc., as well as offering the ability to search, retrieve and manipulate the content.

Power's DSS taxonomy has been preceded by many others in the past. Dating back more than three decades ago, Alter (1980:73 – 93) was one of the first authors to define a DSS taxonomy consisting of seven distinct types. Although somewhat outdated, these types continue to be relevant in modern times and serve as a classic reference today's academia. This is also why subsequent publications, recently also Arnott & Pervan (2005:70), continuously relate Alter's traditional DSS taxonomies to that of modern DSS taxonomies such as Power's (2002:13 - 16), as depicted in Table 5-1.

Power	Alter	Description
Data-oriented	File drawer systems	Any form of access to data items such as SQL queries.
	Data analysis systems	Support the manipulation of data by unique or general operations such as an EDW.
	Analysis information systems	Access to decision-oriented databases and small models such as a product planning analysis.
	Accounting and financial models	Sensitivity analysis exploring the accounting consequences of different actions, such as a product break-even analysis.
Model-oriented	Representation models	Conducting scenario analysis by exploring the impact of actions on casually related variables, such as a market response model.
	Optimisation models	Suggests the optimal configuration based on inputs and desired output, such as resource allocation.
	Suggestion models	Proposing an action through logical processing such as a risk scoring model.

Table 5-1: Alter's DSS Taxonomy Compared to Power's DSS Taxonomy (Arnott & Pervan, 2005:70)

The identification of these different DSS instances is important as they each uniquely enable decision-making. These instances act as technological artefacts that enable different aspects of the decision-making process. The next section elaborates on the manner in which these instances relate to the generation of knowledge and consequently also how these instances support the decision-making process.

5.3.2 DIKW Hierarchy, Decision-Making and DSS

The DIKW hierarchy (see Figure 5-4) illustrates how technology artefacts (such as data and information presented through DSS) offer a value proposition that can result in the creation of knowledge and wisdom of human agents. The DIKW hierarchy originally presented by Ackoff (1983:3) has long been referenced as a perspective on how IT enables decision-making through knowledge and wisdom creation. This is also important to understand when designing DSS. A study by Sun & Liu (2001:248) mentions all but one of the DIKW levels, namely wisdom. This is not surprising

considering that research on DIKW has favoured the lower part of the hierarchy (data, information, knowledge), consequently resulting in the wisdom level having received limited academic focus up to date (Rowley, 2006:1246). More recently, Pan (2010:46) used DIKW as the basis to develop a framework for continuous knowledge discovery. Bird (2008:226) elaborated on DIWK by adding human understanding and content retrieval dimensions to the hierarchy, aspects that DIKW was lacking at that point in time. Batra (2010:57) referenced DIKW to explain the relationship between data, information and knowledge in an attempt to explore new advances related to knowledge management. A study by Courtney (2001:23) also focuses on DIKW and knowledge management when proposing the integration of knowledge management and DSS for enhanced organisational decision-making. Publications such as Rowley (2007:163) have since made significant contributions supplementing the original DIKW publications. These contributions include various elaborations on the model, but more importantly, the relevance of the model has to the different types of information systems. However, DIKW has not been universally accepted and its validity has been criticized by some academics. Bunnell & Boyland (2003:272) are of the opinion that 'new information' cannot be derived from data if it is not already embedded in the data. More recently, Devlin (2013:45) again questions the validity of DIKW in IS research. Specific mention is made of information existing independently of data and knowledge existing independently of information, in addition to data, information and knowledge not being exclusively defined. The author subsequently adjusts the DIWK hierarchy to a model he refers to as the Modern Meaning Model. Fricke (2009:131) states that the relationship between data, information, knowledge and wisdom is not necessary linear or even related to each other. As an example he states that DIKW's position on information offers little value to decision-making as it is nothing more than 'weak knowledge'. He refers to the hierarchy as being 'dated' and having 'unsatisfactory philosophical positions'. Having said this, Fricke does recognise that DIKW has been fundamentally embedded and accepted in the information and knowledge management domain, as is supported by Pan (2010:46). Whilst acknowledging these critiques, the researcher is of the opinion that the DIKW hierarchy is valuable to this research and that past publications have successfully managed to ensure the credibility of the hierarchy.

Ackoff (1983:3)'s DIKW hierarchy uses data as a starting point. Data is a series of symbols that represent properties of real world objects and events, and are derived from observations. The value of data viewed in isolation is limited. Data only starts to derive meaning when it is conceptualised and analysed, resulting in data to be transformed into the next DIKW layer, namely information. Information is data that has been interpreted to represent meaning and value, thus highlighting the functional difference between data and information. Information describes real world objects and events. The human consumption of information leads to the third layer of DIKW, namely knowledge. Knowledge is explained as the 'know-how' and 'know-that' and in essence defines the existence and being of a human agent. Knowledge transforms information into action and/or the control over actions. Lastly, knowledge is accumulated to obtain the highest level of the DIKW hierarchy, namely wisdom. Wisdom evolves from knowledge over extended periods of time and explains the deep mental understanding of matters influencing the world. Whereas knowledge promotes efficiency (doing things right), wisdom promotes effectiveness (doing the right things). Wisdom has received very little discussion by academics, perhaps because of what Fricke (2009:131) describes as the lack of theory supporting the concept of wisdom in general. For this exact reason the remainder of this research makes very limited reference to wisdom.
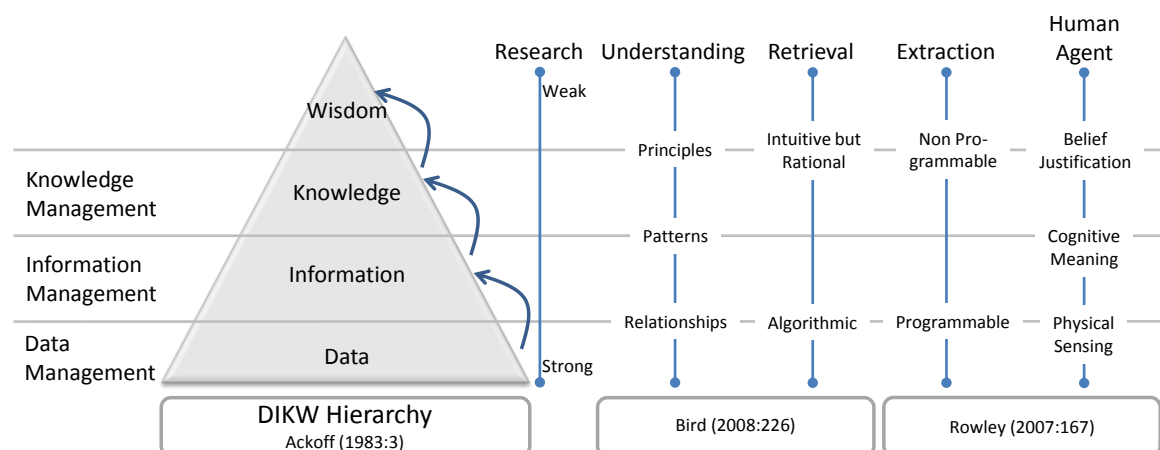
Figure 5-4: DIKW Hierarchy (Adapted from Ackoff, 1989:3; Bird, 2008:226 and Rowley, 2007:167)

The DIKW enhancements proposed by Bird (2008:226) and Rowley (2007:168) are of particular value to this study and worth elaborating on. These enhancements suggest an additional four dimensions supplementing DIKW, namely understanding, retrieval, extraction and human agents. The 'understanding' dimension relates to the manner in which human agents derive meaning from the hierarchy, which in essence explains the transition between the different layers in the hierarchy. The bottom section of the DIKW hierarchy is mainly defined by the relationships between data and/or information. It is the middle section of the hierarchy that offers information and knowledge insights aimed at facilitating basic human understanding. This is supplemented by the top section of hierarchy focusing on knowledge and wisdom that enables a sophisticated level of understanding for advanced decision-making. The 'retrieval' dimension explains how human agents extract meaning from the hierarchy: The bottom of the hierarchy favours algorithmic retrieval whereas the hierarchy's top section is based on intuition and rationality. Algorithmic retrieval refers to the structured approaches used to withdraw data and information from the information systems. This is in contrast to the unstructured awareness exercised by human agents during decision-making. The 'extraction' dimension explains the manner in which each of the hierarchy levels delivers its content and ranges from a programmable ability at the bottom of the hierarchy to a non-programmable ability describing the top of the hierarchy. Programmable extraction typically occurs in an organised, linear and sequential fashion whereas non-programmable extraction is the exact opposite. Lastly, the 'human agent' dimension describes the manner in which humans create cognitive structures from the hierarchy. The hierarchy's bottom section favours the physical sensing typically associated with the collection of data. Human agents use cognition to attach interpretation and meaning to the bottom two layers of the hierarchy, whereas the top of the hierarchy is characterised by the beliefs and justifications of human agents. A summary of DIKW together with the enhancements discussed in this section is presented in Figure 5-4. This overview forms a critical perspective on the different layers associated with DSS, as well as the different dimensions associated with its usage. These conclusions serve as introduction to the different types of DSS, as discussed in Chapter 6.

The DIKW hierarchy has been widely cited in the past literature and especially in the fields of data management, information management and knowledge management (Rowley, 2007:164). Aligning with the DIKW hierarchy, the organisational management of each level is also hierarchical by nature. Data management precedes information management, according to Detlor (2010:104), whereas Kruger & Johnson (2010:57) explicitly state that information management is a fundamental prerequisite and enabler for knowledge management. Further insights by Armistead & Meakins (2002:51) explain that from a cognitive perspective, new knowledge is generated from continuous insights obtained from data and information. The researcher criticises the authors' informal usage of 'new knowledge' as they believe that meaning can only be derived from existing knowledge obtained in the past. Section 5.4.1 further elaborates on this concept. However, Rowley (1998:367) disagrees by stating that the relationship between information and knowledge is not linear, but rather interwoven in a recursive manner. Information creates knowledge which then in return creates information again. The researcher regards this perspective as a technicality that has limited influence over the manner in which DIKW supports decision-making through DSS. However, this perspective is acknowledged and explored in the knowledge generation process presented in section 5.4.2.2.
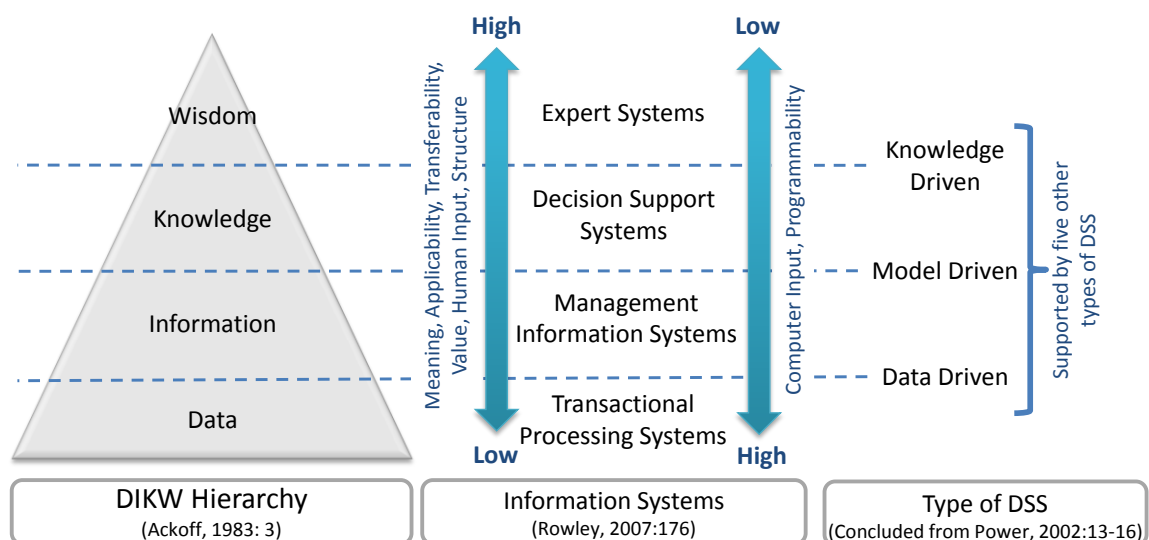
Figure 5-5: The DIKW Hierarchy. Adapted from Ackoff (1983:3), Rowley (2007:176) and Power (2002:13-16)

The preceding DIKW discussions have only made reference to DSS in a general manner. The remainder of this section changes this perspective by making explicit reference to the different types of DSS, as introduced in 5.3.1. Figure 5-5 builds on the conclusions of Figure 5-4. In doing so, it is shown how different IS instances relate to DSS as per Rowley (2007:176) in addition to illustrating how IS relate to the unique instances of DSS prescribed by Power (2002:13-16). At the lowest level of DIKW is data as stored in transactional processing systems. These systems are used to support the operational processing of institutional functions and in doing so, generate data on a continuous basis. It is only when this data is interpreted when it becomes meaningful and subsequently valuable to decision-makers, as described in the information level of DIKW. Management IS describe the technology artefacts that convert data into information in support of general managerial decision-making. The knowledge level of DIKW represents the instances where explicit and implicit insights are applied to information, resulting in a more sophisticated level of decision-making. The final and upper level of DIKW, namely wisdom, is best related to technology artefacts in the form of expert systems.

Whilst acknowledging the perspectives of Rowley (2007:176), the researcher disagrees with the manner in which DSS are positioned to only apply to the knowledge layer of DIKW. Instead, this research follows the proposal by Power (2002:13 - 16), which seems more compatible with DIKW. Section 5.3.1 and particularly Chapter 6 explore the different forms of DSS and in these discussions it becomes evident that DSS also have relevance to the data, information and knowledge layers of DIKW. Data-driven DSS is centred between the data and information DIKW layers because a significant amount of data interpretation is incorporated into the information layer. Model-driven DSS also presents information but has a certain amount of explicit knowledge embedded into the DSS to assist decision-making. For this reason, model-driven DSS are positioned between the information and knowledge DIWK layers. Lastly, knowledge-driven DSS make use of both explicit (knowledge layer) and implicit knowledge (wisdom layer) to not only assist with decision-making, but in many cases also execute decision-making on behalf of human agents. This is

why knowledge-driven DSS are placed between the knowledge and wisdom DIKW layers.

The subsequent sections are dedicated to the discussions of the human actions associated with each of these DIKW layers and consequently the associated DSS. These sections focus on data management, information management and knowledge management.

5.3.3 Data Management

Data is the recorded capturing of observations describing things, events, activities and transactions. Data is without meaning and value as it remains unprocessed, unorganised and consequently also not interpreted (Rowley, 2007:170; Liebowitz & Megbolugbe, 2003:198; Fricke, 2009:131). Data management is the storage and processing of "raw facts" related to events and/or entities typically stored in transactional systems (Detlor, 2010:104). Data management attempts to manage the lifecycle of data, ranging from acquisition to manipulation to eventual discontinuation. In doing so, the objective of data management is to ensure the speedy, accurate and efficient manipulation of data. Data management has evolved from being a technical function dedicated to database management to a much broader management function (Guynes & Vanecek, 1996:202). Koh & Watson (1998:301) list data management as possibly the most important critical success factor to DSS. They point out that 90% of the effort spent on building DSS is related to sourcing and ensuring accurate data. They subsequently recognise inaccurate and disparate data to be the most likely reasons for DSS failures.

Data management forms the first layer of the DIKW hierarchy and is mainly concerned with the managerial activities associated with raw technological artefacts. Data management is especially relevant when discussing data-driven DSS (see section 6.4). Much like data advances to become information, information management also follows data management as the second layer of the DIKW hierarchy.

5.3.4 Information Management

It is generally accepted that information is created when patterns are derived from data through various forms of formatting and processing. The result is the interpretation and understanding of its content (Liebowitz & Megbolugbe, 2003:198) after which meaning, value and purpose are attached to the data (Rowley, 2007:171; Detlor, 2010:105).

However, information management has different meanings in different contexts, partly because its scope has evolved significantly over time (Schlögl, 2005). The traditional proposition of information management is what is today referred to as content management. Content management has subsequently also evolved from the manual process of managing documents to the management of information as an organisational resource. Information management has since become increasingly technology-oriented partly because of its dependency on data management. In doing so, the automated management of information has become important as organisations viewed information as an organisational resource from which strategic value can be derived. Rowley (1998:359) also referenced this perspective more than a decade ago when information management was defined as a technical activity focused on the processing and utilisation of data. The concept of information management has subsequently evolved from a technical function into a broader business-oriented activity. An example is the perspective presented by Detlor (2010:103): 'Information management concerns the control over how information is created, acquired, organized, stored, distributed, and used as a means of promoting, efficient and effective information access, processing and use by people and organizations.'

An influential article by Bergeron (1996:263) explains that information is much like any other asset in an organisation in the sense that it has to be continuously managed to improve productivity, competitiveness and performance in an organisation. The author takes a different and more comprehensive perspective when coining the term information resource management as the 'improved strategy' of information management. Information resource management is described as the all-inclusive collective effort aimed at '… [getting] the right information at the right time in the

right form to the right person', which is ultimately aimed at increasing the quality of organisational decision-making. The management of information has many different strategic value propositions, ranging from cost and risk reduction to additional organisational value and enhanced information systems (Detlor, 2010:104). However, these information management benefits are not without its challenges. It is not within the scope of this research to elaborate on these challenges, but reference is made to Evgeniou & Cartwright (2005:293) who discuss a variety of these challenges.

A different emphasis is placed on information management when Orlikowski (2001:182) makes specific reference to public sector institutions such as revenue collection agencies. The emphasis focuses on the protection of information assets, something that is critical to the state's national security and economic well-being. Quite ironically, the infrastructure supporting these information assets is often controlled by the private sector, suggesting that the protection thereof is a joint responsibility between the public and private sectors. A study by Steventon et al. (2012:162) evaluated the importance of information management in government. The results indicate that more than 85% of senior managers confirmed information management to be critical in materialising their organisation's objectives. Having said this, there is no doubt that information management can be discussed from many different angles and that these perspectives differ significantly between public sector and private sector. Despite these differences, it is generally accepted that the usage of information does enhance the knowledge of human agents which in most cases also improves decision-making. This is typically done through technological artefacts in the form of DSS.

Information management serves as an important activity related to the building and administration of DSS. It is concerned with the sourcing and distribution of multiple sources of data that is represented in a meaningful manner through DSS to decision-makers. With the exception of data-driven DSS in the form of data warehouses and data marts (refer to section 6.4.1), the output of all other DSS instances forms part of information management. For this reason information management forms an integral part of DSS ability to enable organisational decision-making.

The linkage between information and knowledge is not as clear as the linkage between data and information. This is because knowledge is not the product of a technology - unlike data and information - but rather a cognitive function by human agents. The next section elaborates on this differentiation by discussing knowledge management.

5.3.5 Knowledge Management

Organisations have successfully progressed over time to offer technologies that enable fact-based decision-making. Despite this, only a fraction of the information needed for comprehensive decision-making is stored using technology. The rest and arguably most important information are stored as knowledge in the mind of its employers (Nemati et al., 2002:143). Consequently, the management of these intellectual assets has become increasingly important to organisations.

The previous section explained how information management is concerned about getting the right information at the right time in the right form to the right person. However, this does not ensure good decision-making as the ability for the 'right person' to comprehend the 'right information' cannot always be assumed. Power (2002:49; 141) coins the failure of information consumption by human agents as the 'lack of knowledge impediment' and states that knowledge is only valuable when shared amongst decision-makers. The process of knowledge sharing between human agents in an organisational context is referred to by Bhatt & Zaveri (2002:298) as 'organisational learning'. This knowledge creation process is critical as it can be seen as a strategic asset in the organisation which consequently also offers a competitive advantage if embraced in the correct manner (Bolloju et al., 2002:165). Zack (2007: 1664) agrees by stating that the management of knowledge in an organisation's decision-making principles can be considered a strategic capability of the organisation. Perhaps this is why Armistead & Meakins (2002:49) include knowledge as an organisational 'asset'. The suggestion that knowledge management is an organisational asset implies that it should benefit the organisation. However, Chen & Chen (2011:3862) state that academics have yet to illustrate a correlation between

knowledge management practices and an organisation's productivity and profitability. Even more interesting is a 2003 KPMG survey highlighting the inability for organisations to derive value from knowledge management (Raub & Von Wittich, 2004:714). The survey details that 80% of the participants perceived their organisational knowledge as a strategic asset, yet 78% of these respondents acknowledged that their organisations are failing to derive business opportunities from their knowledge base. This predicament is perhaps a result of the inconsistent perceptions that exist on the topic of knowledge management.

Much like data and information, many different perspectives on knowledge exist. The terms 'knowledge' and 'knowledge management' have proven to be 'ambiguous and equivocal terms' (Rowley, 2007:172; Schlögl, 2005). Lai (2007:4072) adds to this statement when explaining that the extensive scope of 'knowledge management' has resulted in the topic being approached from many different perspectives, resulting in many different conceptualisations. Two examples illustrating such an extreme variation are a technology perspective, which focuses on the solutions enabling knowledge management; and a management perspective, which elaborates on the manner in which knowledge is created and disseminated. This inconsistency is supported by Kruger & Johnson (2010:57) who state that knowledge management means 'different things to different companies'. Knowledge is derived over time from information that is extracted from data. Combined with expertise and skills, knowledge becomes an attribute of people which essentially enables the capability to execute certain actions. This study approaches the different aspects of knowledge according to the school of thought summarised by Shin et al. (2001:335), namely that of mind; object; and process. Knowledge management in terms of 'mind' relates to the cognitive human processes associated with the generation of knowledge. Section 5.4.2.2 elaborates on this when discussing the two most popular models describing the knowledge creation process, namely SECI and CYNEFIN. These models also explain the process in which existing knowledge is 'recycled' into new knowledge in order to address new and/or different requirements. Knowledge in the 'object' state is concerned with cognitive presence thereof, which might at first seem contradictory because of the intangible characteristic of knowledge. Instead, knowledge in the form

of objects refers to technological implementations. Section 6.6 focuses on this concept in greater detail by explaining how knowledge forms a critical extension of modern DSS in the form of knowledge-driven DSS. An example is mentioned by Schlögl (2005) namely knowledge repositories and solutions that aim to store knowledge in a searchable form allowing for the retrieval and consumption of its content. These repositories are required for organisations to transform personal knowledge into 'organisational memory'. More on knowledge repositories is presented in section 6.3.3. Ur-Rahman & Harding (2012:4729) estimate this organisational memory to be as much as 80% of an organisation's information. The final knowledge state is that of 'process', which explains the management of knowledge in an organisational context. Walsham (2001:600) criticises the mind, object and process composition of knowledge management defined by Shin et al. (2001:335) and suggests the inclusion of a social perspective when considering knowledge management. The researcher agrees with this critique because it is believed that society allows for a deeper interpretation of matters, which communities can easily share through language and functions, that would otherwise not have been the case. This concept is further explored in section 5.4.2.

The importance of knowledge management in the public sector is raised by Steventon et al. (2012:158). More particularly, Kruger & Johnson (2010:58) explain knowledge management to deeply contextual and largely dependent on a variety of factors that are unique to each organisation. More specifically, they found that knowledge management in the context of South Africa is quite challenging, mostly because of the multicultural attributes defining South Africa. Cultural influences such as language make it challenging to understand, transfer and value knowledge. From an organisational perspective, the managerial style of human agents is yet another important determinant of the manner in which knowledge management is executed. Kruger & Johnson (2010:59) specifically discuss the evolution of knowledge management in South African firms. The strong western political presence in South Africa has introduced a Eurocentric knowledge management style of individualism and self-centredness. The typical African management style is that of Ubuntu – an Afrocentric approach that embraces the inclusiveness and collectiveness of all

community members. Despite this, the Eurocentric management approach cannot be ignored given the requirement for African companies to be globally competitive. The basic principles of Ubuntu are equally important as they are deeply rooted in the African culture. This is why South African firms are increasingly moving towards a 'synergistic inspirational' managerial approach. This approach embraces the African management practices, principles and philosophies whilst executing Western management methods. This is especially true given the diversity in race employment by SARS.
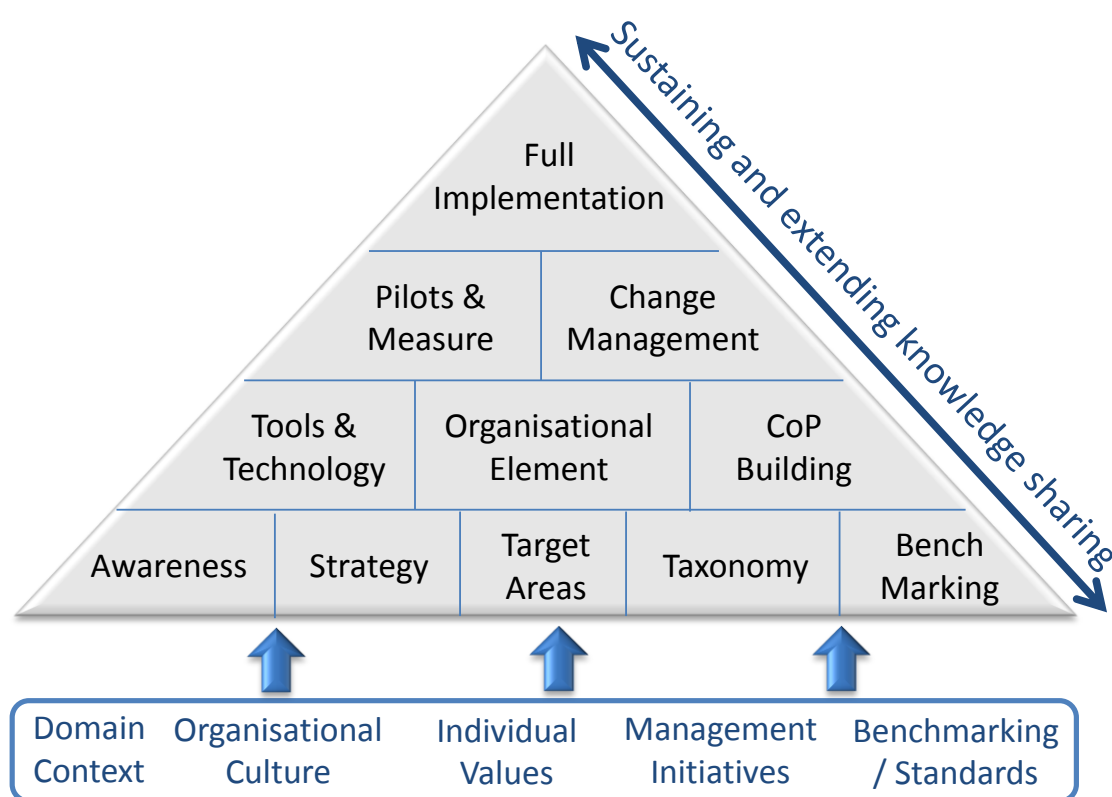
Figure 5-6: Knowledge Management Framework (Liebowitz & Megbolugbe, 2003:190)

It is not within the scope of this research to develop or study knowledge management frameworks. It is, however, fit to present an example of such a framework to serve as reference for the empirical study. One of the better examples is the framework by Liebowitz & Megbolugbe (2003:190) as presented in Figure 5-6. It is also important to acknowledge the general critique on knowledge management frameworks especially given the concerns raised in this section. An example is the critique by Chen & Chen (2011:3862) who are of the opinion that the implementation of these

frameworks lacks both the measurement and evaluation. This section presents the final layer of the DIKW hierarchy, namely knowledge. The section concludes that the creation of organisational knowledge, implementation of knowledge repositories (which is one instance of DSS, see section 6.6) and the management of all facets related to this knowledge are critical enablers of organisational decision-making.

The previous sections explained the managerial consequences when technology becomes a product of human action in an institutional setting. The discussion used DIKW as the foundation describing DSS as the technology product and subsequently presented insights related to the data, information and knowledge layers. The remainder of this chapter explores the opposite of this, namely the impact of technology as a medium for human action.

5.4 Technology as a Medium for Human Action (SMT's Influence B and INOD's Activity 5)

Many different human actions are facilitated by technology. Actions can range from physical actions and objects, to computerised learning and perhaps most importantly, the facilitation of organisational processes. The human action explored in the study is that of decision-making. The human decision-making process is elegantly described by Karahanna et al. (1999:185) who state that "[the] decision process leading to institutionalisation of usage may be conceptualised as a temporal sequence of steps through which an individual passes from initial knowledge of an innovation, to forming a favourable or unfavourable attitude toward it, to a decision to adopt or reject it, to putting the innovation to use, and to finally seeking reinforcement of the adoption decision made". From an organisational decision-making perspective, the 'temporal sequence of steps' are strongly embedded in technology. SMT prescribes that the usage of technology to enable human action such as decision-making is best explored under the topics of interpretive schemes, norms and facilities. Liebowitz & Megbolugbe (2003: 189) explain that such usage of technology in conjunction with business processes is essential to organisational decision-making.
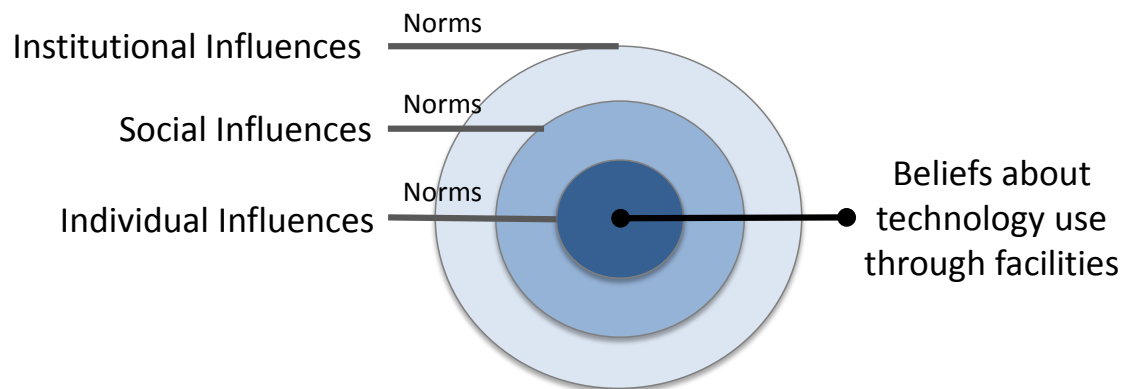
Figure 5-7: Sources of Influence on Beliefs about Technology Use (Adapted from Lewis et al., 2003:659)

The relationship between technology and human agents in an organisational context is multidimensional. Lewis et al. (2003:659) mention some of these aspects as summarised in Figure 5-7. The interpretive schemes influencing a human agent's beliefs about technology start with what is prescribed by the institution. Such prescriptions typically form part of the individual's employment terms in an organisation. Second to that are social influences that relate to the communal setting of the individual. The third and last influence is that of the individuals themselves. It is interesting that the individual influences are listed last, which implies that the institutional and social influences supersede those of the individual in an organisational context. The institutional, social and individual influences prescribe certain norms in terms of how the human agent is 'expected' to interact with technology in an organisational setting. In return, these norms determine how the human agent uses the institution's facilities to perform the intended function. The subsequent sections each touches on the interpretive schemes, norms and facilities influencing decision-making, as prescribed by SMT.

5.4.1 Interpretive Schemes

Interpretive schemes explain the manner in which human agents experience technology. It not only represents the way in which human agents interpret technology, but also how knowledge is embedded in IT through DSS. The interpretive schemes are discussed under the topics of hermeneutics of DSS, the adoption of technology and the effect that DSS have on decision-making.

5.4.1.1 Hermeneutics of DSS

The principle of hermeneutics was first introduced in section 2.3.4. Hermeneutics in conjunction with SMT's interpretive schemes explains how humans experience technology from an organisational perspective with the objective of performing their desired role. With specific reference to decision-making, technology presents humans with the interpretive stimulus that sparks cognition. This cognition is of course grounded in traditions unique to the individual and therefore neither technology nor its usage could be perceived in isolation. The presence of technology influences the social dynamics amongst humans as well as the manner in which they execute decision-making. The impact of technology is also unique to each social structure. An example is illustrated in a study by Djamasbi & Loiacono (2008:854), in which it is suggested that the utilisation of DSS is experienced differently by men and women. A similar example by Gray & El Sawy (2010:387) focuses on how different cultures experience DSS.

Sen (1998:212) was one of the first academics to recognise that DSS are much more than just technological artefacts functioning in insolation from human agents and institutional properties - a view that is supported by Massa & Testa (2005:710) when they distinguish technological artefacts from technological usage. Technological artefacts are merely the physical objects representing IT and DSS specifically. Technology usage refers to the enablement experienced by decision-makers when using these artefacts, when the artefacts are reshaped again according to future expectations. Sen (1998:206) further states that a more focused scope of DSS is obtained from the perspective of SMT and subsequently proposes a taxonomy called decision support process (DSP). In doing so, he agrees that the true meaning and value of DSS can only be appreciated when it is understood how human agents apply technological artefacts in an institutional setting to achieve specific objectives. DSP aims to establish the relationship between these three components with the goal of simplifying the extensive scope of DSS through the understanding of its usage by humans. This perspective emphasises the importance of aligning DSS designs with the cognitive capabilities of human agents (O'Donnell & David, 2000: 189). However

the opposite is also true as presented in section 4.4.1: DSS can also act as a structure of domination which influences the cognitive capabilities of human agents.

The hermeneutics of DSS serves as a brief introduction to the subsequent sections discussing the adoption of technology and the manner in which it influences decision-making.

5.4.1.2 Adoption of Technology

The adoption of technology is quite different to the usage of technology in the sense that adoption is mostly dependent on the human agent, whereas the usage of technology is influenced by a variety of institutional factors. The manner in which an institution's management adopts technology is recognised by Lewis et al. (2003:659) as the most important factor influencing the general adoption of the technology in the organisation. The different ways in which technology can be adopted is outside the scope of this study, but Karahanna et al. (1999:185) can be referenced for further insights on the topic.

Technology was introduced in organisations to facilitate the core functions of the organisation and in particular transactional processing. Initially, technology offered limited value in enabling organisational decision-making (Boland et al., 1994:456). The concept of DSS was first introduced more than three decades ago in an attempt to address this limitation. DSS have since been used in a variety of ways to enable decision-making. Sceptics initially suggested DSS to be just another technology buzz and hype, although subsequent years proved this not to be the case. The positioning of DSS in the field of IS was first done by Sqrague Jr (1980:6) in which DSS was defined as "…a class of information system that draws on transaction processing systems and interacts with the other parts of the overall information system to support the decision-making activities of managers and other knowledge workers in the organizations". Broadly speaking, DSS can be used for a variety of purposes aimed at facilitating human decision-making (Bunnell & Boyland, 2003:272). DSS can improve the factors influencing a particular decision by explaining the mechanisms leading to certain events. This is typically done by presenting data in different ways.

The most popular form of DSS is perhaps that of BI reporting (see section 6.4.2), which can integrate a variety of data sources and in doing so, highlights the relationships and comparisons between different data elements. DSS can also guide management practices by predicting the outcomes of certain events based on the underlying mechanisms. However, accurate and reliable prediction is worth very little without a comprehensive understanding thereof by the decision-maker. For this reason, DSS are also used to derive knowledge following the knowledge management principles mentioned in section 5.3.5. Chapter 6 elaborates in greater detail on different types of DSS and how they facilitate organisational decision-making.

	Humans are weak relative to DSS	**DSS are strong relative to humans**
1	Humans are naturally biased.	DSS are unbiased unless programmed in that manner.[1]
2	Humans are overconfident and influenced by political pressures.	DSS are rational and not influenced by any form of pressure.
3	Humans are subject to emotion, tediousness and weariness.	DSS are unfeeling and untiring.
4	Human cognition has limited capacity to process data.	DSS can source and optimise integrated data.
	Humans are strong relative to DSS	**DSS are weak relative to human**
1	Humans have intuition, general knowledge and gut-feel.	DSS are naïve and do not 'know' anything except what is programmed in them.
2	Humans can make subjective evaluations.	DSS can only make use of objective measurements.
3	Humans are flexible and can adapt to dynamic changing conditions.	DSS behaviour are rigid and static by nature.

Table 5-2: Human Versus DSS Decision-Making (Willemain et al., 2003:951)

A comparison between human decision-making and DSS is presented Table 5-2. The comparison highlights scenarios when human decision-making is preferred to DSS, as well as scenarios where the opposite is true. This understanding is important in order to appreciate the adoption of DSS by humans. The table concludes that DSS are excellent at processing large volumes of data possibly in conjunction with complex algorithms and models. However, a major limitation of DSS is that it cannot

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[1] Although technology itself is unbiased, the human implementation thereof is bias as humans themselves are bias in nature.

incorporate the social dynamics and intuition related to certain types of decision-making. It is therefore up to the decision-maker to find a balance between technological enablement and his 'know-how'. This finding once again substantiates the fact that no single organisational decision-making characteristic (also refer to Table 4-1) is preferred and that the best scenario is probably a combination of all characteristics.

The recursive relationship between technology and human agents has been mentioned in various past sections. Consequently, the adoption of technology in the form of DSS also influences the manner in which decisions are made by human agents, as discussed in the next section.

5.4.1.3 DSS Effect on Decision-Making

The purpose of DSS is to assist humans in making potentially poor decisions better. Although this is often the case, different studies have also indicated that the usage of DSS does not necessarily improve decision-making. Some studies even suggest that DSS can degrade decision-making quality (Lee et al., 2008: 349). An example is the study by Mennecke et al. (2000:601) in which it is confirmed that the usage of technological artefacts (in this case spatial DSS/GIS, further discussed in section 6.4.3) does not necessarily equate to accurate decision-making. The study argues that the manner in which the decision-maker engages the problem is the primary factor influencing the quality of decision-making. Such an approach is unique to each decision-maker and consequently highlights the importance of human knowledge as one of the most important factors influencing the quality of decisions. It is nevertheless generally agreed that the usage of DSS has a substantial effect on decision-making behaviour – mostly in a positive and constructive manner.

Two main theories exist that describe the effect of DSS on decision-making behaviour (Chu & Spires, 2001:228). These theories are not contradictory to each other, nor are they mutually exclusive. To some degree the two theories can even be considered complementary to each other. The first theory is referred to as the bounded rationality theory, which acknowledges the limited cognition of humans. Technological artefacts

such as DSS are positioned to elevate this limitation by performing certain functions on behalf of humans. This allows humans to focus on the value generation of the decision-making process and in doing so the abstract and interpretive aspects associated with decision-making are generated. The second theory is the cost-benefit theory. This theory describes the process in which the decision-making effort required (referred to as the cost of the decision) and the decision quality (referred to as the benefit of the decision) are optimally balanced. This research considers 'decision cost' to be the DSS's level of sophistication as well as the effort associated in its establishment. In most scenarios a direct relationship exists between decision cost and decision benefit: it is often the case for complex decisions that an increase in decision quality also implies an increase in associated costs. This is less true for simple decisions, where a good quality decision can be made without necessarily implying significant costs. At the very least, DSS can significantly lower the effort associated by decision-making through the processing of large amounts of data into a usable format. More elaborate examples of how DSS decrease decision-making costs are when DSS predict outcomes and recommend actions to the decision-maker. Research has shown that decision-makers typically prefer decision strategies that require less effort and consequently less cost (Williams et al., 2007:469) - despite sacrificing some degree of the decision's quality. In most cases the quality of decision-making increases significantly in accordance with the DSS sophistication. The level of decision sophistication is closely associated with restrictiveness of the DSS and the knowledge of the decision-maker. As Lee et al. (2007:350) point out: the less restrictive the DSS and the more knowledgeable the DSS user, the better the decision-making quality. However, one must also acknowledge that DSS force rational decision-making by promoting only the variables incorporated in the DSS and therefore dictate the decision-making process to some degree (Fuglseth & Gronhaug, 2003:503). This point again touches on DSS as a structure of domination (see section 4.4.1), which in this case prescribes and/or limits the manner in which humans make decisions. Such a scenario is even worse when human error is introduced during the decision-making process. Human error can either originate in the DSS design and/or build, or in the interpretation of the DSS results. On the positive side, a study by

Willemain et al. (2003:949) illustrate how DSS errors can easily be overcome and that an awareness of these errors can even increase the quality of decision-making.

The previous three subsections described the interpretive schemes associated with the adoption of technology. It is concluded that these schemes are greatly influenced by the past experiences of individuals. It is therefore appropriate to also explore how individual norms and the generation thereof influence a human agent's usage of technology artefacts.

5.4.2 Norms

Norms describe the organisational fashion in which technology prescribes human agents to conduct their activities. Norms is an extension of SMT's structures of signification; domination and legitimation as presented in section 4.4.

5.4.2.1 Decision-Making Norms

Individual norms are important influencers of the manner in which humans embrace technology. Normative influence determines the adoption of technology, whereas attitudinal influences determine the continuous use of technology. Both influences are equally important to the long term sustainability of DSS implementations. Decision-making norms are determined by multiple influences, some of which are presented by Karahanna et al. (1999:185): In particular, information influences are determined by the manner in which an individual accepts information as a reflection of reality. In doing so, individuals often 'bond' with selected sources of information until the sources become obsolete. However, even when information is accepted as an accurate reflection of reality, it is not to say that an individual will act according to that reality. This concept leads to normative influences. Normative influences are apparent when an individual's choice of decisions is based on the acceptance and expectation of others as opposed to the reflection of reality. Lewis et al. (2003:659) refer to these as 'social norms' and list departmental peers; informative circle; professionals and managers as examples of social factors influencing social norms. Furthermore, normative influences are often determined by the perception of reward or punishment determined by various organisational factors and forces. Power (2002:49) mentions a

similar point related to normative influences which he labels the 'tradition and status quo bias impediment'. This is when decisions are taken in accordance with historical selections simply because it is a tradition in continuance. Normative influences can potentially be countered by means of integrating DSS and knowledge management principles, as proposed by Bolloju et al. (2002:164). In doing so, organisations will build a repository of knowledge allowing decision-makers to leverage from the organisation's 'memory' (also see section 5.3.5), thereby increasing the consistency of their decision-making. Over time this knowledge repository will evolve into matured states and so too should the organisational decision-making. The concept of a knowledge repository was briefly introduced in section 5.3.5, but is comprehensively discussed in section 6.3.3. Lastly, it is important to mention that individual norms are also influenced by the ethics of the individual. Goles et al. (2006:86) state that decision-making is mostly based on an individual's perception of a situation in conjunction with the ethical and moral intensity of the situation. This is also why increasing emphasis is placed on the inclusion of ethical components when designing DSS.

5.4.2.2 Knowledge Generation through Norms

Knowledge generation is an important aspect of individual decision-making and consequently also organisational decision-making. The norms of both the individual and organisation form an imperative aspect of knowledge generation and the management thereof. Bolloju et al. (2002:163) explain that decision-making involves a better understanding of the problem at hand and by becoming more aware of the problem and possible solutions, the decision-maker instinctively creates knowledge. The purpose of this section is not to focus on the organisational management of knowledge, as this is discussed in the previous section 5.3.5, nor to discuss the topic from a knowledge-driven DSS perspective, which is discussed in section 6.6. Rather, this section explores the individual generation of knowledge and its application to organisational decision-making. The conclusions derived in this section are important as they influence the manner in which knowledge repositories and knowledge-driven DSS should be designed.

Much like the existence of multiple perspectives on knowledge management, Courtney (2001:23) explains that the concept of knowledge generation diverges just as much. Examples include explicit vs. tacit knowledge; procedural vs. declarative; esoteric vs. exoteric; and shallow vs. deep, to name but a few. Whilst acknowledging these different perspectives, the scope of this research is limited to that of explicit and tacit knowledge. This is because SMT prescribes such a perspective and subsequently also complements this study. Referring back to the SMT's 'Duality of Structure' presented in section 4.4, Orlikowski (2000:409) explains that human agents build on their tacit and explicit knowledge to 'structure their social action' through the utilisation of the facilities available to them, in conjunction with the norms guiding their actions. Agents therefore do not act in isolation, but rather in a manner iterating between themselves, the institution they operate within and the technology they use. This is why academics such as Kroeze (2012:47) describe knowledge's recursive nature as 'fluid and emergent'. Such iterations create an awareness of the matters of interest and consequently also insights, which ultimately equates to the knowledge required to facilitate decision-making. The individual's past interactions with the matters of interest determine the individual's present usage thereof. This is especially true for technology because it is mostly created with a specific purpose in mind. An individual's interactions with technology are shaped by the attributes of technology (attributes essentially describe the presence of technology) and the properties (properties in this instance refer to everything allowing it to have purpose) determined by the technology designers. During the usage of this technology by human agents, the recursive nature of interaction leads to institutional structures being continuously validated, established and re-established, which ultimately results in SMT's 'institutionalisation of technology'.

The ability to incorporate knowledge into organisational decision-making is perceived as a strategic capability (Zack, 2007: 1664). It is therefore important to understand how knowledge is derived in order to appreciate how it supports decision-making, and ultimately how DSS should store explicit knowledge. As previously mentioned, different perspectives on knowledge exist and this is no different with models describing the generation of knowledge. However, over the years two models in

particular have evolved to become widely respected in this domain. Models such as SECI (Nonaka, 1991) presented in Figure 5-8 and subsequently CYNEFIN (Snowden, 2002) illustrated in Figure 5-9, are two examples explaining how knowledge is created to facilitate decision-making. SECI was introduced in the early 1990's as the first generally accepted model explaining the knowledge generation process. The model has since served as the foundation for various other researchers by addressing the topic of knowledge creation and management. Examples are Walsham (2001:599), Armistead & Meakins (2002:69), Courtney (2001:24), Bolloju et al. (2002:165) and Chen & Chen (2001:3864). A decade later the CYNEFIN model was introduced, which elaborated on SECI but addresses many of the limitations subsequently identified by academics. The most important critique on SECI is that the model assumes that knowledge starts from nothing. CYNEFIN addresses this limitation by introducing a social aspect to knowledge generation. Both these models have formed the basis of how knowledge is generated and allow for a deeper understanding of how norms influence the knowledge acquisition required to perform decision-making. This section is limited to the detailed discussion of SECI. A brief overview of CYNEFIN is also presented but simply to act as a point of reference to ensure the comprehensiveness of this section. CYNEFIN is not elaborated on because it does not have a technical focus and therefore does not contribute towards the development of a conceptual DSS framework. The motivation for SECI's elaboration is because the model is prescribed by Nemati et al. (2002:145) and Bolloju et al. (2002:165-176) as a theory supporting the construction of DSS in the form of knowledge warehouses.

Nonaka's SECI model explains the continuous pattern of knowledge creation in the form of tacit and explicit knowledge. Knowledge creation moves through four sequential quadrants referred to as socialisation, externalisation, combination and internalisation. This process is referred to as the 'spiral of knowledge'. Tacit knowledge is uniquely derived from an individual's technical skills combined with their cognitive ability. Tacit knowledge is difficult to express, communicate and consequently harder to transfer. Nemati et al. (2002:145) describe tacit knowledge as the 'subjective' expertise of an individual which includes the personal believes and perceptions derived over extended periods in time.

Tacit Knowledge	to	Explicit Knowledge

Tacit Knowledge	**S**ocialisation	**E**xternalisation
from		
Explicit Knowledge	**I**nternalisation	**C**ombination
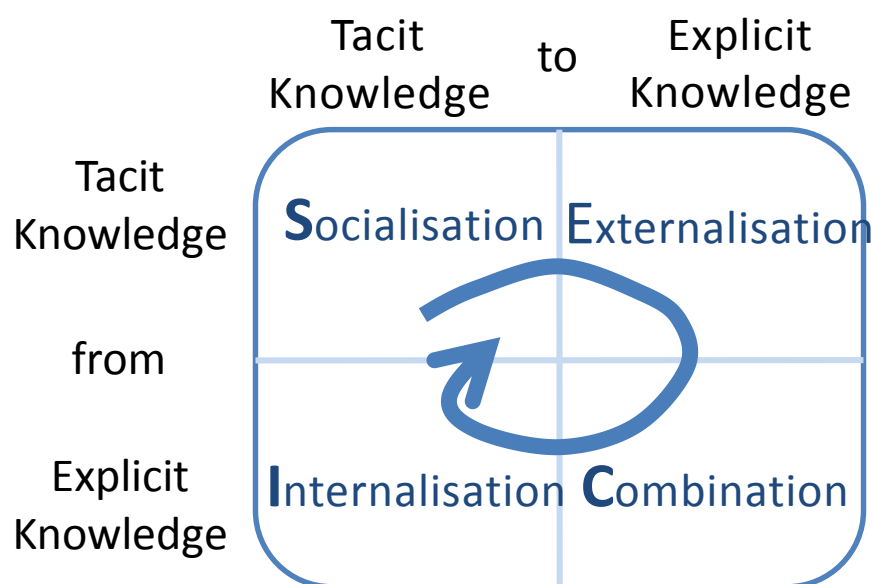
Figure 5-8: The SECI Knowledge Creation Spiral (Adapted from Nonaka, 1991:4)

Courtney (2001:23) explains tacit knowledge as the natural instinct of humans, making tacit knowledge almost impossible to accurately capture. It can be concluded that tacit knowledge is unique to each individual as it is based on their distinct past experiences (Walshem, 2001:599). The past experiences establish what the individual regard as their current norms and form the basis of all their decision-making. It is therefore clear that tacit knowledge is critical to the sustainability of organisations as certain individuals contain pockets of organisational knowledge that cannot be extracted for others to consume. To the contrary, explicit knowledge is human insights that can easily be documented, articulated and shared with others. Explicit knowledge is tacit knowledge that has been extracted, captured and formalised allowing it to be easily communicated and transferred. It is explicit knowledge and not tacit knowledge that gets captured in DSS. Explicit knowledge is quantifiable, consistently communicated and applied through language and symbols (Nemati et al., 2002:145). Having said this, Walshem (2001:600) explains that explicit knowledge cannot be consumed without the tacit knowledge of an individual. Because explicit knowledge is an extraction of tacit knowledge, an individual's implicit knowledge must still be complementary to the interpretation of explicit knowledge. Without this the explicit knowledge will remain meaningless. A practical example is as follows: a mathematical equation can only present itself as explicit knowledge to an individual if the individual's tacit knowledge allows for the recognition and interpretation thereof.

The continuous effort of converting tacit knowledge into explicit knowledge should be an on-going priority for organisations. This is because explicit knowledge allows organisational expertise to be shared across the organisation, thereby creating decision-making sustainability, continuity and inclusiveness. The usage of explicit knowledge also allows individuals to spend less effort on routine decision-making and more effort on the non-routine decision-making that requires tacit knowledge. This is especially the case where knowledge-driven DSS add value to an organisation through decision automation.

The spiral of knowledge by SECI refers to the process in which different forms of knowledge are created through the recursive iterations between tacit and explicit knowledge. The process involves four successive dimensions referred to as socialisation, externalisation, combination and internalisation. The sequential iteration between these dimensions creates new knowledge. The maturity of an organisation's knowledge management activities is measured based on the success it has in terms of managing this spiral of knowledge through DSS. Socialisation is the process when an individual learns from another through observation and imitation while no systematic insight is obtained. This typically includes the sharing of experiences, technical skills and mental models. Differently stated, socialisation creates additional tacit knowledge from existing tacit knowledge through social practices. Socialisation empowers other individuals to also perform certain decisions, but these decisions are still dependent on that individual's knowledge. DSS offer limited value to socialisation, perhaps only through self-learning algorithms (also discussed in section 6.6). Externalisation converts existing tacit knowledge to that of limited explicit knowledge through various forms of articulation, which might otherwise have been difficult to communicate. This limitation is simply because not all tacit knowledge can be converted to explicit knowledge as it cannot be articulated. Externalisation is important to organisations because it allows for the knowledge extraction of expert decision-makers and in doing so creates an opportunity for these decisions to become routine with little involvement. DSS in the form of knowledge repositories offer great value to externalisation. Combination occurs when explicit knowledge is transferred to further explicit knowledge, mostly through explicit communication and execution

observation. It is important to understand that SECI's combination dimension creates an additional version of existing explicit knowledge and that in doing so, a deeper and often hidden dependency exists between these versions. Knowledge-driven DSS is a prime example of such. The final dimension in the spiral of knowledge process is internalisation. Internalisation transpires when explicit knowledge is institutionalised amongst multiple stakeholders to once again become a richer and more comprehensive tacit knowledge. Internalisation is the deeper understanding of explicit knowledge in which new insights, patterns, relationships and conclusions are derived that ultimately lead to further tacit knowledge. Further tacit knowledge is derived by decision-makers through the usage of DSS and, in doing so, supports the internalisation knowledge creation process.

From the previous discussion one must agree with the critique stating that SECI limits the knowledge creation process to that of the individual. The CYNEFIN model addresses this critique by recognising the existence of knowledge sources such as organisational knowledge. Organisational knowledge influences individual decision-makers by means of their social setting in the organisation (Snowden, 2002:104). The sharing of this knowledge is done through different levels of abstractions ranging from low abstraction where explicit knowledge is generally distributable, to high abstraction where tacit knowledge is obtained through expert interactions. Three supplementary aspects of CYNEFIN are presented, namely common sense making (see Figure 5-9); decision making and knowledge flow (see Figure 5-10). The common sense making model is used to describe the manner in knowledge is created through communities. The decision-making model builds on this social dimension by specifically addressing decision-making from an organisational perspective. Closely associated with this is the knowledge flow cycle model that explains how different states of knowledge are generated from information.
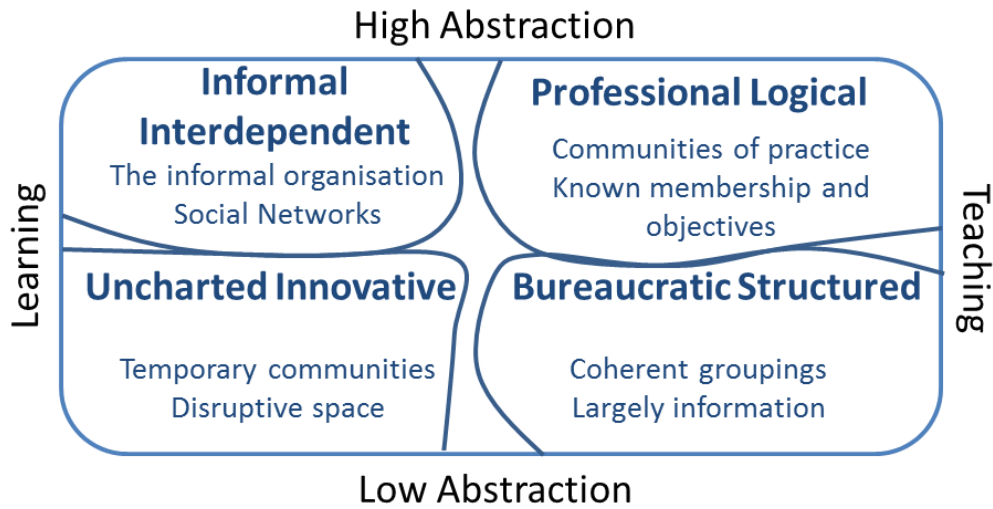
Figure 5-9: CYNEFIN'S Common Sense Making (Snowden, 2002:104)[2]
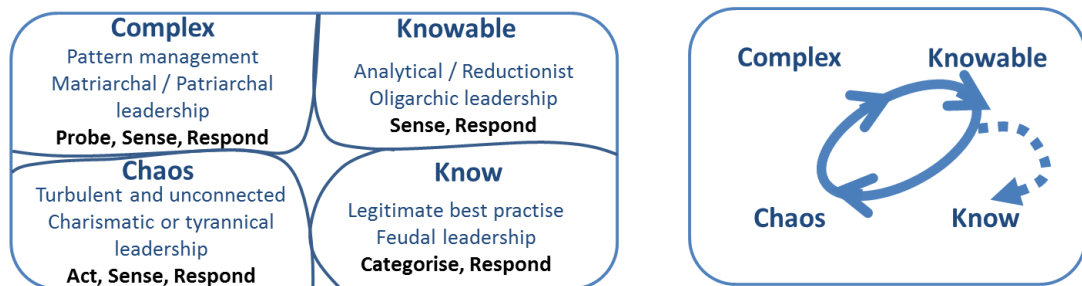
Figure 5-10: CYNEFIN'S Decision Making Model and Knowledge Flow cycle (Snowden, 2002:104)[3]

The SECI and more sophisticated CYNEFIN models explain the knowledge creation process from an individual and organisational setting respectively. In doing so it is recognised that both individual and organisational norms influence the manner in which knowledge is created and ultimately how decisions are made. This is important to understand as it influences the manner in which DSS are designed to support decision-making. The next section touches on the technological facilities used for individuals to perform organisational decision-making.

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[2] It is important not to interpret the various CYNEFIN models as 2x2 matrixes. Snowden (2002:104) describes its contexts as having four 'domains' and not 'quadrants'. The domains create a center of focus and have loosely defined boundaries as they do not encompass all possibilities. This is also one of the aspects differentiating CYNEFIN from SECI.
[3] Refer to footnote 2

5.4.3 Facilities

Facilities refer to the technological resources used to facilitate the actions of human agents in their execution of a particular institutional function such as decision-making. The framework proposed by Armistead & Meakins (2002:51) and shown in Figure 5-11 maps the process of individual knowledge creation with that of the organisational knowledge creation. This association links knowledge management principles such as SECI with that of institutional decision-making in the form of operational, tactical and strategic decision-making. This linkage to these decision types is important as it stipulates the requirements needed for technology facilities in the form of DSS to enable organisational decision-making.

	Imposed	Empowered
Organisational	Prescribed	Adaptive
Individual	Compliance	Self-determination
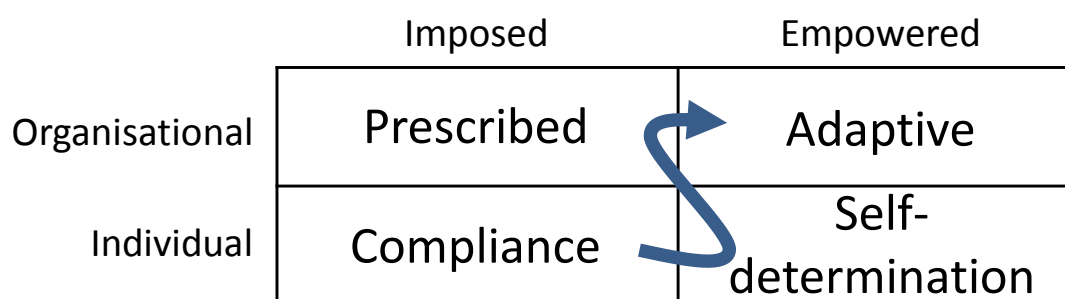
Figure 5-11: Framework for Knowledge Approaches (Armistead & Meakins, 2002:51)

Whilst acknowledging the importance of technology as a facilitator of the knowledge creation process, Armistead & Meakins (2002:67) explain that technology is ultimately only the enabler of human knowledge. Knowledge cannot be created by technology and technology can only capture explicit knowledge when articulated by human agents. Knowledge management's relevance to decision-making ranges from an individual's tacit knowledge and to explicit knowledge being captured into an organisation's knowledge base. Liebowitz & Megboluge (2003:189) differentiate the two aspects by stating that knowledge is generated by an individual whereas knowledge is managed by an organisation. The individual and organisational dimensions are considered against two participation perspectives, namely imposition and empowerment. In doing so, four quadrants are introduced namely compliance, grouping, prescribed and adaptive. The compliance quadrant describes individuals who participate in knowledge activities through contract and regulation. An example is when an individual makes submissions to his/her organisation's knowledge base

because it is prescribed in performance management practices. These individuals become empowered when they progress to take responsibility for the creation, contribution and learning of knowledge, as described in the self-determination quadrant. Individual contributions are but one of many other contributions from an organisational context, and consequently become formalised knowledge assets supported by various DSS technologies. This state is referred to as the prescribed quadrant, which over time evolves to the adaptive quadrant. The adaptive quadrant explains the 'social fabric' of knowledge management supported by sophisticated DSS offerings. Through the understanding of these quadrants, one can appreciate the manner in which individual tacit knowledge becomes explicit organisational knowledge. With this in mind, one must next understand how organisational knowledge generation support organisational decision-making in the form of operational, tactical and strategic decision-making. One can subsequently identify the DSS facilities required to facilitate these different decision types.
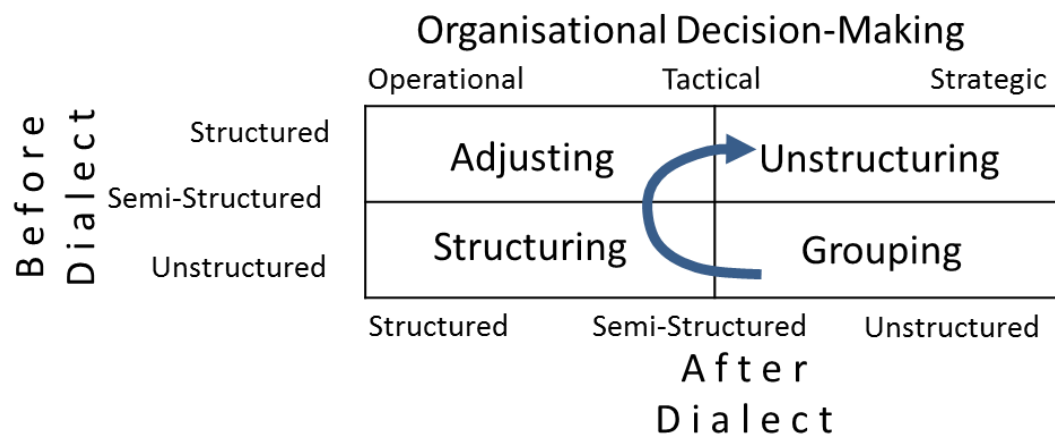
Figure 5-12: Dialect Perspectives for Decision-Making – Derived from Millet & Gogan (2006: 435, 438)

Organisational decision-making is the dialectical process in which a problem moves between unstructured and structured states, although never being in the purest state of any of the two. Decision-makers question the information at hand during the unstructured phase, consider alternatives and debate different outcomes, amongst others. In general, decision-makers use the unstructured phase to expand the problem space with the goal of finding common ground between the problem under consideration and the decision-maker's knowledge at hand. The structured phase is

quite the opposite: the decision-maker references existing knowledge to consider different objectives, references clearly defined assumptions and problem specific variables. This decision-making process, in which a problem iterates between unstructured and structured states, consists of four phases as illustrated in Figure 5-12. The first phase is the grouping phase, in which decision-makers attempt to create structure from the unstructured state. The grouping phase is typical to the early stages of problem solving in which ambiguity and uncertainty exist. The process then moves from the unstructured state to a structuring state in a phase referred to as the structured phase of the decision-making dialect. In most cases this is done by associating the problem at hand with problems previously resolved. The adjusting phase builds on the structuring phase by means of iterating through the problem solving constraints at hand. The final phase is the unstructuring phase which moves the problem solving from the structured state back to the unstructured state but this time in an informed and controlled manner. This phase recognises the insights derived from the other sequential phases but more importantly attempts to incorporate existing and new insights into the derived knowledge. The result moves the structured knowledge into unstructured knowledge, but this time in a formalised manner.

More importantly, each of these phases relates to organisational decision-making and more specifically, decision-making in the form of operational, tactical and strategic nature. Operational decision-making are typically executed by ground level workers and ranges between the structuring and adjusting phases. The operational structuring phase is typically associated with decisions that have been automated or that are well supported by solutions specifically designed for that purpose. This phase builds on the structuring phase but allows some flexibility to optimise and improve operations. This process can be the mere reconsideration of a decision-making variable. Tactical decision-making ranges between operational and strategic decision-making. Strategic decision-making can be either in the grouping or unstructuring phases and mostly associated with executive decision-making. The strategic grouping phase allows decision-makers to associate seemingly unrelated variables in an attempt to structure the problem at hand. In contrast to this, the strategic unstructuring phase is aimed at questioning existing structures with the goal of identifying weaknesses that can be improved.
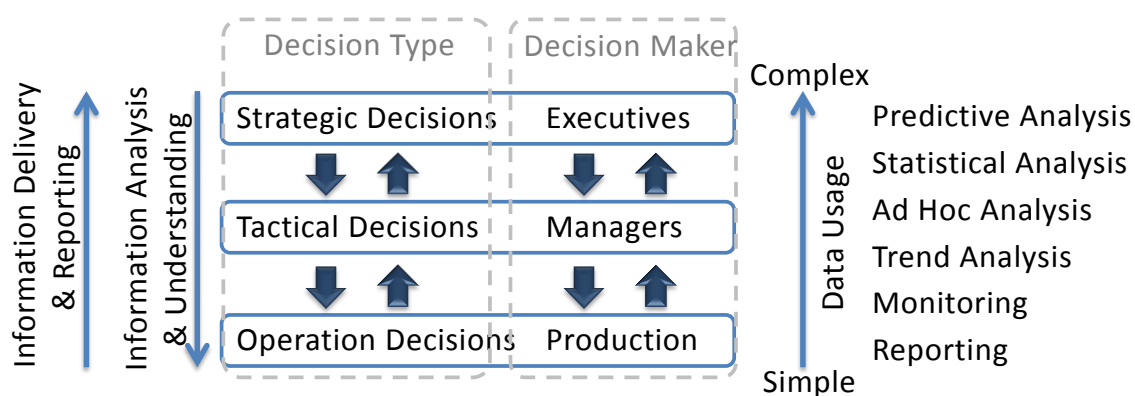
Figure 5-13: Data Processing for Decision Support - Derived from Varga (2005:21, 27)

A subset of Varga's (2005:21, 27) model explaining data processing for decision support (Figure 5-13) was first introduced in section 4.3.2. At this time the types of institutional decision-making were presented with the objective of understanding how it relates to the technological artefacts and specifically DSS. This section elaborated further on this model by identifying the types of human agents associated with each of the decision-making styles, namely executives performing strategic decision-making, managers executing tactical decisions and production workers performing operational decisions. In addition to this and more importantly, this section also presents the types of DSS required by these human agents to successfully conduct decision-making. These technological facilities are identified by Lai (2007:4072) as the most critical factor enabling knowledge generation in support of organisational decision-making. Information delivery and reporting through DSS follow a bottom-up approach (production workers typically reporting the state of the organisation to executives), whereas the DSS enabling information analysis follows a top-down approach (executives optimising the activities of production workers). The DSS required to drive these decision-making capabilities progressively ranges from simple data usage such as reporting and monitoring to complex data usage such as statistical and predictive analytics. Reporting is typically a parameter driven display of information. Monitoring is the continuous usage of reports whilst also accommodating alerts to proactively manage the particular business function. Trend analyses use historical information to determine continuous patterns and clustering. Ad hoc analyses allow for data to be interactively manipulated into information through user-defined queries.

Statistical analyses cater for the modelling of data according to statistical functions and relevance such as regression analysis, often with the objective of forecasting business metrics. Lastly, predictive analyses use historical data to identify attributes characteristic to certain business behaviour and then using those characteristics to predict future behaviour. Chapter 6 continues to expand Varga's (2005:21, 27) model by elaborating in much greater detail on the different technological artefacts in the form of DSS that support decision-making.

5.5 Constructing the Conceptual DSS Framework

The previous chapter enhanced the conceptual DSS framework under construction by contributing the institutional aspects related to the research problem. The framework is now further enhanced by including the findings derived in this chapter and is also included in Appendix C, which illustrates the development phases of the conceptual framework. The findings include aspects related to human agents and the information demands they have to address the tax gap phenomenon.
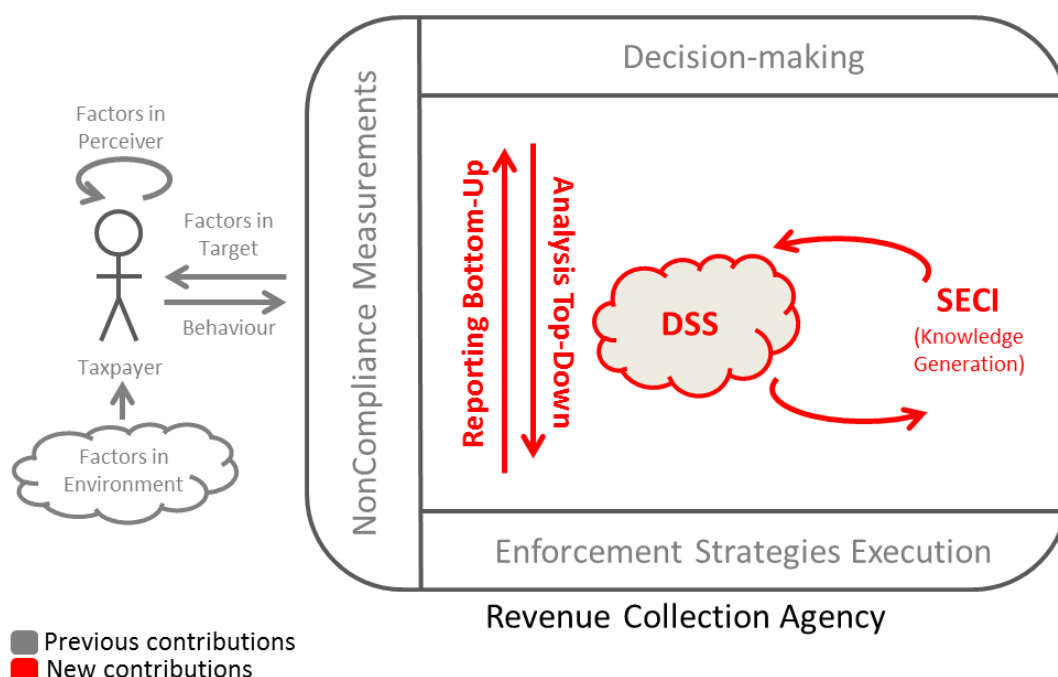
Figure 5-14: Framework Construction - Incorporating Human Agents

Chapter 5 enhanced the conceptual DSS framework by including the metrics in which the tax noncompliance behaviour of taxpayers is measured. The outcome of these

measurements called for the inclusion of different enforcement strategies, which are executed with the goal of addressing noncompliance taxpayer behaviour. The enforcement strategies are performed through decision-making and facilitated by IT. This chapter focused on the manner in which human agents perform decision-making and the knowledge generation process associated with it. Section 5.3 elaborated on the IT component of the framework by identifying five DSS instances that enable organisational decision-making. These instances are collectively grouped and included in the conceptual DSS framework as DSS. Also included in the framework is the top-down decision-making style through analytics as well as the bottom-up decision-making style through reporting. The final component included in the framework in this chapter is that of knowledge generation through the SECI model (refer to section 5.4.2.2). The next chapter concludes the development of the conceptual DSS framework from a theoretical perspective. It does so by elaborating on each of the five DSS instances and the relationships they have with one another.

5.6 Conclusion

The focus of this chapter is that of human agents which make up the second component of SMT. Additionally, the information demand of these human agents is behaviour dominated and determined by their decision-making objectives in an institution. It is the purpose of this chapter to understand how IT supports the decision-making of tax practitioners in their objective to reduce the tax gap.

The chapter addresses the research questions from two perspectives as prescribed by SMT. The first perspective is that of technology as a product of human action, which in this study focuses on the enablement of decision-making through IT. The DSS products created by human agents are identified as data-driven, model-driven, knowledge-driven, communications-driven and document-driven DSS. DIKW is referenced as one example prescribing how technology supports human decision-making. The hierarchy describes how decision-making is supported by means of data that gets processed to become information only to be consumed by human agents in the form of knowledge. The management of these different DIKW levels is discussed and also the manner in which DSS relate to each level. The second SMT perspective

is that of technology acting as a medium for human action and focus is placed on how technology is used as enabler of organisational decision-making. It is emphasised that technology is uniquely adopted; used and interpreted by human agents. The chapter elaborates on the ways in which technology facilitates the knowledge creation process required for decision-making and also the manner in which technology is used by human agents to facilitate their decision-making process.

The conceptual DSS framework was enhanced in this chapter by including specific IT instances in the form of DSS. These DSS enable the decision-making execution related to the different enforcement strategies aimed at managing tax noncompliance. This is done by either following a bottom-up approach through reporting or a top-down approach through analytics. The final component added to the framework in this chapter is the knowledge generation processes, as explained by referencing the SECI model.

The conclusions of this chapter serve as a good introduction to the next chapter that focuses on the detailed instances of DSS used to address the tax gap phenomenon. The emphasis on technology and its ability to offer information through various DSS is the third and final component of SMT. These DSS are extensively discussed in the next chapter and are subsequently also included in the conceptual DSS framework.

CHAPTER 6: THE VALUE PROPOSITION OF DECISION SUPPORT SYSTEMS
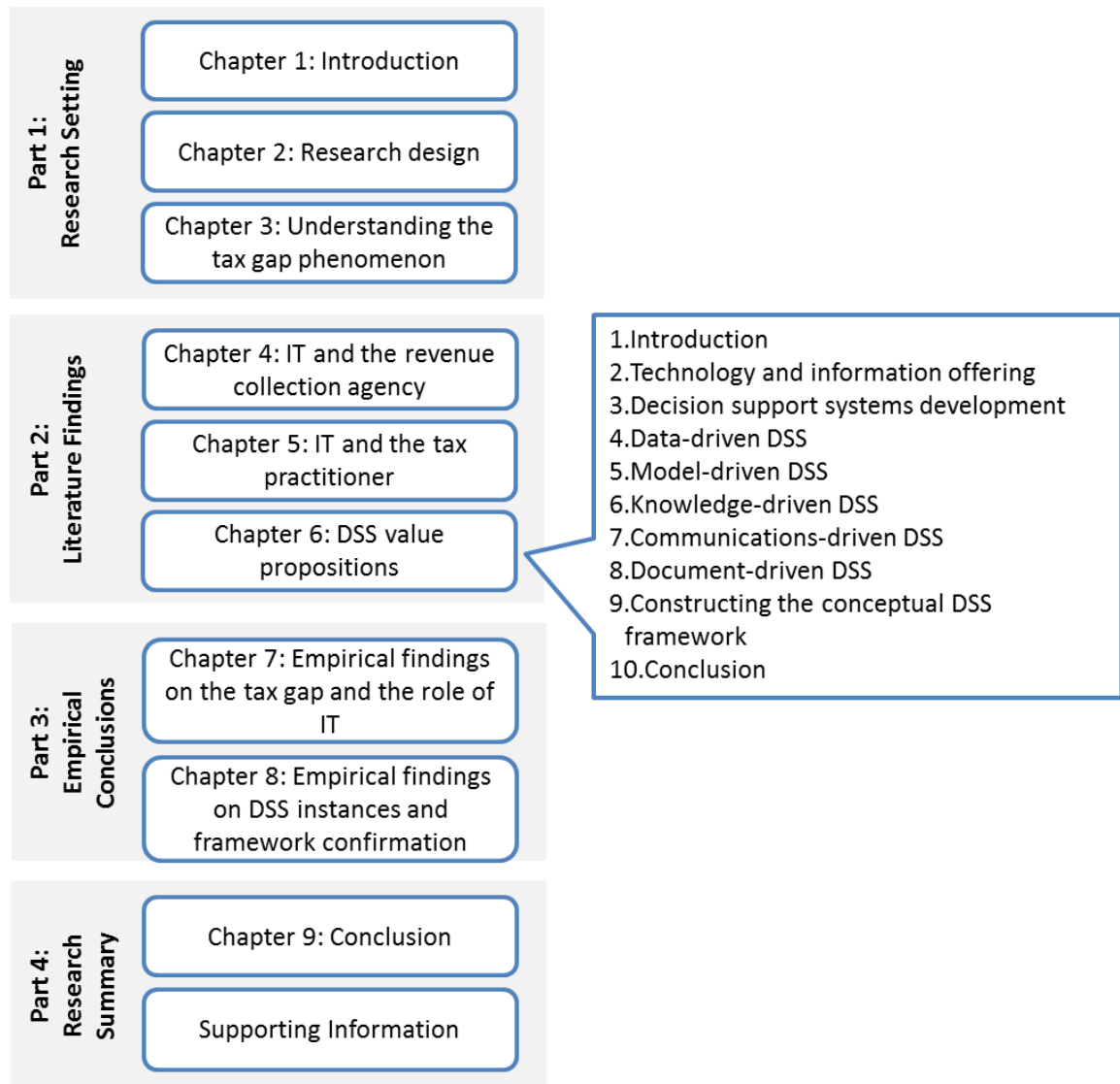
Figure 6-1: Chapter 6 Roadmap

6.1 Introduction

The previous two chapters explored the manner in which SMT's institutional properties and human agent components facilitate the minimisation of the tax gap phenomenon. The third and final component of SMT, namely technology, is discussed in this chapter. Focus is placed on the manner in which DSS enable human agents to perform decision-making in an institutional setting. Unlike the previous two chapters, this chapter does not elaborate on the relationships between SMT's institutional properties, human agents and technology as those have been fully explored in the previous two chapters. Instead, this chapter presents the specific technological instances as well as their information offering capabilities. The research question addressed in this chapter asks:

"Which decision support systems enable IT's value proposition to minimise the tax gap phenomenon through enforcement capabilities?"

The research question is addressed by presenting the manner in which DSS are deployed in an organisation, followed by a detailed elaboration on how the different types of DSS can be used to minimise the tax gap.

6.2 Technology and Information Offering

The SMT model was first introduced in section 1.6 after which subsequent chapters were dedicated to the discussion of particular SMT components. The INOD model was jointly referenced with SMT to ensure the study specifically focuses on IT and decision-making. Chapter 4 commenced this discussion by focusing on the institutional properties component in conjunction with the information needs of an institution. The human agent component of SMT and the information demands they have were subsequently discussed in Chapter 5. The third and final outstanding component of SMT is discussed in this chapter, namely technology. Technology supports decision-making through information offerings that are presented to decision-makers, as proposed by INOD.
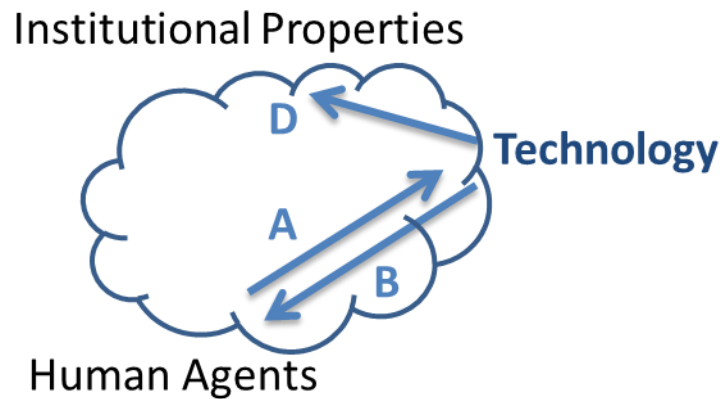
Figure 6-2: The Structuration Model of Technology (Adapted from Orlikowski, 1992:410)

Orlikowski (1992:410) summarises the technology component of SMT as "the material artefacts mediating task execution in the workplace". Figure 6-2 displays the relationship that technology has with institutional properties and human agents through influences A, B and D. Technology's relationship with institutional properties is indicated by arrow D, described as the institutional consequences of interaction with technology. This influence is presented in section 4.4. Technology's influences with human agents are recursive in the sense that each component influences another. Influence A explains how technology becomes a product of human action and is discussed in section 5.3. Its counterpart is influence B, which defines the manner in which technology acts as a medium of human action, as presented section 5.4.

Information offerings describe technology's ability to convert data into information from which humans can derive knowledge (refer to section 5.3.2 for a discussion on the DIKW hierarchy). The relationship that INOD's information offerings have with information needs (activity 4) and information demand (activity 5) is presented in Chapter 4 and Chapter 5 respectively. Activity 2 is the remaining activity to be discussed and essentially describes the scenario of information being on offer but for which there is neither need from an institutional perspective nor any demand from human agents. Such a scenario is a prime example of when technology is misaligned with the institutional objectives. These technological implementations are in essence irrelevant to the institution and offer very limited return on investment, if any.
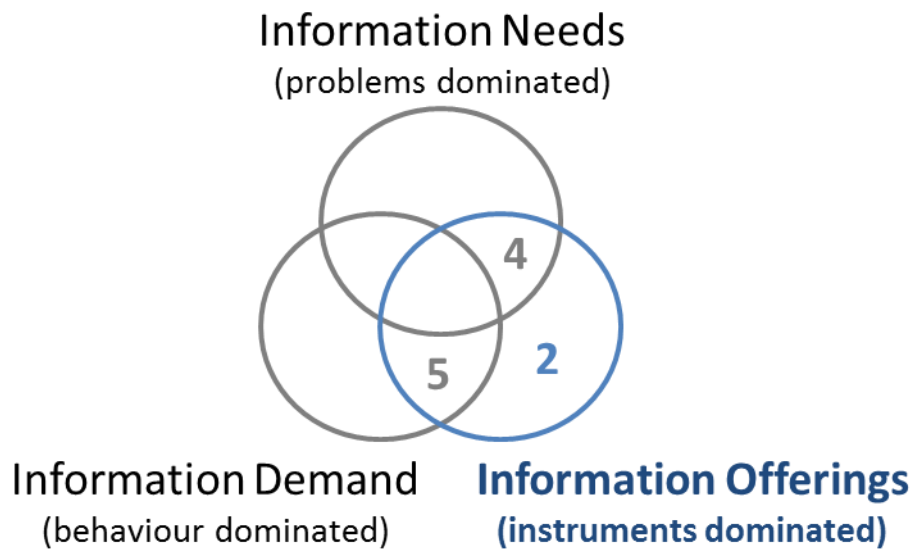
***Figure 6-3: Relationship Between Information Offerings, Demand and Needs
(Adapted from Osmanagic-Bedenik & Varga, 2006:141)***

Technology acts as an instrument for human agents to enable the functions prescribed by their organisation. In terms of decision-making, technology has the ability to offer data, information and knowledge in various forms through DSS. It is the purpose of this chapter to present different insights related to these forms of DSS and especially the manner in which it enables organisational decision-making. This 'enablement' that technology offers to human agents is referenced by INOD as information offerings. The chapter presents the manner in which technology is positioned in an institutional setting, as well as the different instances of information offerings. However, prior to doing so, it is appropriate to explore the theoretical positioning of technology in both society and an organisation. This positioning is done according to the recommendations by Heinze & Hu (2005:892) in which they specifically reference the public sector (in particular e-government). The authors suggest that technology is approached from three perspectives, namely technology determinism, technology as strategic choice and structuration theory. Each of the perspectives is now discussed.

6.2.1 Technology Determinism

The first theoretical dimension of technology is that of being deterministic by nature. Determinism implies that the presence of technology is inevitable and that technology over time naturally evolves to become what it is. Technology is therefore perceived as a self-controlling and self-determining object that acts independently from other environmental variables and objects. Once stabilised, technology is perceived as predictable and complete. Two supporting perspectives of technology determinism are defined by Heinze & Hu (2005:893). The first perspective is utopian technology determinism that views technology as a socially constructive force. Its function is to enable and promote advances in society to ultimately improve the state of all. An example of utopian technology determinism from a public sector perspective is when service delivery to citizens is improved through e-government technology instances. A particular instance related to revenue collection agencies is the ability for citizens to file their tax returns electronically. Prior to this, many citizens located in remote locations were non-compliant simply because of travelling constraints with regard to the nearest tax service centre. Contrary to utopian technology determinism is the second perspective of anti-utopian technology determinism (also referred to as dystopia technology determinism), which perceives technology as being socially destructive. Technology is seen from this perspective as a negative force destroying the social aspects of society. Through technology's destruction, society digresses from established norms and practices to that of despair and malfunction. Such a perspective regards technology as a force instilling misery in human agents as it controls them in a manner they do not always comprehend. This is especially evident in modern times when technologically restrained human agents are socially less active than those with technical competence (section 4.4.1 elaborated on IT as a structure of domination). Referencing the public sector again, anti-utopian technology determinism exploits how the privacy of human agents is violated when they are forced to submit their personal particulars through e-government. In this example technology can possibly be perceived as a security threat to these human agents. A specific example from a revenue collection agency perspective is when third party data is provided to revenue collection agency for the population of an individual's tax return without the consent

of the individual. These individuals may regard technology as intrusive and controlling.

The researcher questions the validity of technology as a deterministic force and in doing so supports the perspectives of Orlikowski (2000:406). It is argued that numerous empirical studies illustrate the ever evolving nature of technology once human agents have been introduced. Technology is therefore not seen as a static isolated force but rather as an ever evolving force constantly influencing and being influenced by society. Section 6.2.3 further elaborates this viewpoint from the perspective of Structuration Theory.

6.2.2 Technology as Strategic Choice

The second perspective states that technology is only present to support and enable the strategic objectives of an organisational. This perspective regards technology as a tool selectively implemented by business stakeholders with the objective of meeting specific organisational requirements. Tallon (2008:228) explains that the alignment between technology and business remains to be the most important factor influencing the degree of value delivered from technology (see Figure 6-4). Technology only becomes a strategic choice when the equilibrium between technology strategy and business strategy is achieved. A failure thereof can threaten the organisation's performance; competitiveness and often even its survival. Technology should therefore be perceived as much more than a mere enabler of the business. Rather, technology should be seen as a strategic choice having the ability to unlock the hidden potential of the organisation.

Other academics such as Carr (2003:41) disagree with technology being a strategic choice and believe that technology has little strategic relevance. It is argued that IT has become an organisational commodity and has lost its value as a strategic asset. This is due to the fact that IT has become affordable and accessible to most organisations, resulting in the loss of its capability to deliver strategic value and subsequently also its competitive advantage. These authors argue that organisations should take a defensive approach to IT by cutting costs, focusing more on IT

vulnerabilities than opportunities and only invest in mature IT capabilities. The researcher disagrees with such a proposal as many examples exist that illustrate IT's strategic relevance in organisations. An example is Bhatt & Grover (2005:274) who argue strongly against the proposal of IT as a commodity. Their empirical research indicates that although an organisation's IT infrastructure itself cannot necessarily deliver strategic value or competitive advantage, the IT capabilities obtained from this infrastructure can. These IT capabilities are established through the knowledge and innovation of their employees.
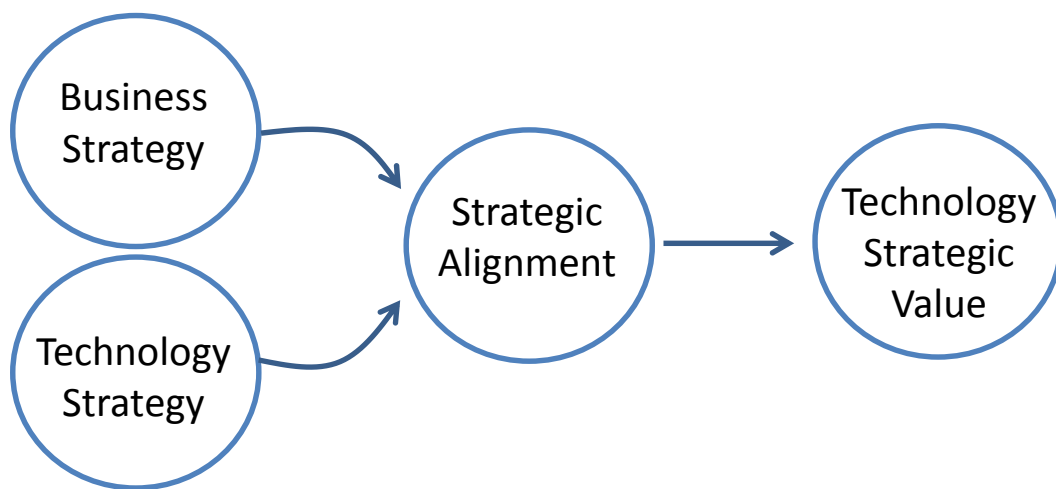
Figure 6-4: Technology as Strategic Choice (Adapted from Tallon, 2008:230)

Technology as a strategic choice positions technology as an institutional support and enablement function. Such a perspective is in contrast to technology acting as a 'structure of domination' (refer to section 4.4.1), which stipulates technology to be a force dictating human behaviour as opposed to enabling it. There are of course some scenarios in which technology acts as both a structure of domination and an institutional strategic choice. A concept referred to as technochange describes exactly that. Technochange is the scenario where organisations deliberately deploy technology as a strategic force with the purpose of introducing organisational change (Markus, 2004:5) and, in doing so technology becomes a force of domination. Executive decision-makers often follow the technochange approach when the tactical and more so operational decision-makers fail to drive the strategic changes prescribed by these executives. Technology is then used as a force driving such change and in doing so often becomes a structure of litigation (refers to section 4.4.2).

6.2.3 Structuration Theory

Heinze & Hu (2005:892) and Hossain et al. (2011:577) discredit both technology determinism and technology as strategic choice as adequate explanations describing the role of technology in an institution. The third perspective on technology's role in an institution is introduced for this reason, namely that of structuration theory. Unlike the previous two perspectives, structuration theory recognises the recursive role of technology as both influencer and influence. Technology is therefore not seen as a static object functioning in isolation, but rather as a dynamic and ever-evolving force influencing whatever interacts with it. Orlikowski's SMT is fundamentally grounded in the theory of structuration, which is why section 4.4 has discussed the topic in greater detail. A reminder is as follows: Structuration theory suggests the existence of a recursive relationship between an institution, the related human agents and technology implementations. Institutions implement technology as enablers of human agents to perform the institution's objectives. However, the mere introduction of technology has reactive consequences which in return introduce change in both the institution and human agents. This section does not aim to repeat previous discussions on structuration theory, but rather acknowledges structuration theory as the third and final perspective describing technology's role in an institution.

6.3 Decision Support Systems Development

6.3.1 Objectives of Decision Support Systems

DSS has evolved significantly over recent years, both in terms of its definition and also the underlying technologies it uses. Its purpose has however remained consistent, namely to offer the appropriate technology artefacts that will enable the cognitive process of a decision-maker. In addition to this, academics such as Bunnell & Boyland (2003:269) and Power (2002:6, 13) mention various high level objectives of DSS. These objectives range from the facilitation of individual decision-making to the actual and automated decision-making by DSS alone; DSS can aid individual research activities and can also guide managerial activities in an attempt to increase organisational performance through monitoring and analytics. In doing so, DSS aims to be agile and responsive to the dynamic needs of decision makers in order to

promote fact-driven decision-making through the generation of individual knowledge. These objectives should ultimately improve the quality of organisational decision-making and subsequently also the organisation's problem solving capabilities.

A publication by Devlin & Murphy (1988) was one of the first in its nature to distinguish DSS from on-line transactional processing systems (OLTP). This publication eventually contributed to the establishment of DSS as it is perceived today. The publication explains that even during the early days of OLTP, organisations became increasingly dependent on a dedicated reporting environment that would not interfere with their operational processing. DSS are quite different from OLTP, as explained by Kimball & Ross (2002:7), Power (2002:8) and El-Sappagh (2011:91), and so too the development of these systems. The main distinction between the two technologies is the fact that OLTP are created to enable operational processing whereas DSS are aimed to facilitate organisational decision-making. Whilst OLTP do cater for some level of decision-making, Thalhammer et al. (2001:241) go as far as stating that OLTP are 'poorly suited for decision support'. Many would debate such a perspective since OLTP can offer sufficient support for operational decision-making, but most would agree that OLTP has weak support for tactical and strategic decision-making. This is because the main focus of OLTP is that of instant transactional processing, fast performance and continuous availability, with little focus on the content and format of data as is required for decision-making. For this reason the data stored in DSS are specifically designed to allow for the instant and bulk extraction and manipulation of data. The interaction with OLTP is typically also fast but only by means of single transactional queries updating, inserting or deleting few record instances at a time. In fact, DSS are designed to efficiently process large and complex analytical queries ranging across multiple data elements. Such a task would otherwise have been impossible to execute if not for the specific DSS design. No historical data is kept in OLTP and the data distributed across OLTP are mostly disjointed, neither integrated nor shared between the different systems. DSS integrate the data elements sourced from various different systems into a unified structure, whilst explicitly catering for the storage of historical data. OLTP often provides the standard business reports required for operational decision-making. Such

reports are typically a current state reflection of specific business activities running on isolated OLTPs. In fact, DSS typically integrate a variety of data sources, which at times even includes external data, to provide an integrated reporting perspective. These differences between OLTP and DSS are but a few examples. In summary, OLTP is designed to support operational efficiency whereas DSS are concerned with enabling decision-making. Despite these differences, Chen et al. (2000:104) recommend the success of DSS to be measured in the same way as other IS such as OLTP, simply because DSS are one particular instance of IS. Such measurements include the quality of the system and its data; its ease of use; the level of user requirement satisfaction; and lastly, the impact that the system has on the individual user and respective institution.

The next two sections further elaborate on the implementation approaches and architecture differentiating DSS from other forms of IS such as OLTP.

6.3.2 Implementation Approaches

The characteristics of an organisation, as well as the manner in which IS are embraced by the organisation, are key determinants of the manner in which the organisation adopt DSS. It often happens that organisations initiate their DSS journey with data-driven DSS (often even in a limited form) simply because most other instances of DSS are fundamentally dependent on data-driven DSS (Wu et al. 2001:109). This is no different for the case study, as is illustrated in the empirical findings represented in Chapter 7 and 8. It is also for this reason that many academics focus on data-driven DSS to motivate the general adoption of DSS in an organisation. A study by Ramaurthy et al. (2008:831) explored various organisational factors influencing the successful adoption of data-driven DSS. Five variables in particular proved significant, of which an organisation's commitment to improved decision-making is listed as the most important factor for the adoption of DSS. The 'absorptive capacity' of an organisation refers to ability to stimulate and prioritise IT innovation, another variable proven to strongly influence DSS adoption. This absorptive capacity also relates to an organisation maturity level in terms of their DSS adoption. Not surprisingly, the study also confirms that larger organisations are more open to DSS.

Perhaps this is somewhat related to their ability to absorb the associated cost much easier than smaller organisations. It is perhaps also because larger organisations are competitive by nature and therefore better positioned to justify the related costs. Lastly, the perceived advantages of DSS considered against its complexity in terms of implementation, maintenance and utilisation proved another important variable influencing the adoption of DSS. Again, it is much easier for larger organisations to justify the development of complex DSS than it is for smaller organisations. However, smaller organisations do not need complex DSS and may opt for the adoption of simple DSS sufficient for their decision-making needs. Ariyachandra & Watson (2010:211) identify seven organisational factors that affect the implementation of specifically data-driven DSS, but these factors can easily be abstracted to be applicable to all DSS instances. These factors are now discussed in Table 6-1.

Different approaches can be considered when designing a DSS, of which two dimensions are presented by Power (2002:61-65). The first dimension evaluates whether a DSS should be procured or developed. When procured, the architectural design and functionality are predefined and an organisation must adapt to the solution. However, packaged DSS are faster to implement and mostly offer the best of standard industry practises. In-house DSS developments are designed to fit the organisation, but the delivery thereof is often limited in scope, time-consuming and consequently also expensive. The second dimension is the DSS delivery approach. The most typical delivery approach is that of systems development life cycle (SDLC), based on a series of formal steps following a general sequence of requirements collection; system development; user evaluation and finally solution signoff. SDLC is often the approach of choice when multiple stakeholders are involved that requires structured and well-defined boundaries. Rapid prototyping is another delivery approach that addresses the lengthy formalities associated with SDLC by deploying quick, often imperfect iterations of DSS development. This approach is aimed at delivering constant value by being agile, rather than delivering a perfect solution over a long period of time. The end-user DSS development approach has gained much popularity as it allows DSS users to not only influence the scope of the DSS, but also to develop, manage and maintain the DSS themselves. This approach has received much criticism such as

the limited technical knowledge of the end-user; a decrease in quality; and even the end-users bias influence over the DSS. Despite this, the end-user development approach has also achieved much success. This is because of the fact that the decision-maker using the DSS is the same individual designing, developing and managing the DSS.

Factor	Description	Generalisation
Information Independence	Degree of information reliance across different business units based on the execution of daily tasks.	Decision interdependencies call for shared, centralised and scalable DSS.
Implementation Urgency	The timeframes available to implement the DSS.	Pressured DSS implementations address immediate business lack sustainability because of its purpose to act in isolation.
Task Routineness	The extent to which decision-making is routine versus ad hoc.	Irregular and unpredictable decision making requires in-depth and complex DSS
Strategic View	The long term positioning, relevance and value proposition of the DSS.	The strategic importance of the DSS implementation determines the sophistication of the solution.
Resource Constraints	The availability of resources in the form of business and IT staff; funds; and infrastructure.	Fewer resources will result in a less sophisticated, centralised and generalised DSS
Perceived Ability of IT Staff	The level of confidence, expertise and experience of IT staff.	Competent IT staff will successfully implement DSS addressing business needs.
Sponsorship Level	The extent of executive sponsorship involved.	Political influence and DSS sponsorship originating from a single business unit is likely to result in a DSS implementation offering limited value to the rest of the organisation.

Table 6-1: Organisational Factors Influencing DSS Implementation Approach (Ariyachandra & Watson, 2010:211)

The implementation approaches of DSS listed in this section are important to understand as they influence how DSS are developed. Unlike other industries, the distinct nature of the revenue collection industry in conjunction with the unique South African tax regime disqualifies SARS to procure 'packaged' DSS. These packaged

DSS typically contain predefined reports, models and algorithms. Revenue collection agencies procure 'packaged' development tools allowing them to create their own DSS. However, the actual DSS of the different revenue collection agencies are mostly developed in-house. This is why a conceptual DSS framework aimed at addressing the tax gap is important and consequently researched in this thesis. The custom development of DSS subsequently calls for a discussion on the architectural approach taken.

6.3.3 Architecture

The architecture of DSS has evolved and matured quite significantly over time. As previously discussed in section 6.3.1, the publication by Devlin & Murphy (1988) introduced one of the first DSS architectures. Although somewhat outdated, this architecture is conceptually very similar to what is referenced today. The general design of DSS is referred to by March & Hevner (2007:1036) as a 'layered' architecture because each 'layer' is dependent on the previous layer. They roughly define the layers as a content layer; integration layer and utilisation layer, each to now be discussed in greater detail. An understanding of DSS architecture is important as it not only stipulates the manner in which DSS are constructed, but also illustrates how the different types of DSS vary.

A generally accepted high level architecture is illustrated in Figure 6-5, as presented by Chaudhuri et al. (2001:299) and Shin (2002:586) amongst many others. Most DSS are primarily designed to store and integrate data sourced from multiple OLTP where they are then manipulated to deliver a variety of reporting, data analytics and/or data mining models, amongst others. Data is extracted from a different set of data stores such as OLTP systems and external data sources. Transformation rules are subsequently applied before the data is loaded into what is typically referred to as a data warehouse (DW). A DW which hosts enterprise content is referred to as an enterprise DW (EDW). Both are generally referred to as the content layer. It is important for the content layer to differentiate OLTP from a DW. As previously explained, OLTP systems are application-oriented solutions used to run the daily operations of a business whereas DW solutions are subject-oriented and specifically

designed to support decision-making. Data transformations occur when a DW is populated and, in doing so, convert normalised data structures from the OLTP into the denormalised data structures (also referred to as dimensional models and star schemas) of the DW. This process is also referred to as the extract, transform and load (ETL) and is intended to source, cleanse, transform and standardize transactional data prior to loading it into the DW (Ramaurthy et al., 2008:817). Shin & Sanders (2006:268) differentiate normalised and denormalised data structures and motivate why data denormalisation is the preferred approach for DW. Normalised data structures are consistent with that of OLTP of which third normal form (3NF) has arguably proven to be most popular. Preference to denormalisation mainly relates to the significant performance improvement of the large data extractions typically needed for decision-making, as well as the simplicity of the supporting data structures. Such simplicity is needed to accommodate complex decisions. Denormalised data structures are therefore faster to retrieve in addition to dimensional modelling being specifically designed to address particular business questions. This is also the downside of denormalisation, as the design requires a preconceived understanding of the problem and a lack of design flexibility.
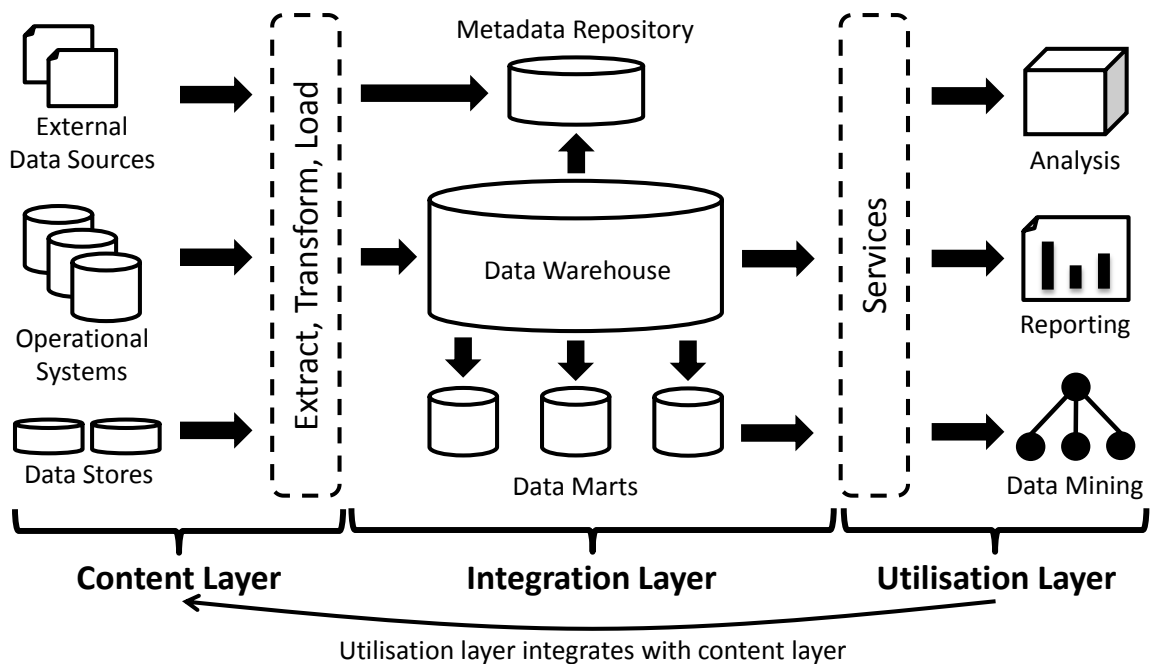
Figure 6-5: Basic Architecture of a Typical Data and Model-driven DSS (Adapted from Chaudhuri et al., 2001:299 and March & Hevner, 2007:1036)

A metadata repository is an important yet often less emphasised component of a DW. Metadata is the 'semantic description of content and services' of a DW (Nogueras-Iso, 2012:118). Metadata is often simply described in laymen's terms as 'data describing other data'. Simple as it may sound, various metadata standards exist that prescribe the manner in which metadata semantics must be stored. Examples of semantics are an explanation of the content, the content's level of quality, an explanation of the ETL conditions leading to the content's existence, and its authorship, to name but a few. The storage of metadata is referred to as a metadata repository. Past perspectives of metadata repositories were simply limited to a single database instance in which metadata was stored. Vassiliadis et al. (2000:92) criticise the one dimensional perspective on metadata repositories as being outdated and suggest a three layer metadata repository. Firstly, the data meta-layer stores the attributes describing the integration layer, which includes both technical and business perspectives. The second layer is the data quality meta-repository. As its name suggests, this repository stores the quality ranking of the data loaded in the DW. Examples of quality measurements are the timeliness of data, availability of data accuracy, completeness, and consistency, to name but a few. Thirdly, the process meta-repository captures the process elements associated with the DW such as the business transformations. The process meta-repository describes how data is transferred from source system (content layer) to DW target area (integration layer), together with the transformation frequency and transformation rules. Further critique generally raised against metadata repositories is the lack of a metadata management tool. This critique is addressed by Wu et al. (2001:109) when they suggest a fourth layer to the metadata repository, namely a management tool allowing for the capturing, design and editing of metadata. These tools enable users to query and maintain the metadata repository and will in many cases also facilitate the on-going design of the DW – especially with regard to the ETL process. One can image that the administration of large DW can become quite cumbersome and overwhelming. Without a metadata repository editor, data warehousing developers can introduce various issues such as the duplication of tables or the failure to understand existing tables.

The DW acts as a platform in which all enterprise data is stored and integrated once it is populated from the content layer. The result of this ETL process is known as the integration layer and typically consists of a metadata repository, DW and data marts (DM). DM are at times built as subsets of the DW and are dedicated to serve very specific information needs. More on the differences between a DW and a DM are presented in section 6.4.1. Different technologies are used to extract data from the DW and DM in order for data to become information that can be used to satisfy the information demands of decision-makers. These technologies include analytical exercises (such as descriptive statistics, clustering and association analysis), different forms of reporting (such as detailed data extractions and BI reporting) and also data mining (such as forecasting, predictive modelling and text mining). The collective of these vast technologies are labelled the utilisation layer, many of which are discussed in sections 6.4, 6.5 and 6.6.

The preceding architectural overview describes the traditional perspectives of DSS. Critique has been expressed on these perspectives stating that its value proposition is limited to that of passive intelligence. Past DSS were described as being 'disconnected' from the rest of the organisation and criticised for functioning in a delayed or 'after the fact' manner. To address this critique DSS have since evolved to become closely integrated with other OLTP, even acted as OLTP themselves. This is illustrated in Figure 6-5 by means of data flowing from the utilisation layer to the content layer. An example of this paradigm shift in DSS is by Tang et al. (2001:233) in which a geographical information system (GIS) (discussed in section 6.4.3) is used as both DSS and OLTP. This integration between DSS and OLTP has resulted in DSS becoming very relevant to the immediate affairs of an organisation. Another critique against traditional DSS relates to the static nature of its service offerings. Modern DSS use various techniques to overcome this problem by adapting to the dynamic environment within which it operates (Chuang & Yadav, 1998:74; Bhatt & Zaveri, 2002:298). These systems are called active intelligent DSS and are fundamentally based on the ability to derive 'new' knowledge from past lessons learned. Such a proposal is presented in Figure 6-6 and subsequently discussed.
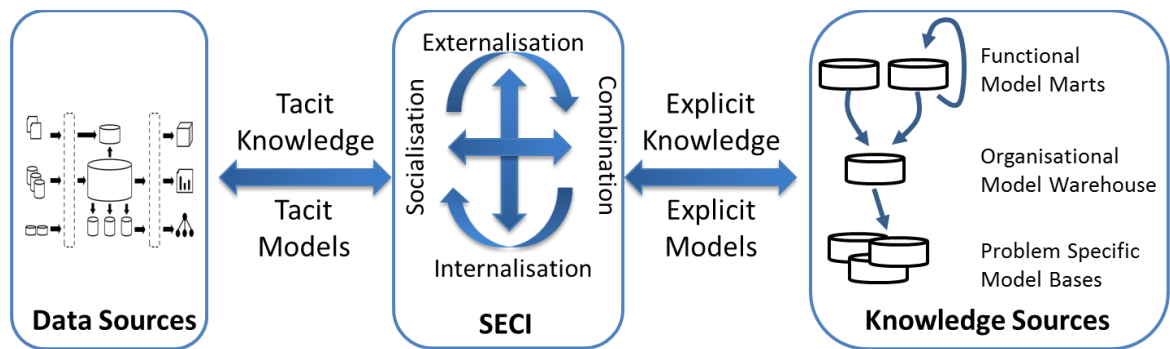
Figure 6-6: Integrating Data and Model-driven DSS with Knowledge Management / Knowledge-driven DSS (Adapted from Bolloju et al., 2002:165-176)
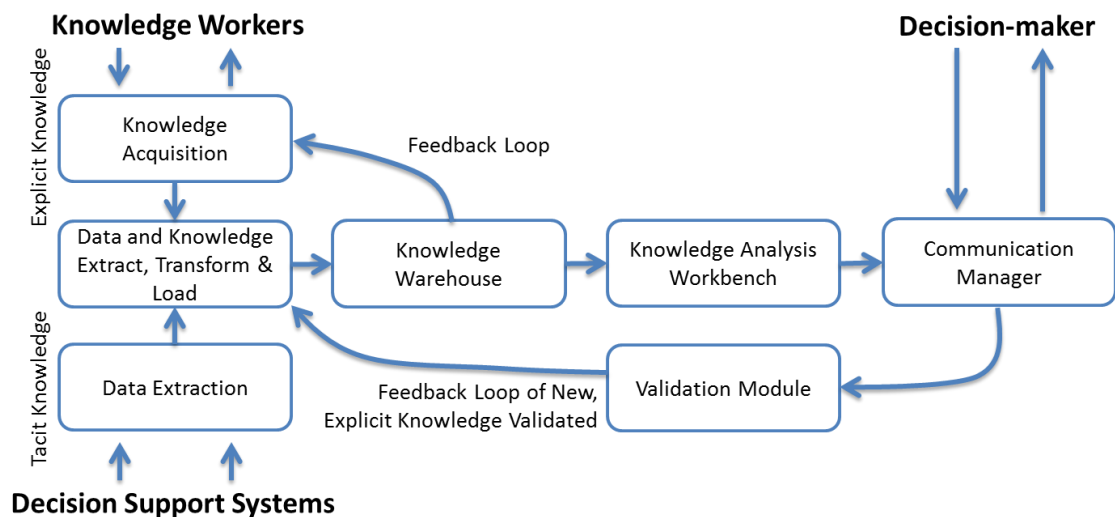
Figure 6-7: Knowledge Warehouse Architecture (Adapted from Nemati et al., 2002:151)

Power (2002:6) also addresses the critique stating that DSS are passive intelligence by suggesting for modern DSS to be enhanced with a body of knowledge that can present knowledge on an ad hoc basis. A similar but more detailed proposal is made by Bolloju et al. (2002:165-176) on how to incorporate knowledge management principles, such as those introduced in section 5.4.2.2, into a DSS environment. One can recall that tacit knowledge is converted to explicit knowledge through externalisation. Similarly, the DSS equivalent can be explained by means of decision-modelling which describes the process of problem exploration to resolution presentation. The most significant reason for incorporating knowledge management into DSS is to convert tacit knowledge into explicit knowledge models. Once converted, these knowledge models are stored in knowledge sources that consist of

model bases, model marts and model warehouses. These concepts are very similar to databases, DM and DW except that it stores knowledge models. Much like OLTP databases populate DM and DW, model bases populate model marts and model warehouses. Model bases are problem specific as databases are transaction specific. Similar to DM storing data pertaining to a particular business domain, model marts store the problem-solving and decision-making knowledge associated with the particular business domain. For this reason, model marts are considered to be functional specific. A knowledge warehouse acts like a DW by serving as an all-inclusive integration platform for the different knowledge bases and knowledge marts. The knowledge models stored in model marts and model warehouses are referenced by decision-makers to enhance their decision-making capabilities. Figure 6-7 illustrates a SECI (refer to section 5.4.2.2) 'flavoured' knowledge warehouse concept by Nemati et al. (2002:151) in support of the DSS architecture of Bolloju et al. (2002:165-176) shown in Figure 6-6. The modern DSS architecture displayed in Figure 6-6 forms is an important enhancement to the traditional DSS architecture presented in Figure 6-5.
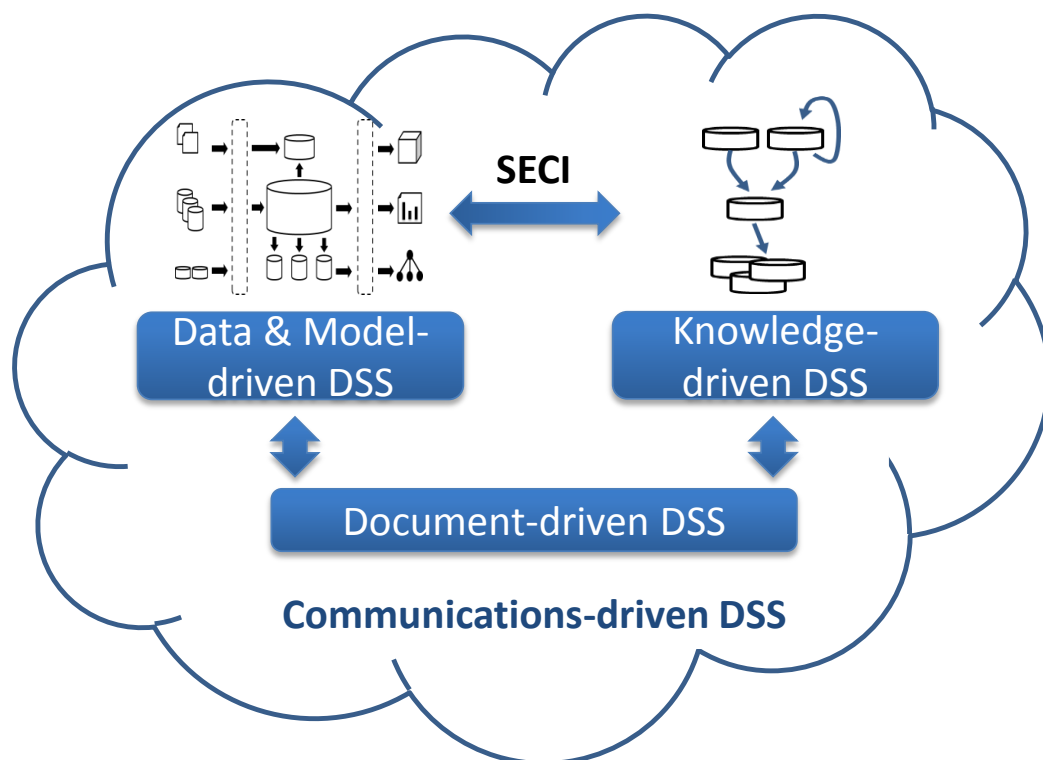
Figure 6-8: Relationships between DSS Instances

The architectural relationships between the different types of DSS (refer to section 5.3.1 for the list of DSS) are illustrated in Figure 6-8 and derived from the conclusions of this section. Figure 6-5 shows the architecture of data-driven and model-driven DSS. Data-driven DSS are used to store data, most often in the form of DW, and are utilised by most other forms of DSS. One such example is model-driven DSS, which presents decision-makers with various statistical and analytical abilities through techniques such as data mining. Figure 6-6 enhances the data-driven and model-driven DSS architecture by also including knowledge warehouses in the form of knowledge-driven DSS. The remaining two types of DSS are that of document-driven DSS and communications-driven DSS. Document-driven DSS are used as a medium to capture, display and present the results derived from data, model and knowledge-driven DSS. Communications-driven DSS relate to the mechanisms used to enable and facilitate the decision-making interactions resulting from the other four DSS instances. This section therefore builds on Chapter 5 that defined the different types of DSS by presenting the relationship between these DSS types. The conceptual DSS framework is also enhanced in section 6.9 to include these conclusions. Lastly, an understanding of this relationship is imperative before each of these five DSS instances are discussed in greater detail. The remainder of this chapter now discusses the manner in which these DSS are used to address tax noncompliance.

6.4 Instances of Decision Support Systems: Data-Driven DSS

Data-driven DSS store, retrieve, manipulate and display large volumes of data. This data has a typical structured nature, but recent years have also illustrated the importance of unstructured data. In general, this data is considered 'hard' because of its quantitative characteristics. Examples of data-driven DSS are DW, DM, the programmes used to store, manipulate and retrieve data (the ETL process), and also the interfaces required to present the data such as BI reports. A more basic example of a data-driven DSS is a plain file that can be processed by a reporting tool. The simplest such example is that of a Microsoft Excel document. More complex examples are that of DW. Data-driven DSS are typically designed and tailored according to specific institutional needs, storing and integrating a wide range of historical data that are updated frequently and, in doing so, offer a sophisticated level

of decision support. As previously said, data-driven DSS are often seen as the starting point for other - more sophisticated - instances of DSS (Ramaurthy et al., 2008:817). This is because these other DSS instances are typically enabled through data-driven DSS. Data-driven DSS and especially DW and DM offer limited value when acting in isolation as mere data repositories. The true value of data-driven DSS can only be derived through the other instances of DSS – as presented in subsequent sections. For this reason, Shin (2002:588) explains that data–driven DSS projects (such as the establishment of a DW) should at the very least partly include the delivery of other DSS instances in order to show business value.

Power (2002:123), Glorio et al. (2012:884) and Bahrami et al., 2012:164) describe data-driven DSS as an interactive IT solution that enables decision-makers to interrogate large historical business databases with the objective of facilitating decision-making. The authors identify different instances of data-driven DSS namely that of DW; on-line analytical processing systems (OLAP); business intelligence Systems (BI); executive information systems (EIS) and geographical information systems (GIS), each which is presented in the subsequent sections.

6.4.1 Data Warehouse and Data Marts

The concepts of data warehousing and DM were briefly introduced in section 6.3. Data warehousing has proven to be one of the most powerful DSS of recent times, resulting in its strategic value to be undisputed (Shin, 2002:581). However, various studies have expressed critique regarding the number of failed DW implementations, which have been suggested to be up to 50% of all projects (Ramaurthy et al., 2008:817). This is quite staggering considering that 85-90% of the Fortune 500 companies either has or intends to have DW (Shin, 2002:581). One of the reasons contributing towards these failures might be the fact that data warehousing and strategic decision-making have received very little attention by academics when compared to other topics (March & Hevner, 2007:1031). DW are furthermore user-driven technology artefacts with its success measured mostly through user satisfaction (Chen et al., 2000:103). This is in itself very relative to the user's unique experience and once again emphasises the interpretive schemes associated with technology as a

medium for human action (See section 5.4.1). Some academics state that there is also limited research available proving that DW significantly enhances the performance of organisational decision-making (Park, 2006: 51; Ariyachandra & Watson, 2010:200; Chen et al., 2000:103). This is not only true for the private sector, but also for the public sector. Having said this, DW used in conjunction with other DSS instances have become critical enablers to combat the tax gap (Wu et al., 2012:8770).

A DW is described as a database designed to load, manipulate and retrieve large amounts of data with the specific intention of supporting organisational decision-making. This data is specific to time and is static by nature, or in other words, the data loaded into a DW is time-stamped and is subsequently rarely updated. March & Hevner (2007:1031) emphasise that one must distinguish a DW, which is essentially an integrated data repository, from data warehousing. Data warehousing describes the activities, technical or managerial by nature, which contributes towards the continuous existence of DW.

It is important to present the two schools of thought that dominate the manner in which DW are implemented (Ramaurthy et al., 2008:817; Bahrami et al., 2012:164). Bill Inmon proposes a single integrated DW whereas Ralph Kimball prefers silo DM conforming to particular standards. Inmon's DW centralises data in the organisation and stores it in normalised data structures based on a top-down organisational decision-making approach. In some cases limited denormalisation can occur for performance reasons, but these cases are few in comparison with the overall relational design. This implementation becomes a formal extension of an enterprise's data architecture and therefore offers sustainability and reliability. However, these benefits come at the cost of increased infrastructure sophistication and significantly more complex construction when compared to DM. Kimball's DM design follows a decentralised data storage bottom-up approach aimed at serving the specific needs of the relevant business division. Although these DM initially function in isolation, they evolve over time to interact with one another, thereby simulating a centralised DW. This is referred to as the DM bus architecture (Ariyachandra & Watson, 2010:200). DM store data in a specific multidimensional and denormalised data structure referred

to as a snowflake schema, which is specifically designed for fast and precise storage and retrieval of large amounts of data. DM become conformed when they share dimensions describing certain measurements, of which date and geography are the simplest of examples. Both Kimball's and Inmons's designs have been widely accepted as industry standard data warehousing and DM design principles (Shin & Sanders, 2006:268). In many cases DM even coexist with DW, thereby delivering the benefits from both approaches. This is often the case when a DM is populated from a much richer DW, amongst others, in order to transform data into the format uniquely required by the specific business unit. At times this is referred to as the 'hub and spoke' architecture (Ariyachandra & Watson, 2010:200). However, Wixom & Watson (2001:37) criticise the development of DM as they eventually evolve into a disparate collection of information silos. This is but one instance of the many technical challenges posted by Wixom & Watson that are associated with building a DW. Other technical challenges include the expertise and sustainable implementation approaches whereas nontechnical challenges include political agendas preventing implementation success; business sponsorship and monetary commitment. These challenges are often overcome through the progressive building of DM which eventually results in the establishment of a DW.

Certain DSS instances do have a preference to a DM design versus a DW design. One such preference is that of GIS, as elaborated on in section 6.4.3. The increasing emphasis on GIS in recent years has called for a revision in the designs of DW and DM. Accordingly to Glorio et al. (2012:884), a DM approach should be taken to successfully integrate business data with GIS. This can be done by adding a spatial dimension to all relevant data elements in the DW but to hide these complexities to the decision-maker through DM. Such DM are then designed to address specific predefined business questions and thereby allowing the complex spatial dimension to act in a simple manner – much like any other standard dimension. The motivation for this approach touches on a broader DW versus DM preference and the manner in which some of the complexities associated with data warehousing can be simplified by introducing additional DM.

As previously mentioned, an ETL process is used to load data from source into a designated DW / DM through what is referred to as a mapping area responsible for data cleansing and transformations. El-Sappagh et al. (2011:91) identify this ETL process as the largest undertaking when building a DW, partly because the complexities associated with data is likely to consume most of the available time, effort and cost. Mannino & Walter (2006:124) elaborate on the ETL process by focusing on the frequency of DW updates. Their study explains that DW are typically updated when the associated record on the source changes. The bulk of these updates are done during non-business hours, although some updates can occur on a less frequent basis, such as weekly or even monthly. This data is referred to as passive data. However, the need for active data obtained through frequent updates, or near real-time updates, has become an increasingly important requirement for data-driven DSS. This is referred to as 'active data warehousing', which Thalhammer et al. (2001:242) pose as a possible solution to automate routine decisions and tasks. The frequent update of active DW allows for a closer integration between what used to be a large disjoint amongst transactional and OLTP, as first discussed in 6.3.1. However, the building of active DW poses some challenges, some of which are identified by Mannino & Walter (2006:136), namely: the time available to access the data source; the time involved to compute and integrate the data sources; and the loading restrictions prescribed on the DW such as processing and storage limitations, to name but a few. The evolution of traditional passive DW to active DW has also resulted in an evolution of the reporting capabilities it enables. One such example is operational BI reports using active data warehousing. The concept of operational BI originated from traditional BI reports using passive data warehousing (see section 6.4.2). Some of these reporting capabilities are discussed in the next section.

DW and DM perform the same function when considering their value proposition in terms of addressing the tax gap phenomenon. Their function in this regard is that of acting as an integrated and centralised data store which enables many other DSS instances such as those presented in the subsequent sections. Without a DW and/or DM, other forms of DSS can only function in a limited manner, if at all. DW and DM thereby support the other forms of DSS that enables operational, tactical and strategic

decision-making. It is for this reason that DW and DM forms the foundation of the conceptual DSS framework under development.

6.4.2 OLAP Systems / Executive Information Systems / Business Intelligence Systems

OLAP refers to the technology used to process multidimensional data, which is often also referred to as data cubes. OLAP populates data cubes by extracting data from DW and/or DM and aggregating the data into a specific multidimensional format which can enable various analytical capabilities (Bolloju et al. 2002:163). This allows instantaneous 'slicing-and-dicing' of the factual data using a variety of predefined dimensions aimed at describing the data that is required by reporting and analytics. OLAP is therefore another alternative to the storage of data in DW and DM, into which other DSS capabilities can be plugged into.

Although OLAP is excellent in handling aggregated multidimensional data, it struggles to accommodate complex data structures and relationships (Pedersen et al., 2009:453). These structures are best supported by object oriented databases as they are designed for complex detailed-level data, but fail to support the high performance queries of OLAP. The importance of knowledge creation in support of decision-making again becomes relevant when a recommendation is made by Prat et al. (2011:732), who suggest knowledge structures to be embedded into OLAP. Decision-makers will, through this embedment, be presented with predefined 'insight' related to the content that is displayed in OLAP systems. Such an approach party addresses the OLAP critique raised by Hsu & Li (2011:3743), namely that knowledge generation in OLAP systems are limited to the decision-maker's ability to derive knowledge from a variety of static and often disconnected sets of OLAP reports. Instead, the authors recommend that other techniques such as data mining are used in conjunction with OLAP reports to complement the knowledge creation of the decision-maker. The data mining techniques suggested by Hsu & Li are of less depth than that discussed in section 6.6, which is why they introduce a fairly new concept referred to as on-line analytical mining (OLAM). OLAM uses similar principles as data mining, namely to search data for hidden classifications, relationships and

patterns (amongst others), but from aggregated OLAP cubes instead of detail transactional records typical to data mining. OLAM is aimed at exploring hidden data patterns in aggregated reports through shared dimensions and business measurements.

OLAP DSS are typically used in revenue collection agencies for tactical decision-making where the decision-maker wishes to explore certain data elements in a report like manner whilst aiding his/her knowledge creation process. These explorations usually focus on the identification of tax noncompliance instances, ranging from specific industries to particular taxpayer segments.

Executive Information Systems (EIS) are software solutions designed with the specific goal of satisfying the decision-making needs of executives. In doing so, EIS places emphasis on sophisticated and easy-to-use graphical user interfaces. Predefined analytical reports with deep drilldown capabilities and tailored to the specific needs of executives, are distinctive characteristics of EIS.

A study by Averweg & Roldan (2006:625) explores EIS from a South African perspective and in doing so specifically focuses on the strategic decision-making typical to executives. Their study concludes that EIS in South Africa at that stage was in an uncertain state because its adoption was limited. Another study by Arnott et al. (2007:2078) explores EIS in emerging economies much like South Africa's economy and identifies a list of factors critical to the success of an EIS implementation. The cultural fit on EIS proves to be one of the most important factors critical to a successful EIS implementation. The South African cultural fit relates to the manner in which an emerging economy organisation's social and cultural influences on IT relate to those considered acceptable by large western organisations, where EIS concepts and principles originated. This is even more important to government organisations, as pointed out by Watson & Carte (2000:371). Their study explains that IT developers often find it challenging to deliver on executive solutions, not only because these developers have a limited understanding of executive work, but also because executives often have limited IT skills. Furthermore, the authors indicate that the building of EIS in the public sector is significantly more challenging than the

equivalent for the private sector. This is partly because of the limited technological innovation in government and also because public sector knowledge is scarce, resulting in various challenges related to the development of public sector EIS. Other challenges differentiating the public and the private sector include the allocation of sufficient budget for EIS development, the poor data quality typical to the public sector which EIS is dependent on, the political influences and lastly, the level of organisational appetite for EIS. The last point suggests that the public sector's uptake of EIS is less aggressive because this sector is not as competitive as the private sector and therefore the requirement for EIS is not as demanding.

EIS have relevance to this study because it specifically supports strategic decision-making through dashboard-like reporting. Having said this, executive EIS were very popular between 1990 and 2000 but have in most cases since been replaced with Business Intelligence (BI) reports. BI is very similar to EIS from a technology perspective, but offers significantly more sophistication to its users. This functionality allows for BI to support not only strategic decision-making, but also tactical and operational decision-making.

Business Intelligence is defined by Elbashir et al. (2008:136) as a type of DSS that is designed to query, analyse and report on large volumes of data. A more comprehensive description is given by Bahrami et al. (2012:162) who describe BI as 'a set of concepts, methods and processes' aimed at improving different types of decision-making at all levels in the organisation. They position BI as technology artefacts being central to institutional activities by means of supporting managerial decision-making. In doing so they coincidentally also align BI to SMT and INOD, making their conclusions very relevant to this research.

BI has evolved to become a critical decision-making enabler to most modern organisations by not only supporting the strategic decision-making of organisations, but also tactical and operational decision-making. BI does this by placing detailed emphasis on organisational business processes – one of many characteristics differentiating BI from EIS. The term 'operations intelligence' (OI) has since been

introduced to describe this particular dimension of BI. OI encapsulates to the 'know-how' related to the execution of business activities and processes (March & Hevner, 2007:1032). The intention of OI is therefore to ensure a closer alignment between BI reporting and OLTP which is in particular aimed at supporting operational decision-making.

Jun & Jun (2011:1822) focus on BI's ability to generate knowledge when defining BI as a set of scientific and mathematical models used to derive insights from data. BI's dependency on data is supported by Popovic et al. (2012:729) who elaborate on BI's positioning the maturity of an organisation's analytical decision making capabilities: BI is dependent on the quality of data as stored in DW / DM, or stated differently, as stored in the data layer of DIKW. However, BI also forms part of DIKW's information and knowledge layer. This is because BI allows decision-makers to derive insights from data. As the analytical capabilities of an organisation mature, decision-makers will also derive knowledge from BI using techniques such as data mining (discussed in 6.6). BI therefore eventually feeds into the knowledge layer of DIKW.

BI's ability to continuously present decision-makers with information and knowledge derived from organisational data has resulted in BI becoming a critical necessity for organisational growth. However, Petrini & Pozzebon (2009:178) are of the opinion that BI's role has since evolved into much more than simply a decision-making enabler, as BI also supports an organisation's sustainability. Davenport (2006:100) agrees by explaining that the analytical capabilities and maturity of an organisation are key determinants influencing its competitiveness. It is also suggested that BI acting in isolation has become insufficient in its objective to help organisations obtain a competitive advantage. Rather, organisations are integrating BI DSS with their model-driven and knowledge-driven DSS for more sophisticated knowledge generation (see sections 6.5 and 6.6 respectively). Modern BI DSS also seeks to incorporate additional external data that can be incorporated to further enhance their knowledge generation.

Nonetheless, BI has proven and continues to be an effective tool for addressing the tax gap and in particular to identify tax evasion (Wu et al., 2012:8769). The inclusion of BI in a conceptual DSS framework is imperative. Instances in which BI enables the management of the tax gap relates mostly to the enablement of tactical and strategic decision-making concerned with the segmentation of tax noncompliance through reporting capabilities. This section has furthermore illustrated that BI is increasingly becoming integrated with OLTP to enable true 'finger on pulse' decision-making. Additionally, modern BI is also closer aligned to model-driven and knowledge-driven DSS than what was previously the case. These findings are important as they influence the manner in which these concepts should be positioned in the conceptual DSS framework developed in this research.

6.4.3 Geographical Information Systems

GIS enables the geographical reporting and analysis of data. GIS is also at times referred to as spatial on-line analytical processing (SOLAP) (McHugh et al., 2009:2041). Through a GIS decision it can interact with geospatial maps by overlaying layers representative of business facts on vector or areal imagery. In doing so, insights regarding the geographical patterns, clustering and segmentation of these business facts can be interrogated through location and routing analytics.

Limited research exists that addresses the value proposition of GIS in revenue collection agencies – not to mention specifically in the South African context. An outdated example and perhaps the only one available is by Van Wyk (1985:1). His study presents the taxable income and tax assessments raised through two dimensions, namely the taxpayer's spatial segmentation and race classification, which provided valuable economic insights at the time. A decade later the publication by Ventura (1995:467) also attempted to position the value of GIS in the public sector by stating that the DSS presents a significant opportunity if it can be enhanced to address the unique geographical challenges experienced by government. He criticised the GIS as it was then for simply acting as a visualisation mechanism that uses maps, and proposed that technology also facilitate the decision-making process associated with such visualisation. Haque (2001:259) makes specific reference to the public sector

when stating that GIS offers 'unparalleled power to examine social, economic and political circumstances'. Haque promotes GIS as the best DSS to support decisions related to 'place and space'. This is especially true for revenue collection agencies, whose agenda is closely associated with the social and economic states of geographical locations. However, Haques also criticises GIS research for mainly focusing on technique as opposed to application. He states that the potential value of GIS in the public sector remains relatively unexplored, thereby also promoting the inclusion of GIS in this research. This is quite ironic considering his statement that government generates 90% of all GIS data. Having said this, GIS has evolved quite significantly over the past few years, as evident in the discussions below.

Reference is made to a famous quote by Tobler (1970:236) to motivate the essence of GIS: '…everything is related to everything else, but near things are more related than distant things.' Tobler's statement expressed the importance of geographical correlation between objects. The positioning of objects in space undoubtedly has a relationship, mostly because of their social relevance. This is why Boothby & Dummer (2003:300) emphasise the social influence of GIS, especially in terms of construction, usage and interpretation. This is supported by Haque (2001:262) who states that GIS gives an accurate reflection of 'real life' in the sense that the social composition of society becomes clearly visible when viewing/comparing neighbours, communities, towns, cities and provinces. Elementary forms of GIS have been in existence since the drawing of geographical maps many decades ago, but only started achieving significant momentum after the turn of the century. Decision-makers have since realised that GIS is much more than a digital visualisation of what was previously paper based maps. The mainstream adoption of GIS technology has enhanced the computational capacity of decision-makers and has subsequently resulted in the existence of GIS. Much has changed since then and for many people, speaking figuratively only, the world has become a much smaller place compared to a few decades ago, partly because of GIS's contributions.

GIS essentially consists of spatial data and maps displayed through a reporting and data analysis layer (Haque, 2001:259). The maps are created by merging spatial data

with business data, in order for business facts to be geographically represented. The spatial data can be either in the form of a vector or a raster. Vector GIS uses points, lines and polygons to display continuous areas identified through X and Y coordinates. Raster images, which are less popular and considered outdated, can best be described as a grid of tiles located through X and Y identifiers almost in a spread sheet line fashion. See Figure 6-9 for examples of vector and raster GIS.
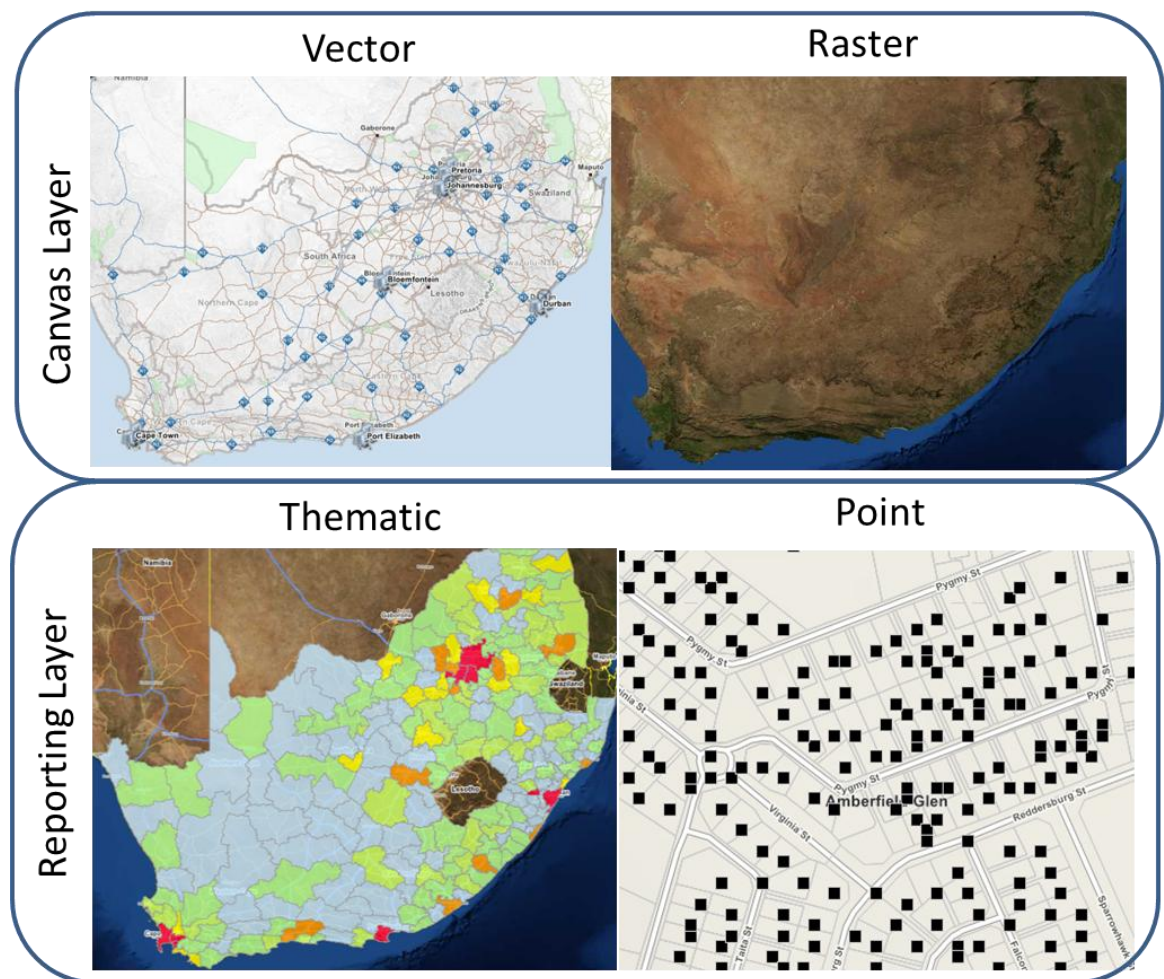
Figure 6-9: GIS Examples

Boothby & Dummer (2003:300) split GIS solutions into two categories, namely active and passive. Active GIS describe real-time GIS solutions that focus on mobile tracking – mostly through global positioning systems (GPS). Active GIS has become very popular in recent years. Examples include the tracking of mobile resources, such as fleet; movable personnel; and assets in transport, or even CCTV which is a geospatial phenomenon, to name but a few. Passive GIS refers to the traditional

reporting and analytics of spatial data that are typically static by nature. Examples of traditional reporting include the plotting of points on maps where each point can differ in colour to represent a particular business fact. Other examples include the creation of thematic layers which are overlaid on a map to cover certain geographical areas and thereby representing business facts through different colours. Refer to Figure 6-9 for examples of point and thematic maps. More recently geovisualisation, also referred to as geovisual or geospatial analytics, has become very popular. It essentially offers the ability to visually perform analytical reasoning on data with a geographical dimension to it (Andrienko et al. 2011:251). Knowledge from complex spatial structures can be derived through this functionality to ultimately facilitate decision-making (Mennis & Guo, 2009:403) – an offering that significantly enhances the traditional viewing of maps. Some of the additional functionalities are listed by Murayama (2000:166), namely geographical distance calculations; identifying geographical clusters based on the attributes of business facts; exploring the geographical relationship between different objects (nearest-neighbour analysis); defining geographical relevance to objects through geocoding; and identifying the spatial connectivity of different objects (network analysis); to name but a few. Academics regard geovisualisation and analytics as a multidisciplinary research field because it incorporates cartography; human computer interaction; psychology; information management and computer science, amongst others (Kraak, 2009:468).

Whilst the previous section explained how various academics have regarded geovisualisation as an evolution of traditional GIS, Mennecke et al. (2000:601,602) take a different perspective when stating that a 'spatial decision support system' (SDSS) is but one instance of GIS. The authors distinguish SDDS from GIS by explaining that GIS is limited to being a graphical tool used to render maps. SDSS is much more than the static geographical representation of data – the technology offers decision-makers the ability to explore and analyse geographical data dynamically and interactively. Despite their variation upon the classification of technology, their study concludes that GIS and especially SDSS do increase the decision-making efficiency of complex problems with geographical relevance, especially for tactical and strategic decision-making. There is general agreement on this as many academics are of the

opinion that GIS can and should be integrated with other DSS for enhanced SDSS decision-making, as is the case in the following examples: Tang et al. (2001:233) and Boothby & Dummer (2003:300) mention that GIS can also act as an OLTP by capturing, storing and manipulating spatial business data. Mennis & Guo (2009:403) illustrate how GIS's integration of knowledge-driven DSS supports spatial data mining. Similarly, the study by De Silva & Eglese (2000:423) successfully integrates a GIS with a simulation model-driven DSS to experiment with emergency evacuation contingencies. Another integration example is Durduran (2010:7729) who used GIS with a variety of different model-driven DSS algorithms to successfully manage traffic flow, including the prediction and scenario planning of future traffic accidents (the last mentioned are examples of model-driven DSS). A study by Tang et al. (2001:233) incorporates GIS with knowledge-driven DSS to 'interactively assist' the user to construct geographical queries. Communications-driven DSS are integrated with GIS and labelled by Balram et al. (2009:1963) as group-spatial DSS, which is aimed at supporting decision-making collaboration when the participants are spatially scattered. A similar study by Jankowski & Nyerges (2001:68) illustrates the importance of collaborative spatial decision-making and suggests that a facilitator is appointed to guide decision-makers through what is often a sophisticated process of spatial decision-making. This concept of collaborative decision-making is further explored in 6.7.

GIS is the last instance of data-driven DSS that enables decision-making. This section illustrated the value proposition for GIS to support operational decision-making through active GIS reporting, whereas passive GIS reporting is aimed at enabling tactical and strategic decision-making. Furthermore, this section also emphasised the cross-functional integration of DSS by listing examples of how GIS integrates with other data-driven, model-driven, knowledge-driven and communications-driven DSS. This finding is important as it influences this study's objective of constructing a conceptual DSS framework. Lastly, the section also illustrates that GIS offers many opportunities for revenue collection agencies – especially given the fact that taxpayers are social beings and that their behaviour typically have spatial relevance. These opportunities range from analytical reports such as understanding the income

distribution of taxpayers and non-compliant geographical areas; to the tracking of assets and mobile enforcement tax practitioners.

6.5 Instances of Decision Support Systems: Model-driven DSS

Model-driven decision support systems are parameter driven statistical and analytical software allowing users to analyse a particular situation in a quantitative manner, typically by a non-technical decision-maker (Power & Sharda, 2007:1044). These models are normally intended for purposes ranging from decision analysis; simulation models; optimisation models; forecasting models; and optimisation models, to name but a few.

Decision analysis involves defining, quantifying and evaluating alternative courses of action. In simulation models, various variables are predefined in an attempt to describe a particular scenario outcome by minimising the associated ambiguity and uncertainty (Bhatt & Zaveri, 2002:305). Decision-makers can then manipulate these variables to simulate different scenario outcomes. Forecasting uses similar principles but is time sensitive when identifying the states of future scenario based on the patterns of past variables. Optimisation models are used to seek solutions to problems given limited boundaries. These models use a combination of decision analysis, simulation and forecasting to suggest the optimal configuration for an ideal state of business operations (Bunnell & Boyland, 2003:271). All models have a similar purpose regardless of the algorithm and technology used: they define and evaluate different solutions to a particular problem given clearly defined boundaries that would be impossible for the human mind to compute. Typically, model-driven DSS users will supply the DSS with appropriate data in a structured format, followed by a set of custom parameters aimed at describing a desired scenario. Such a model is made up of various variables considered against each other in accordance with certain predefined assumptions. The DSS then interprets the data and parameters defining the model specifications. The end result is the simulation(s) of the defined modelled scenario.

Bunnell & Boyland (2003:269) state that a model-driven DSS and its data source are inseparable. This implies that a model's ability to address a business problem is fundamentally dependent on the problem's ability to generate data that 'describes' the model. This is also true for the algorithm selected, where each algorithm has its specific purpose. Models simply apply explicit knowledge to present information in a more convenient form. For this reason, academics such as Binbasioglu (1995:422) split the construction of DSS models into two phases in an attempt to ensure that models are created in a manner corresponding with the cognitive characteristics of decision-making. The first phase, which is the classification phase, is aimed at providing structure to the modelling process. This structure is based on the selection of the appropriate algorithm that addresses the particular business problem with the data available. The second phase is the construction phase. This phase assembles and integrates the different components of the model development in a linear approach, similar to the typical decision-making process. A critical component required in both phases is the inclusion of a domain expert to guide development activities of the model expert (Bertolino et al., 2011:1089). The domain expert is needed to embed certain 'knowledge' into the model, thereby attempting to transform tacit knowledge to explicit knowledge. Although model-driven DSS are implemented in a variety of industries, only a limited number of publications exist that explore model-driven DSS within the context of revenue collection agencies. A recent example is by Goumagias et al. (2012:76), focusing explicitly on the Greece Revenue Authority. Their study illustrates how model-driven DSS can be used to simulate the potential impact of tax policy changes.

This section established that model-driven DSS also build on data-driven DSS and listed various examples of how model-driven DSS are used to facilitate decision-making. Model-driven DSS therefore also forms an important aspect of the conceptual DSS framework in development.

6.6 Instances of Decision Support Systems: Knowledge-driven DSS

Knowledge-driven DSS is an extension of data-driven DSS and are in many cases also referred to as artificial intelligence (AI); (management) expert systems;

suggestion DSS; rule-based DSS and intelligent DSS (Power, 2002:141,142). Knowledge-driven DSS simulates - in a limited manner - certain human intellectual capabilities and recommends specific actions to users based on criteria specified (Eom & Kim, 2006:1272 – 1275). Section 5.3.5 discussed the principles of knowledge management and concluded that the topic is in a state of evolution. Section 5.4.2.2 presented the process of knowledge generation and explained in section 5.4.3 the manner in which knowledge generation ultimately enables different types of organisational decision-making. Based on these findings, section 6.3.3 illustrated the current evolution of DSS in which knowledge warehouses form an integral part of modern DW.

Knowledge-driven DSS make use of knowledge warehouses in which explicit knowledge is stored in the form of business rules pertaining to specific business problems (Power, 2002:141,142). These business rules are extracted through knowledge-driven DSS and applied to vast amounts of data using data mining algorithms and techniques. The concept of data mining is briefly explained as the ability to detect hidden patterns and relationships in large volumes of historical data, which is then used to predict, forecast and estimate future state(s) (Wu et al., 2012:8770). An important ability of knowledge-driven DSS is mentioned by Chuang & Yadav (1998:73) and Bhatt & Zaveri (2002:300), namely to be adaptable to its environment through self-teaching and self-learning techniques. In doing so and referring back to knowledge sources listed in section 6.3.3, the DSS is equipped to store knowledge about the decision-maker (metadata repository); knowledge about the problem (problem specific model bases); knowledge about the tasks associated with the problem (functional model marts); and knowledge about the institutional aspects related to the problem (organisational model warehouse).

In the past, statisticians used to explore the large volumes of data stored in DSS through hypothesis testing, during which the relationships amongst data entities were explored. This approach followed a 'verification' principle and has subsequently been enhanced with data mining techniques that are aimed specifically at following a 'discovery' principle. A study by Liao et al. (2012:11308) evaluates the evolution of

data mining techniques from 2000 to 2011 and concludes that data mining has progressed to become diversified in terms of its objectives, expertise-oriented in terms of its usage and problem specific in terms of its application. Many would argue that this statement suggest the state of maturity for data mining. This perspective is supported by Seng & Chen (2010:8043 – 8046) who explain that choosing an appropriate data mining algorithm to best address a particular business problem can be a daunting task even for the experienced data miner. For this reason they list a set of typical business problems that can be addressed by data mining and categorise the various data mining algorithms accordingly. Liao's study lists a few of many data mining algorithms that have been proven popular. These include association rules; decision trees; neural networks; classification rules; feature selection; support vectors; fuzzy logic; appropriate algorithms; clustering; link analysis and genetic algorithms. Data mining algorithms are supplemented with data visualisation tools making statistical and mathematical algorithms easier to understand. An elaboration of the statistical nature of these data mining algorithms is beyond the scope of this research. However, it is important to recognise that these algorithms are not exclusive of one another. A study illustrating this is reported on by Mennis & Guo (2009:404) who integrate data-driven DSS in the form of GIS with knowledge-driven DSS in the form of data mining. Particular reference is made to the usage of spatial classification and prediction; spatial association rules; spatial clustering; regionalization and point pattern analysis; spatial neural networks; collective nearest neighbour; and genetic spatial algorithms.

A more relevant example of a knowledge-driven DSS aimed at addressing the tax gap phenomenon is presented by Wu et al. (2012), which is surprisingly similar to an older study by Gupta & Nagadevara (2009). The example makes use of data-driven DSS in the form of a DW being integrated with knowledge-driven DSS. This is done through data mining techniques that evaluate the VAT tax return declarations of taxpayers, predicting which taxpayers are most likely to evade taxes. Traditional approaches to this exercise included the evaluation and selection of non-compliant taxpayers using personal intuition for what was often random sample audit selections. This was typically combined with criteria based audit selections which would be

seasonally redefined. However, these approaches have become obsolete because of increased volumes of data, in this case tax return volumes. Not to mention the ever increasing complexity of tax regimes combined with the growing level of sophistication regarding modern day tax evasion. Furthermore, random audit selection suggests the equal treatment of compliant and non-compliant taxpayers considered against criteria based selection that assumes the continuance of past noncompliance characteristics. Neither of these approaches is ideal. Using data mining, revenue collection agencies can improve the performance of tax evasion detection by optimally and intelligently selecting non-compliant taxpayers marked for audit. This is especially important given the limited audit capacity of revenue collection agencies.

This section highlights the importance of including knowledge-management DSS in the conceptual DSS framework. The section also reinforces the idea that most DSS are in effect inseparable and function in a manner complementary to each other.

6.7 Instances of Decision Support Systems: Communications-driven DSS

Whilst the previous forms of DSS are regarded as decision-making enablers, the two remaining DSS, namely communications-driven DSS and document-driven DSS, are regarded as facilitators of organisational decision-making. Communications-driven DSS have made significant advances in the field of organisational interaction and collaboration and even more so since the explosion of social media. In doing so, various past communication challenges have been addressed through DSS (Power, 2002:112) by means of enhancing communications, idea explorations and concept formulations. Communications-driven DSS can also model decision-making activities. In more advanced communication decision-making can even automate decision-making when integrated with other forms of DSS such as knowledge-driven DSS.

Three factors are identified by Power (2002:106, 109) as being critical to understanding communications-driven DSS, namely time, location and nature of communication. Time can be either in real-time or delayed time. Location can be in close proximity versus wide proximity. Nature of communication is typically either ad

hoc or on-going. Communications-driven DSS technologies related to decisions in the same time and location are decision rooms; display screens and voting tools, to name but a few. Examples of same time different places communications-driven DSS technologies are video and audio conferencing; white boards; screen sharing and chat rooms. Communications-driven DSS of different time but same location are document sharing and workstation software for shift work. Examples of communications-driven DSS supporting different time and place are conferencing tools; bulletin boards; email and voice mails. Having listed these examples, it is important to appreciate the comments from Gopal & Prasad (2000:512) in which they criticise the past focus of communications-driven DSS research as being too technical by nature. Instead, they emphasise the social nature of DSS and state that the usage of communications-driven DSS is relative to the manner in which communications occur within the respective social boundaries. This perspective is also emphasised in the interpretive schemes characteristics of DSS, as originally discussed in section 5.4.1.

GDSS used to be one instance of communications-driven DSS but have since become a topic in its own right. GDSS support the decision-making process by providing interactive technologies that facilitate the group interaction amongst decision-makers. This capability is especially valuable to the 'Lockean' type of decision-making organisation, as discussed in section 4.2.1. These technologies include, amongst others, messaging, emails, discussion forums, bulletin boards and document sharing. Bhatt & Zaveri (2002:306) explain the value of GDSS from a decision-making perspective. GDSS promote cohesion amongst decision-makers in which a collective effort is made to address a particular problem in a unified fashion. Such a collective effort is especially of importance in a multi-cultural society such as South Africa where distinct social values and different languages introduce various challenges to communications-driven DSS. It has been found by Daily & Teich (2001:70) that such diverse groups often result in fewer decision alternatives; lack of participation; and higher conflict – all which sacrifice the quality of decisions and consequently the organisational performance. They promote the usage of GDSS to present equal opportunity of expression to all parties involved, especially those in ethnic minorities. However, the successful employment of communications-driven DSS is not promoted

by all academics. Cappel & Windsor (2000:95) raise critique by arguing that there is no significant difference between GDSS and face-to-face interactions in terms of the decisions made. As a matter of fact, their study contradicts many others by stating that face-to-face decisions materialised more quickly and general consensus were achieved more frequently. Additionally, some participants experienced GDDS technology as intrusive and impersonal and were frustrated by the technology, which resulted in poorer decisions made.

Very little research exists on communications-driven DSS in the public sector, let alone publications addressing the tax gap phenomenon. One such example is that by McHugh et al. (2009:2041), who propose an interesting integration between GDSS and SDSS when introducing the concept of a public participation geographic information system. This concept promotes the collective collaboration of decision-makers to decide on matters with geographical relevance such as the construction of, for example, hospitals and schools. Such a proposition integrates GIS capabilities supported by data-driven DSS, but also incorporates the group decision-making capabilities offered by communications-driven DSS. This section addresses the lack of communications-driven DSS research related to the public sector, but only in a limited manner. Communications-driven DSS have a supportive relationship with other forms of DSS and are therefore limited to acting as a facilitator of organisational decision-making.

6.8 Instances of Decision Support Systems: Document-driven DSS

Document-driven DSS equip decision-makers with the ability to store, collect, retrieve, categorise, manage and analyse unstructured data (Power, 2002:124). Much like communications-driven DSS, document-driven DSS act as facilitator of organisational decision-making and this is especially relevant to the 'Singerian' type of decision-making organisation (refer to section 4.2.1). Data stored in document-driven DSS is considered 'soft' because of its qualitative and unstructured nature. This is also why search engines form such an integral part of document-driven DSS. Examples of unstructured data are Word documents, blogs and web pages, but also images, sounds and videos, to name but a few. From an organisational perspective,

document driven DSS are typically in the format of policies and procedures, specifications, minutes of meetings, surveillance and recordings, amongst others.

Unstructured data typically conveys knowledge about a particular 'instance' of the matter under consideration and are usually stored as organisational documents. These organisational documents constitute the organisational memory (also see sections 5.3.5 and 5.4.2) of an institution. At best it is a challenge for organisations to derive sustainable value from these unstructured text documents (Baker et al., 1998:244). Data mining has evolved from its historical focus on numerical data to address this challenge using text mining, which essentially focuses on deriving patterns from unstructured text and images (Gopal, 2011:727). These patterns would otherwise only be derived through a tremendous amount of manual effort, if at all (Ur-Rahman & Harding, 2012:4729). Research focusing on the applications of text mining in the public sector is very limited. An example of such a study is by Sobkowicz et al. (2012:470), in which the political opinions and sentiments of citizens are not only analysed to derive generalisations, but also used to predict future perceptions. An emerging concept similar to text mining is applied on imagery also referred to as imagery mining, which is another instance of document-driven DSS. A study exploring the integration between imagery mining and GIS is presented by Lee & Wang (2012:8954). In this study they use text mining principles to successfully derive geographic knowledge from imagery. They argue that existing geo-tagged imagery (images with spatial attributes assigned to them) can be used to statistically derive clustering patterns. Imagery mining can then match these patterns against imagery without any spatial relevance, in an attempt to automatically derive its associated geographic knowledge.

Document-driven DSS are used by revenue collection agencies to combat tax noncompliance in a variety of ways. The simplest examples relate to the decision-making support of operational activities in the form of document management. More sophisticated examples occur when text mining is used to identify hidden patterns and emerging trends in call centre recordings, as well as the suspicious activity reports (SAR) submitted by taxpayers. SAR reports are documents containing unstructured

text in which the public can anonymously report tax avoidance and evasion. The empirical study elaborates on this example in section 8.3.6. Document-driven DSS support organisational decision-making from an operational perspective and therefore indicate the final type of DSS to be included in the conceptual decision-making framework developed in this study.

6.9 Constructing the Conceptual DSS Framework

Prior chapters commenced the building of the conceptual DSS framework by including different aspects associated with the research problem, the institutional information needs as well as the information demands of human agents. This chapter concludes the theoretical construction of this framework by also including the information offerings from technological artefacts in the form of DSS. The enhanced conceptual framework also forms part of the framework's development lifecycle presented in Appendix C. The subsequent chapters are aimed at validating and enhancing this framework by means of various empirical audiences.
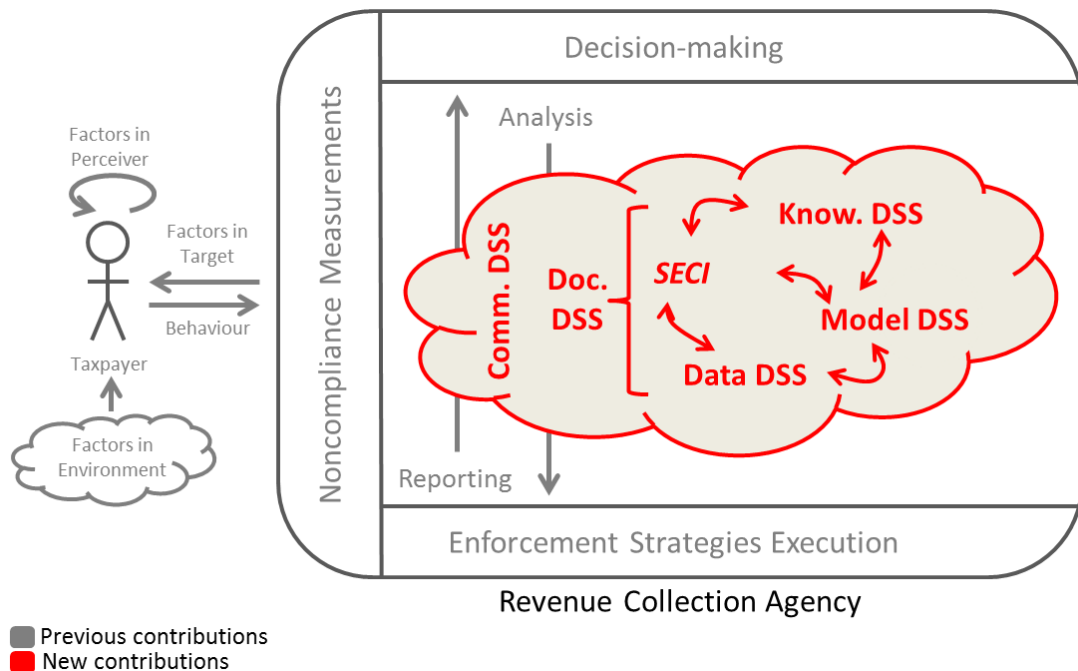
Figure 6-10: Framework Construction - Incorporating Technology (Specifically DSS)

The purpose of Chapter 6 is to provide insights regarding DSS architecture, the different types of DSS and also the relationship between them (refer to section 6.3). In doing so, this chapter enhances the conceptual DSS framework by elaborating on the DSS component defined in the previous chapter. The framework includes five types of DSS (elaborated upon in sections 6.4 to 6.8 respectively) namely data-driven DSS, model-driven DSS, knowledge-driven DSS, communications-driven DSS and document-driven DSS. Model-driven DSS and knowledge-driven DSS are dependent on data-driven DSS's ability to deliver rich data offerings to them. In some instances (such as the usage of sophisticated algorithms) the statistical offerings of model-driven DSS at times precede the sophisticated algorithms of knowledge-driven DSS. In other instances knowledge-driven DSS embed the explicit knowledge derived from the SECI knowledge generation process. Most of the DSS output is presented to decision-makers in various forms of documents, which is why document-driven DSS are also included in the conceptual DSS framework. Finally, the decision-making process itself is rarely performed in isolation. Communication-driven DSS not only facilitates the collaboration amongst decision-makers, but also the technical 'communication' between different forms of DSS.

The purpose of the next chapter is to commence the empirical evaluation of the conceptual DSS framework derived by the literature survey. In doing so, the empirical study also illustrates practical examples of how the different types of DSS are used to minimise the tax gap.

6.10 Conclusion

Chapter 6 focused on the final component of SMT, namely technology, and its ability to offer information to decision-makers. The chapter supplements the two prior chapters which focused on institutional properties and human agents, together with their relationships with technology and each other. By focusing on technology, this chapter aimed to explore the value proposition of DSS in terms of addressing the tax gap phenomenon through specific information offerings.

The chapter commenced with an elaboration of technology's position in an institutional setting and the manner in which human agents experience these technology artefacts. Specific focus was placed on the manner in which DSS should be deployed in an organisational setup to effectively support organisational decision-making. In doing so, reference was made to the different types of institutional decision-making introduced in section 4.3.2, as well the knowledge creation process that enables decision-making as presented in section 5.4.2.2. The chapter proposed an implementation DSS architecture that also served as blueprint for the conceptual DSS framework developed in this study. In doing so, the chapter also recognised the emerging state of DSS in which knowledge warehouses form an integral part of the traditional DW.

Chapter 6 further elaborated on the different types of DSS first identified in section 5.3.1. The architectural composition of these DSS as well as the relationship amongst them was subsequently presented. Emerging developments of these DSS instances were also presented, in which it was generally concluded that the different types of DSS are increasingly becoming integrated with each other, in addition to becoming incorporated with OLTP. Each of the DSS instances was then discussed in detail as well as the manner in which they are positioned to address the tax gap phenomenon. The chapter concluded with the inclusion of each of these DSS types in the conceptual DSS framework, as well as their relationship with one another.

Chapter 6 concluded the construction of the conceptual DSS framework using the literature. Part three of the research refines the conceptual DSS framework by exploring the respective topics from an empirical perspective. The purpose of these empirical findings is to supplement the literature findings identified thus far.

PART 3: EMPIRICAL CONCLUSIONS

CHAPTER 7: EMPIRICAL FINDINGS ON THE TAX GAP AND THE ROLE OF IT
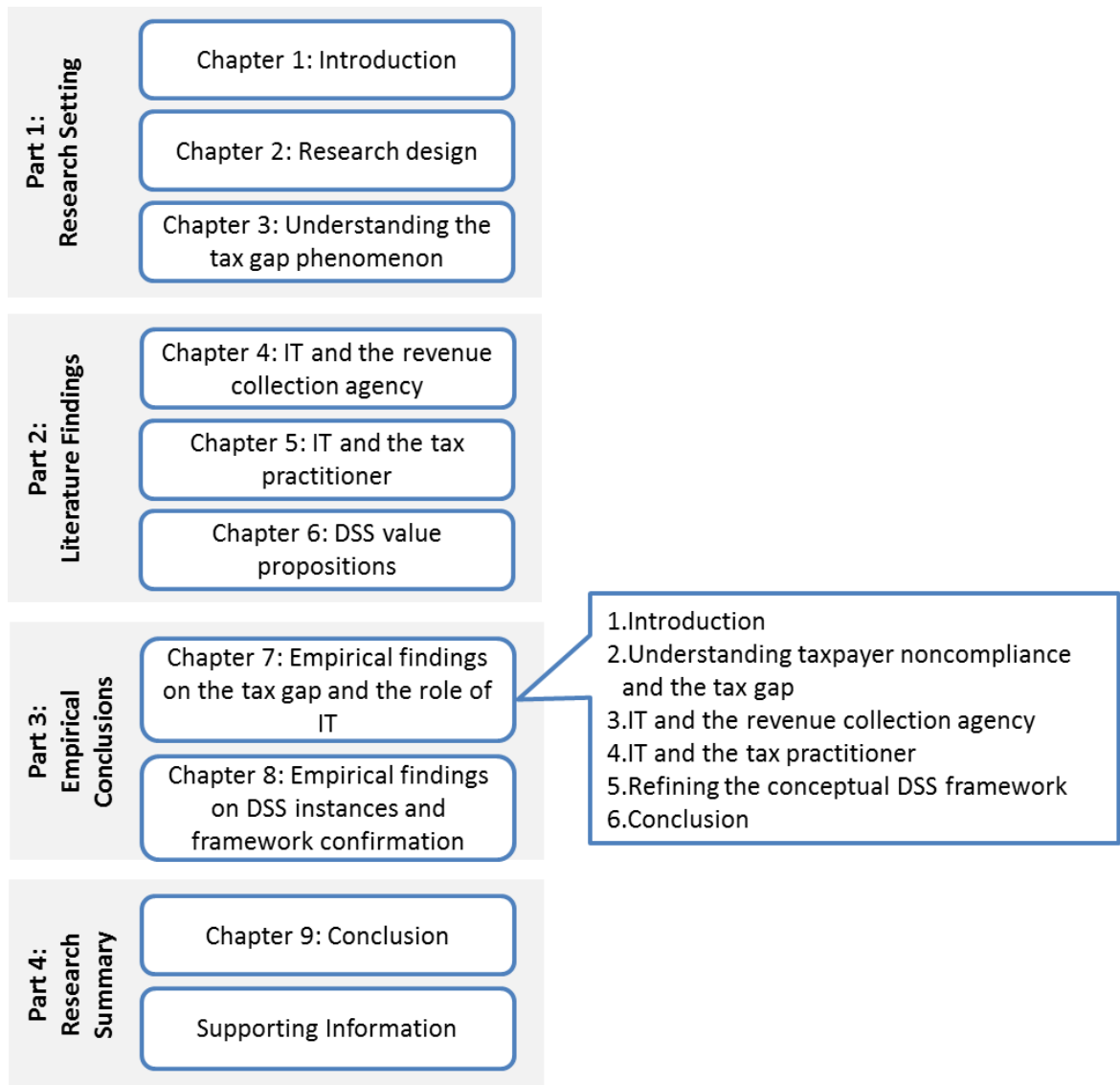
Figure 7-1: Chapter 7 Roadmap

7.1 Introduction

Part three of the research consists of two chapters dedicated to the empirical findings of the study. The first thereof is this chapter that commences the empirical study. The chapter focusses on the conceptualisation of the tax gap and tax noncompliance, as well as the role IT plays in an organisation. The literature's perspectives on these topics are respectively presented in chapter three (that focussed on the tax gap) and chapters four and five (focussing on the role of IT). Chapter seven consequently addresses the following research questions but from an empirical perspective:

"What is the nature of the tax gap phenomenon experienced by revenue collection agencies and why does it continue to exist?" (also addressed in Chapter 3);

"How does IT influence a revenue collection agency's ability to address the tax gap?" (also addressed in Chapter 4); and

"How does IT support tax practitioners to reduce the tax cap?" (also addressed in Chapter 5)

The empirical study findings are considered against those from the literature in an attempt to supplement derived conclusions. As a result of this, the chapter concludes by refining the conceptual DSS framework.

7.2 Understanding Taxpayer Noncompliance and the Tax Gap Phenomenon

The empirical study commences with a brief focus on the tax gap phenomenon and the factors associated with it, as first presented by the literature in Chapter 3. The purpose of this section is to refine the literature findings with that of the empirical study. The empirical perceptions on the tax gap are found to be fairly consistent with that of the literature. This is somewhat expected given the seniority of the interviewees participating in this phase of the empirical study. These participants were first introduced in section 2.9.3 and are the Executive: Enforcement Strategy, Executive: Tax Research, and the Senior Manager: Tax Enforcement Planning. The empirical results are presented under two sections, namely an overview of tax noncompliance and the factors contributing thereto, as well as the perspective on the tax gap phenomenon.

7.2.1 Tax noncompliance and the Factors Influencing Taxpayer Compliance

SARS's annual reports commence with their mission statement stating that subsequent to the collection of all revenue due, SARS's mandate is to ensure the maximum compliance of taxpayers (SARS, 2012c:2; SARS, 2013a:21). SARS follows a 'voluntary compliance' approach in pursuit of this objective. This means that noncompliant taxpayers are initially enabled through different service delivery channels; followed by education initiatives to make provision for any unintentional noncompliance. Only then are noncompliant taxpayers pursued through an enforcement capacity (SARS, 2013a:23). Given this, it is somewhat surprising that neither the Tax Compliance Programme (2012a:23) nor the internal communication thereof (SARS, 2012d) distinguishes between tax avoidance and evasion, and only focuses on the latter. The empirical participants however accurately differentiate between noncompliance, tax avoidance and tax evasion. The Executive: Tax Planning took the stance that noncompliance is the failure of a taxpayer to meet his/her tax obligations. The Executive: Enforcement Strategy and Senior Manager: Enforcement Planning had a stronger position by explicitly referring to the failure of a taxpayer to conform to tax legislation. The Tax Compliance Programme counters tax evasion by following the tax compliance pyramid (SARS, 2012a:4, 5) prescribed by Leviner's (2009:420) framework for Tax Compliance and Risk Management (originally introduced in section 4.3.1). The conceptual DSS framework constructed also already refers to the compliance pyramid by means of the enforcement strategies execution as concluded in Chapter 4. It is not within the scope of this section to revisit discussions on the tax compliance pyramid as they have been comprehensively discussed in prior chapters.

As previously stated, the SARS modernisation programme is aimed at simplifying the ability for taxpayers to meet their obligations (SARS, 2012a:4, 5). Significant investments have subsequently been made to offer taxpayers various electronic interaction channels, through which 95% of income tax returns and 90% of customs declarations have been filed in the 2012/2013 filing season. These investments, amongst others, have not only made it easier for taxpayers to comply but have also simplified the administrative functions of SARS. The tax compliance pyramid's levels one and two promote the self-compliance of taxpayers and are typically related to that

of transactional IS. Enforcement intervention forms part of levels three and four and these levels subsequently have a much larger dependency on DSS. The third level of the pyramid is 'deter by detection', which aims to stop the early tax noncompliance through limited enforcement capabilities. Examples include the 700,000 taxpayers penalised for their outstanding returns. The fourth and final level prescribes aggressive action against noncompliant taxpayers by using the full force of the law, which includes audits and prosecutions. More than 230 taxpayers faced prosecution in 2012. Specific examples are shown in chapter eight to illustrate how specific DSS facilitate the execution of levels three and four.

The Executive: Enforcement Strategy made mention of the four tax compliance pillars when referring to noncompliance (namely taxpayer registration, tax return filing, tax declaration and tax payment) as per the OECD's Compliance Risk Management Process. The enforcement strategies prescribe that "… a taxpayer should be registered for taxes if earning an income exceeding the minimum tax threshold, have to file tax returns, make accurate declarations of his tax affairs to SARS and also pay the due taxes promptly.". Only the Senior Manager: Enforcement Planning mentioned that noncompliance can be a result of deliberate and accidental actions. He also differed from his superior's perspectives by stating that the four tax compliance pillars (see section 3.8) of the tax compliance and risk management framework are only relevant to tax evasion because they imply intentional noncompliance. The three participants agreed that tax evasion is the failure of taxpayers to comply with tax legislations whilst being aware of the legal prescriptions. One of the participants even labelled tax evasion as '…criminal behaviour by taxpayers aimed at enriching themselves.' All three participants described tax avoidance as the instance when a taxpayer manipulates his/her tax affairs to minimise his/her tax liability within the legal boundaries of the tax legislation. The Senior Manager: Enforcement Planning correctly pointed out that tax avoidance is limited to the declaration pillar of the tax noncompliance measurements.

The implications of tax noncompliance were mainly discussed from a monetary and social perspective by the case study participants. All three participants pointed out that taxpayer noncompliance has a direct impact on the taxes collected and

consequently also on the government's budget. The Senior Manager: Enforcement Planning elaborates when explaining that the impact of fewer taxes collected might cause an increase in government's borrowing, which will also result in a larger deficit of government's national account. Closely related to this is SARS (2012d:4) stating that a failure in tax collection results in a greater dependency on state donors. This is in addition to a decrease in government's expenditure and the subsequent failure to stimulate economic growth. The Executive: Tax Planning emphasised the importance of wealth distribution in South Africa by means of tax collection: "A significant decrease in the taxes collected will ultimately result in an unequal society". She also agreed with the executive enforcement strategy, who argued that the noncompliance of some taxpayers forces additional burdens on those taxpayers that are compliant. The three participants also pointed out that tax noncompliance suggests a larger noncompliance in society such as the failure to pay traffic fines, which ultimately prevents government from delivering fair and adequate services to its citizens. The empirical documents are more specific in terms of the impact on tax noncompliance: tax noncompliance greatly impacts government's ability to deliver on the National Development Plan (NDP), a plan aimed at fuelling economic growth for the general improvement of previously disadvantaged citizens by 2030 (SARS, 2013a:12; SARS, 2013b:12).

The factors influencing taxpayer compliance were discussed by the interviewees and explored in the empirical documents from three viewpoints namely, the taxpayer himself/herself, the environment in which the taxpayer operates and also service delivery aspects of the revenue collection agency. This is also consistent with the role-players included into the conceptual DSS framework originally presented in section 3.9. From a taxpayer's perspective, financial self-gain was identified by all three participants as the most important reason for being noncompliant. Most of these perspectives are consistent with those listed by the literature in section 3.7 and are therefore not worth further elaboration. They range from sociology; economy; industry; business; and psychology to specific taxpayer attributes such as perception; cognition; affect; beliefs; norms; and social influences. All of these influences already form part of the conceptual DSS framework developed under the factors of perceiver component. SARS (2012d:11) lists another important role player influencing tax

compliance, namely 'systems of compliance' of which DSS are explicitly listed as one example of such. However, the factors in target component of the conceptual DSS framework already include this.

The Senior Manager: Enforcement Planning explained that some taxpayers can perceive noncompliance as a manner to express dissatisfaction with government. Although also recognised by the executive tax planning, she stated that no evidence exists to support this statement. She elaborated by explaining that hardly any research has been published that explore the behavioural patterns of taxpayers. She is of the opinion that the social setting and influences of a taxpayer were identified as the most important environmental factor influencing taxpayer compliance. This is supported by SARS (2012d:14) which mentions that going forward research surveys will form the basis for understanding the psychological and behavioural factors influencing taxpayer compliance. These opinions are also already reflected in the factors in environment component of the conceptual DSS framework. Adding to this, the Senior Manager: Enforcement Planning mentioned that "…in general, some taxpayers and even some societies are more prone to risk taking and consequently also noncompliance". A lack of adequate service delivery from SARS was also recognised as a possible factor influencing taxpayer compliance. Examples of these are the high compliance cost for taxpayers, the unfair treatment of taxpayers resulting in resistance towards SARS and the failure of SARS to honour its legislative obligation towards taxpayers, to name but a few.

This section summarises various empirical findings related to tax noncompliance and factors influencing taxpayer behaviour. The findings of section 7.2.1 confirm various facets of the conceptual DSS framework. Most importantly, confirmation is given on the three factors influencing tax noncompliance namely the taxpayer as perceiver, the environment and also the revenue collection agency as factors in target. Further confirmation is given that the four tax compliance pillars are used to measure tax compliance, as already indicated in the conceptual DSS framework and labelled as noncompliance measurements components. The section also confirmed the enforcement execution strategies which the literature and empirical participants

referred to as the tax compliance pyramid. Lastly, explicit confirmation was given that DSS support the management of tax compliance.

7.2.2 Perspectives on the Tax Gap Phenomenon

As one would expect, all three case study participants accurately described the tax gap to be the difference between the real tax liability (or the potential taxes that should have been collected) and the actual taxes collected by SARS. The content of the tax gap is also specified by all the participants to be structured according to Leviner's (2009:420) pyramid for tax compliance. The Executive: Enforcement Strategy explained the tax gap to be a direct result of taxpayer noncompliance. The estimation of the tax gap is challenging, especially given the 'fuzziness' between tax evasion and tax avoidance, as stated by the executive tax planning. This estimation can be either monetary or non-monetary by nature. However, the Senior Manager: Tax Planning disagreed with this when stating that non-monetary measurements of the tax gap should rather be labelled the "compliance gap" because "…one is not aware of the tax implication until the declaration has been received and scrutinised for under declaration…". In doing so, he implies that the tax gap is only limited to the declaration compliance pillar, which is incorrect according to the literature. The literature regards the tax gap as the result of noncompliance in all four compliance pillars. The Executive: Enforcement Strategy had a different perspective when he stated that the remainder of compliance pillars also contribute to the tax gap. The registration pillar gap refers to the citizens that should be registered for taxes but are not; the filing pillar gap describes the outstanding tax returns of liable taxpayers; and the payment pillar gap which relates to the outstanding payments/debt of taxpayer. In addition to this, the Executive: Tax Planning and Senior Manager: Risk Planning also mentioned the tax gap to be measured from two approaches, namely bottom-up and top down. In a bottom-up approach, the detailed entities would be considered against the estimated noncompliance cost as calculated / estimated from historical compliancy. Past instances of the taxpayer's compliance are therefore used to estimate current levels of tax noncompliance. In contrast to this, a top-down approach references internal and external economic data in an aggregated form to derive the estimated value of the tax gap. An example of this is when the VAT tax gap is estimated as a percentage of consumer expenditure statistics.

It is important to understand how SARS perceives the tax gap as their perceptions greatly influence the manner in which they use DSS to address taxpayer noncompliance. The variances between the literature and empirical participants, as well as the empirical participants themselves, are insignificant. As such, the empirical perspectives on the tax gap are mostly consistent with that of the literature. The tax gap can simply be explained as the difference between the total taxes due as defined by legislation, and the actual taxes collected. It is agreed that this difference exists because of taxpayer noncompliance. The subsequent section aims to elaborate on the tax compliance measurements that need to form part of DSS to successfully manage the tax gap phenomenon.

7.3 IT and the Revenue Collection Agency

The literature survey presented in Chapter 4 discussed the theoretical aspects describing the manner in which revenue collection agencies interact with technology to address the tax gap phenomenon. In essence, the relationship between IT and the revenue collection agency is 'problem dominated' in the sense that the organisation has specific information needs to support their objective of addressing taxpayer noncompliance. The subsequent sections continue this discussion by providing an empirical perspective on the conditions in which SARS interacts with technology, and also the consequences of this interaction. The findings concluded in this section are mostly derived from the empirical documents collected and limited reference is made to the empirical interviews. This is because the interviews focussed mostly on the practical value proposition of DSS to address tax noncompliance and is subsequently discussed in Chapter 8.

7.3.1 Institutional Conditions of Interaction with Technology (SMT's Influence C and INOD's Activity 6)

SARS follows the compliance risk management approach presented in Figure 7-2 to address the tax gap phenomenon (SARS, 2012a:7; SARS, 2013d:24). SARS's approach is a variation of the one prescribed by the OECD (2008:8) as originally presented in section 4.3.2. The approach commences by integrating different data sources, including third party data, as the basis to identify taxpayer noncompliance. Using this data, various compliance analyses are conducted by using different DSS

instances. Many of these DSS instances are discussed in Chapters 6 and 8. The four tax compliance pillars (see section 3.8) serve as the basis of these compliance analyses. Most publications reporting on noncompliance, including the SARS annual reports (2012c:24-31), publish their compliance statistics according to these four tax compliance pillars. Table 7-1 discusses these tax compliance pillars by elaborating in greater detail on the core compliance measurements used by SARS. It is important to understand that these measurements equate to the information needs of the institution and consequently determine the manner in which DSS are used to facilitate decision-making. At a more granular level, over 70 tax compliance measurements are derived from these 20 core measurements. It is not within the scope of this study to elaborate on these 70 measurements, but only to provide a brief overview of the 20 core measurements.
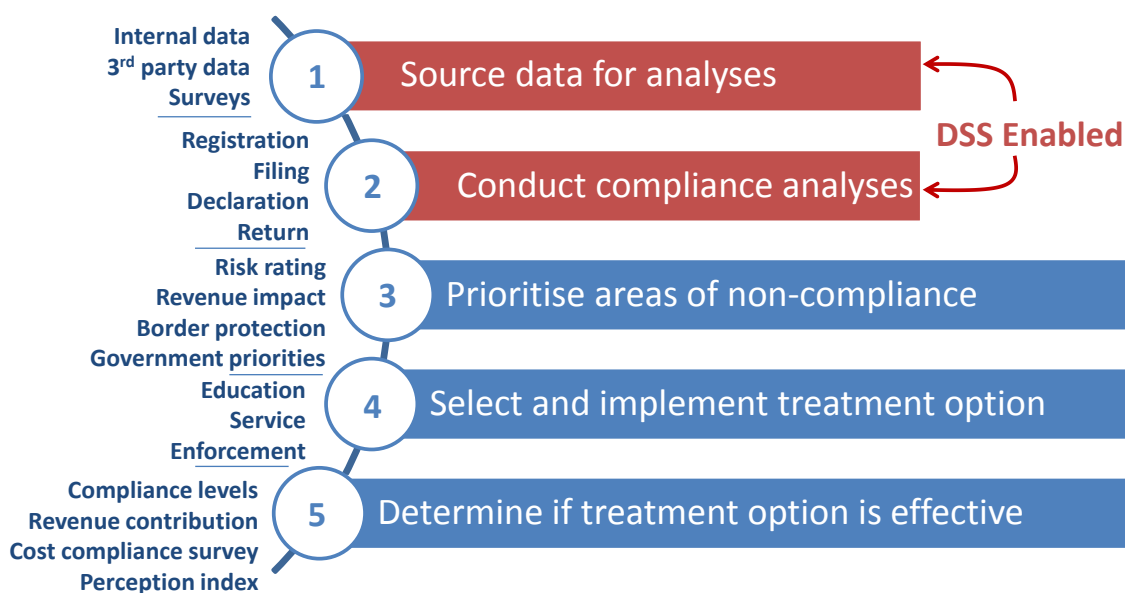
Figure 7-2: SARS's Approach to Managing Tax Noncompliance (Adapted from SARS, 2012a:7)

Compliance Pillar	Measurement
Registration	1. Growth in register. Measures the registration of new taxpayers.
	2. Incidence of not changing registered particulars. Measures the number of inaccurate taxpayer particulars.

	3. Registration on time. Measures the number of timely registrations by taxpayers.
Filing	4. Filing on time. Measures the number of returns submitted on time before the filing season deadline.
	5. Incidence of late filing. Measures the number of returns received after the filing season deadline.
	6. Incidence of non-filing. Measures the number of returns expected for past filing seasons but not yet received.
	7. Returns submitted without full payment. Measures the number of returns submitted but for which no payment has been made.
	8. Incidence of credit returns filed. Measures the number of refund returns submitted.
	9. Value of credit returns filed. Measures the value of refund returns submitted.
Declaration	10. Incidence of accurate declarations. Measures the number of declarations that was not revised.
	11. Incidence of inaccurate declaration. Measures the number of declarations revised by either the taxpayer or SARS.
	12. Incidence of inaccurate declaration – average yield. Measures the average yield of declarations audited by SARS.
Payments	13. Timeliness of payment. Measures the number of payments received on time.
	14. Incidence of late payment. Measures the number of payments received after the prescribed payment date.
	15. Incidence of non-payment. Measures the number of taxpayers with accounts in arrears

	(outstanding debt).
	16. Debt written off. Measure the number of taxpayers with outstanding debt whose account balances have been written of.
	17. Value of debt written off. Measures the value of outstanding debt that has been written of.
	18. Judgements instituted. Measures the number of hard enforcement instances taken.
	19. Adherence to deferred arrangements Measures the number of taxpayers who honour deferred arrangements to settle accounts in arrears.
	20. Non-adherence to deferred arrangements. Measures the number of taxpayers who do not honour deferred arrangements of accounts in arrears.

Table 7-1: SARS's Core Compliance Measures (SARS, 2011b:4 - 5)

One noticeable difference between the OECD's approach to managing tax compliance and that of SARS is the manner in which technology - and in particular the usage of DSS – is fundamental to SARS's efforts in addressing tax noncompliance (refer to the first two steps of Figure 7-2). This is done by integrating all transactional data sources into various data marts and/or data warehouse. Section 6.4.1 elaborates on these concepts in much greater detail. Using these data sources, SARS identifies risk by means of either transactional events or taxpayer profiles (SARS, 2012a:23). Examples of transactional events include the submission of a tax return which acts as a trigger to validate the tax declaration. Taxpayer profiling is not event-driven and can therefore occur at any given point in time. Such an approach usually triangulates many different taxpayer dimensions to make sure his/her tax declarations correspond as a whole. An example is when a low personal income is declared by a director of a wealthy company whilst he is in possession of various expensive assets. Both the transactional and profile risk management approaches are dependent on a comprehensive and integrated data store from which different analytical exercises can be executed to support the various compliance analyses. Many of these analytical exercises are

elaborated on in section 8.3. The number of noncompliant taxpayers identified from these analyses often exceeds the enforcement capacity of the SARS tax practitioners. For this reason audit prioritisation, which is the third step of the compliance risk management approach, is required to identify specific noncompliant taxpayers. It is important to understand that the audit prioritisation of taxpayers is influenced by four factors, as explained by the Senior Manager: Case Selection. The first factor is that of suspicious activity reports (SAR) submitted by the outside public. SAR are essentially anonymous 'tip-offs' of taxpayer noncompliance submitted by the general public. SAR were first discussed in section 6.8 and again elaborated on in section 8.3.6. The second factor comes from within SARS, namely the referrals from the SARS auditors. Referrals are identified when other noncompliant taxpayers are audited. The third factor relates to what is regarded as reasonable expectations by the public domain (for example, the media) in terms of possible tax noncompliance, but which might not explicitly be reported to SARS. The final factor and arguably the most important factor influencing audit prioritisation is the SARS Compliance Programme. Once prioritised for audit, the next step in the compliance risk management approach is the selection of a treatment option, which can be a combination of taxpayer education, service delivery and enforcement action. The suggestion by the Senior Manager: Case Selection that the enforcement activities do not function in isolation and that service and education are close facilitators of taxpayer compliance is refreshing. Although this finding was briefly discussed by the literature survey in section 3.3.2.1, the finding was not deemed as important at that stage. However, the finding is now identified as an improvement to the conceptual DSS framework under construction. Section 7.5 presents this improvement. The final step in the compliance management approach is that of evaluating whether the treatment of taxpayer noncompliance is effective.

The SARS Strategic Plan emphasises the important role DSS play in combating the tax gap phenomenon (SARS, 2013a:24; SARS, 2012d:24): "This [improved compliance] means that SARS has to segment the taxpayer population according to the level of risk and service needs and this requires that SARS activities be data-driven to enable SARS to match its response to the profile of each segment". Supporting and elaborating on this stance is the Tax Compliance Programme which is

quoted as follows (SARS, 2012a:3): "The modernisation of our tax systems [that include various DSS, see section 8.3] has led to improvements in the quality and integrity of data. This has enabled us to sharpen our research and analytical capabilities, providing us with key insights which have enhanced our understanding of taxpayers and traders. From this data, we have been able to prioritise segments that require our immediate attention, the results of which have informed our Compliance Programme". Empirical conformation is therefore given that DSS is a critical enabler of managing tax noncompliance.

The Senior Manager: Case Selection confirms data analytics to form the basis of the SARS modernisation programme. Analytical exercises are mostly compliance focussed with the goal of identifying systematic mechanisms to minimise the "revenue leaks" resulting from taxpayer non-compliance. Typically, these preventative mechanisms are in accordance with compliance pillars and aim to address specific compliance measurements. The interviewee, more importantly, explains that preventative mechanisms are accompanied with complementary services to ease the burden of taxpayers wanting to be compliant. These services are closely aligned with the compliance measurements but understandably with a different focus, namely that of compliance facilitation as opposed to noncompliance detection. These services also include taxpayer education. A more relevant example focussing on IT is the pre-population of tax returns with third party data. Instead of only using third party data as a risk trigger aimed at identifying taxpayers who under declares, third party data is also used as a service to pre-populate the tax returns in an attempt to make it easier for taxpayers to file. This example points out the manner in which data-driven DSS facilitate the 'make it easy' enforcement strategy by providing a service to taxpayers.

This section concludes that taxpayer noncompliance does not function in isolation and that taxpayer compliance is strongly influenced by service and education. It is a finding that is worth incorporating in the conceptual DSS framework under construction and is therefore again presented in section 7.5.

7.3.2 Institutional Consequences of Interaction with Technology (SMT's Influence D and INOD's Activity 4)

The literature discussed the institutional consequences of interaction with technology from the SMT perspectives of signification, domination and legitimation. An empirical point of view on these structures, although limited in scope, is presented in this section.

Section 4.4.1 described structures of signification as 'that which informs, defines and gives meaning to any type of interaction in the organisation'. The manager enterprise measurement explains that DSS only become a structure of signification when decision-makers establish an "emotional appetite" for decision-making. When this occurs, DSS consequently becomes what the literature refers to as a 'bounded reality' in which a decision-maker's problem 'awareness' and remedy 'options' are limited to that presented through the DSS. Examples of this are the strategic reports supporting the SARS modernisation implementations: A limited audience defines the respective reporting requirements, but their DSS designs subsequently dictate the manner in which the remainder of stakeholders manage the daily operations. Another empirical example is the manner in which the information flows across the organisation, significantly improving the turnaround times of customs trade, as well as the accuracy of customs inspections, which ultimately limits taxpayer noncompliance (SARS, 2013b:19). A more technical example is the prescription of XBRL as the financial reporting standard (SARS, 2012a: 24; SARS, 2013b: 27), as originally also confirmed by the literature as a structure of signification. Using this standard, SARS can easily obtain and integrate third party data from various external entities (such as financial institutions) to validate taxpayer declarations. A similar example is that of the 'regional information exchange' that consists of interconnected systems making use of a 'cross border data reference model'. This model is aimed at standardising the data communication format between South Africa and its neighbouring countries (SARS, 2013b:20) and in doing so simplifies decision-making. These are but a few examples of how DSS act as a structure of signification in SARS.

The literature explained that structures of domination 'constitute to any resource that is used to achieve a certain business objective and/or through which power is

exercised in order for it to become authoritative over human actions' (refer to section 4.4.2). There is little doubt that DSS are structures of domination in terms of organisational decision-making. Not only is DSS an organisational resource used by tax practitioners to facilitate their decision-making, these systems also dominate their decision-making process. Domination is implicit when DSS enable and facilitate decision-making, whereas explicit domination occurs when the DSS actually perform decision-making on behalf of humans. An example of implicit domination is when DSS allow its owners to become very influential merely by means of association with the DSS. Differently stated, DSS empower these decision-makers with knowledge and in doing so they become dominant stakeholders with overwhelming influence over the strategic direction of the organisation. This empirical finding links back to the 'technocracy' concept introduced by the literature. An example of explicit domination is the SARS risk engine and it is arguably the most important instance of how IT acts as a structure of domination. The SARS risk engine identifies and prioritises noncompliance risks prior to allocating them to the respective tax practitioners (SARS, 2012a:23). The risk engine also does cross matching across different SARS systems and third party data to identify declaration discrepancies (SARS, 2013b:30). The risk engine is more comprehensively discussed in section 8.3.5. The DSS also acts intelligently when it not only determines the most appropriate follow-up mechanism for the identified risk but also 'evolves' by continuously optimising itself through the usage of historical audit data (SARS, 2013b:26). In doing so, the risk engine dictates the next cases to be audited by tax practitioners, thereby eliminating their ability to select their own cases (SARS, 2012c:22). The risk engine therefore becomes a structure of domination that controls the work activities of the audit tax practitioners. Other examples of how DSS act as structures of domination are dashboard reporting (also see section 8.3.2). Whilst the alignment and centralisation of organisational measures support effective management, it eliminates the intuition and 'gut feel' of experienced managers.

According to the literature in section 4.4.3, structures of legitimation are best described as the "norms that govern the actions of human agents". The literature argues that the norms of human agents are derived from their values and beliefs and therefore govern the manner in which they conduct decision-making. Individual

norms are evaluated, revised and adapted when human agents function as a social collective. Social collective norms then become the culture of an organisation. This culture acts as a structure of litigation, thereby determining how the organisation collectively performs functions such as decision-making. It must, however, also be acknowledged that organisational culture is transferred from one employee to the other and subsequently changes over time (as pointed out by the Manager: KM). A more specific example of how DSS act as a structure of litigation is the information request and exchange programme in honour of the Foreign Account Tax Compliance Act. Under this act, data is shared with other countries with the objective of limiting the tax evasion of international citizens (SARS, 2013b:28; SARS, 2013a:16). Another example is SARS's usage of performance measurement and reporting DSS to reflect on the productivity of the organisation (SARS, 2013b:36). SARS's productivity measurement is moving towards an output-based focus as opposed to the traditional outcome focus because of this. An example of the last mentioned is the number of returns taxpayers file, whereas the first mentioned would rather focus on the number of returns processed. Perhaps the most important example of how DSS acts as a structure of litigation is the data and information distribution channel in SARS. Although there is a great amount of DSS decentralisation in SARS (as further elaborated on in section 7.4.1.1), only data/information from a specific business unit is regarded as being 'official'. It could be that other distribution channels are more accurate, but this does not disqualify the 'official number'. In doing so, DSS essentially becomes a structure of litigation in SARS.

The previous two sections concluded the empirical study focussing on the role between IT and the revenue collection agency. In doing so, institutional conditions as well as institutional consequences of interaction with technology were discussed. The next section discusses the relationship between IT and the tax practitioner.

7.4 IT and the Tax Practitioner

The relationship between IT and the tax practitioner was first discussed by the literature in Chapter 5. This section continues the discussion but from an empirical perspective, with the main focus being on the interpretations derived from the empirical documents collected, as well as insights shared by the Manager: KM.

Tax practitioners have certain information demands as determined by organisational setting. Technology becomes a product of tax practitioners because of this, but also acts as a medium for tax practitioners to enable the execution of their tasks. It is important to note that this section is written in a true narrative fashion. Such an approach supports the research data analysis requirements prescribed by the literature for a single case study (also refer to section 2.6). Perhaps just as importantly, the narrative analysis provides an overview of how DSS came to be in SARS. This deep understanding of the case study allows for a better appreciation of SARS's DSS maturity, as also elaborated on in Chapter 8, and in doing so contributes to the refinement of the conceptual DSS framework. Such an understanding also enables future users of the conceptual DSS framework to appreciate the framework's implementation journey. After all, the Manager: Information Integration explains that "When you study these kinds of things [referring the level of DSS sophistication in general] all of it is theory that sounds wonderful … but it requires a certain amount of maturity in the organisation to make it acceptable and to make it work". It is the purpose of the next section to elaborate on SARS's DSS maturity, as it is a product of human action.

7.4.1 Technology as a Product of Human Action (SMT's Influence A and INOD's Activity 5)

7.4.1.1 Data Management and Data-Driven DSS (With Database Focus)

SARS (2011a:5-7) describes the progress of data management in SARS from a DSS perspective – a process that has occurred over many years. Phase one of this process describes how DSS originated as a reporting capability within the IT department. The supporting data structures used by these DSS were limited to that of the transactional systems. Static data extractions ran from these structures and consequently offered limited flexibility in terms of supporting decision-making. In addition to this, the DSS development activities enjoyed limited prioritisation over the transactional system developments, mostly because it was the same staff performing both functions. These limitations were addressed in phase two when a dedicated 'Information Management' capacity was established with the sole objective of developing DSS. A 'clone' of the transactional systems database was created utilising the same hardware infrastructure

(namely the SARS mainframe) to support the new capacity's dedicated mandate of developing DSS. The new capacity followed formalised SDLC principles and created elementary data-driven DSS. The newly established information management capacity soon became overwhelmed by new business requests, which resulted in an overutilization of the hardware infrastructure shared with transactional systems. Additionally, the business requirements became more sophisticated and in doing so, called for advanced data-driven DSS technologies and approaches. It became clear that SARS required a dedicated data warehousing capability, leading to the commencement of phase three. Phase three established a data warehouse that operated in complete isolation from transactional systems. At first, single disparate sources of data were loaded at weekly and monthly frequencies. This was soon improved to daily loads consisting of multiple data sources (internal and external) stored into an integrated data model. Phase three contributed significantly towards the maturity of DSS in SARS, enabling the organisation to move from intuitive decision-making to that of fact-driven decision-making. The data warehouse allowed for various other sophisticated forms of DSS to be deployed, as further elaborated on in sections 7.4.1.2 and 7.4.1.3. Various business units soon became fundamentally dependant on the data warehouse to drive their everyday activities. These units subsequently sought greater influence over DSS developments and in some cases even executed the technical implementations themselves. An example is the creation of data marts by them aimed at supporting their specific decision-making needs. This state of affairs introduced phase four, which essentially extended the offerings of phase three by also catering for an enablement / self-service capability. Using this capability, business units achieved a level of independence by performing their own functions in parallel to the offerings formalised and maintained by the information management capacity. This state is referred to by the literature as 'information democracy', and is discussed in section 4.4.3. It was during this phase that different data marts were established, many of which were updated with near-real time data. At first these data marts were mainly populated from the data warehouse, but eventually progressed to a state of full independence. This state allowed them to load data as they liked, often resulting in data duplication, redundancy and inconsistencies, not to mention the additional costs associated with the underutilised infrastructure hosting the data marts. This unintended state of DSS decentralisation eventually competed and even replaced

many of the 'official' functions traditionally centralised under the information management capability. The situation progressed to a state in which the traditional governance structures ultimately became irrelevant, subsequently resulting in a state where no 'single version of the truth' existed. SARS recently embarked on a journey to re-establish a centralised data warehouse and the governance structures associated with it in an attempt to once again reduce data duplication. Included in this journey, SARS is also focussing on the establishment of an operational intelligence (OI) data mart (SARS, 2012g:5-8). This data mart supplements the data warehouse in the sense that it enables the near real-time and in-depth reporting of operational activities as they occur. It also addresses the disconnect that traditional data warehouses have had with the operational activities of an organisation – as stipulated in the literature and discussed in section 6.3.3. Section 8.3.1 further elaborates on the value proposition of the OI data mart and the impact this development has on the conceptual DSS framework.

This section elaborated on the data management DSS journey of SARS over the past two decades. Although valuable, data management DSS acting in isolation offers very limited decision-making support. Data management DSS can only deliver on its true potential when joined with information management DSS.

7.4.1.2 Information Management, Data-Driven DSS (With Reporting Focus) and Model-Driven DSS

Parallel to the data management phases, information management in SARS has also progressed substantially over the past decade. SARS (2011a:8-10) presents this journey, which is now briefly summarised

Phases one and two were recognised as DSS in the form of large data extractions in flat file formats. The static nature of these large extractions had to be scheduled to run in batches and allowed for very limited manipulation by the business users. Users were essentially limited to after-the-fact reports satisfying pre-defined questions such as 'What happened?'. The establishment of the data warehouse (phases three onwards) offered various opportunities for the development of data-driven and model-driven DSS. These DSS were initially limited to the ad hoc querying of what had

previously been static reports, in order to provide additional insights related to the business questions at hand. These queries were typically something similar to 'Why did it happen?'. OLAP functionality soon followed, allowing users to interactively explore data by means of slicing-and-dicing cubes of data. BI reports came into existence, thereby delivering parameter-driven reports through web interfaces. GIS was also introduced at this stage and offered a wide range of analytical reports illustrating the spatial segmentation of different business measurements. Closely associated with these developments was the establishment of reactive alerts, which are triggered when certain business metrics exceed predefined thresholds. These alerts allowed SARS to have a finger-on-pulse monitoring approach to the management of their daily affairs. Up to this stage the information management maturity in SARS was still very much data-driven, but subsequently progressed to also include model-driven DSS. Model-driven DSS started with typical descriptive and statistical analyses focussing on 'Why things are happening' and how it can be prevented going forward. Data exploration, clustering, pattern recognition, correlation testing, outlier detection and regression modelling are a few such examples. Time-series forecasting was the natural next step, asking 'What will happen and by when?'. Forecasting established itself as a critical component in managing the revenue collections as well as the capacity management of various resources in SARS. Once this was understood, SARS started using DSS to influence the future state of affairs through predictive modelling – thereby supporting the question 'What do I want to happen?'. The focus was on influencing the behaviour of taxpayers such as their tax compliance levels, as well as the occurrence of events such as taxpayer communications. Predictive modelling essentially allowed SARS to drive towards the desired future state of being able to proactively influence the probability of certain events occurring. SARS is currently focusing on the optimisation of organisational resources as the next cycle of information management evolution. Optimisation aims to answer the question of 'How do we do things better?' and it does so by optimally aligning organisational resources with business processes to achieve the most attractive cost-benefit balance.

It is clear that information management DSS combined with data management DSS can enable various forms of sophisticated decision-making. The subsequent section describes another important component to this decision-making progress, namely

knowledge management DSS, which supports the creation of knowledge by individuals.

7.4.1.3 Knowledge Management DSS

Knowledge management in SARS consists of two separate streams. The one stream delivers knowledge-driven DSS through data analytics and mining techniques such as those listed in section 6.6 (SARS, 2011a:12). The other stream delivers solutions that enable implicit knowledge to be converted to explicit knowledge and the subsequent storage thereof.

The first stream focusses on data analytics and mining. As part of the SARS modernisation programme a continuous effort is made to redesign and integrate IT systems with the goal of obtaining a holistic view of the taxpayer (SARS, 2012a:33). The modernisation developments are gradually replacing the traditional fractured view of taxpayers obtained from disparate legacy tax systems. SARS only recently consolidated its various data sources through advanced DSS, thereby enabling the integration of taxpayer information. This has resulted in a burst of SARS knowledge and has greatly assisted tax practitioners with their audits (SARS, 2012a:23). Further emphasis is also placed on the sourcing and integration of external third party data to supplement the tax data for even broader insights related to the taxpayer (SARS, 2013a:23). Amongst others, third party data includes data from the banks, credit bureau, pension funds, insurance companies and other government departments. These data sources are ultimately stored in a data warehouse from where various analytical capabilities are executed to drive knowledge creation. However, SARS's approach to knowledge management is much wider than just that of SARS. SARS is increasingly exposed to the 'whole of government approach' where different state departments collaborate to improve service delivery to its citizens (SARS, 2013a:18). The basis of this approach is the sharing of citizen data, which should at the very least simplify the interactions that citizens and companies have with government (SARS, 2013a:18). Under the new Global Forum's Mutual Administrative Assistance Agreement, SARS is enabled to use the data and knowledge of third party vendors to strengthen their ability to combat tax noncompliance (SARS, 2013a:16; SARS, 2013b:27). A particular example is outstanding debt, where the debt collectability of

taxpayers is obtained from third party credit bureaus. One can sufficiently conclude that SARS has become 'data and information rich' and in doing so is becoming more knowledgeable in terms of the trends and patterns related to the noncompliance of taxpayers (SARS, 2013a:25). The Tax Compliance Programme also explains the process of generating tacit knowledge from data analytics and converting it to explicit knowledge, allowing various areas of tax noncompliance to be prioritised. Sections 8.3.4 and 8.3.5 offer a continued discussion on data analytics and mining by presenting various examples illustrating the technical implementation of knowledge management.
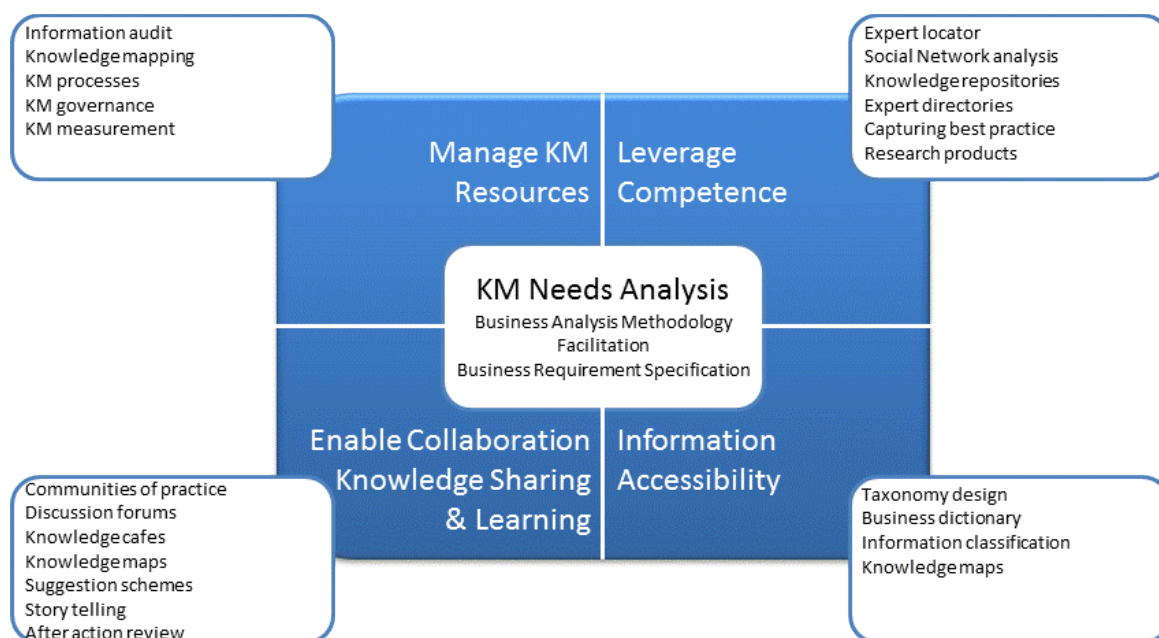
Figure 7-3: SARS Knowledge Management Framework (Adapted from SARS, 2009a:7; SARS, 2012f:11, SARS, 2013e:8)

The second stream focuses on the actual management of human knowledge. The SARS KM framework is presented in Figure 7-3. This framework is comparable to an equivalent framework proposed by the literature in Figure 5-6. The main difference between the two frameworks is that the literature framework is very general, whereas the SARS framework consists of the practical aspects associated with the implementation of knowledge management. Although knowledge management in SARS has been in existence for over 10 years – according to the Manager: KM – the business impact thereof has disappointingly been much less than that of other forms

of DSS. The Manager: KM admits that "…we don't really do well in managing that [referring to knowledge management]". Much like the literature, the Manager: KM confirms the limited uptake of knowledge management to be partly because "…the definitions thereof differ considerably", so everybody has a different opinion about it. Also consistent with the literature is the manager's definition and description of knowledge management by means of referencing SMT and DIKW. SARS's knowledge management capability presents a remarkable resemblance to both the SMT and DIKW theoretical foundations used in this study (SARS, 2013e:3, 5). It is not within the scope of this section to revisit discussions on SMT and DIKW, as these have been comprehensively discussed in sections 1.6 and 5.3.2 respectively. Much like DIKW, SARS also presumes knowledge to be a product of data and information. Similar to SMT, SARS also acknowledges the importance of technology used by humans in an institutional setting to support the creation of knowledge. A factor depicting the contribution to knowledge management is assigned to each of the SMT components: technology contributes 10%, the institution 20% and human agents an overwhelming 70%. It is because of this human agent element that organisations experience challenges with regard to the sharing of knowledge amongst employees. Three challenges are raised with regard to knowledge sharing (SARS, 2012f:6). These barriers are personal barriers (individuals not wanting to share knowledge), collective barriers (inadequate knowledge sharing processes) and structural barriers (inadequate technologies). It is not within the scope of this study to discuss the impact of these barriers at SARS, but it is worth mentioning that these limitations are again referred to in section 8.2, which discussed the DSS data architecture of SARS, and section 8.3.5 discussed why knowledge-driven DSS have not matured to SARS's intended state. At this stage it should be acknowledged that very few of the literature's technical propositions aimed at managing knowledge (listed in section 6.3.3) have materialised in SARS. However, various managerial initiatives have been implemented in an attempt to manage the human capital of SARS employees. The subsequent section 7.4.2.2 elaborates on this. Some of the technology products identified in the KM framework are the expert locator system, knowledge bases (although very limited), social network analysis (also refer to section 8.3.5), business dictionaries and knowledge maps. Many of these products are subsequently included in the final conceptual DSS framework presented in Chapter 9.

Two streams of knowledge management in SARS are identified in this section. The first stream is that of data analytics and mining, which are elaborated on in the next chapter. The other stream is the management of human knowledge, of which some of the aspects influencing this process are discussed in the next section.

7.4.2 Technology as a Medium for Human Action (SMT's Influence B and INOD's Activity 5)

7.4.2.1 Interpretive schemes

Section 5.4.1 explained the concept of interpretive schemes as the manner in which human agents experience technology. The Manager: KM explained interpretive schemes as being largely dependent on a human's knowledge and as essentially "…everything about that person…so it incorporate his background, past experience, culture, norms, and values…". She elaborates on reasons why the management of interpretive schemes are so important when developing DSS. She explains that SARS is increasingly finding itself in a predicament where the experienced resources are ageing towards retirement and the younger, inexperienced resources are not learning fast enough to replace them. This challenge is general to the public sector, where industry expertise is limited. The manager refers to this phenomenon as "polarisation through levels of abstractions". In summary, her concept explains that the knowledge transfer between experienced resources and inexperienced resources is not a simple matter of having inexperienced resources apply the best practice of experienced resources. This is because the interpretive schemes used by experienced resources typically exceed the conceptualisation of inexperienced resources. "The higher the expertise…you can combine, just by the terminology used, years of knowledge in a [single] concept. So in other words, the level of abstraction is so high that you cannot apply it ...where there is nothing [referring to the interpretive schemes of the inexperienced resources]". Having said this, it must also be acknowledged that certain organisational experts chose to retain their knowledge as a method of ensuring job security. Interpretive schemes reinforce importance of designing DSS to firstly accommodate different levels of knowledge. Secondly, it emphasises the importance of encapsulating explicit knowledge where possible which in return will improve the decision-making capabilities of less knowledgeable resources.

The interpretive schemes of a human agent are continuously evolving based on the knowledge generation of individuals. The next section discusses norms, which serve as the foundation for knowledge generation.

7.4.2.2 Norms

Section 5.4.2 discusses how different influences determine the manner in which human agents use technology to facilitate decision-making. Core to these influences are the individual beliefs of the decision-maker. These beliefs are a result of the individual's ability to generate knowledge and set the norms in terms of how technology is used as a medium for human action.

Knowledge management in SARS specifically references the SECI model (Figure 5–8 presented the SECI model). The Manager: KM explains that SARS's knowledge management efforts focus on explicit knowledge and the activities associated with capturing this. In doing so, SARS's KM framework (see Figure 7-3) lists the practical aspects associated with each of the quadrants (SARS, 2010a: 14). The socialisation quadrant captures and transfers tacit knowledge from one individual to another through job rotation; mentoring; and storytelling. This quadrant addresses the personal barriers associated with knowledge sharing amongst individuals. The externalisation quadrant organises tacit knowledge into explicit knowledge through peer reviews; frequently asked questions; and suggestion schemes. The collective barriers of knowledge sharing are addressed by the externalisation quadrant. Explicit knowledge is transferred as such by the combination quadrant through formal DSS such as data warehousing; data mining and the associated business rules. This quadrant is technical by nature and consequently addresses the structural barriers associated with knowledge sharing. The final quadrant, namely internalisation, aims to convert external knowledge to tacit knowledge through eLearning; 'on the job training'; and the sharing of best practices. Selected instances of these quadrants are included in the final conceptual DSS framework presented in Chapter 9.

Interestingly, SARS's differentiation between implicit and explicit knowledge differs from what is proposed by the literature. Furthermore, the different empirical sources are also inconsistent with each other. According to the literature, implicit and explicit

knowledge form part of an individual's knowledge. The Manager: KM agrees with this, although she limits SARS's knowledge management activities to explicit knowledge. In fact, SARS (2010a:2) limits tacit knowledge to human agents and explicit knowledge to that embedded in IT. This variation is worth mentioning although it does not really impact the conclusions of this research. However, the variation does lead to another important empirical finding: According to the Manager: KM, SARS will never fully 'own' the knowledge of its employees. This presents a problem as one cannot manage something which is not owned. "When I leave the office I take it [referring to knowledge] with me, when I resign I take it with me – so it's not something which the organisation can manage like an asset" (Manager: KM). This is perhaps why SARS (2013e:4) defines another type of knowledge separate to that of tacit and explicit knowledge, namely organisational knowledge. Organisational knowledge is not prescribed by individuals or media, but rather by an institution. Institutions impose certain 'knowledge' on individuals simply because it has been embedded into processes, business rules, IT systems and corporate culture. An example thereof is SARS's various knowledge management initiatives aimed at establishing the level of expertise of customs and excise traders. In doing so, SARS is attempting to identify those qualifying as preferred traders (SARS, 2013b:20) with the objective of improving the tax compliance of customs and excise.

7.4.2.3 Facilities

The SARS Commissioner is quoted (SARS, 2012a, 3) as saying that "[SARS] is not out to catch people. Rather we are in the business of getting everyone to do the right thing willingly", but he also adds that "…[we must ensure] that those who don't pay their fair share and don't abide by the rules are brought into the fold.". In doing so, IT and in particular DSS are used as one of the main facilities to combat taxpayer noncompliance. Many would argue that SARS's usage of sophisticated DSS has successfully influenced taxpayers to rather choose the path of tax compliancy (SARS, 2012d:11).

The Senior BI Developer suggests that DSS can also be used to pro-actively address tax compliance, as opposed to the reactive management thereof. However, he explains that "…it's a very fast playing game, the minute those types of people [referring to

noncompliant taxpayers and especially tax syndicates] are catching on that you know, they change their story [referring to their noncompliant behaviour]". In saying so, the developer emphasises that DSS are only used as a medium to facilitate decision-making related to noncompliant taxpayers, and that "very bright" internal and external people are needed to stay ahead of the ever evolving tax gap. The manager information integration confirms the importance of human agents when it was stated that "…you can't automate everything and make everything robotic…you've got a human factor in the whole thing [referring to the implicit knowledge of tax practitioners assisting them with decision-making]". This distinction between reactive and proactive decision-making is also worth incorporating in the final conceptual DSS framework presented in Chapter 9.

The Manager: KM puts a different perspective on how DSS can be used as an organisational facility, and explains that knowledge management through DSS should be used to 'kick start' innovation. It is believed that this will ensure the long term sustainability of an organisation. Such an approach links to the previous paragraph's message stating that DSS can be used to proactively manage the tax gap. The manager explains the importance of using knowledge as an enterprise facility and also acknowledges that this is unfortunately not the case in SARS. Challenges such as political influence are arguably the most prominent reasons for this (also refer to section 7.4.1.3 for knowledge management barriers). The manager addresses this challenge following a bottom-up approach by means of what she refers to as "guerrilla tactics". This is done by liaising with lower level business managers directly. In doing so she gets different business units to participate according to the knowledge management facilities applicable to them. Such an approach is different to the best practice of following a top down, executive-driven approach.

The empirical study's findings in terms of how DSS are used as an organisational facility to drive decision-making are mostly consistent with the literature findings presented in section 5.4.3. SARS (2012b:11) elaborates on how reporting and data analytics support the three types of decision-making, namely operational, tactical and strategic decisions. Operational decision-making supports the 'execution' users located in the different SARS branches. Tactical decision-making supports the

regional users that are typically focussed on 'exploration'. Strategic decision-making is conducted by centralised head office executives who are mostly super users of DSS. The specific DSS instances supporting the three types of decision-making have been discussed at a high level in section 7.4.1.2 and are further elaborated on in Chapter 8.

An interesting observation is the inconsistency between the literature and empirical findings in terms of the reporting and data analytics alignment in the organisation. The literature suggests in Figure 5–13 that reporting follows a bottom-up approach whereas data analytics follows a top-down approach. To the contrary, SARS (2012b:11) suggests reporting to follow a top-down approach whereas data analytics follow a bottom-up approach. SARS's top-down reporting approach is a result of its modernisation implementations that have to continuously be monitored from an executive managerial level. On the other hand, data analytics follows a bottom-up approach as the impact of the modernisation changes needs to be investigated from an operational level upwards. This study presumes the position suggested by the literature, namely that reporting follows a bottom-up approach whereas analytics follow a top-down approach. This is because SARS's modernisation journey, which is essentially the reason for the discrepancy between the literature and empirical findings, is unique to SARS and a conceptual framework portraying this will have limited transferability.

7.5 Refining the Conceptual DSS Framework – Empirical Phase One

Chapter 7 commenced the empirical study by exploring the aspects associated with the research problem itself, namely the tax gap phenomenon. Figure 7-4 illustrates the enhancements to the framework based on the conclusions of this chapter and is again presented in Appendix C. A summary of the empirical findings is presented in Table 7-2. Most of the findings from the literature survey are confirmed, especially with regard to factors present in the perceiver, factors in the environment and factors in the target that influence taxpayers to be noncompliant. A valuable empirical finding was that of noncompliance measurements. Whereas the literature only defined the four pillars used to measure compliance, section 7.3.1 identified the 20 most important measurements that can be used to practically monitor taxpayer noncompliance. Another valuable point was identified by the empirical study with regard to the

research problem: noncompliance does not exist in isolation and should consequently be measured in close conjunction with taxpayer service and education. This finding has been incorporated in the framework.

Participant	Main Contribution
Executive: Enforcement Strategy	• Confirms literature conclusions related to tax gap, tax noncompliance, tax avoidance and tax evasion. • Introduces the 'four tax compliance pillars' used as noncompliance measurements. • Lists various reasons for tax noncompliance. • Discusses the various ways of measuring the tax gap.
Executive: Tax Research	• Confirms literature conclusions related to tax gap, tax noncompliance, tax avoidance and tax evasion. • Emphasises the importance of tax collection. • Lists various reasons for tax noncompliance.
Senior Manager: Tax Enforcement Planning	• Confirms literature conclusions related to tax gap, tax noncompliance, tax avoidance and tax evasion. • Explains that the tax compliance pillars are limited to tax evasion. • Explains the impact of tax noncompliance. • Lists various reasons for tax noncompliance. • Introduces the concept of 'compliance gap' that relates to all non-monetary aspects of the tax gap.
Senior Manager: Case Selection	• Lists various factors influencing audit prioritisation. • Emphasises the practical importance of DSS. • Explains that taxpayer compliance cannot be disconnected from service & education measurements.
Manager: KM	• Explains that organisational culture is transferred between employees and changes over time. • Discusses the SARS knowledge management framework. • Elaborates on the importance of interpretive schemes with regards to the creation and transfer of knowledge. • Introduces the concept of organisational knowledge as another dimension to explicit and tacit knowledge.

Table 7-2: Empirical Summary – Phase One of Empirical Study
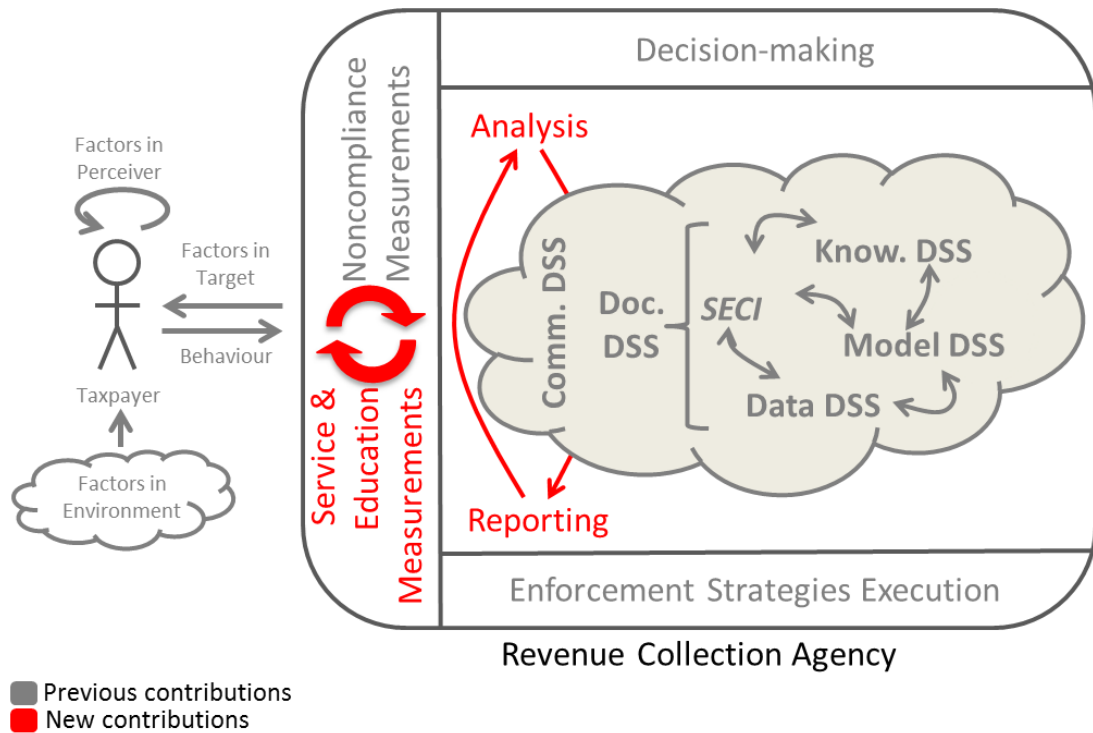
Figure 7-4: Framework Refinement - Phase One of Empirical Study

The empirical conclusions related to the role between IT, the revenue collection agency and the tax practitioner were also consistent with the literature. The exception to this was the relationship between reporting and data analytics, and how these capabilities support the different types of decision-making. The literature recommended that reporting follows a bottom-up approach and analytics a top-down approach, whereas the empirical findings suggested the opposite. The framework was updated with this finding by enhancing the relationship between reporting and data analytics from being one-directional to being bi-directional. In doing so, the framework now illustrates that a recursive relationship exists between reporting and analytics and that although reporting commences from the bottom and analytics from the top, each is influenced by the other. Analytics is therefore used to make new discoveries that should be reported on and reporting prompts curiosity that requires the matter to be analysed further.

7.6 Conclusion

The empirical study commenced in this chapter and aimed to supplement the literature conclusions derived from the previous chapters. In particular, Chapter 3's conclusions on the tax gap phenomenon and taxpayer noncompliance were empirically validated, as well as the role of IT in an organisation as originally presented in Chapter 4 and 5.

Participants at various managerial levels in SARS were asked to reflect on their perspectives pertaining to the tax gap phenomenon, taxpayer noncompliance and the role of IT in SARS from a decision support perspective. Their perspectives were supplemented with a wide range of empirical documents collected. The empirical findings were largely consistent with that of the literature. This is because the participants referenced the OECD's publications in most cases and these publications have already been incorporated in the literature. It is not surprising given the fact that the OECD comprises one of a few independent parties specialising in tax administration. However, a particular empirical finding was valuable in terms of enhancing the conceptual DSS framework. The finding stated that the measurement of taxpayer noncompliance should not be done in isolation to the measurements of taxpayer service and education. This is because the failure of the last mentioned inevitably results in future taxpayer noncompliance, although this might not necessarily be the taxpayer's intention. DSS should therefore also measure taxpayer service and education when addressing taxpayer noncompliance.

The empirical findings on the role between IT, SARS and the tax practitioners gave a narrative summary of the case study. Valuable conclusions included the identification of detailed noncompliance measurements that essentially prescribe the main compliance measurements to be addressed by DSS. Further insights included the evolution and current positioning of data, information and knowledge management in SARS, which provided a better understanding of DSS's role in the case study. The insights can also be used as guidance for the users of the conceptual DSS framework. More importantly, these insights set the background required to appreciate the empirical discussions on how DSS are implemented in SARS. Another valuable empirical finding called for a revision of the literature's one-directional relationship between reporting and data analytics. It is suggested that this relationship is rather

recursive by nature, resulting in another refinement of the conceptual DSS framework.

The next chapter continues the empirical study by specifically focusing on the detailed instances of DSS aimed at addressing taxpayer noncompliance. These findings are used to further refine the conceptual DSS framework. Furthermore, the next chapter concludes by not only validating the framework, but also testing the transferability of the framework.

CHAPTER 8: EMPIRICAL FINDINGS ON DSS INSTANCES AND FRAMEWORK CONFIRMATION
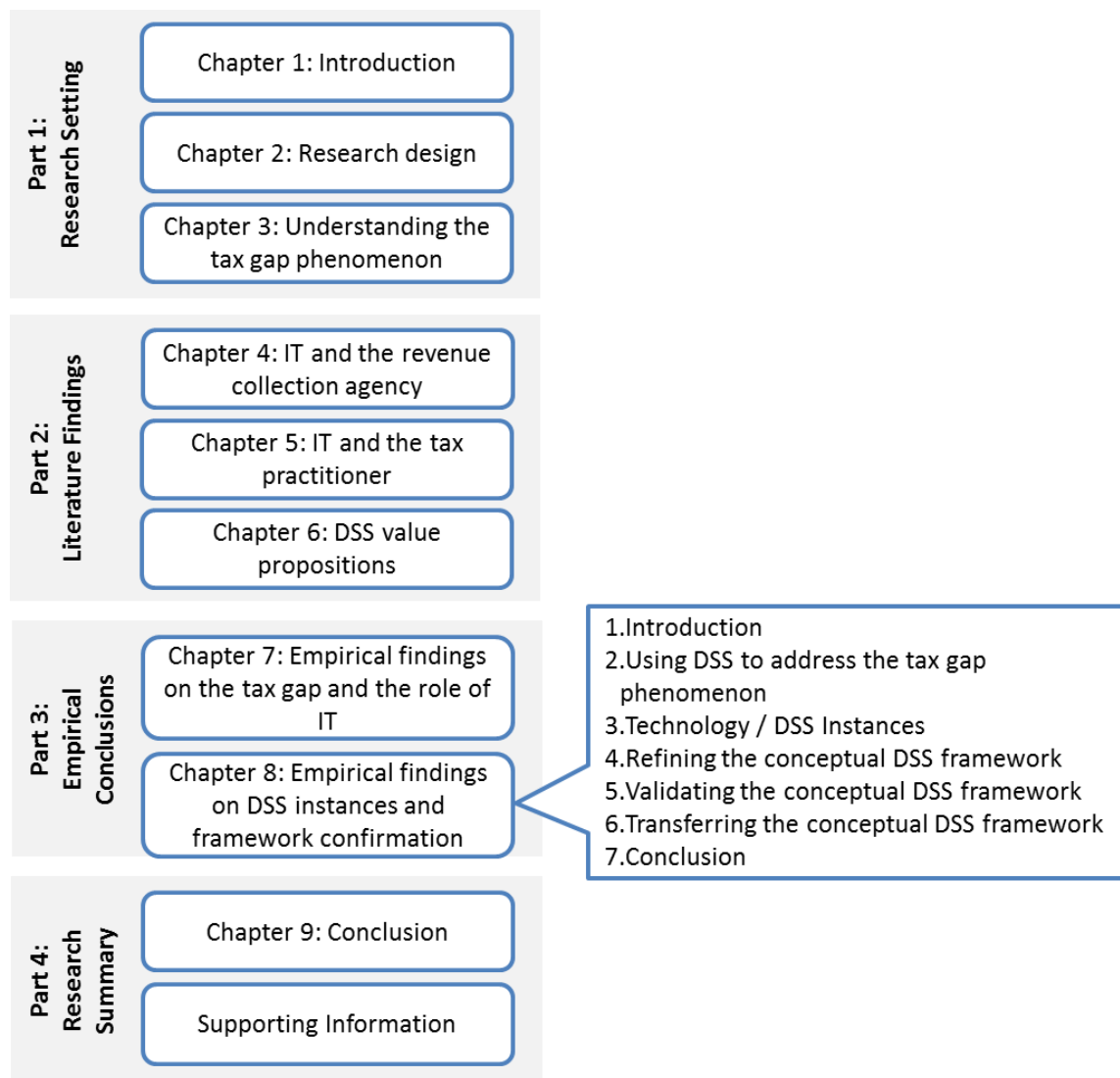
Figure 8-1: Chapter 8 Roadmap

8.1 Introduction

The preceding chapter commenced phase one of the empirical study by focussing on the tax gap phenomenon, reasons for taxpayer noncompliance, as well as the relationship that exists between IT, SARS and tax practitioners. Chapter 8 continues the empirical study by conducting phase two of the empirical study that focusses on the manner in which specific DSS enable decision-makers to manage taxpayer noncompliance. The chapter does so by firstly discussing the architectural positioning of DSS in SARS, and secondly by elaborating on each of the DSS instances prescribed by the literature. Chapter 8's empirical study relates to the literature presented in Chapter 6 and consequently also addresses the following research question:

"Which decision support systems enable IT's value proposition to minimise the tax gap phenomenon through enforcement capabilities?"

The conclusions derived from the above-mentioned empirical exercise results in the final refinement of the conceptual DSS framework. The chapter also conducts phase three of the empirical study by subsequently validating the framework through the empirical participation of senior SARS representatives. The validation of the framework is aimed at ensuring the accuracy of the conclusions derived during the framework's construction and refinement phases. Finally, phase four of the empirical study tests the transferability of the conceptual DSS framework. The framework's transferability is tested by means of a critical evaluation done through group discussions with other revenue collection agencies.

An important point must be made prior to the illustration of SARS's practical implementations referenced in this chapter: All references made to these implementations are illustrative and are by no means a reflection on actual taxpayers, SARS' performance or official publications pertaining to statistical summaries.

8.2 Using DSS to Address the Tax Gap Phenomenon

This section presents the architectural state of SARS's DSS prior to illustrating the practical examples thereof. The conclusions derived in this section are mostly from the empirical documents collected, whereas the conclusions from section 8.3 onwards

are mainly based on the interpretations of the empirical interviews. Figure 8-2 commences this discussion by detailing the manner in which data-driven DSS (with specific database focus) is deployed in SARS. This is followed by Figure 8-3 that elaborates on SARS's reporting and data analytics architecture. The reason for understanding these architectures is threefold. Firstly, such an understanding is compulsory to appreciate the subsequent sections focussing on the various DSS instances deployed in SARS. Secondly, its serves as confirmation that SARS's DSS implementation is consistent with that prescribed by the literature, thereby giving credibility to the conceptual DSS framework presented by this research. Thirdly, the architectural overview provides additional perspectives to the users of the conceptual DSS framework as it illustrates the implementation architecture used by the framework.

SARS's data-driven DSS architecture is at face value consistent with that traditionally prescribed by the literature originally presented in sections 6.3.3 and 6.4.1. The architecture consists of four layers namely the operational layer, data production layer, information publication layer, solution presentation layer and finally the end users layer. The literature refers to the solution operational layer as the content layer and essentially includes all OLTP and external data sources. ETL tools and approaches are used to extract data from this layer into a primary staging area where various technical transformations occur. A few examples of such transformations are data integration; creating historical time slices; data conversions, formatting and cleaning, to name but a few. Once transformed, the data is loaded in the data warehouse which essentially comprises of two components. First populated is the production component, which is at times also referred to as an operational data store (ODS). An ODS typically stores data in structures similar to that of the source system, from where the data can be further manipulated into the appropriate data warehousing data structures. The load frequencies range from near-real time to monthly loads, and the data is stored with historical time-slicing in an integrated data model conforming to 3NF standards. The publication component of the data warehouse gets populated from the production component, although at times it also gets populated from the operational layer. A secondary staging area is populated during this ETL process. Data is transformed from the relational structure to that of a denormalised

dimensional structure consisting of fact tables and conformed dimensions. The publication component of the data warehouse comprises of various data marts, data cubes and also an enablement / self-service capability first mentioned in section 7.4.1.1. A practical example of this self-service capability is discussed in section 8.3.2. The data production layer and information publication layer are jointly referred to by the literature as the integration layer, whereas the solution presentation layer and end users layer are jointly labelled by the literature as the utilisation layer. Last mentioned is elaborated on in the subsequent section that discusses the SARS DSS reporting and analytics architecture. The SARS metadata repository was designed to be an overarching repository supporting both the operational databases as well as the data warehouse. However, SARS has achieved limited success in the establishment of a lasting metadata repository. The empirical participants explained that metadata has always been 'a second priority'. Similarly, very limited progress has been made in moving towards the evolved DSS state known as knowledge warehousing. This is despite various past commitments made on such an initiative (SARS, 2012e:4). Some of the reasons for this were briefly explained in section 7.4.1.3.

The SARS DSS reporting and data analytics architecture is presented in Figure 8-3. This architecture builds on the DSS data architecture and is illustrated in the horizontal foundation blocks at the bottom of the figure. These blocks again illustrate how OLTP systems load data-driven DSS (with database focus) in the form of a data warehouse. The data warehouse enables the creation of standard data offerings in the form of data marts/cubes. The enablement/self-service offering is also derived from the data warehouse and supplements the standard data offerings. The different reporting and analytical DSS can only be established once these supporting data structures are in place. Examples of such include data-driven DSS (with reporting focus); model-driven DSS and knowledge-driven DSS, each originally introduced in Chapter 6 and further discussed in the subsequent sections of this chapter. The model-driven DSS and knowledge-driven DSS form the 'analytics' grouping shown to the left of the figure, whereas data-driven DSS (with reporting focus) is displayed as a 'reporting' hierarchy grouping centre to the figure. Both these groupings are viewed from two dimensions, namely the managerial levels consisting of operational; tactical and strategic decision types (originally introduced in section 4.3.2) and the DIKW

hierarchy layers namely data; information and knowledge (wisdom is excluded as this is not a technology deliverable).
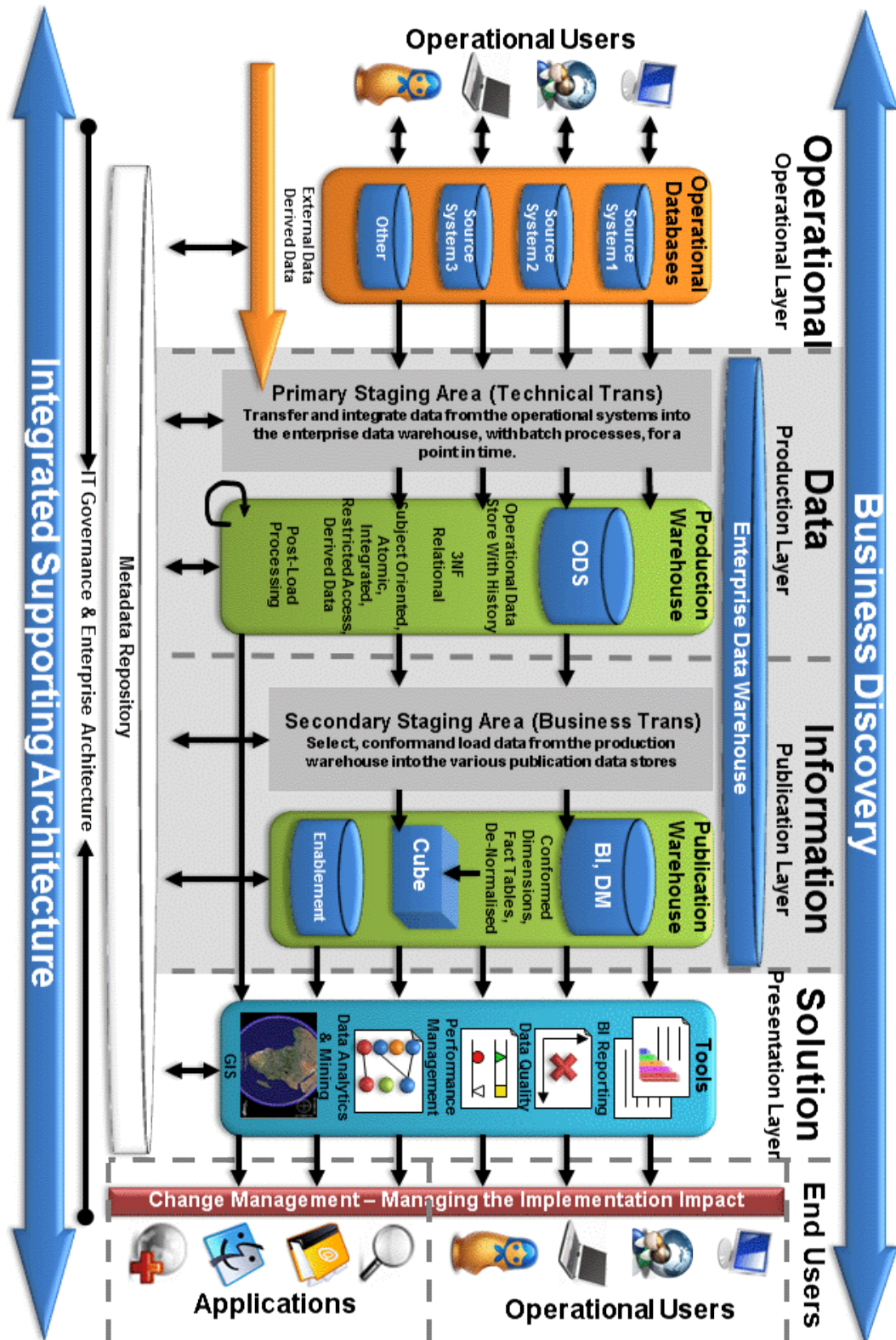

Figure 8-2: SARS DSS Data Architecture (SARS, 2011a:14
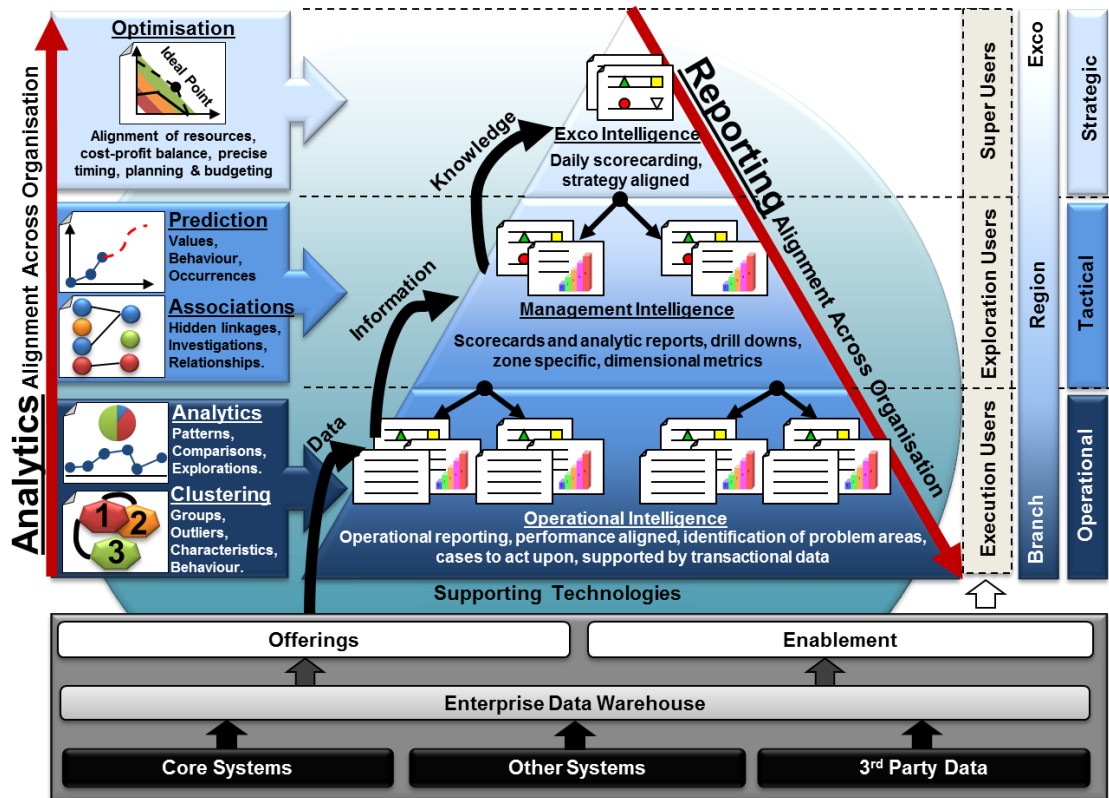
Figure 8-3: SARS DSS Reporting & Data Analytics Architecture (SARS, 2011a:15)

The next two paragraphs elaborate on the manner in which reporting and data analytics are aligned to SARS's decision-making. The argument on the validity of SARS's top-down reporting and bottom-up data analytics approaches has been concluded in section 7.5. It was concluded for this relationship to be recursive by nature rather than being one-directional. Despite this, the subsequent discussions continue with SARS's original perspectives in order to derive further insights from the empirical documents.

The data analytics grouping is aligned across the organisation in a bottom-up fashion. The bottom layer comprises of execution users performing operational decision-making using different data sources. The bottom layer is characterised by statistical analytics and clustering initiatives that is aimed at exploring patterns and irregularities in data. These techniques are used to better understand the characteristics of taxpayers and their behaviour, as well as those not behaving according to statistical norms which consequently pose a risk to SARS. A statistical understanding of taxpayer

attributes acts as a foundation for the middle analytical layer. This analytical layer consists of users that convert the data derived from the bottom layer into information used for tactical decision-making. The middle layer uses statistical attributes to predict the future state of a taxpayer's affairs, as well as the associations (direct and indirect) which such a taxpayer might have with other entities. The insights derived from the middle layer are converted into knowledge by 'super users' (users with sophisticated DSS skills) who typically execute strategic decisions. This top layer is focussed on the optimisation of organisational resources.

In contrast to the data analytics grouping is the top-down organisational reporting grouping. A top-down approach is preferred to ensure the alignment of performance measurements across the organisation, as well as the consistent reporting thereof. The top layer consists of executive decision-makers who perform strategic decisions using the knowledge at their disposal. These executives define the performance indicators that measure the supporting hierarchical levels. Measurement results are typically displayed in business scorecards and dashboards and are collectively labelled as 'Exco Intelligence' reports. The purpose of these reports is to provide a general overview of the state of the organisation, as well as emerging risks and opportunities. The middle layer is represented by regional managers executing tactical decision-making in support of 'managerial intelligence'. They too use business scorecards to indicate performance (although at a more granular level). However, these reports are supplemented by analytical reports that provide additional information on their respective performance measurements. The bottom layer provides 'Operational Intelligence' to branch managers through detailed transactional reports in support of their operational decision-making activities.

Both the reporting and data analytics groupings are supplemented by 'supporting technologies' which, amongst others, include the communications-driven and document-driven DSS. These technologies are collectively grouped as they 'facilitate' decision-making as opposed to 'enable' decision-making. Examples include the SARS portal, GDSS software, and instant messaging, to name but a few. Section 8.3.6 continues with a discussion on communications-driven and document-driven DSS.

The architectural overview of SARS's data, reporting and data analytics build on the maturity level of SARS's DSS originally presented in section 7.4.1. The architectural overview elaborates on many of the detailed DSS instances that should be incorporated in the conceptual DSS framework. It is the purpose of the next section to provide practical insights on each of these DSS instances as deployed in SARS. The empirical insights obtained further refine the conceptual DSS framework.

8.3 Technology / DSS Instances

It is the purpose of this section to present the interpretations from the empirical interviews illustrating the ways in which DSS can be used to address the taxpayer noncompliance. This section concludes phase two of the empirical study aimed at refining the conceptual DSS framework. A summary of the interviewees are presented in section 2.9.3 and consists of the following participants listed in alphabetical order: Manager: Enterprise Measurement, Manager: Information Integration, Manager: Knowledge Management (KM), Manager: Monitoring and Analysis, Senior BI Developer, Senior Enforcement Data Analyst, Senior Geographical Information Systems (GIS) Developer, Senior Manager: Case Selection and the Senior Social Network Analysis (SNA) Developer.

8.3.1 Data-driven DSS: Data Warehouse and Data Marts

The concept of data warehousing and data marts has been presented in various previous sections. The literature survey in sections 6.3.3 and 6.4.1 first introduced the concept. The empirical study continued the discussion in section 7.4.1.1, which elaborated on SARS's data warehousing journey and subsequently in section 8.2 that detailed SARS's data warehousing architecture. It is not the purpose of this section to revisit these discussions. Instead, this section aims to identify new empirical findings that can further refine the conceptual DSS framework.

In describing the future state of SARS's data-driven DSS, the Manager: Information Integration highlights some of the recent challenges experienced with SARS's DW. He explains that in the past it took too long for solution enhancements to be implemented and that this was a result of rigid prescribed formalities and governance processes prescribed at that time. SARS's DW consequently lacked agility and soon

lost touch with its modernisation programme. In doing so, the DW lost its relevance to business. The data latency of the DW, which was at that stage one day, also became problematic as SARS moved towards the real-time monitoring of its business. The answer to these challenges was the creation of an 'operational intelligence' (OI) data mart. The purpose of SARS's OI data mart is to host a smaller but very specific subset of data that is highly agile by nature. Its data is of recent latency with limited historical snapshots, thereby supporting its objective to deliver near real-time reporting. The objective of the OI data mart is therefore in sharp contrast to the DW, which is to host rich and deep data in support of detailed data analytics. A summary of this differentiation between the OI data mart and DW is listed in Table 8-1. Interestingly enough, SARS also uses the OI data mart to ETL data into the DW on a daily basis. This is because many of the transformations are already completed by the OI data mart. The Manager: Information Integration explains that "…because you're packing that fact table [referring to the OI data mart] real-time, at the end of the day you just copy it once across [to the DW] instead of it running through the whole process which would normally take an hour. It is now just like a copy and paste [from OI data mart to DW]".

OI Data Mart	**Data Warehouse**
Agile and flexible in design	Rigid and static in design
Subset of data	Richness in data
Limited history	Comprehensive history
Near real-time data latency	Delayed data latency
Simple data structures	Complex data structures
Fast response	Slower response
Reporting	Analytics
Operational and tactical decision-making	Tactical and strategic decision-making

Table 8-1: SARS's DW and OI Data Mart Distinctions (Manager Information Integration)

To some degree, the OI data mart is similar to the 'active DW' concept presented by the literature survey in section 6.4.1, although the OI's intent is to function in isolation of the DW. Another reference to OI is made by the literature in section 6.4.2, in which the concept is explained as the incorporation of business processes in BI reporting. The empirical study illustrates that SARS's perception of OI is somewhat of a hybrid between these two perspectives.

The introduction of the OI data mart has seen SARS's OLTP, data mart and DW environments becoming increasingly interwoven. This is true to the degree where certain systems cannot be distinguished as being solely OLTP or DSS. This evolution has consequently also impacted SARS's decision-making. Tactical and strategic decisions were made over long periods of time in the past, but SARS has evolved to make these decisions much more frequently. Part of this reason is the ability for the OI data mart to provide a finger-on-pulse monitoring of SARS's strategic measurements. "Gone are the days where you [referring to SARS's executives] would make a strategic decision after [waiting for] three months of data" (according to the Manager: Information Integration). In saying so, specific mention is made of SARS's modernisation programme and the pace at which the executive decision-making is occurring. "A very good example is how returns [submissions] have changed. Historically, a return was assessed … over multiple days, then it moved to 24 hours, then a few hours and now we are in seconds – you can see how things have changed … over a very short period in time". This change has not only enabled the SARS decision-makers to become more aware of tax noncompliance, it has also equipped tax practitioners to actively pursue noncompliant taxpayers.

The concept of an OI data mart acting as middle layer between OLTP and DW has fundamentally repositioned the role of data-driven DSS in organisations. Given the fact that other DSS instances are mostly enabled through data-driven DSS, this finding also repositions their value propositions to business. For example, in the past GIS solutions were only used to display passive information. With the introduction of the OI data mart, GIS solutions can now show active information in support of operational decision-making. More on the difference between passive and active GIS is presented in section 8.3.3. This empirical finding suggesting the close integration of

OLTP, OI and DW is worth incorporating in the conceptual DSS framework and is therefore used in section 8.4 to further refine the framework.

Phase one of the empirical study highlighted the importance of third party data as a method to detect noncompliant taxpayers. It therefore warrants a brief further elaboration in terms of the practical usage thereof. The Senior Enforcement Data Analyst as well as the Senior SNA Developer confirmed that they make extensive use of third party data to detect taxpayer noncompliance. They argue that most taxpayers evading tax (as opposed to avoiding, see section 3.2) are identified through external data sources. Without external data sources, these taxpayers will remain 'unknown' to SARS and consequently not become registered taxpayers. An example is when an individual is not registered for taxes but purchases a property. SARS would become aware of this transaction by means of the data received from the South African Registrar of Deeds. Tax avoidance is also identified through the usage of third party data as it can be used to detect under declaration by taxpayers. An example is when taxpayers own multiple properties without declaring any rental income. SARS's ability to match its data to third party data is often the only manner in which sophisticated tax avoidance is identified, as confirmed by the senior enforcement data analyst: "…we often find that it is guys [taxpayers] that are very wealthy who are avoiding SARS".

An important aspect of data warehouses is its ability to act as the central repository of all organisational and third party data. More importantly, it is the purpose of a data warehouse to consolidate and integrate these different data sources. The Senior BI Developer explains data matching algorithms to do exactly that. The previous paragraph concluded by also emphasising the importance of data matching third party data to SARS's data with the goal of detecting tax evasion and avoidance. The developer elaborates on the importance of data matching algorithms to ensure the integration of seemingly disconnected data. One such example is the sophisticated data matching algorithm referred to as the 'Integrated Business Register' (IBR), shown in Figure 8-4. SARS's legacy systems maintained tax registrations in isolation, meaning that the different tax registrations (such as IT, VAT and PAYE) of a single tax entity were unrelated to each other.

An example of different tax registrations matched to a single entity using DSS algorithms. From an OLTP perspective, these registrations have no relationship with each other. This matching allows SARS to obtain a single-view of the taxpayer.

Figure 8-4: IBR Matching Algorithm's Result[1]

It is the purpose of the IBR to link these different tax registrations with the goal of creating a single view of a tax entity. This perspective is critical for tax practitioners to obtain a comprehensive understanding of a taxpayer's compliance status. The linkage to a single tax entity is done through a sophisticated matching algorithm. The algorithm does so by 'connecting' the different taxpayer attributes obtained from various disconnected data sources, with third party data being fundamental to the matching process. Various other internal and external data are then linked to the single tax entity, which especially includes data supporting the four tax compliance pillars and its measurements (see section 7.3.1). The Senior BI Developer explains that the IBR's matching algorithm is especially valued by SARS's enforcement agents because "Currently we have a total picture [referring to taxpayer compliance]… that is updated on a daily basis. Instead of going to all the systems [referring to the various disconnected OLTP], you [the enforcement agents] hit one button to then decide what to do about it [referring to the taxpayer's noncompliance]". This ability is of particular interest in support taxpayer lifestyle audits. The concept of lifestyle audits is further elaborated on in section 8.3.5 under Social Network Analysis (SNA).

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[1] The company names used are illustrative and do not reflect upon true taxpayers

This section presented some of the data-driven DSS topics that have not enjoyed attention in the literature survey and previous phase of the empirical study. Most important of these is the introduction of OI data marts aimed at bridging the gap between OLTP and the traditional DW. This finding is subsequently used to refine the conceptual DSS framework in section 8.4. The subsequent section discusses the reporting mechanisms associated with data-driven DSS.

8.3.2 Data-driven DSS: OLAP Systems / Executive Information Systems / Business Intelligence

The literature survey presented in section 6.4.2 explained that traditional EIS has, in most ways, been replaced by modern BI. This is also the case in SARS. EIS was a critical enabler of organisation decision-making during phase one and two of the data management evolution at SARS (refer to section 7.4.1.1), but was subsequently replaced with BI reporting capabilities from phase three onwards. It is the purpose of this section to elaborate on the practical implementation of BI reporting in SARS and how it is used to manage tax noncompliance.

The Manager: Enterprise Measurement explains that the ability for DSS to support organisational decision-making starts with BI reporting. He further states that BI reporting is not about showing numbers, but rather "about getting true measurements that you can really understand and that make a difference in the organisation at an operational, tactical and strategic level". In stating so, he also confirms the literature findings emphasising the importance of aligning DSS with business processes. It is through this alignment that tax practitioners can derive value from BI and in doing so, BI converts data into knowledge (SARS, 2012g:2). This finding again confirms the appropriateness of the DIKW hierarchy to this study, as originally prescribed by the literature in section 5.3.2. SARS's BI reporting capabilities is summarised in the DSS reporting architecture shown in Figure 8-3. The hierarchical top-down reporting alignment with business 'segments' SARS's decision-makers into three categories, namely executives with strategic focus, middle management with tactical interest and operational users performing routine activities (Manager: Monitoring and Analysis).

Strategic BI reports on national totals

	Original Assmts Raised (Nr)
NATIONAL TOTAL	**80,793**
COMPANIES/CLOSE CORPORATIONS (CC'S)	16,899
INDIVIDUAL	62,714
TRUST	1,180
EASTERN CAPE — COMPANIES/CLOSE CORPORATIONS (CC'S)	1,343
EASTERN CAPE — INDIVIDUAL	4,188
EASTERN CAPE — TRUST	93
Total (EASTERN CAPE)	**5,624**
FREE STATE — COMPANIES/CLOSE CORPORATIONS (CC'S)	743
FREE STATE — INDIVIDUAL	3,694
FREE STATE — TRUST	138
Total (FREE STATE)	**4,575**
GAUTENG CENTRAL — COMPANIES/CLOSE CORPORATIONS (CC'S)	3,282

Tactical BI reports on provincial totals supplemented by analytical dimensions

			Original Assmts Raised (Nr)
Total (EASTERN CAPE)			**4**
COMPANIES/CLOSE CORPORATIONS (CC'S)			1
INDIVIDUAL			1
TRUST			1
EAST LONDON	COMPANIES/CLOSE CORPORATIONS (CC'S)	BU	1
		Total (COMPANIES/CLOSE CORPORATIONS (CC'S))	**1**
	INDIVIDUAL	BU	1
		S	1
		SB	1
		SS	1
		Total (INDIVIDUAL)	**4**
	TRUST	TR	1
		Total (TRUST)	**1**
	Total (EAST LONDON)		**3**
MTHATHA	COMPANIES/CLOSE CORPORATIONS (CC'S)	BU	1
		Total (COMPANIES/CLOSE CORPORATIONS (CC'S))	**1**
	INDIVIDUAL	BU	1
		S	1
		SB	1
		SS	1
		Total (INDIVIDUAL)	**4**
	Total (MTHATHA)		**2**
PORT ELIZABETH	COMPANIES/CLOSE CORPORATIONS (CC'S)	BU	1

Operational BI reports on detailed taxpayer transactions at tax office level

Row Nr	Taxpayer Area	Assmt Area	Tax Reference Nr	Taxpayer Name/Surname	Taxpayer Initials	Taxpayer Category	Assmt Classification
1	0088	0088	960260	COBITO	-	C	BU
2	0088	0088	9179249	LETAB PROJECT	-	C	BU
3	0088	0088	0179008	BEETO	RWW	I	SB

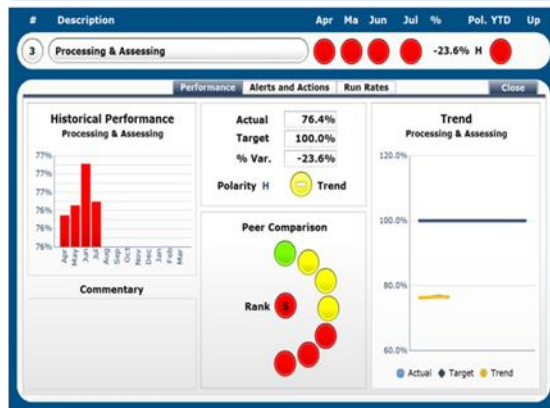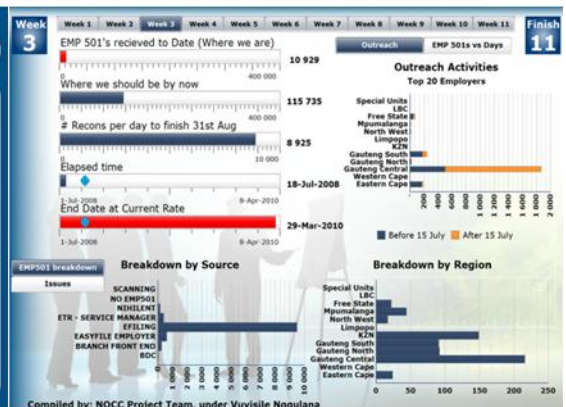*Figure 8-5: BI Reporting Example*

Figure 8-6: BI Dashboards Examples

Figure 8-5 shows illustrative BI reports designed to support this hierarchical decision-making. Not surprisingly and much like the literature, the Manager: Monitoring and Analysis also confirms that strategic decision-makers focus mainly on summary and dashboard reports that show a "bird's-eye view" of tax compliance (see Figure 8-6 for an example), whereas operational users mostly make use of detailed data extractions allowing them to action specific noncompliant taxpayers. Yet, this seemingly comprehensive view that BI offers is criticised by the Manager: Enterprise Measurement when he states that BI reporting shows too much information with too little of it relevant to decision-makers. He elaborates by stating that decision-makers often only use BI reports once they have an 'emotional appetite' for it. "One of the biggest problems have always been that people [referring to the SARS decision-makers] don't have that emotional appetite [for BI] at a specific point in time to actually start engaging [referring to the management of business operations], which is bad for the organisation because normally that takes it [the organisation] into a crisis mode". The concept of having an emotional appetite for decision-making was also previously discussed in section 7.3.2.

A specific example of how BI reporting assists SARS in managing the tax gap is discussed by the Manager: Monitoring and Analysis. He identifies the Compliance Evaluation and Monitoring Information System (CEMIS) as the main DSS supporting the strategic management of tax compliance. CEMIS is a DSS that provides a collection of BI reports aimed at measuring tax compliance on a monthly basis. CEMIS supports SARS's tax compliance management approach by hosting a variety of BI reports that addresses, amongst others, the 20 tax compliance measurements originally introduced in section 7.3.1. These BI reports are supplemented with detailed data extractions containing taxpayer information that allows for the specific instances of noncompliance to be pursued at an operational level. The CEMIS reports are interpreted by SARS Strategy and Enforcement representatives, which at times also prompt further analysis of the area of concern. The Tax Compliance Programme is consequently developed and published according to the conclusions derived from CEMIS. In return, the recommendations made by the Tax Compliance Programme influence the selection criteria used by the SARS risk engine. The SARS risk engine aims to identify noncompliant taxpayers and suspicious tax declarations and is a

typical example of a knowledge-driven DSS. Section 8.3.5 further elaborates on the SARS risk engine as well as other knowledge-driven DSS.

Figure 8-7: Near Real-time Mobile BI Through iPad

Alert through trigger

Mobile 'report'

Figure 8-8: Near Real-time Mobile BI Through SMS

An important recent development in the field of BI is the near real-time reporting of business measurements. Near real-time reporting is enabled through SARS's OI data mart as first introduced in section 8.3.1. SARS (2012g:6) separates near real-time BI reporting from the strategic BI reporting by stating that the first mentioned is executed multiple times a day in an automated manner and also contains time-specific information pertaining to detailed transactions or business events. On the other hand, strategic reporting is less frequently executed - often monthly in an ad hoc manner, and focusses on summarised versions of historical data. However, near real-time reporting is only valuable to decision-makers that have continuous access to the reports. For this reason, mobile BI reporting has gained increasing popularity in recent years. Through mobile BI reporting decision-makers can conveniently monitor the business measurements of interest through their mobile devices such as cell phones and tablets. The Manager: Information Integration states that "Mobile [reporting] has definitely become the new form of tracking in our business". He raises the importance of mobile BI reporting by stating that it provides "mobile intelligence" that aims to support the time-sensitive decisions of "on-the-go" executives. Examples of mobile intelligence are specifically iPad dashboards (see Figure 8-7), but also more simplistic delivery mechanisms such as SMSs (see Figure 8-8). In addition to BI reporting, mobile BI reporting is also used to set triggers that inform decision-makers when certain business measures exceed predefined threshold criteria, in which case the event calls for their manual intervention. The purpose of these triggers is to "…notify me or tell me when there is something wrong, don't let me try and look for it [referring to the problem]" (Manager: Information Integration). An example of SMS triggers is when a head office executive is informed of delayed queues at a specific service centre. This is important because long service queues might prevent taxpayers from becoming compliant. Mobile BI reporting is especially valuable during the financial year end, when the collection of revenue is closely monitored. The Manager: Information Integration explains that triggers keep the relevant decision-makers focussed on the revenue target: "We actually have SMSs going out on the hour, telling you where we are currently".
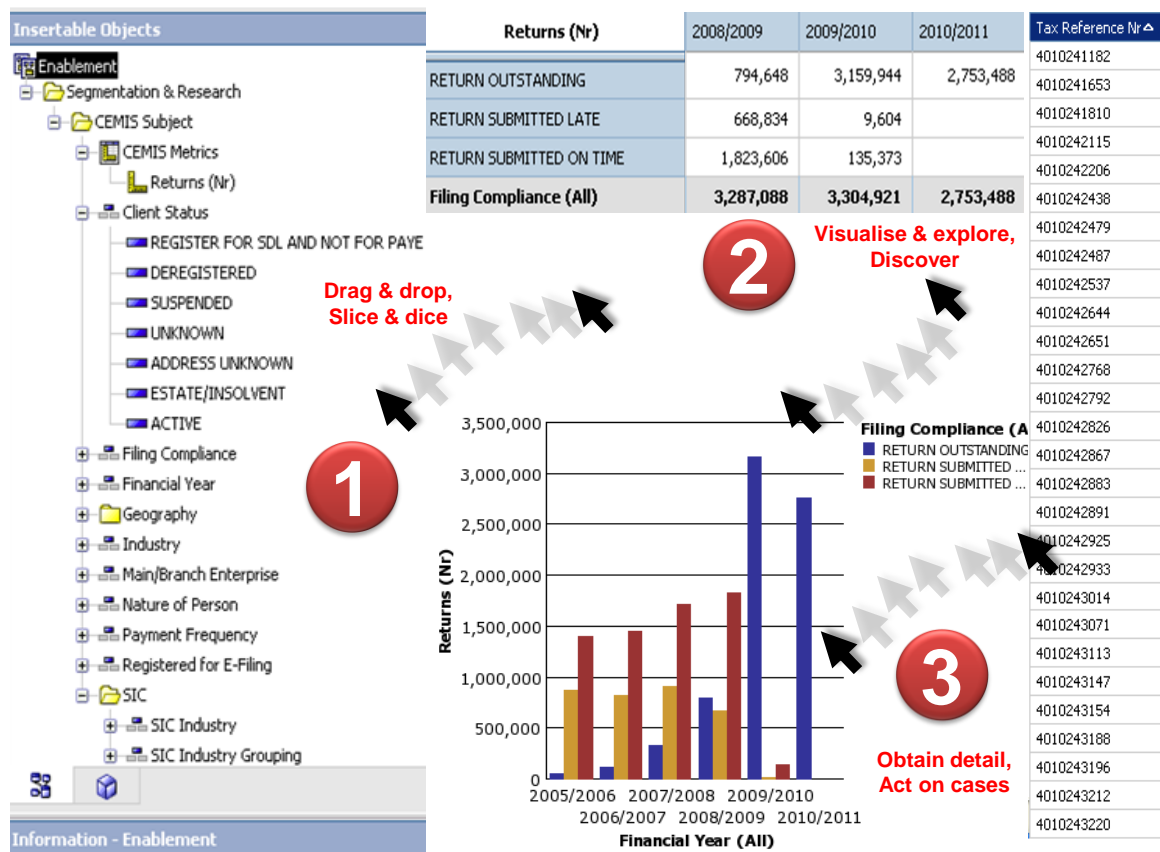
Figure 8-9: 'Self-service' BI Reporting (SARS, 2011a:18)[2]

The final BI reporting capability empirically identified is that of BI 'self-service'. BI 'self-service' is explained by the senior enforcement data analyst as a type of BI reporting functionality that allows non-technical decision-makers to develop their own reports using a drag-and-drop reporting environment. The Manager: Monitoring and Analysis also promotes the usage of self-service BI: "If you look at BI reporting and specifically CEMIS, you have standard reports but you can also … slice-and-dice the data in the way that you want … People can go in there [referring to the self-service BI functionality] and draw their own reports in the way in which they want the data to be structured [to support the intended decision-making]". This self-service functionality of BI reporting builds on the enablement component of the data warehouse first mentioned in sections 7.4.1.1 and 8.2. 'Self-service BI' can be explained as a visual 'wrapper' over the DW data structures that give business meaning to the technical implementations. It provides functionality that enables

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[2] Numbers 1 to 3 and the associated mouse movement attempt to simulate self-service reporting functionality through the drag-and-drop activities of a decision-maker.

decision-makers to 'drag-and-drop' business measures and dimensions at will. An example of 'self-service BI' is shown in Figure 8-9 where the user specifically explored the filing compliance measurement. 'Self-service BI' is used by tax practitioners to conduct ad hoc reporting and analytics in support of their knowledge generation process.

This section presented a few empirical findings on data-driven DSS in the form of BI reporting that have not been apparent in the literature survey and phase one of the empirical study. Most importantly, the section explained how tax compliance is measured using BI reporting through the CEMIS DSS. The section confirmed and illustrated how BI reporting supports the different types of decision-making prescribed by the literature. The potential that mobile BI reporting offers to report on tax noncompliance was also presented. In conclusion, the section elaborated on 'self-service BI' and illustrated how this capability can be used to support ad hoc investigations pertaining to the tax noncompliance. These components are subsequently included in the final conceptual DSS framework presented in Chapter 9. The next section is dedicated to the remaining component of data-driven DSS, namely GIS.

8.3.3 Data-driven DSS: Geographical Information Systems

SARS's has had an interest in GIS for many years. What commenced as a mere interest in understanding the geographical distribution of taxpayers has, over the years, evolved into an interactive solution enabling the dynamic spatial reporting and tracking of various business measurements. Much like BI, these measurements are obtained from a data-driven DSS that are typical according to the tax compliance measurements listed in section 7.3.1. The remainder of this section does not elaborate on the theoretical aspects of GIS, as these were originally introduced in section 6.4.3, but rather on the practical value proposition thereof. According to the Senior GIS Developer, GIS in SARS consists of three components namely geocoding, reporting and analytics, each to now be discussed in greater detail.

Geocoding is the process in which a spatial position is assigned to an entity with geographical relevance, as defined by the Senior GIS Developer. The developer

mentions that there are around 31 million SARS addresses geocoded with monthly updates totalling an estimated one million (also refer to Table 8-2). This spatial position is typically represented by longitude (X) and latitude (Y) coordinates. Taxpayers are geocoded based on the physical addresses they specify upon filing a tax return. These addresses are stored as unstructured text and subsequently require conversion to geospatial points that can be displayed on a GIS map. This is done through an engine that uses a predefined GIS data hierarchy to match the taxpayer's address against. The hierarchy consists of the following levels: national; provincial; municipal; town; suburb; street; and stand. Each of these levels has a centroid acting as the centre of spatial area and to which the taxpayer's address is assigned. At times a taxpayer's address cannot be geocoded to the lower levels, in which case the centroid of the higher level is assigned to the taxpayer. This becomes a GIS limitation as multiple taxpayers can be assigned to the same centroid. This consequently skews the GIS reporting and analytics results. The GIS developer elaborates on reasons for geocoding 'mismatches' that are unique to South Africa and specifically SARS. The most important thereof is the usage of various different languages, each with its own terminology describing geographical reference points. Secondly, the South African government is continuously altering historical geographical reference points dating prior to the establishment of South Africa's democracy in 1994. However, more importantly the senior GIS developer explains that taxpayers often explicitly specify invalid addresses in an attempt to make them "untraceable" to SARS. This is a prime example of the game playing taxpayer motivational postures referred to in Figure 4-4. Many a times SARS's usage of third party data rectifies such inconsistencies, which again emphasises the importance of third party data.

Level	Number (Millions)	Percentage
Street number	12.7	40%
Street	4.4	14%
Suburb / town	10.4	33%
Failed	1.1	4%
No address specified	2.6	9%
Total	31.2	100%

Table 8-2: SARS Geocoding Statistics (SARS, 2013c:2)

*Thematic Layer for Strategic
and Tactical Reporting*   *Points Layer for Operational Reporting*
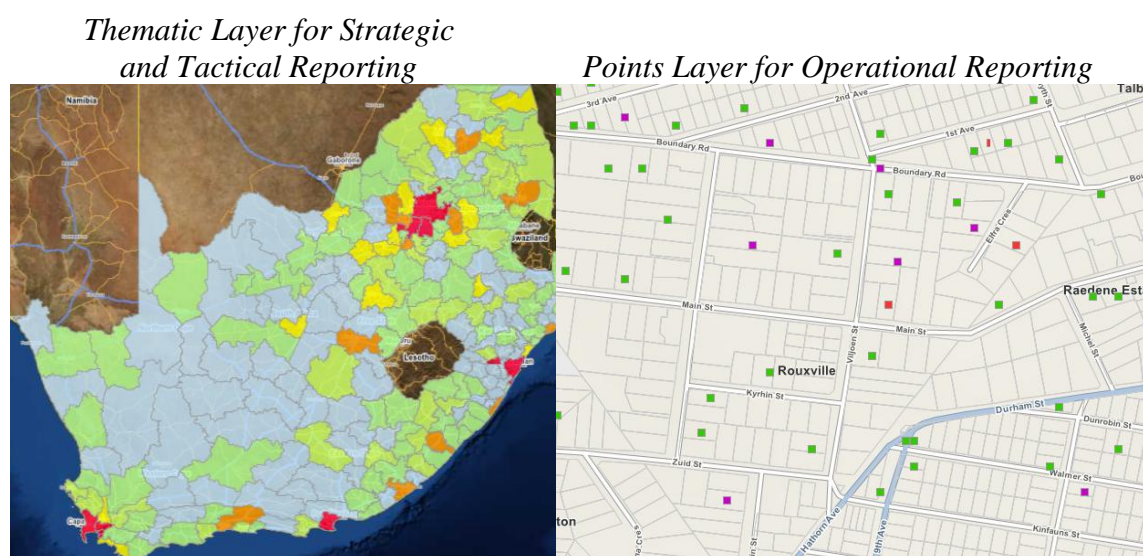
Figure 8-10: GIS - Passive Map Example

GIS reporting and analytics can only commence once the geocoding of taxpayers has been completed. GIS reporting in SARS offer both passive and active reporting through a formalised web solution. The Senior GIS Developer elaborates on these categories. Passive reporting uses the spatial position of taxpayers to develop thematic and point maps according to the geocoding levels previously listed. Examples of these maps are shown in Figure 8-10. Thematic maps are typically associated with strategic and tactical decision-making as they provide spatial insights at an aggregated level. The mapping of taxpayer population density, the tax noncompliance level of suburbs, industry segmentation, and tax audit coverage are but a few example instances. SARS uses point maps to support operational decision-making by mapping specific spatial instances at the lowest level of the GIS hierarchical data. The plotting of individual taxpayers with outstanding returns is one example of reporting on the filing compliance measurement. Another example unique to GIS is the plotting of all property owners that are not registered for taxes, which relates to the registration compliance measurement. The Senior GIS Developer states that "…if you can afford a property, surely you can afford to pay income tax". Point maps can also support active GIS reporting when they are updated on a near real-time basis. These include static points updated frequently, as well as movable points updated in a near real-time fashion. As mentioned previously, SARS's OI data mart plays an important enabler role in doing so. An example of the first mentioned is the service queues at the SARS service centres (shown in Figure 8-11). An example of the last mentioned is SARS's

usage of GIS management solution to track their fleet and mobile workforce. These reports are often used during taxpayer education campaigns, but at times also for mobile enforcement campaigns targeting specific geographical locations (see Figure 8-12).
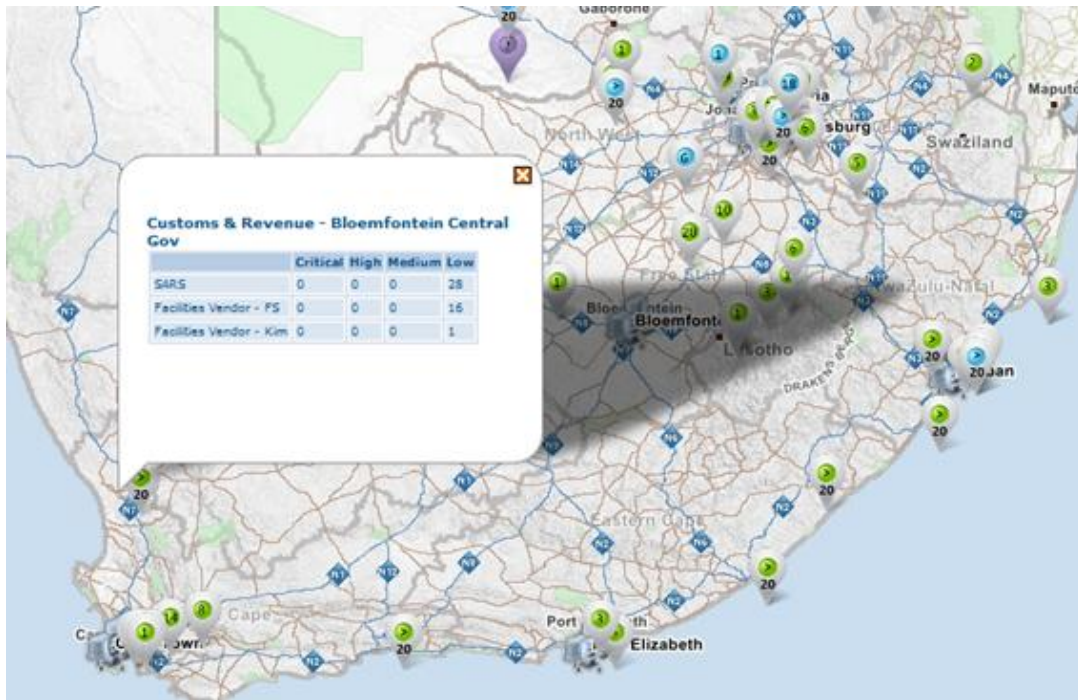
Figure 8-11: GIS - Active Map Example: Tracking Business Measurements
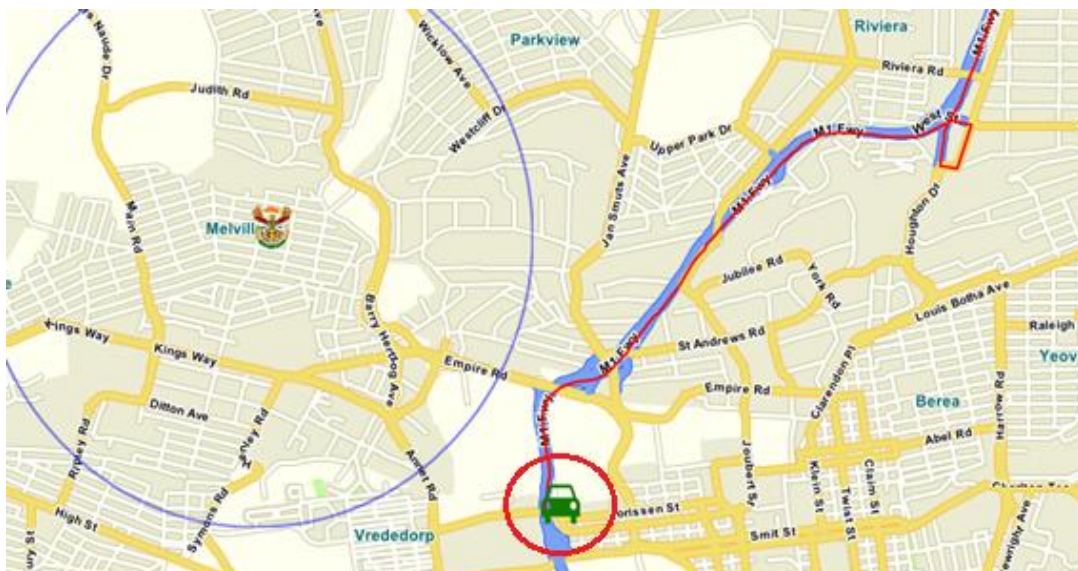
Figure 8-12: GIS - Active Map Example: Tracking Movable Items (SARS, 2011a:30)

GIS report for strategic decision-making
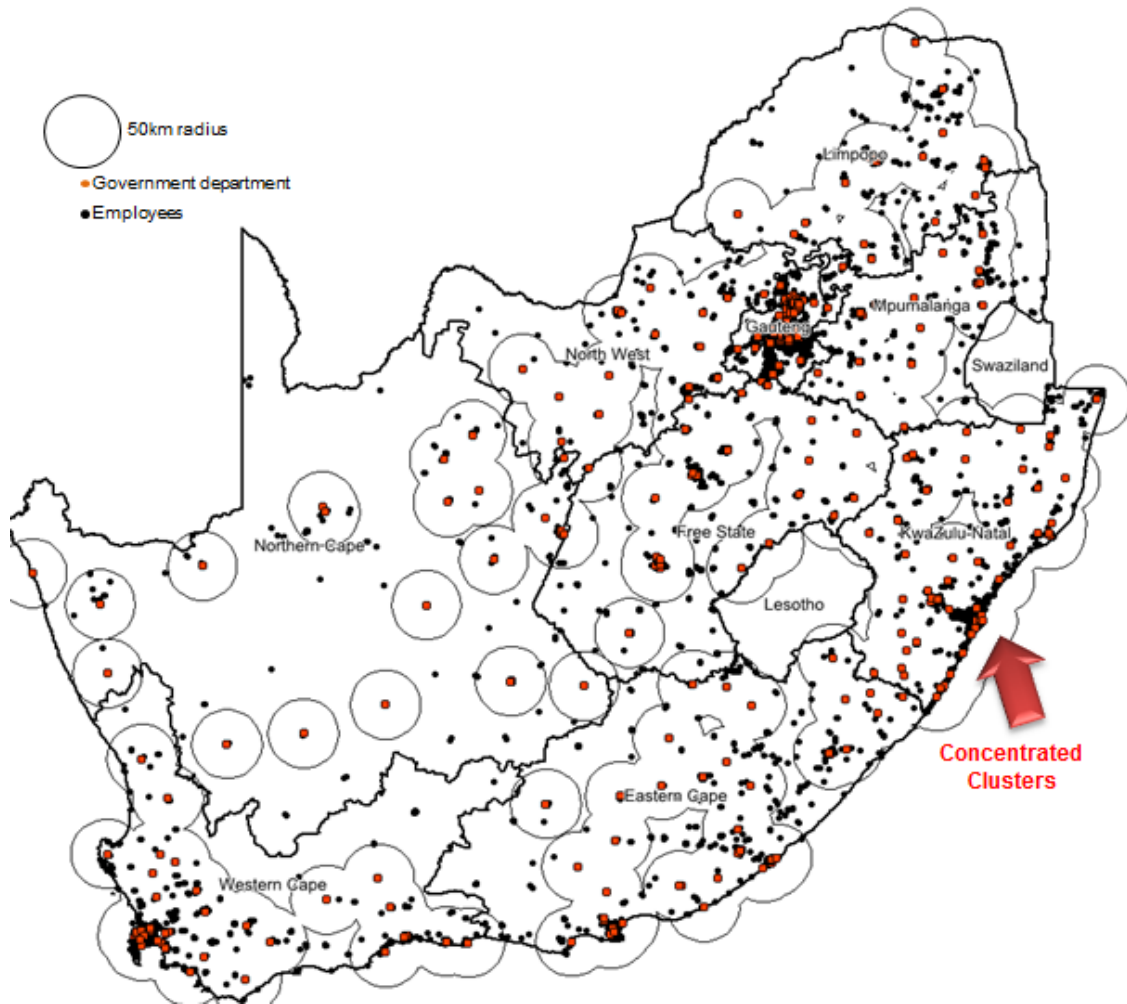
GIS Analytics Example (Figure continues on next page)

GIS report for tactical decision-making
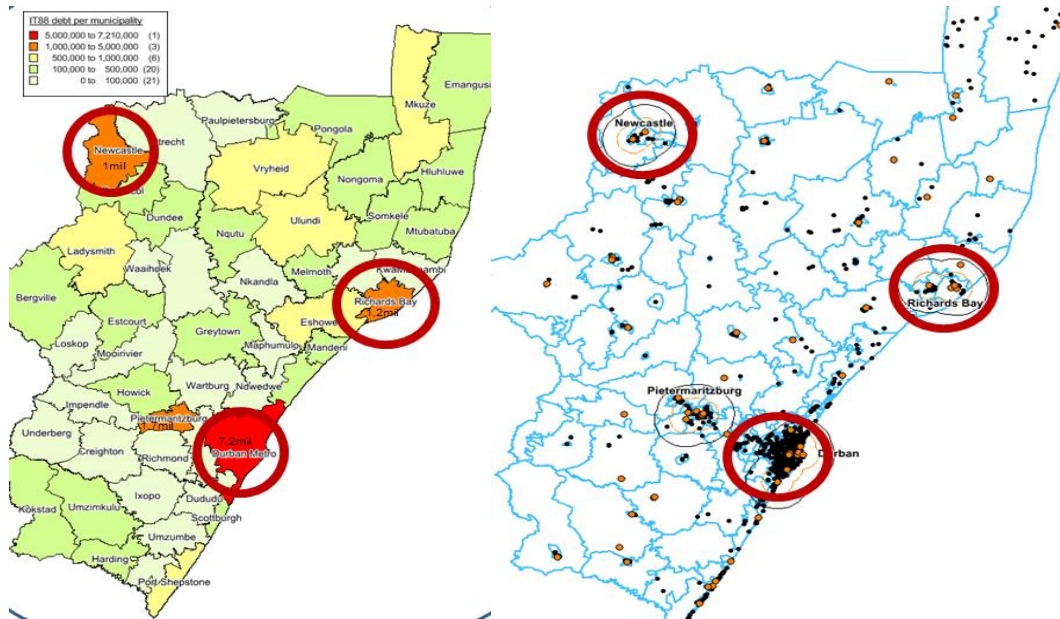
GIS report for operational decision-making
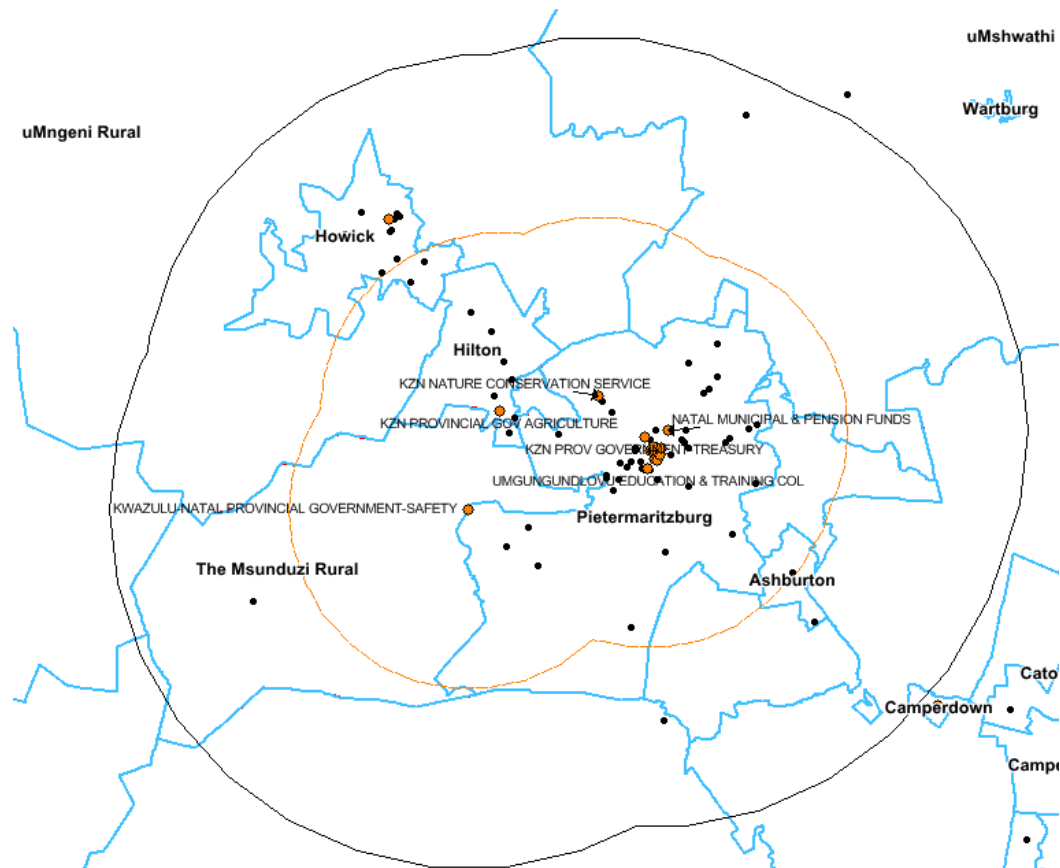
Figure 8-13: GIS Analytics Example (SARS, 2013d: 1 – 10)

The Senior GIS Developer uses an example to distinguish between thematic maps and passive point maps. He was tasked to develop a GIS report that showed the average taxable income per suburb in order to identify the geographical locations posing a non-compliance risk in the form of under declaration. A thematic GIS map showed high income suburbs as red and faded to green for low income suburbs. The report showed certain suburbs as red with very high income, whereas these suburbs were traditionally very poor. This posed a compliance risk to SARS as the taxpayers located in these suburbs might have received very little focus in the past. Furthermore, the report indicated that the service centres closest to these suburbs were much further than what would be considered a fair travelling distance. Suddenly, the monetary value of these few noncompliant taxpayers with outstanding returns became a priority. The identification of these taxpayers was possible by drilling down from the thematic layer to the point layer. This allowed SARS to act decisively on the noncompliant taxpayers – this would have been missed if not for the GIS offering.

In addition to GIS reporting, SARS also conducts GIS analytics in support of specific and unique initiatives that do not form part of the standard GIS reporting. These initiatives are typically complex because of the sophisticated techniques and algorithms performed during the analysis. The Senior GIS Developer elaborates on a specific example illustrating the unique value of GIS analytics. A summary is shown in Figure 8-13. The analysis focussed on the spatial distribution of taxpayers belonging to the government pension fund and was aimed at identifying possible locations for new service centres. At strategic level all taxpayers were plotted on a national level. At first, the results seemed incorrect when significant clusters of taxpayers were positioned in remote areas where "…nothing is happening, there is nothing there" (Senior GIS Developer). This finding was quite different to the typical GIS reports showing concentrations of taxpayers in urban areas. Upon closer investigation, it was realised that the taxpayers were staying in these remote areas for the rustic peaceful environment, which makes perfect sense considering that they are pensioners. The original intent to establish additional service centres in central business districts was soon reconsidered as these locations would, in many cases, be out of reach for the pensioners they were intended for. Although such a finding seems

obvious in hindsight, the conclusion might not have been so apparent was it not for SARS's GIS capability.

This section concluded the third and final component of data-driven DSS, namely GIS. The section distinguished between GIS reports and analytics, passive and active maps, as well as thematic and point maps. The components are subsequently included in the final conceptual DSS framework presented in Chapter 9. A few examples were also presented to illustrate how GIS is used in SARS to identify taxpayer noncompliance. The next section continues the empirical survey on how model-driven DSS instances are used in SARS.

8.3.4 Model-driven DSS

Model-driven DSS was first touched on by the literature in section 6.5 and again during the first phase of the empirical study in section 7.4.1.2. The bottom-up alignment between data analytics and SARS's decision-makers was also introduced in section 8.2. The academic terminology of 'model-driven DSS' are in many cases referred to by the empirical participants as data analytics. For this reason these two terms are interchangeably used in this section.

The Manager: Enterprise Measurement explains that data analytics in the form of model-driven DSS are often initiated as the next step after BI reporting. "I think analytics shows … the real benefit [when compared to other forms of DSS] in terms of how you want to drive the organisation". He explains that BI reporting provides a limited picture of business measurements, as opposed to data analytics that derive detailed and rich insights on the matter. In certain cases, model-driven DSS can even forecast future states. The manager again touches on the concept of decision-makers having an emotional appetite (other references in sections 7.3.2 and 8.3.2) prior to the initiation of data analytics. This is typically not a problem as decision-makers initiate analytical investigations to gain further clarification on problematic matters shown through BI reporting. This is indeed true for SARS, as the Senior Manager: Case Selection explains that data analytics form the basis of the SARS modernisation programme. It is explained that analytical exercises often highlight deficiencies in the OLTP systems, which again identifies opportunities for the tax system to undergo

further modernisation. He explains the usage of model-driven DSS as being pro-active towards identifying taxpayer noncompliance, whereas the risk engine (a specific instance of knowledge-driven DSS, further discussed in the subsequent section) is mostly re-active. Pro-active activities through model-driven DSS include hypothesis testing, as well as exploratory data analysis and optimisation, to name but a few. Other model-driven DSS statistical techniques used to address taxpayer noncompliance also include ratio analysis (SARS, 2013a:28; SARS 2013b:27) and taxpayer segmentation (SARS, 2013a:24).

Strategic forecasting on national totals showing return submissions
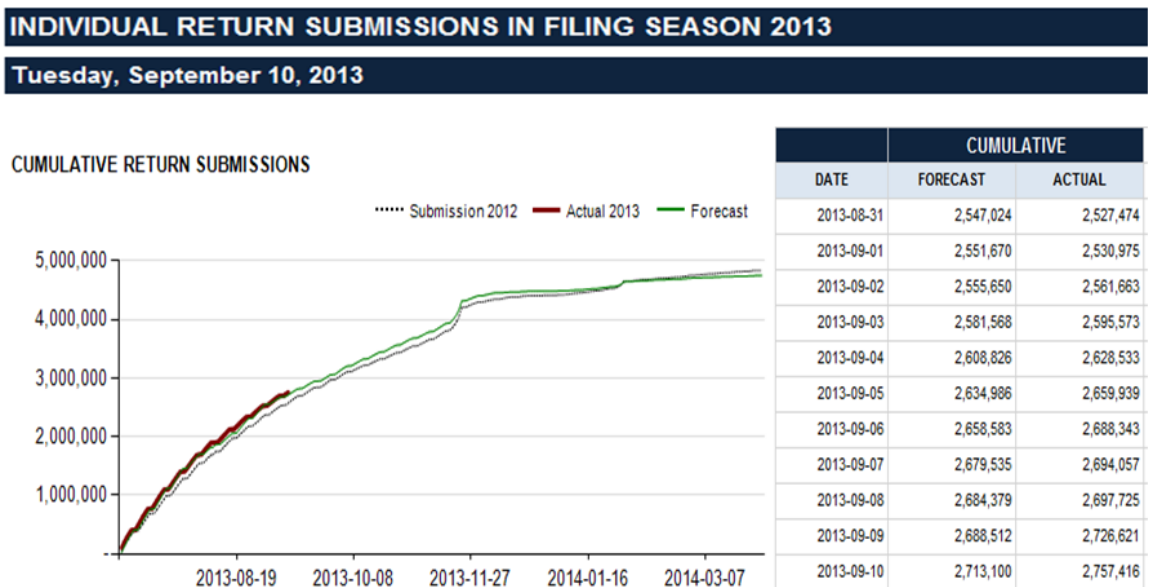
Operational forecasting on individual taxpayers showing revenue potential
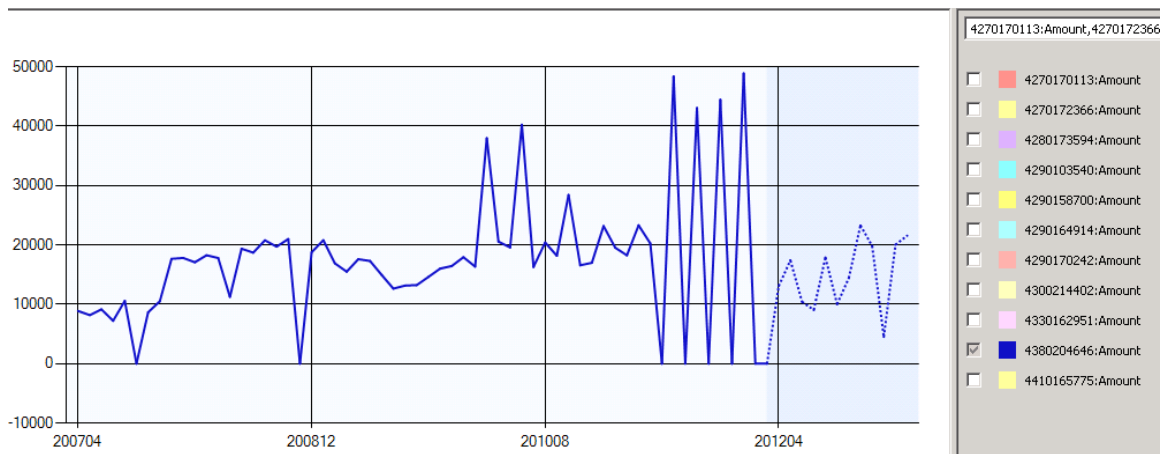
Figure 8-14: Forecasting Examples (SARS, 2011a:28)

Two examples of model-driven DSS focussing on tax compliance are presented in Figure 8-14. The first illustrates the forecasting of return submissions for SARS's filing season and is aimed at supporting strategic decision-making. The purpose of such a forecast is to accordingly adjust the efforts by tax practitioners in order to ensure maximum service delivery to taxpayers. After all, there is little point in tax auditors being available at the early stages of the filing season. Instead, they should be available after the bulk of returns have been received at which time the majority of audits are initiated. The second forecasting example shown in Figure 8-14 is intended to support operational decision-making. The potential tax revenue for each taxpayer is calculated in this forecasting example. The model does so by considering past revenue contributions in conjunction with the seasonality associated with it. The forecasts are then used to identify possible taxpayer noncompliance through the identification of deviations in taxpayer behaviour by means of comparing what is expected (i.e. the forecast) and what has actually materialised.

The Manager: Enterprise Measurement also highlights the fact that there is a close relationship between model-driven DSS and knowledge-driven DSS. This section confirmed that model-driven DSS is often used by SARS in the form of analytical initiatives aimed at supporting strategic and tactical decision-making. The results of model-driven DSS can then be supplemented by knowledge-driven DSS to obtain a higher level of decision-making sophistication. The example presented in the previous paragraph describes a forecasting model-driven DSS that is used to determine the number of return submissions expected during filing season. Such a model can be supplemented with a knowledge-driven DSS that predicts the probability / likelihood of each individual taxpayer filing his tax return on time. The number of taxpayers with a high likelihood of submission is then considered as a variable contributing to the model-driven DSS.

The Senior SNA Developer explained how social network analysis (SNA) – another instance of model-driven DSS – is used to address the tax gap phenomenon. SNA is used to support enforcement investigative activities through data analytics in order to "…identify and also assess…" taxpayer non-compliance. This is done through "…charts which give[s] you a visual representation of where the problems [referring

to non-compliance instances] are". These charts are derived from data marts and often supplemented with third party data. The purpose of these charts is to visually illustrate complex relationships hidden in what are typically vast amounts of data. Such an approach facilitates decision-making "…because your brain reads a picture much easier than it does text [referring to data]". A popular application of SNA is that of lifestyle audits, in which an all-inclusive view of a taxpayer's affairs are considered against the taxpayer's declarations. This view typically comprises of the assets in the form of property, vehicles, aircrafts, amongst others, as well as company and trust registrations associated with the taxpayer. SNA "guides" the decision-maker to identify cases where a taxpayer's worth is inconsistent with his tax declarations, which would imply tax non-compliance in the form of under declaration. More importantly, SNA is often valuable when the decision-maker tries to crystallise the relationship between entities through complex associations (see Figure 8-15).

The Senior Enforcement Data Analyst explains that association analysis can be used "…to prove your point [of the non-compliance instance] … when there is no other evidence [linking different non-compliance entities] … linking two people who you would normally not link together". These associations can be in many forms such as shared addresses, telephone numbers, tax advisors and company directors, to name but a few. The SNA Developer also explained that these SNA usages are examples of reactive operational decision-making. SNA can support tactical decision-making when clusters of non-compliance, such as the grouping of different industries instead of individual taxpayers, are grouped and measured according to different noncompliance indicators. These indicators support all four tax compliance pillars and favour the 'deter by detection' and 'full force of the law' enforcement strategies. Lastly, the empirical participants also mentioned the value of integrating SNA with GIS to be an effective combination used to understand the spatial distribution of certain social networks.
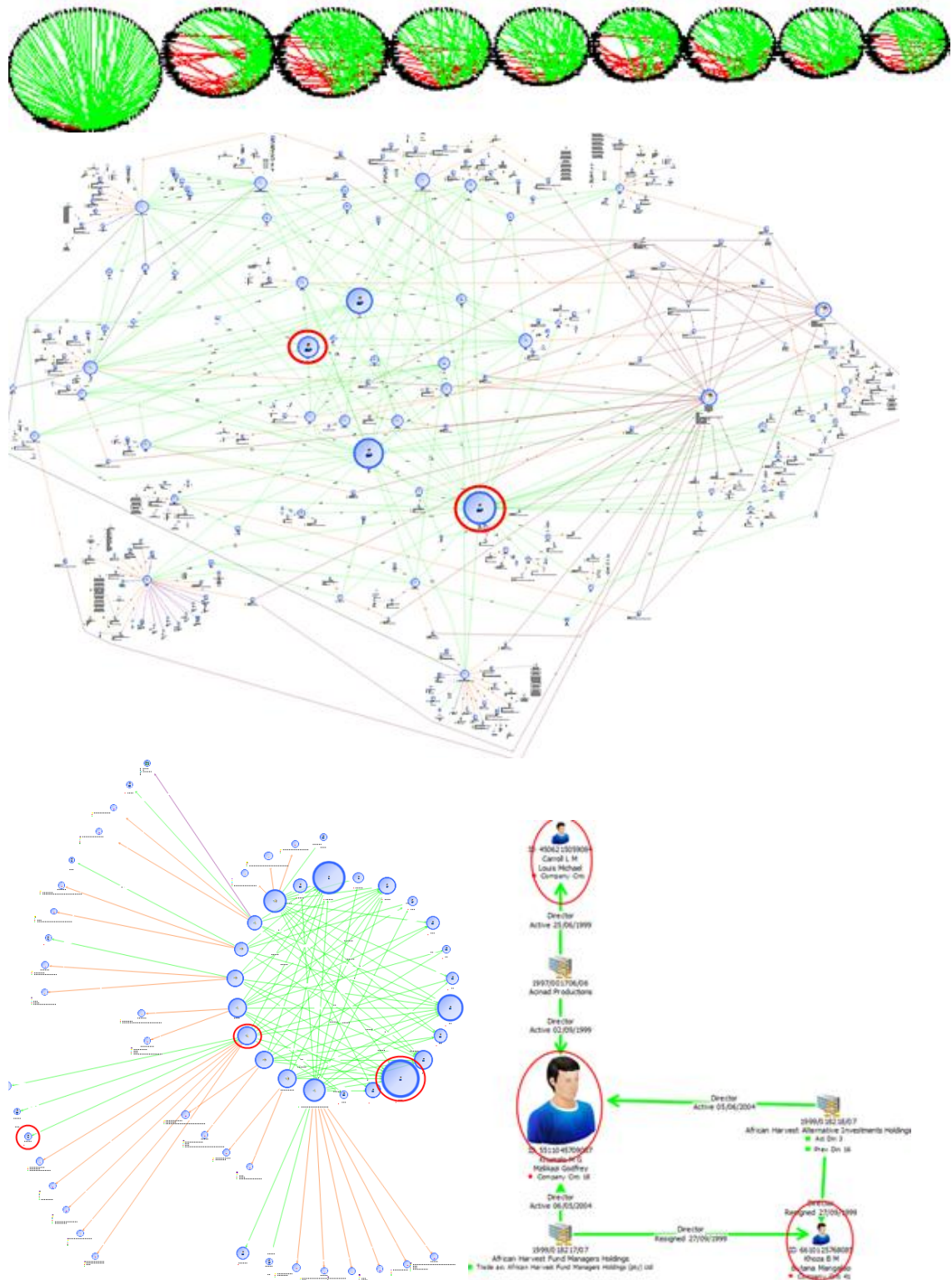
Figure 8-15: Social Network Analysis for Operational Decision-making

The empirical investigation on how SARS's usage of model-driven DSS addresses taxpayer noncompliance resulted in interesting findings. Most importantly, model-driven DSS is used to supplement BI reporting as it provides further insights pertaining to particular areas of interest. These insights are derived through normal descriptive statistics and also more sophisticated algorithms allowing for clustering and forecasting, amongst others. A few examples were also shared that illustrate how model-driven DSS is used to address taxpayer noncompliance. Another example illustrated how model-driven DSS can also be integrated with knowledge-driven DSS – a concept that is further elaborated on in the next section.

8.3.5 Knowledge-driven DSS

The concept of knowledge-driven DSS can only be appreciated once the process of knowledge generation is understood. This is because knowledge-driven DSS is based on the capturing of explicit knowledge and explicit knowledge is the end result of the knowledge generation process. The knowledge generation process was discussed in section 5.4.2.2 and was succeeded by the literature's perspective on knowledge-driven DSS in section 6.6. The empirical study's section 7.4.1.3 subsequently presented knowledge-driven DSS as a technology product of tax practitioners and elaborated on its alignment with SARS's decision-making in section 8.2. The section further established that knowledge management in SARS is approached from a data analytics and mining perspective, as well as the management of human capital. This section mainly focusses on the first mentioned by illustrating the practical usage of knowledge-driven DSS in SARS. The management of human capital is subsequently discussed in section 8.3.6, as well as the motivation for not including it with knowledge-driven DSS.

The maturity of an organisation is an important factor influencing the uptake of knowledge-driven DSS. Unfortunately SARS has had a limited uptake of knowledge-driven DSS, partly because of SARS's limited "emotional appetite" (Manager: Enterprise Measurements). Contributing to this is also the fact that knowledge-driven DSS mainly supports operational decision-making, according to both the Manager: Enterprise Measurements as well as the Senior Enforcement Data Analyst. The Manager: Enterprise Measurements also explains that the poor uptake of knowledge-

driven DSS by SARS is a result of the substantial time and skills required to build a "proper" solution. He explains that because SARS is at times managed in "crises-mode", limited resources exist that allows for such an investment to be made. Another challenge in creating sustainable knowledge-driven DSS is the capturing of explicit knowledge by expert tax practitioners. Some of the reasons for this challenge have been discussed in section 7.4.1.3. In addition to this, the Manager: KM explains that knowledge-driven DSS should not only embed the ever changing explicit knowledge of organisational experts, but should also be continuously updated to ensure its relevance to the business problem it addresses. This is very difficult to achieve without the successful management of human capital, onto which SARS is only now making inroads. These reasons, amongst others, have resulted in SARS having achieved limited DSS sophistication. However, the exception to this is the SARS risk engine, on which the latter part of this section elaborates on.

The purpose of knowledge-driven DSS is explained by the Senior Enforcement Data Analyst as a solution in which you "… pump all your information in there [referring to the DSS] and then … it recommends decisions that you can take, which, just by looking at it [referring to the data], won't tell you". Knowledge-driven DSS is at times also referred to as data mining (see section 7.4.1.3). Data mining can be used by SARS as an effective technique to address taxpayer noncompliance. What distinguishes data mining from model-driven DSS is the fact that data mining is designed for self-optimisation. Self-optimisation algorithms dynamically adjust themselves to continuously stay relevant to the business problem it addresses. Such algorithms are effectively used by SARS to address the ever-changing behaviour of noncompliant taxpayers (SARS, 2012c:23). The most common usage thereof is to predict future instances of taxpayer noncompliance in an attempt to proactively manage the tax gap. The Senior Enforcement Data Analyst explains that past behaviour of taxpayers can be used to "score" a probability of future noncompliance behaviour by taxpayers. Such an example is also supported by the Manager Enterprise Measurement who lists the prediction of taxpayer behaviour as an example of knowledge-driven DSS. Section 8.3.4 briefly elaborated on the relationship between model-driven DSS and knowledge-driven DSS. In this particular example, it was illustrated how a richer understanding of taxpayer submission behaviour can influence

the forecast of the number of tax returns submitted. The example also illustrated how data mining can also determine that taxpayers who received a refund the previous year have a high likelihood of submitting 'early' in the subsequent filing season. This is because taxpayers expect to receive a refund again. Although this finding might seem obvious in hindsight, the example illustrates how data mining serves as a technique to 'discover' many such hidden insights that are not always apparent to the decision-maker.

The conclusions derived from data mining are statistically sound and therefore support fact-driven decision-making. Having said this, the Manager: Enterprise Measurement explains that data mining is often criticised by business representatives because the results are difficult to understand and explain to decision-makers. The critique is understandable given the complexity of data mining's artificial intelligence (AI) algorithms such as neural networks. For this reason, less sophisticated algorithms such as decision trees are often the preferred data mining algorithms. Examples of how neural network and decision tree algorithms specifically address taxpayer compliance are presented in Figure 8-16 and Figure 8-17 respectively. The neural network illustrates how certain taxpayer attributes (such as tax type, gender, income, etc.) are used as inputs to identify whether a taxpayer is likely to respond to an SMS in which he is prompted to pay his outstanding taxes. Each taxpayer's likelihood is subsequently considered and used as a prioritisation mechanism prior to SARS's engagement with the taxpayer. A decision tree algorithm is another example of how knowledge-driven DSS are used to detect tax noncompliance. A taxpayer's declaration is compared with those of other taxpayers that are similar by nature in order to identify declaration discrepancies. These similarities are modelled using variables that include geographical location, income groupings, age, industry, tax status and declaration amount, to name but a few. The last mentioned concept is very similar to that of the SARS risk engine, of which a conceptual description is presented in Figure 8-18 and now further discussed.
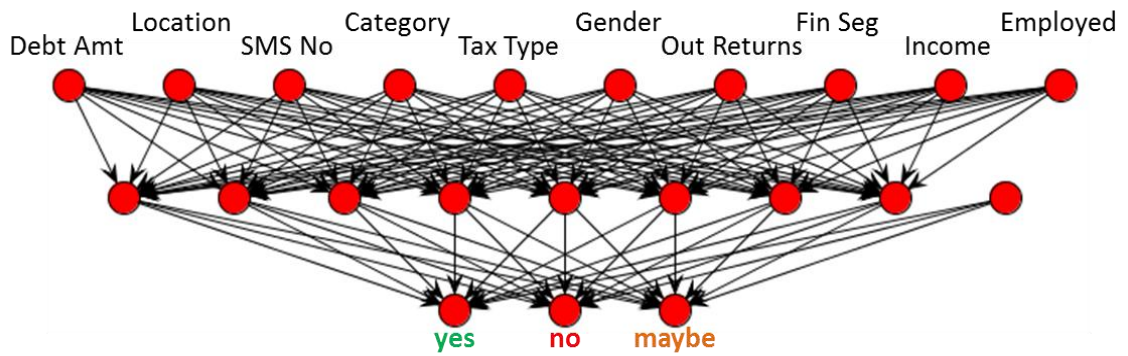
Figure 8-16: Neural Network for Taxpayer SMS Optimisation
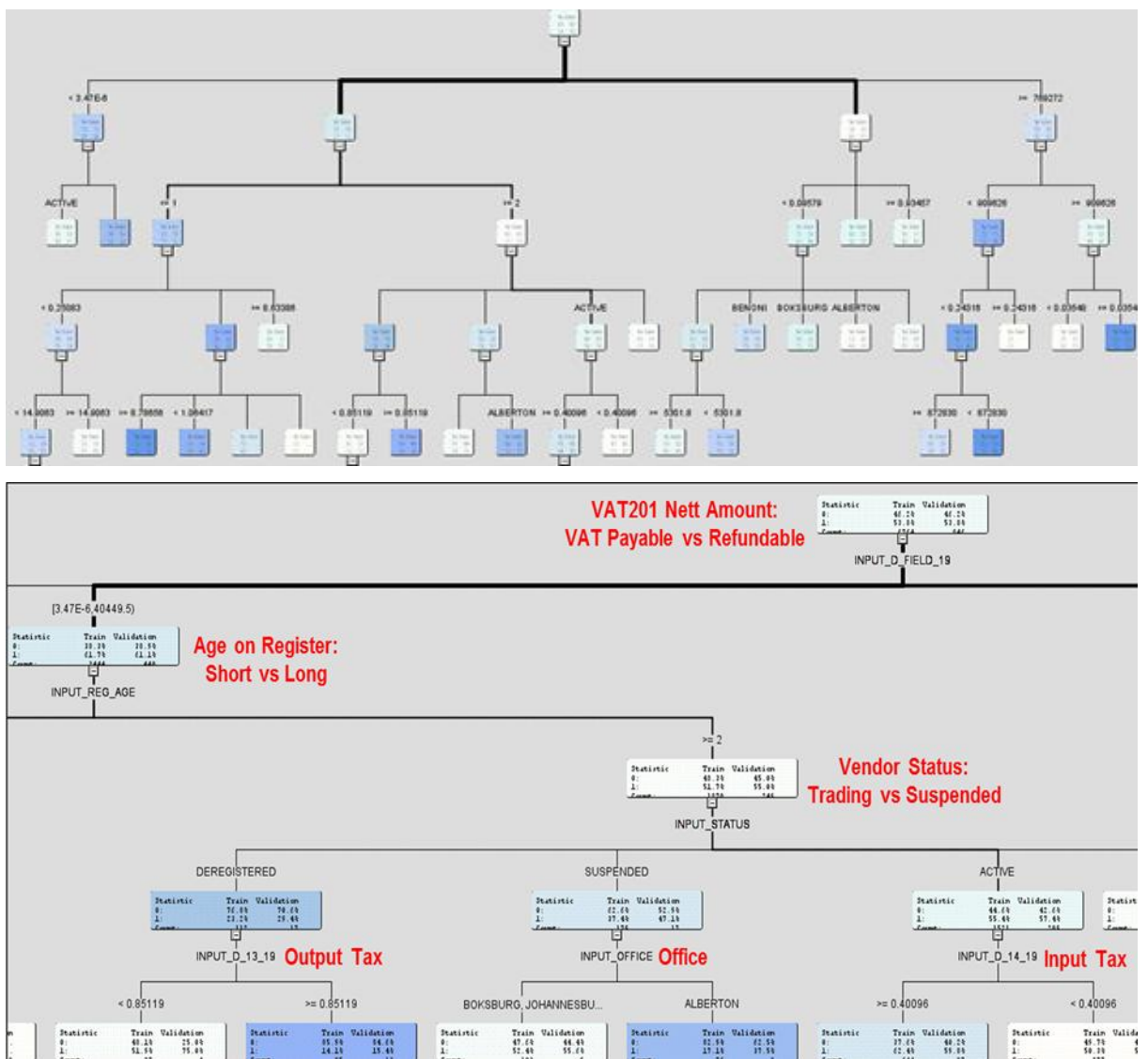
Figure 8-17: Decision Tree for Operational Decision-making
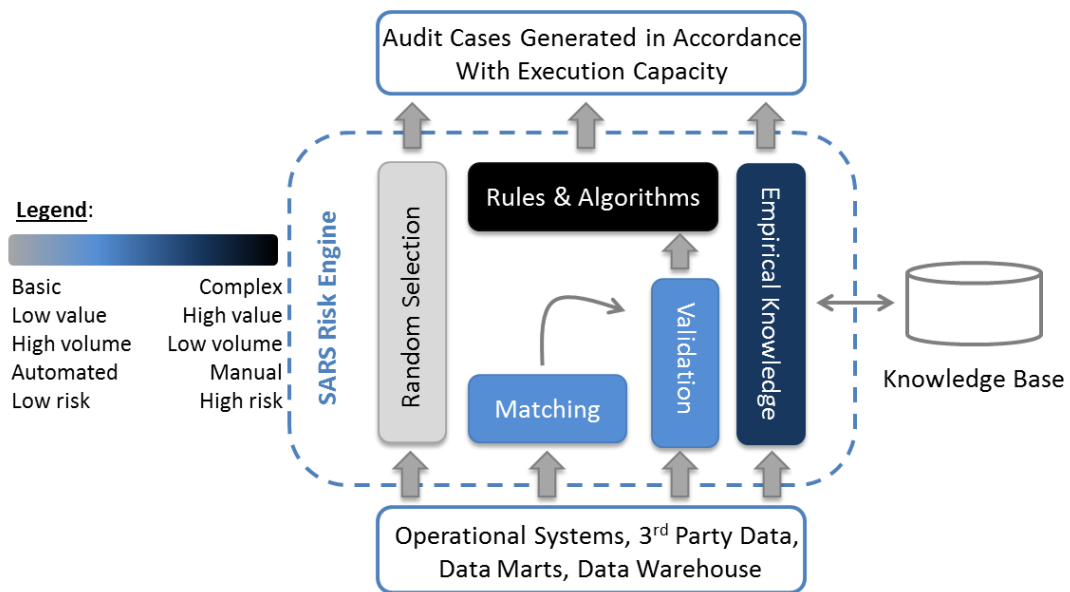
Figure 8-18: Conceptual Description of the SARS Risk Engine

Phase one of the empirical study concluded that OLTP and traditional DW have become integrated through OI data marts. The Senior Enforcement Data Analyst confirms this by stating that the SARS risk engine can theoretically be described as a knowledge-driven DSS, but has practically become an OLTP system in its own right. In doing so, it has arguably become the most important knowledge-driven DSS in SARS. The risk engine is used by SARS to generate cases marked for enforcement intervention and is guided by the Tax Compliance Programme. The Senior Manager: Case Section elaborates on the technicalities of the SARS risk engine, as illustrated in Figure 8-18. Random selection is the first component and is mainly used as a "residual approach… [that] migrates risks that the risk engine does not account for explicitly. It [random selection] is also a sampling technique to identify new risks". The next component is that of matching and validation, which also relates to the usage of advanced matching algorithms. Essential to this component is the usage of third party data, used to identify under declarations. Both matching algorithms and third party data were originally discussed in section 8.3.1 and subsequently also included in the final conceptual DSS framework presented in Chapter 9. The third component serves as the very core of the risk engine, namely that of expert rules used to identify tax noncompliance. Expert rules are subsequently also included in the final conceptual DSS framework. The purpose of this component is to statistically validate the compliance levels of an individual by using his demographics to compare it against,

for example, his past declarations and the respective industry norms. Expert rules essentially equate to proven explicit knowledge that is specified by tax practitioners and the tax legislation and are accordingly programmed into the DSS. It becomes an intensive maintenance process to ensure the validity and relevance of these rules, which is why expert rules are supplemented by self-learning algorithms such as neural networks and decision trees. The fourth and final component of the risk engine is that of empirical knowledge. The Senior Manager: Case Generation explains that "…anything automated [referring to the risk engine] does not give you the degree of insight that an individual does… If you look at it, a risk engine might have a second to make a decision [regarding tax noncompliance] whereas an individual might have three to five days". Empirical knowledge is obtained from the tax practitioners such as risk profilers and auditors. Their tacit knowledge, obtained from years of experience, is captured as explicit knowledge and managed in a knowledge base. The concept of knowledge bases was first discussed in section 6.3.3.

The Manager: KM explains that the SARS risk engine is perhaps the best and most important example of how organisational knowledge can be embedded in DSS to combat tax noncompliance. However, she expresses her concern regarding the manner in which the risk engine's explicit knowledge (in the form of risk rules) have been derived and are maintained. The manager explains that "[At times] we would task one [specific] person… to define it [the risk rules] and that would become the way we operate", instead of driving these rules from an enterprise knowledge management approach. Similar critique is raised by the Manager: Monitoring and Analysis who explains that the risk engine uses triggers, such as the submission of a tax return, to validate risk. These triggers are rule-based events causing the risk engine to tackle taxpayer noncompliance in a reactive fashion. The importance of self-learning data mining techniques are emphasised as part of achieving a higher level of knowledge-driven DSS sophistication. Such techniques will allow SARS to follow a proactive approach to tax noncompliance by answering questions such as "Who are most likely not to be compliant?".

This section presented an overview of how SARS uses knowledge-driven DSS to manage tax noncompliance. It was reiterated that the knowledge generation process

by tax practitioners, as well as the explicit capturing thereof, are important enablers to knowledge-driven DSS. A few examples were listed that illustrated how knowledge-driven DSS can facilitate the detection of noncompliant taxpayers. The most important thereof is the SARS risk engine, which was also presented in some detail. The next section jointly discusses the final instances of DSS, namely communications-driven and document-driven DSS.

8.3.6 Communications-driven and Document-driven DSS

The remainder of DSS instances are discussed in this section, namely communication-driven and document-driven DSS. Sections 6.7 and 6.8 have respectively given the literature's perspective on these instances. However, these perspectives are limited in scope compared to the other DSS instances. The reason for this is because these communication-driven and document-driven DSS are considered facilitators of organisational decision-making as opposed to enablers.

Much like any other modern organisation, SARS also makes use of the 'typical' communications-driven DSS mentioned by the literature, namely messaging, emails, discussion forums, bulletin boards and document sharing. However, the literature survey highlighted GDSS as arguably the most important instance of communications-driven DSS. Unfortunately the empirical study could not identify any instances of 'sophisticated' GDSS such as collaborative decision-making environments. The literature indicated that such environments are useful when dealing with diverse decision-making groups where equality is promoted. Given the multi-cultural employment of SARS, the lack of such a GDSS environment in SARS was a somewhat disappointing empirical finding.

The feedback from the Manager: KM raised an interesting finding with regard to document-driven DSS. It is expected that knowledge management in the form of managing human capital, has a strong focus on knowledge-driven DSS (as per the literature survey and phase one of the empirical study) but this is not the case in SARS. Instead, the management of human capital by SARS is mainly enabled through communications-driven and document-driven DSS. This finding makes sense when considering that SARS's knowledge management capability has yet to reach a mature

state, as confirmed by the Manager: KM (also see section 7.4.1.3). SARS is only now starting the process of "capturing" explicit knowledge and consequently only recently started the management thereof. DSS technologies that support the capturing of unstructured knowledge through decision-making collaboration initiatives are discussions forms, blogs and wikis, to name but a few. Document-driven DSS are typically in the form of content management solutions, which are needed to host structured knowledge. The most important example of such is the SARS portal. The SARS portal acts as a central repository in which all SARS's content is managed. Very important is the ability to retrieve information from communications-driven and document-driven DSS, which is why search engines and text mining are so important. A brief discussion on text mining is given in the subsequent section, but in doing so emphasis is placed on the manner in which text mining can facilitate the management of tax noncompliance – as opposed to deriving insights pertaining to human capital. Although the concept is the same, it is argued that focus on taxpayer noncompliance adds more value to this research.
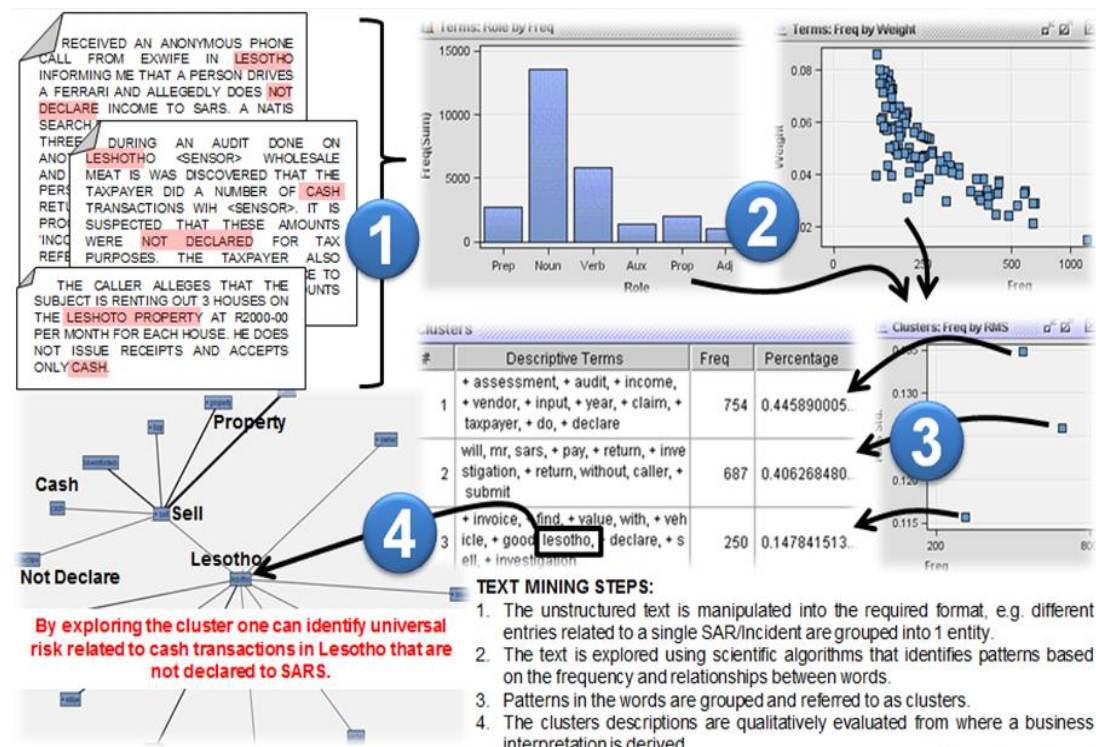
Figure 8-19: Text Mining for Operational Decision-making (SARS, 2011a:27)[3]

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[3] Numbers 1 to 4 indicate the sequential steps of performing text mining. Spelling and grammar of step 1 is purposefully incorrect in some cases as to illustrate the challenges related to unstructured text.

Text mining was first introduced in section 6.8 at which time it was described as a technique used to derive patterns from unstructured text that would otherwise have been hidden to the decision-maker. The most important implementation thereof at SARS is arguably the processing of SAR. SAR were originally described as unstructured text documents ('tip-offs' in laymen's terms) submitted anonymously by the public in which normal citizens report instances of tax noncompliance. The importance of SAR is also explained by the Senior Manager: Case Selection as they support the generation of audit cases. SAR identify very specific instances of possible tax noncompliance when individually investigated by tax practitioners. However, the challenge experienced by SARS is the ability to identify general emerging patterns pertaining to tax noncompliance from these vast volumes of unstructured text documents. It is impossible to do this through manual human effort. Text mining performs such a function using the sequential execution of the steps shown in Figure 8-19. The result of text mining is a set of clusters that each contains terms grouped together because of strong associations between the terms. Each cluster represents a universal concept derived from the unstructured text and described through the terms it consists of. Using this approach, SARS is able to identify emerging forms of tax noncompliance through the holistic processing of SAR.

The remaining two instances of DSS were discussed in this section, namely communications-driven and document-driven DSS. The empirical study confirmed these DSSs to play the role of a facilitator in decision-making as opposed to that of an enabler (as is the case for the other DSS instances). The section also illustrated that knowledge management in SARS has yet to mature to a state beyond that of content management. The section concluded by illustrating the value of text mining by means of a practical example in which tax noncompliance is addressed.

The subsequent section is aimed at refining the conceptual DSS framework based on the conclusions derived from phase two of the empirical study. Subsequent to this, the framework's acceptance is tested through the validation and transferability testing phases.

8.4 Refining the Conceptual DSS Framework – Empirical Phase Two

The second phase of the empirical study was completed in the preceding sections of this chapter and was aimed at illustrating how specific DSS implementations are practically used by SARS to address the tax gap phenomenon. In doing so, the study explored the architectural positioning of data, reporting and data analytics in SARS given the objective of supporting organisational decision-making. A summary of these contributions is depicted in Table 8-3. Subsequent to that discussion, each of the different DSS instances was explored in greater detail. Enhancements to the conceptual DSS framework are presented in Figure 8-20 and consequently again presented in Appendix C when the different phases of the framework's development is summarised.

Participant	Main Contribution
Manager: Enterprise Measurement	• Confirms the importance of BI reporting. • Confirms the recursive relationship between BI reporting and analytics. • Elaborates on reactive vs. proactive decision-making. • Describes the various components of model-driven DSS. • Introduces the concept of 'emotional appetite' as key determinant of decision-making.
Manager: Information Integration	• Comments on the differences between a data mart and data warehouse. • Motivates the inclusion of an operational intelligence data store as a middle layer bridging OLTP and traditional DSS. • Elaborates on the importance of mobile intelligence.
Manager: KM	• Elaborates on the relationship between knowledge-driven DSS and knowledge management. • Differentiates communications-driven and document-driven DSS.
Manager: Monitoring and Analysis	• Elaborates on the practical instances of strategic, tactical and operational decision-making. • Confirms the 20 noncompliance measurements.
Senior BI Developer	• Discusses the importance of matching algorithms.
Senior Enforcement Data Analyst	• Highlights the importance of third party data. • Confirms the importance of 'self-service BI'. • Describes various components of knowledge-driven DSS.
Senior GIS Developer	• Explains the geocoding, reporting and analytics components of GIS.

	• Distinguishes between thematic and point maps, as well as active and passive maps.
Senior Manager: Case Selection	• Describes various components of knowledge-driven DSS.
Senior SNA Developer	• Confirms the importance of third party data. • Describes SNA as a specific instance of model-driven DSS.

Table 8-3: Empirical Contributions
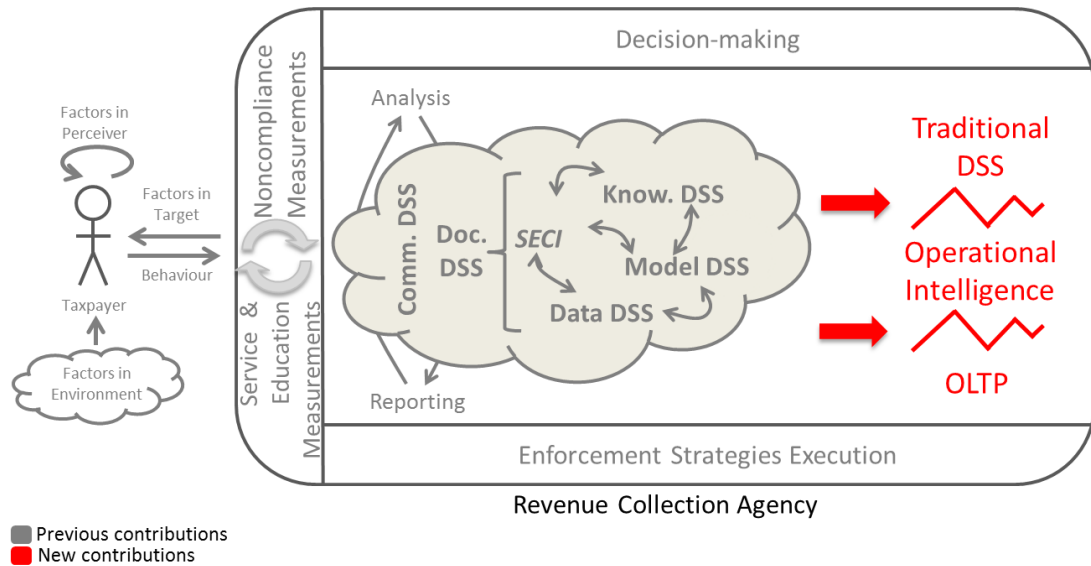
Figure 8-20: Framework Refinement – Phase Two of Empirical Study

One finding became quite apparent throughout phase two of the empirical study, namely that the historical disjoint between OLTP and traditional DW does not exist anymore. DSS became integrated with OLTP to such a degree that, in some cases, one can no longer distinguish between DSS and OLTP. A critical enabler of this is SARS's OI data mart, which hosts near real-time data. Through the supply of near real-time data, the OI data mart has allowed other forms of DSS to become more relevant in addressing the operational needs of SARS. This was also illustrated through practical examples for various DSS instances. Consequently, this finding is incorporated into the conceptual DSS framework, as also illustrated in Figure 8-20. Many other detailed observations regarding the different DSS instances were also discussed in this chapter, but these did not impact the overall design of the conceptual DSS framework. However, they are subsequently also in the final conceptual DSS framework presented in Chapter 9.

The development and refinement of the conceptual DSS framework aimed at addressing the tax gap is concluded in this chapter. The development included the construction of the framework, namely the literature survey (Chapter 3 to 6), as well as a refinement thereof through the empirical study's phases one and two (Chapter 7 and 8). The remaining task is for the framework to be scrutinized. This is done through the validation of the framework (empirical study phase three, section 8.5) and also a transferability test (empirical study phase four, section 8.6).

8.5 Validating the Conceptual DSS Framework – Empirical Phase Three

The validation of the conceptual DSS framework is an important phase to ensure the results collected from the literature survey and also from phases one and two of the empirical study, are an accurate reflection of reality. The empirical study participants thus far included senior management and executives. These top management level participants were selected because they were expected to have a comprehensive overview of what is a complex and perhaps theoretical problem. On the other hand, the interviewees participating in the construction and refinement of the framework were not at a top management level. This is because they were better suited to discuss the intricacies of DSS at a technical level, as was required for the development of the conceptual DSS framework. To the contrary, the validation of the conceptual DSS framework requires an audience who was not involved in the development of the framework, but are senior enough to ensure its validity. Three top level managers involved in the creation, management and strategic direction of SARS's DSS were consequently selected as framework validators. The interviewees included in phase three of the empirical study are the Chief Officer: SEE, Senior Manager: Data Analytics and the Senior Manager: Information Management. The framework validation interviews consisted of an open-ended question asking each participant to critically evaluate the conceptual DSS framework.

The three participants commenced the interview by briefly elaborating on IT's role in SARS and how DSS are used to monitor and address tax noncompliance. "I think in today's times the number one thing business is struggling with is the volume of data. I think IT's role [actually referring to DSS], for me specifically, has always been: how do you take a huge amount of information and package it in a simplistic way in which

business can actually make an informed decision… [DSS help us] to get control of the volumes of data, [and] simplify it for the business user who is not technically inclined – they're just looking for…a quick answer to act upon before the information becomes stale" (senior manager data analytics). The Chief Officer: SEE confirms DSS to be a critical enabler of the Tax Compliance Programme and explains that the tax noncompliance measurements are "…largely done at a relatively macro level and looks across the SARS process chain, namely registration, filing, declaration and payment. It looks at it across various tax types and then looks at it by sector and region… in order to identify where, in any of those major points along our process chain, there are high levels of noncompliance. All of that then is lifted up to then say where we really need to put the emphasis in terms of strategy." The Chief Officer: SEE continues by saying that CEMIS (first introduced in section 8.3.2) attempts to do exactly that by providing decision-makers with "comparatives of compliant and noncompliant areas". A limitation of CEMIS is mentioned when he states that DSS does not monitor tax compliance at a micro level [per individual taxpayer], which means that it "does not go down to specific issues of noncompliance at an individual entity level". Whilst this is perhaps true for CEMIS, the Senior Manager: Data Analytics confirms that various other DSS instances are extensively used by SARS to address specific instances of tax noncompliance at a taxpayer / micro level. Outstanding debt (forming part of the payment compliance pillar and in particular measurement number 15 in Table 7-1) is explicitly referred to when he says that "…it [referring to data-driven, model-driven and knowledge-driven DSS] is used for daily management of the debt and credit book, so managers know exactly where they stand [in terms of managing outstanding debt]. Various categorisation and segmentation are used…to slice-and-dice the debt book… That information is then used and shared across the country with various branches and team leaders and they determine the priorities in terms of how to collect the debt using that information".

An important finding during the framework's empirical validation phase is the absence of performance measurement in the framework. The Chief Officer: SEE elaborates on this by explaining that the management of tax noncompliance is continuously measured by different DSS in a variety of ways. This is of course facilitated by clearly defined key performance indicators (KPI) and performance

scorecards. The Chief Officer: SEE further emphasises the importance of capacity management by stating that "[t]he ability to manage compliance is quite largely dependent on [SARS's ability to] also managing the volumes. Quite a lot of the strategy to date, if we look at the SARS modernisation programme, has really been about being able to manage [and automate] the large volumes in order to give [us the ability to] focus on the exceptions…if you look at the areas in which we are weak [referring tax noncompliance], it is the areas in which we are not able to manage the volumes". This empirical finding certainly makes sense and is subsequently adopted by the conceptual DSS framework (see Figure 8-21) through the inclusion of both performance management and capacity management. This enhanced framework is again shown in Appendix C when the framework's development lifecycle is presented. To some degree the concept of managing SARS's resource capacity through model-driven DSS was also discussed in section 8.3.4.
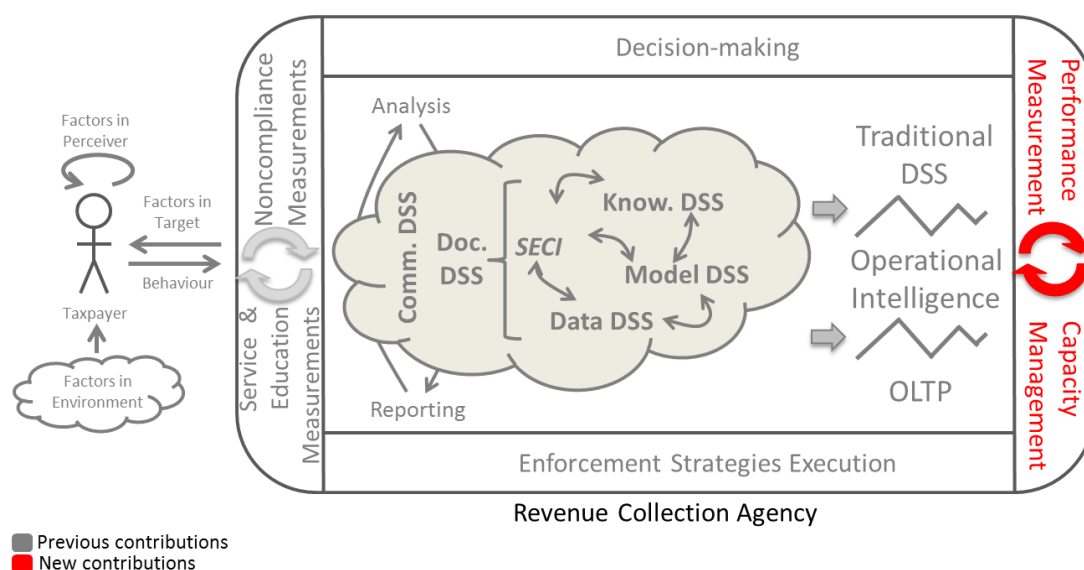
Figure 8-21: Framework Validation – Phase Three of Empirical Study

Other and arguably less significant limitations were identified which included the incorporation of the business process, data quality and input from social media. The Senior Manager: Information Management explains that the conceptual DSS framework does not function in isolation and is an enabler of business processes. For this reason, the interviewee consequently suggests business processes to also be included in the framework. The researcher disagrees with this position by arguing that

the suggestion is beyond the framework's scope and that business processes should form part of the enforcement strategy execution component when explored at a detailed level. However, the inclusion of business processes into the framework does provide interesting future research and this subsequently also suggested in section 9.5. The suggestion that data quality is included in the framework is based on the fact that "A lot of the legacy data still comes from manual capturing forms. So in the outstanding debt environment we always have a suspicion that the account information might be incorrect [because of poor data quality]" (Senior Manager: Data Analytics). This suggestion is included in the final conceptual DSS framework presented in Chapter 9 under the data-driven DSS component. It was also suggested that social media form part of the factors in environment. However, the researcher doubts the validity of this suggestion as it does not influence tax noncompliance. It can also be argued that the social influence of amongst others social media, is already included under the sociological point listed under 'factors of perceiver'.

The Senior Manager: Data Analytics approves of the framework. "I think it is a very good framework in the sense that it covers all the aspects of improving tax compliance. You have captured the human aspects as well as the technology aspect… Too many times people think they can solve a problem by just using clever computer systems, and that is not true". Having said this, however, he also raised a general concern: "It's getting to the point where we have to question ourselves…we have all the data and all the reports, so what is it that we are missing? Why is it not working? [referring to the impact of DSS]… What do we have to do or change, that we can maybe get from the information, to actually make higher impact decisions?". He explains that SARS has come to a point where additional value can be derived from existing data and information only through the usage of more sophisticated DSS, such as knowledge-driven DSS. This finding was also confirmed in section 8.3.5. The Senior Manager: Information Management also gave his approval on the conceptual DSS framework when stating that "I think everything you need to build a ... presentable framework is in there". However, he expressed concern regarding the framework's visualisation and described it as quite overwhelming: "…you need someone to help you make sense out of it". The Chief Officer: SEE also accepted the

model by saying that it "…makes complete sense… I think it is a very nice model actually" after humorously asking permission to reference it going forward.

In conclusion, the Senior Manager: Information Management also touched on the transferability of the framework. Except for a few framework specifics such as the 'Taxpayer' and 'Revenue Collection Agency' labels in framework, as well as the 'Measurements' component, one could comfortably apply the framework to any other enforcement agency in government. He takes the position that the framework can probably also be relevant to the South African Police Service as well as the South African Broadcasting Corporation (where noncompliance equates to the failure of paying television licenses). The subsequent paragraph continues the discussion on the conceptual DSS framework's transferability testing, but does so through a formal empirical assessment.

8.6 Transferring the Conceptual DSS Framework – Empirical Phase Four

Section 2.4 highlighted the importance of case study research being 'transferrable' in order for the derived conclusions to be valuable. Transferability was explained as the interpretivist version of generalisation, as the literature explains generalisation to be more relevant to positivism. Phase four of the empirical study tests the transferability of the conceptual DSS framework with regard to other revenue collection agencies. This test is important as it validates whether the conclusions derived from the single case study are indeed applicable to other institutions of similar nature. If the conceptual DSS framework proves to be transferrable, other revenue collection agencies can use framework as a reference point in their objective of establishing a mature DSS capability. Various institutions were approached to participate in this phase, which included the Australian Tax Office, Her Majesty Revenue and Customs (United Kingdom), the Internal Revenue Service (United States of America) as well as the OECD's Centre for Tax Policy and Administration. Despite following the prescribed engagement formalities, none of these institutions were available to participate in the study. However, the Namibia Inland Revenue (NIR) and Botswana United Revenue Service (BURS) did express interest.

The NIR empirical study consisted of an open ended interview with a working group consisting of nine representatives. The representatives also included three consultants from the international consulting firm Deloitte, who were acting as advisors to the NIR personnel. All nine interviewees occupied senior positions in their organisations with the majority having various IT responsibilities. The group was therefore deemed appropriate for testing the transferability of the conceptual DSS framework. The BURS empirical study consisted of a smaller group made up of five representatives. The representatives included the public relationship officer, two tax compliance risk managers and two senior representatives responsible for client relationship management. The interviews with both NIR and BIRS clearly indicated that the IT maturity of these organisations – and consequently also DSS – is not on par with that of SARS. Many of the conceptual DSS framework's components are still conceptual at their institution, with only a limited form thereof being in an elementary implementation stage. Having said that, the extent of their position could not be quantified as it was outside the scope of this study.

The transferability test was separately discussed with NIR and BURS, but in a similar manner. The empirical study commenced with a detailed discussion on the conceptual DSS framework. The discussion was frequently interrupted by the interviewees in order for them to obtain further clarification on the various topics. Upon completion, the groups were subsequently asked to critically evaluate the conceptual DSS framework.

The framework was generally received in a positive manner by both NIR and BURS participants. The disconnect between the two institutions' current DSS maturity levels and that proposed by the framework became apparent during the interview. Referring to the conceptual DSS framework, a BURS representative stated that "I think it is something that has worth, we do appreciate it – it is something that can work". Similarly, a NIR participant said "In terms of concept, yes, every authority wants to get to that point [referring to the conceptual DSS framework]". This was supported by his co-worker stating "I think conceptually every authority wants to be there… Yes, it is useful but there are other things that come into play in terms of realities on the ground before we can apply it". The NIR group raised various legislative matters

unique to their country as examples, with the most prominent being the collection and usage of third party data. They indicated that NIR must "…first get the basics going and then some of the other DSS tools and functions will become more relevant to us". The inclusions of a "roadmap" on how to implement the framework combined with "maturity levels and prescribed assessments" were some of the positive criticism expressed by the group. Similar feedback was received by BURS. Two BURS participants expressed their appreciation of the conceptual framework's comprehensive overview, but suggested that more information is given on the different framework components. This suggestion is aimed at better enabling them to present the framework as an opportunity to enhance their organisation's enforcement capacity. Although not explicitly part of the conceptual DSS framework, the study does present the implementation roadmap and maturity level of the case study, respectively shown in sections 7.4.1 and 8.2. Whilst these do not address the framework limitations in terms of an implementation roadmap and maturity assessment, it does serve as input to future research opportunities, as again mentioned in section 9.5.

Despite these criticisms, all NIR and BURS participants unanimously agreed that the conceptual DSS framework does serve as a useful reference point for them going forward. One NIR participant even declared that the framework was "exciting" and that "…it will have real tangibles in terms of results on the ground". Adding to that, his co-worker remarked that "[t]his [referring to the framework] strikes me as a very comprehensive end game". A BURS participant even stated that going forward the proposed DSS will be "easy to implement" because the framework presents them with a future state they can work towards. In conclusion, the leading BURS representative expressed his approval of the framework: "It [referring to the conceptual DSS framework] touches on issues we've been discussing back home, issues of [how to address] tax noncompliance… after all, every tax administration is worried about noncompliance." The main NIR representative also expressed her approval and appreciation of the framework by saying that "I see the value – it is just that we are at the starting point of this… We are privileged to have this [referring to the framework] at this point in time because it shows us everything we might be interested in [going forward]".

This section concluded the transferability testing of the conceptual DSS framework, and in doing, also concludes the empirical case study. It is reasonable to state that both the framework validation and transferability empirical testing were positively concluded. The framework is therefore deemed appropriate, relevant and transferrable to other revenue collection agencies with an interest in DSS.

8.7 Conclusion

Chapter 8 concluded the empirical study and consequently also the development, refinement, validation and transferability testing of the conceptual DSS framework. The chapter addressed the research question asking which DSS would enable IT's value proposition to minimise the tax gap phenomenon through enforcement capabilities. In doing so, the chapter aimed to build on the literature's perspective originally presented in Chapter 6.

The chapter commenced with the empirical study's phase two that presented the architectural positioning of data, reporting and data analytics in support of SARS's decision-making capabilities. In this section it was shown how the different DSS instances are associated with the various types of organisational decision-making. The section served as introduction to the empirical discussion of each of the different DSS instances. Data-driven DSS in the form of DW and DM was firstly explored and resulted in an important empirical finding: the historical disconnect between OLTP and traditional DW has elapsed. What used to be two separate and disjointed IT environments have now become integrated through what SARS calls its OI data mart. This data mart connects the near real-time data from OLTP with the rich historical data from the DW, in order to provide a reporting and data analytics platform that can support a wide range of sophisticated decision-making. More importantly, this environment enables most other DSS instances to also support near real-time decision-making. This subsequently introduced mobile BI reporting as well as active GIS reporting. The conceptual DSS framework was subsequently refined with this finding. The empirical study on model-driven DSS illustrated how this DSS instance is often initiated through BI reporting and that it can enable high impact strategic decision-making. Knowledge-driven DSS were subsequently discussed and an overview was given on what is arguably the most critical DSS in SARS, namely the

SARS risk engine. Closely associated with this is the value of data mining and sophisticated AI algorithms, as was illustrated through empirical examples. Communication-driven and document-driven DSS were jointly discussed and concurred the literature's finding stating that these DSS play a facilitator role in support of decision-making as opposed to an enabler role (as is the case with the other DSS instances). An interesting observation was the fact that knowledge management in SARS is mainly supported through document-driven DSS in terms of supporting content management, whereas one would expect this to rather be supported through knowledge-driven DSS (as per the literature). This finding was better understood when it was concluded that SARS's knowledge management capability has not yet matured to its desired state.

The validation of the conceptual DSS framework was done by representatives from SARS's top level management. All three participants expressed their approval of the framework and praised its creation in a variety of ways. However, their critical assessment of the framework did highlight a shortcoming, namely the absence of performance measurement and capacity management. The participants argued that the performance of decision-makers must be evaluated as this influences the management of tax compliance. Closely associated with this is the management of human capacity. Section 2.9.2 explained that the purpose of SARS's modernisation journey is to automate the volumes of tax processing so that human capacity is available to attend to the exception processing. The conceptual DSS framework's inclusion of capacity management aims to cater for exactly that.

The chapter concluded by conducting a framework transferability test. The purpose of the test was to illustrate that the developed conceptual DSS framework is transferrable to other revenue collection agencies. This is especially important given the fact that the framework was developed using a single case study. Although both institutions acknowledged that their IT maturity is not at SARS's level of sophistication, the institutions agreed that they would ideally like to implement all facets of the framework going forward. In doing so, they unanimously approved the framework to be fully relevant to their institutions.

The research is concluded in the subsequent and final chapter, Chapter 9. The chapter presents a summary of the research findings and also the detail aspects associated with the conceptual DSS framework aimed at addressing the tax gap phenomenon. Certain limitations of the study are also highlighted as well as future research opportunities.

PART 4: RESEARCH SUMMARY

CHAPTER 9: CONCLUSION, RECOMMENDATIONS AND FUTURE RESEARCH

Part 1: Research Setting
- Chapter 1: Introduction
- Chapter 2: Research design
- Chapter 3: Understanding the tax gap phenomenon

Part 2: Literature Findings
- Chapter 4: IT and the revenue collection agency
- Chapter 5: IT and the tax practitioner
- Chapter 6: DSS value propositions

Part 3: Empirical Conclusions
- Chapter 7: Empirical findings on the tax gap and the role of IT
- Chapter 8: Empirical findings on DSS instances and framework confirmation

Part 4: Research Summary
- Chapter 9: Conclusion
- Supporting Information

Conclusion:
1. Introduction
2. Research conclusions
3. Research findings: The conceptual DSS framework
4. Future direction relating to the management of tax compliance through DSS
5. Research limitations and future research opportunities
6. Contributions to DSS body of knowledge
7. Conclusion

Supporting Information:
1. Abbreviations
2. Empirical questions
3. Framework Development Lifecycle
4. Participant form
5. References

Figure 9-1: Chapter 9 Roadmap

9.1 Introduction

The main objective of this study is to develop a conceptual DSS framework aimed at managing tax compliance and risk. The preceding chapters constructed the framework by first conducting a literature survey on the tax gap phenomenon, followed by the role IT plays in organisational decision-making, as well as IT's role as decision-making enabler to tax practitioners. The literature survey concluded with an elaboration on the theoretical aspects of the various DSS instances. An empirical study commenced on the same topics with the goal of refining the framework. The subsequent validation phase was aimed at authenticating the framework by means of a critical evaluation thereof. The empirical study then concluded with a framework transferability test, which served as confirmation that the framework is also relevant to other revenue collection agencies.

This chapter concludes the research by presenting the conceptual DSS framework developed in this study and in doing so, answers the main research questions stating: "How can a conceptual decision support systems framework be used to address the tax gap problem experienced by the South African Revenue Service?"

The chapter commences by presenting a summary of the study's findings together with a detailed discussion on the conceptual DSS framework. The chapter concludes by identifying future research opportunities, followed by a discussion highlighting the study limitations and finally the research's contributions to the DSS body of knowledge.

9.2 Research Conclusions

Two theories have served as the basis of this research, namely SMT and INOD, and were first introduced in section 1.6. These theories were referenced throughout the research as they determined the thesis structure, as well as the theoretical and empirical content used to formulate the conceptual DSS framework.
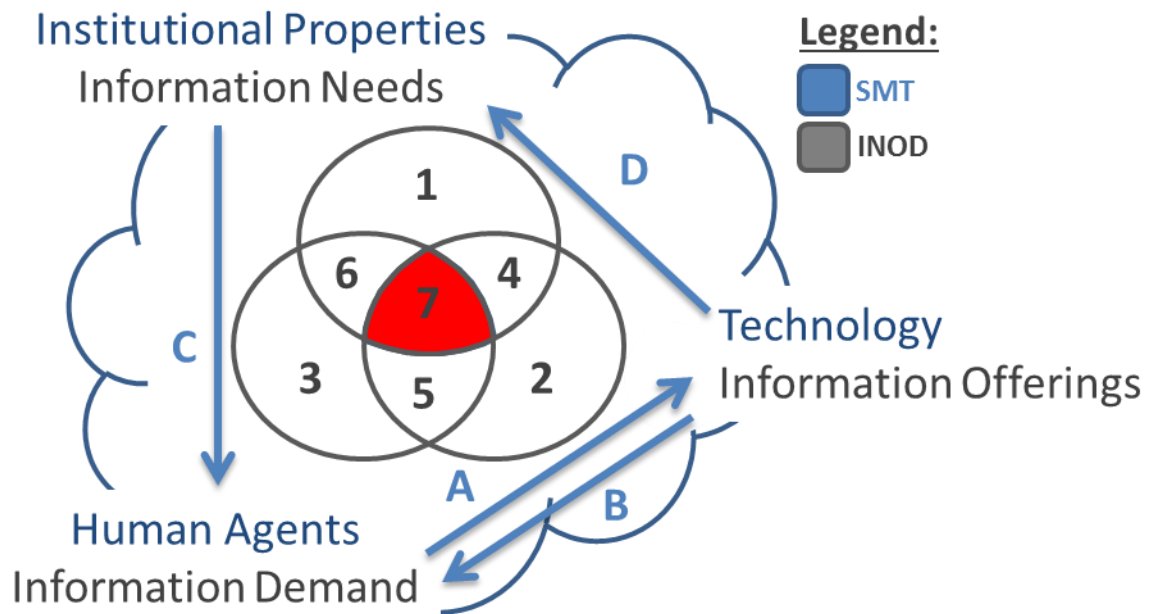
Figure 9-2: SMT and INOD Alignment

SMT serves as a lens through which IT is studied in an organisation. It consists of three components namely the institution, human agent and technology, each connected to the other through a set of complex influences. INOD is closely associated with SMT in the sense that it offers the same three components, although from a completely different perspective. INOD was used in this research as a second lens through which the information flow of an institution is examined. It does so by presenting the activities associated between an institution's information needs (being problem dominated), a human agent's information demand (being behaviour dominated) and technology's information offerings (being instruments dominated). The mapping between SMT and INOD is presented in Figure 9-2 and is similar to that of Figure 1–4, with the exception of activity 7 being highlighted. The reason for this is because all other activities have been discussed: activities 1, 6 and 4 in Chapter 4, activities 3 and 5 in Chapter 5 and activity 2 in Chapter 6. Activity 7 depicts the utopian state in which information is 'offered' to those who 'demand' it because it is 'needed'. Each of these seven activities was addressed by both the literature survey and empirical study, and used to derive the conceptual DSS framework aimed at addressing the tax gap phenomenon.

The conceptual DSS framework derived from this research aims to reflect this ideal position in which information is delivered through DSS (information offerings) to support decision-makers (information demands) in their task to address the objectives of their organisation (information needs). Section 9.3 specifically Figure 9-3 summarises the framework. The framework presents the information offerings in sections 9.3.6 to 9.3.11 when each of the DSS instances is discussed. The organisational information needs in the form of measurements and enforcement strategies are respectively presented in section 9.3.4 and 9.3.5. Lastly, the information demands to support the decision-making of tax practitioners are elaborated on in section 9.3.12. In doing so the main research question is addressed that asks: "How can a conceptual decision support systems framework be used to address the tax gap phenomenon experienced in a South African context?"

Four secondary research questions served to answering the main research question were. The first asked "What is the nature of the tax gap phenomenon experienced by revenue collection agencies and why does it continue to exist?". Chapter 3 addressed this question from a literature survey perspective, of which most conclusions were also confirmed by the empirical study presented in section 7.2. The tax gap phenomenon is explained as an ever present and continuously evolving problem caused by taxpayers who fail to pay their prescribed taxes through tax avoidance and tax evasion, resulting in lower tax collections. Section 3.2 differentiated between tax avoidance and tax evasion, followed by section 3.8 that summarised perspectives related to the tax gap phenomenon. Section 3.7 attempted to present insights regarding the complex factors influencing the continuous existence of taxpayer noncompliance. These factors can originate from the taxpayer (factors in perceiver), the social setting of the taxpayer (factors in environment) and the relationship between the taxpayer, the revenue collection agency and government as a whole (factors in target).

The second research question was: "How does IT influence a revenue collection agency's ability to address the tax gap?. This research question was first answered by the literature survey presented in Chapter 4 and subsequently also the empirical study presented in section 7.3. The research identified that DSS can facilitate the different types of organisational decision-making required to execute various enforcement

strategies. In support of the enforcement strategies, 20 core compliance measurements were identified and each grouped into four compliance pillars, namely registration, filing, declaration and payment. The research furthermore identified that tax compliance measurements should be supplemented by service and education measurements in order to create the comprehensive overview required to manage noncompliant taxpayers.

The literature survey in Chapter 5 and empirical study in section 7.4 addressed the third research question, namely "How does IT support tax practitioners to reduce the tax gap?". The research identified five groups of DSS that support the decision-making of tax practitioners, which are data-driven DSS, model-driven DSS, knowledge-driven DSS, communication-driven DSS and document-driven DSS. Furthermore, the relationships between data, information and knowledge were explored, together with the management thereof, and subsequently also the way in which different types of decision-making is facilitated by these concepts. Specific emphasis was placed on the management of knowledge by organisations, as well as the generation of knowledge by tax practitioners. Both these aspects are important drivers ensuring the sustainability of effective organisational decision-making.

The fourth and final research question asked "Which decision support systems enable IT's value proposition to minimise the tax gap phenomenon through enforcement capabilities?". Chapter 6 (literature survey) and 8 (empirical study) addressed this research question by focusing on the manner in which DSS instances are used to address the tax gap phenomenon. An in-depth overview is given on how DSS have evolved over many years in the case study and also how the five DSS are used to combat taxpayer noncompliance. In doing so, the research identified that the historical disjoint between OLTP and DSS are becoming less so, and that OLTP and DSS are increasingly becoming interwoven to such a degree that in many cases the distinction cannot be made anymore.

The various findings derived from these sub research questions allowed for the creation of a conceptual DSS framework aimed at addressing the tax gap

phenomenon. The following section presents this framework, together with the detailed components of which it consists.

9.3 Research Findings: The Conceptual DSS Framework

The following section presents the conceptual DSS framework aimed at narrowing the tax gap as derived by this research. The framework is presented in Figure 9-3 and was constructed during the literature survey in Chapter 3 to 6, and refined by the empirical study in Chapter 7 and 8. Final adjustments were made to the framework in the empirical validation phase presented in Chapter 8 after which the framework's transferability to other revenue collection agencies was also tested. The components of the framework are briefly discussed in this section whilst reference is made to the respective chapters discussing each of the components in greater detail. This final state of the conceptual DSS framework concludes the framework's development lifecycle, as summarised in Appendix C.

9.3.1 Factors in Perceiver

The factors in the perceiver component relate to the influences taxpayers experience that causes them to become noncompliant. These factors can be sociological, physiological and socio-economic, as elaborated on in sections 3.7.1 and 7.2.1. Sociological factors include taxpayer norms, the taxpayer's social setting and consequently also social conformity. Physiological factors mainly include taxpayer morale and ethics, whereas socio-economic factors relate to the financial attributes and setting of the taxpayer.

9.3.2 Factors in Environment

Sections 3.7.2 and 7.2.1 discussed the factors in environment resulting in the noncompliance of taxpayers. These factors relate to the country's economy, legislative restrictions such as regulation, the political landscape, government influences and stability, crime rate and most importantly industry specific factors such as seasonality, profit margins and cost structures, to name but a few.

Factors in Perceiver
- Sociological
- Psychological
- Socio-economic

Factors in Target
- Government in whole
- Revenue collection agency specifically
- Social contract between government and citizen

Measurements
- Registration
- Filing
- Declaration
- Payment

Knowledge Generation
- Expert locator & directories
- Business dictionary
- Taxonomies
- Knowledge sharing
- Communities of practice

Knowledge-driven DSS
- Knowledge bases
- Self-learning / AI algorithms
- Expert systems / rules
- Prediction
- Classification

Decision-making
- Strategic, tactical, operational
- Reactive vs. proactive
- Real-time vs. afterwards
- Fact-driven vs. intuition

System Integration
- 3NF vs. dimensional
- Real-time vs. near real-time vs. delayed data
- Hot vs. cold data
- DSS themselves

Management
- Scorecards & KPI's
- Benchmarks
- Capacity management

Enforcement Strategies
- Make it easy
- Help to comply
- Deter by detection
- Full force of the law

Factors in Perceiver

Factors in Target

Behaviour

Taxpayer

Factors in Environment

Noncompliance Measurements

Service & Education Measurements

Analysis

Reporting

Comm. DSS

Doc. DSS

SECI

Data DSS

Know. DSS

Model DSS

Decision-making

Enforcement Strategies Execution

Traditional DSS

Operational Intelligence

OLTP

Performance Measurement

Capacity Management

Revenue Collection Agency

Factors in Environment
- Economy
- Legislation
- Political affairs
- Crime
- Industry specific

Comm & Doc-Driven DSS
- Group decision-support
- Collaboration tools
- Text mining
- Content storage in various forms

Data-driven DSS
- Meta-data
- 3rd Party data
- Data marts vs. data warehouse
- Data qualify
- Extract, transform, load
- Data extractions
- Business & Mobile intelligence
- Self-service
- GIS thematic vs. point vs. static vs. active
- GIS Spatial analytics
- Matching and integration algorithms

Model-Driven DSS
- Statistics
- Clustering & segmentation
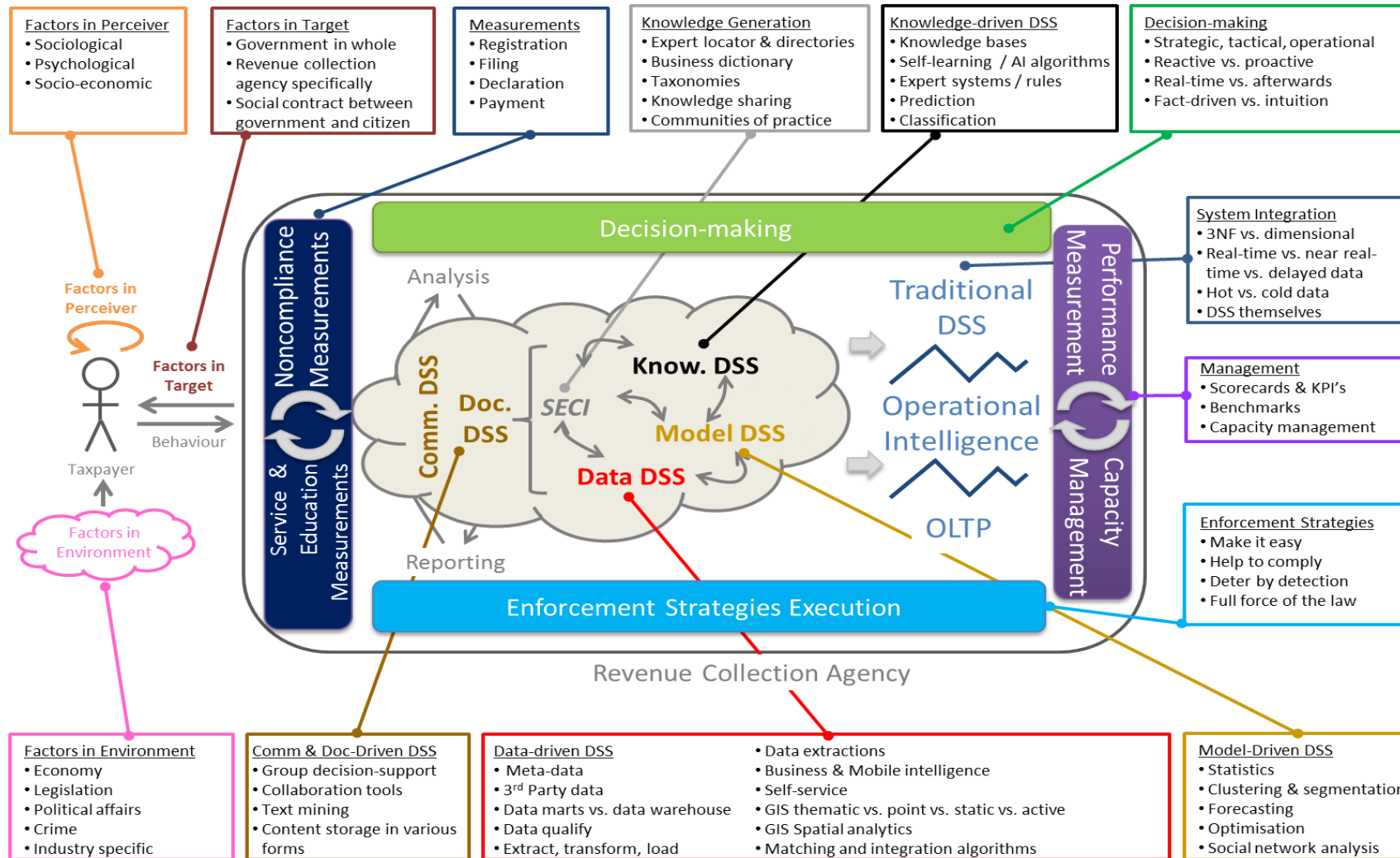- Forecasting
- Optimisation
- Social network analysis

Figure 9-3: A Conceptual Framework Aimed at Addressing the Tax Gap

9.3.3 Factors in Target

The factors in target component is the final influence on taxpayer compliance as was originally discussed in sections 3.7.3 and 7.2.1. These factors mainly relate to the relationship between taxpayers and government as a whole, as well as the relationship with the revenue collection agency. This relationship ultimately establishes a 'social contract' between government and its citizens. With regard to the first mentioned, an important determinant of taxpayer compliance is the taxpayers' perception of the 'value for money' they get for paying taxes, which is mostly measured by means of the services government delivers. The relationship between the taxpayer and revenue collection agency also exerts an important influence on taxpayer compliance. Aspects influencing this relationship include the perception on tax fairness, tax rates, enforcement actions and trustworthiness of tax practitioners, to name but a few.

9.3.4 Measurements

The measurements component mainly consists of the various tax noncompliance measurements grouped in the four tax compliance pillars (see sections 3.8 and 7.3.1). It is important to understand that these measurements do not act in isolation and that the measurement of services and education rendered to taxpayers are equally important.

9.3.5 Enforcement Strategies

Closely associated with the previous section's elaboration on measurements, are the enforcement strategies identified to remedy the taxpayer noncompliance. Four strategies are defined, ranging from little intervention to prosecution intervention, as originally elaborated on in section 4.3.1. An understanding of these strategies is important as they determine the types of decisions that are executed to address tax noncompliance. In return, these enforcement strategies influence the manner in which DSS should enable and facilitate the decision-making by tax practitioners.

9.3.6 Systems Integration

The systems integration component reflects on the manner in which the OLTP systems are integrated with traditional DW through an OI data mart. The concept of an OI data mart refers to the hosting of near real-time data, something which the

literature also refers to as 'active data warehousing'. This integration touches on the data designs, formats, latency and storage, amongst others. The system integration also mentions the evident integration between the different DSS instances themselves. Different sections of this research discussed the various aspects related to the systems integration component, namely sections 5.3, 6.3, 7.4.1.1, 8.2 and 8.3.

9.3.7 Data-driven DSS

Data-driven DSS component was identified as the foundation that enables all other DSS instances. It was comprehensively discussed in sections 6.3.3, 6.4.1, 8.2, 8.3.1, 8.3.2 and 8.3.3. Three instances of data-driven DSS were identified, namely DW, BI and GIS. Aspects associated with DW include meta-data, third party data, data warehouse and data marts, ETL, matching and integration algorithms and data quality. BI is made up by reporting, mobile intelligence and self-service capabilities. The traditional data extractions are part of data-driven DSS, although much of this reporting is now done through BI. Lastly, GIS consists of different types of maps and data latency, as well as spatial analytics.

9.3.8 Model-driven DSS

Sections 6.5 and 8.3.4 respectively presented the literature and empirical discussion on the model-driven DSS component. The component consists of descriptive statistics, clustering and segmentation, both micro and macro forecasting, optimisation and also social network analysis. The study identified model-driven DSS to be the main driver of statistical decision-making and consequently initiates many of the other types of DSS implementations.

9.3.9 Knowledge-driven DSS

Knowledge-driven DSS should ideally incorporate both the management of human capital as well as data mining, as detailed in sections 6.6 and 8.3.5. However, the empirical findings indicated that SARS's management of human capital has unfortunately not matured to a knowledge-driven DSS state. However, the framework does include the management of human capital through the inclusion of knowledge bases under the knowledge-driven DSS component. A knowledge base is populated with explicit knowledge through the knowledge generation process, as discussed in

the next section. The other aspect of knowledge-driven DSS, namely data mining, mainly includes self-learning AI algorithms such as neural networks and decision trees, expert systems and rules, predictions and classifications.

9.3.10 Knowledge Generation

The knowledge generation component is closely related to the management of human capital through knowledge-driven DSS, but focuses more on the non-technical factors. This includes the usage of systems such as an expert locator that allows employees to get in contact with knowledgeable co-workers, and also the establishment of expert directories, business dictionaries and taxonomies. Knowledge sharing and communities of practice make up the social composition of the knowledge generation process.

9.3.11 Communications-driven and Document-driven DSS

Whilst the preceding DSS instances were identified as decision-making enablers, communication-driven and document-driven DSS were identified as decision-making facilitators. These DSS instances were jointly grouped in the conceptual DSS framework as they offered less value to this research (see sections 6.7, 6.8 and 8.3.6) when compared to the other DSS instances. The components forming this grouping mainly include GDSS, collaboration tools, text mining and content storage.

9.3.12 Decision-making

The decision-making component of the framework was mainly discussed in sections 4.3.2, 4.4, 5.3.2, 5.4 and 7.4.2. Although the concept of decision-making is large in scope, this study mainly focused on organisation decision-making in the form of strategic, tactical and operational and how DSS enables these decision-making capabilities. However, the study also touched on reactive versus proactive decision-making, real-time versus after-the-fact decision-making and lastly fact-driven versus intuitive decision-making.

9.3.13 Management

The final component of the conceptual DSS framework is that of management in the form of performance measurement and capacity management. Identified only during

the framework validation phase, this component is briefly discussed in section 8.5. Performance management is required to continuously monitor the effectiveness and efficiency of the organisational decision-making and mainly consists of KPIs and scorecards. Performance management acts jointly with capacity management that consists of the management of organisational resources in order to meet the processing demands of the organisation. Both performance management and capacity management are broad topics in their own right, but receive limited attention in the conceptual DSS framework because of this research's restricted scope. These topics is worth considering for future research.

The preceding sections conclude the discussions on the conceptual DSS framework derived from this study by presenting each of its components. The subsequent section lists some of the limitations experienced throughout the study, as well as limitations regarding the conceptual DSS framework itself.

9.4 Future Direction Relating to the Management of Tax Compliance Through DSS

The modern perspectives on the management of tax compliance were originally presented in section 3.3.2. The perspectives stated that revenue collection agencies should not only focus on enforcement efforts to increase tax compliance. Such an approach has proven to have contrasting consequences as taxpayers object to the harsh enforcement treatment by becoming even more noncompliant. Instead, revenue collection agencies should also focus on preventative cooperation efforts such as the services and education campaigns rendered to taxpayers. This research confirms such a position, which is why the empirical validation phase also included services and education measurements in the conceptual DSS framework. Furthermore, revenue collection agencies should in future rather approach the taxpayer from a social perspective. Such a perspective acknowledges that taxpayers are mere instances of specific social clusters and that complex inseparable relationships exist within and between clusters. Finally, government should approach tax noncompliance as one of many aspects constituting the social contract between government and its citizens. It should be recognised that tax noncompliance and other forms of noncompliance, such as traffic fines, unpaid television licences, outstanding municipal accounts, etc., are

actually inseparable from each other as it constitutes to the same behavioural pattern of citizens. Such a unified enforcement approach will improve both the efficiency and effectiveness of government.

Decision-making of modern times are considered significantly more complex and intertwined when compared to the past. Courtney (2001:17) explains that traditional DSS has largely been technology focused and designed according to structured problems. He calls for a paradigm shift in DSS design aimed at allowing modern DSS to also accommodate unstructured problems. Such a paradigm shift will enable decision-makers to specifically consider a range of environmental, economic and also social factors. This proposal is perfectly aligned with the future direction envisioned for the management of tax noncompliance, as discussed in the previous paragraph. The projected ability of DSS to promote creativity in decision-making will also improve the quality of decisions (Forgionne & Newman, 2007:2126). A key part of this paradigm shift should be the explicit incorporation of certain knowledge management principles into knowledge-driven DSS. However, this journey is not as simple. Despite various attempts over many years, the case study that has yet to achieve an appropriate level of knowledge-driven DSS sophistication. Many academics such as Bolloju et al. (2002:163) and Courtney (2001:22), have suggested different approaches to address this gap between knowledge management and DSS.

Another significant evolution in the field of DSS is that of ethical DSS as proposed by Mathieson (2007:269). Ethical decision-making consists of four dimensions, namely emotion, cognitive factors, social influences and philosophical challenges, and are incorporated into other DSS instances to ultimately improve decision-making quality. Ethical significance becomes present when the decision-maker's actions have a potentially cascading effect (positive or negative) on others. By adding this dimension to DSS, organisations can minimise the impact of unethical decision-making potentially hurting customers, the organisation, investors and perhaps even general society. Over time, ethical DSS should become self-evolving in the sense that they might associate an ethical confidence level with a particular decision based on past patterns. This characteristic also suggests the future integration of knowledge-driven DSS into other forms of DSS. An ethical DSS differs from traditional DSS in the

sense that it is a social platform in which multiple stakeholders participate in an attempt to evaluate the ethical validity of certain decisions based on the supporting information at hand. From this perspective, such a proposal also suggests the future inclusion of GDSS into ethical DSS.

The concept of distributed DSS seems like the natural evolution from today's typical single DSS instances (Eom & Kim, 2006:1272 – 1275). The traditional perspective of a one-decision-maker one-DSS relationship was already questioned many years ago when Boland et al. (1994:458) suggested what was at the time referred to as 'support decision-making groups'. Distributed DSS focus on decisions that affect multiple business units or even multiple organisations. Given the multiple stakeholders involved in distributed DSS, one can easily envision future DSS to also include what Eom & Kim (2006:1272 – 1275) refer to as negotiation support systems. A negotiation support system is a specific instance of DSS in which the communication between bargainers is electronically mediated and facilitated to promote the possibility of agreement. Such a system acts as independent facilitator that stimulates communication, manages conflict, identifies opportunities and seeks mutual grounds for agreement.

The future of DSS in terms of infrastructure and products is also expected to change. In recent years, organisations have generated extraordinary amounts of data, hence the 'big data' concept. The case study presented in this research also indicated the wealth of value that organisations can derive from such data and, more importantly, for data to be transformed into knowledge to enable decision-making. However, Jun & Jun (2011:1825) point out that organisations will find it increasingly challenging to commit to the significant IT infrastructure investments required to host and process these large volumes of data. Going forward, the authors suggest that increasing emphasis is placed on cloud-computing-based decision-making. Their calculations suggest a three to seven times monetary saving on the processing and storage; a factor of seven times the saving in administrative cost; and three times the savings in power costs. Despite the successes of cloud computing, cognisance must be taken about the security concerns related to cloud computing. The usage of open-source DSS are also becoming increasingly popular (Power, 2002:22) as another cost-saving opportunity

for organisations. Organisations had to invest significant resources to establish their DSS during the early days. Since then, DSS technologies have become relatively affordable, with various open-source products offering similar functionality. A few of these products are worth mentioning. Examples include Infobright for data-driven DSS, Japersoft for BI reporting and QGIS for GIS. Open source model-driven DSS include products such as R used for data analytics, in conjunction with Gephi and Cytoscape for network analyses. RapidMiner is an example of open source knowledge-driven DSS. A vast amount of open-source communications-driven and document-driven DSS are available which includes WorldPress for blogging, Drupal for content management, Pidgin for group discussions, MediaWiki for Wiki's and OpenOffice for document creation.

The purpose of this section was to summarise the conclusions derived from research, as well as presenting some of the emerging concepts related to the management of tax compliance through DSS. The next section elaborates on the study findings by presenting the conceptual DSS framework concluded from this study.

9.5 Research Limitations and Future Research Opportunities

The study limitations are discussed from two perspectives, namely the research execution and the research results. The research execution refers to the challenges experienced throughout the execution of the research approach, whereas the research results refer to limitations of the derived conclusions.

The most significant limitation of the research is the fact that the research is based on a single case study. This is despite the fact that a strong argument and motivation have been made in sections 1.9 and 2.5 in support of a single case study, in conjunction with a comprehensive research verification approach presented in section 2.7. The research verification consisted of a framework validation phase as well as a framework transferability test phase, respectively presented in sections 8.5 and 8.6. The transferability test is of particular importance in addressing the single case study limitation. Although two institutions were used, these institutions were not ideal as their level of IT sophistication does not compare with that of SARS. Ideally, the transferability test should have been conducted on revenue collection agencies of a

first world country. The numerous efforts requesting such institutions to participate were unfortunately unsuccessful.

The research results and more specifically the conceptual DSS framework derived in this research also have their limitations. Firstly, the framework originally only focussed on the enforcement measures (see section 7.3.1), but the empirical study subsequently also identified service and education measurements were part of the framework. However, the detailed service and education measurements have not been identified by the research. This is certainly an opportunity for future research.

The second limitation pertaining to the conceptual DSS framework is the absence of business processes supporting the different facets of the conceptual framework. The role of business processes in general was discussed in section 5.4.1.1, when reference was briefly made to DSP. DSP emphasises the importance of embedding business processes that support decision-making in DSS. Further reference was made to business processes in section 6.4.2, in which it was recommended that a closer relationship between BI and business processes can enhance organisational decision-making. However, a more comprehensive inclusion of a business processes component in the conceptual DSS framework can define the execution of the different decision-making types, as well as the specific execution of the various enforcement strategies. More importantly however, such an inclusion can also clarify the uncertainty regarding the process in which DSS support the different types of decision-making during the execution of a particular enforcement strategy.

The third and final limitation of the conceptual DSS framework is the lack of an implementation roadmap and maturity measurement guide. The framework was explained by empirical participants to be very comprehensive but consequently also quite overwhelming. An implementation roadmap can address this concern by illustrating the sequential steps of implementation. Closely associated with this limitation is the potential value of a maturity measurement guide aimed at measuring an institution's competency level during the framework implementation. To some degree, both the implementation roadmap and maturity measurement have been discussed from the case study perspective in sections 7.4.1 and 8.2 respectively.

9.6 Contributions to the DSS Body of Knowledge

The tax gap phenomenon has widely been recognised as a continuous challenge by revenue collection agencies across the word. The efficient utilisation of IT presents various opportunities to address this challenge. This study specifically focuses on how the decision-making capabilities of tax practitioners can be enhanced through DSS. These DSS have the goal of improving the tax compliance management and ultimately to minimise the tax gap.

Only a limited number of publications exist that address both tax compliance and DSS. The vast majority of these publications relate to particular DSS instances, such as data mining. These instances can only be used to address specific aspects of tax noncompliance like fraudulent tax declarations (Gupta & Nagadevara, 2009; Lakshmi & Radha, 2011; Wu et al., 2012). Although still valuable, most of the existing publications fail to present a wider range of value propositions that IT offers to address the tax gap phenomenon. DSS is one such example. The conclusions derived in this research allow revenue collection agencies to reference a conceptual DSS framework that addresses the tax gap phenomenon through various types of decision-making in accordance with different enforcement strategies.

9.7 Conclusion

Chapter 9 concludes the research by presenting a summary of the derived conclusions, as well as limitations to the study, future research opportunities and contributions to the DSS body of knowledge. An overview of the conceptual DSS framework aimed at addressing the tax gap phenomenon is presented together with the detailed aspects it consists of, as concluded in preceding chapters.

The research addressed a series of questions that eventually resulted in the creation of the conceptual DSS framework. The first thereof explored the tax gap phenomenon, which was explained as the difference between the actual taxes collected and that which should ideally be collected. Various factors influencing the existence of the tax gap phenomenon were explored and subsequently also included in the conceptual DSS framework. The research then focused on the manner in which IT influences the revenue collection agency's ability to address the tax gap. Various enforcement

strategies were identified as well as the manner in which IT enables decision-making in support of the compliance risk management process. Next the research focused on the way in which IT supports the decision-making process performed by tax practitioners. The concept of DSS was introduced in conjunction with the management of data, information and knowledge, as these are required to support organisational decision-making. Closely associated with this is the knowledge generation process of tax practitioners, at which time the research also indicated how this process supports the different types of decision-making. Specific focus was subsequently placed on IT and in particular DSS. Various instances of DSS were discussed in great detail, together with the value proposition they offer to the management of tax noncompliance. The study finally concluded with the empirical validation and transferability testing of the framework – both of which were successful.

The conceptual DSS framework developed in this study acts as a reference point for other revenue collection agencies intending to utilise DSS to address their tax gap. In a time of global recession and economic turmoil, the collection of taxes is pivotal to the sustainability of economies across the world. This is especially true for a developing country like South Africa, with high ambitions regarding their National Development Plan. A famous quote by Benjamin Franklin still seems relevant today and reads:

> "…in this world nothing can be said to be certain, except death and taxes."

This research aims to reinforce the latter, namely taxes and does so by providing a conceptual framework in which sophisticated DSS can be used to address the tax gap.

PART 4: SUPPORTING INFORMATION

APPENDIX A: ABBREVIATIONS

Abbreviation	Description
3NF	Third Normal Form
AI	Artificial Intelligence
BI	Business Intelligence
BURS	Botswana United Revenue Service
CEMIS	Compliance Evaluation and Monitoring Information System
CYNEFIN	Welsh word describing the simple, complicated, complex and chaotic knowledge management framework
DM	Data Mart
DSP	Decision Support Process
DSS	Decision Support System
DW	Data Warehouse
EDW	Enterprise Data Warehouse
EIS	Executive Information Systems
ETL	Extract Transform Load
GDSS	Group Decision Support Systems
GIS	Geographical Information Systems
GNP	Gross Net Product
GPS	Global Positioning Systems
IBR	Integrated Business Register
INOD	Information Needs, Offer and Demand Model
IRS	Internal Revenue Service
IS	Information Systems
IT	Information Technology
KM	Knowledge Management
KPI	Key Performance Indicators

NDP	National Development Plan
NIR	Namibia Inland Revenue
ODS	Operational Data Store
OECD	Organisation for Economic Co-operation and Development
OI	Operational Intelligence
OLAM	On-line Analytical Mining
OLAP	On-line Analytical Processing
OLTP	On-line Transactional Processing
PPGIS	Public Participation Geographical Information Systems
SAR	Suspicious Activity Reports
SARS	South African Revenue Service
SDLC	Systems Development Life Cycle
SDSS	Spatial Decision Support Systems
SECI	Socialisation, Externalisation, Internalisation and Combination
SEE	Strategy, Enablement and Enforcement
SMT	Structuration Model of Technology
SNA	Social Network Analysis
SOLAP	Spatial on-line Analytical Processing
SQL	Structured Query Language
US	United States of America
XBRL	eXtensible Business Reporting Language

APPENDIX B: EMPIRICAL CASE STUDY QUESTIONS

The following open-ended research questions were posted to the case study participants:

Phase one: Empirical refinement on the tax gap phenomenon

1. What are the definitions and differentiation between tax non-compliances, tax evasion and tax avoidance?
2. What are the implications of tax non-compliance?
3. What are the reasons for taxpayers being non-compliant?
4. What factors contribute towards taxpayer compliance? Consider factors originating from the taxpayer, environment and revenue collection agency.
5. What is the tax gap?
6. What is the composition of the tax gap?
7. How can the tax gap be measured? Consider monetary and non-monetary approaches.

Phase two: Empirical refinement on DSS

1. Tell me a about yourself and your current role and responsibilities in SARS.
2. What types of decision support system (DSS) instances do you use to address / investigate / analyse / report / prevent taxpayer non-compliance?
3. How do you practically use these DSS instances and can your usage be grouped in different categories?
4. How does your usage of DSS support the different types of decision-making as well as the different enforcement strategies of SARS?
5. Can you list specific practical examples in support of the previous question?

Phase three: Empirical validation

1. Tell me about yourself and your current role and responsibilities in SARS.
2. How does IT, from a decision-making perspective, support SARS' objective of minimising the tax gap and managing taxpayer noncompliance?

3. The framework is presented to the participant and comprehensively discussed.

4. Can you identify any limitations of the framework, or express any critique that can lead to the improvement of the framework?

Phase four: Empirical transferability test

1. Tell me about the working group and their intent.

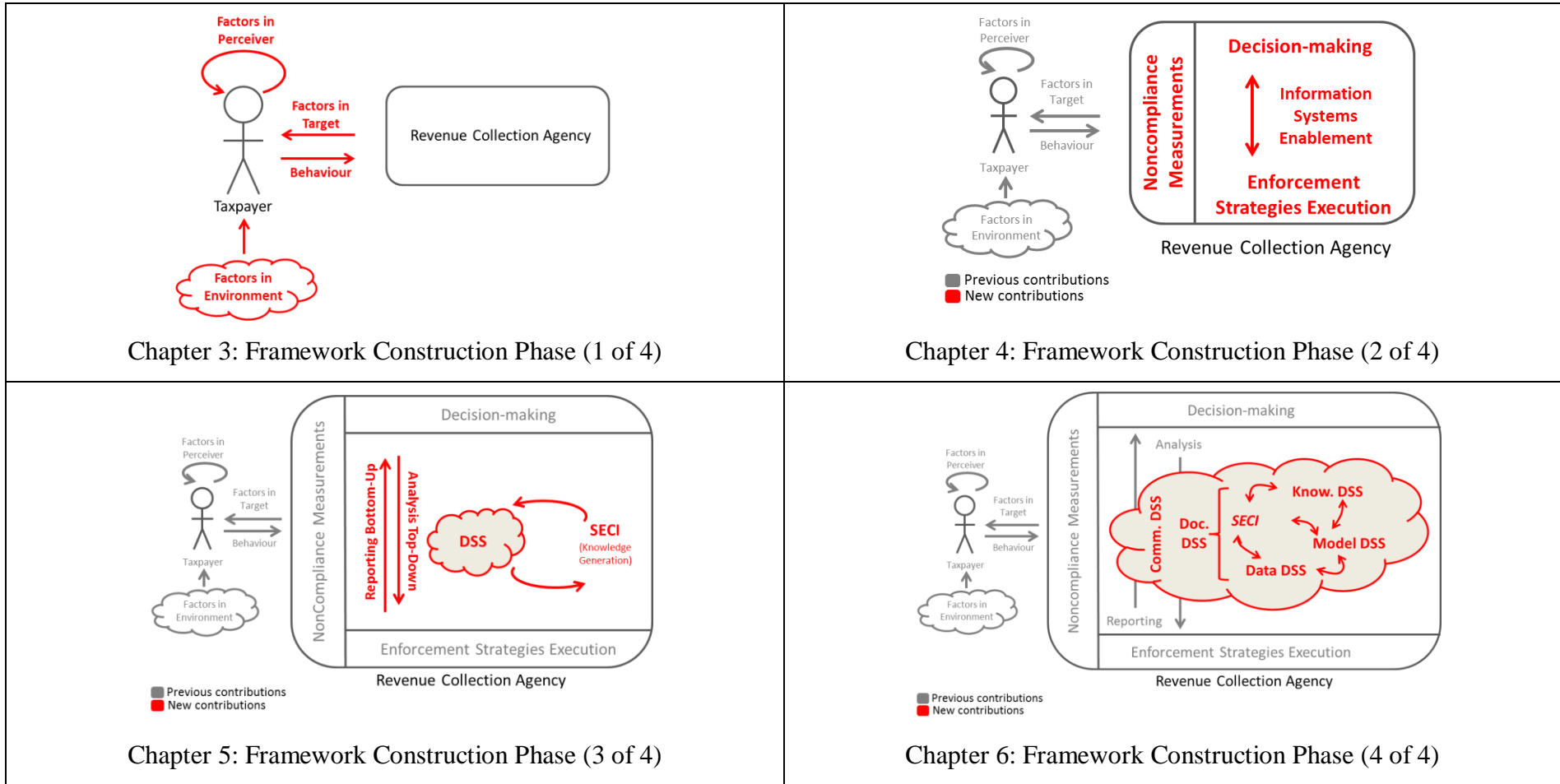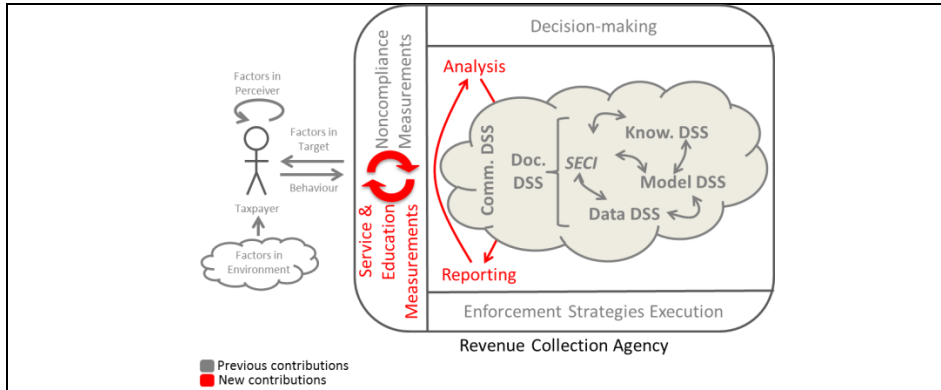2. How does IT facilitate the management tax compliance in your institution?

3. The framework is presented to the participant and comprehensively discussed.

4. Can you identify any limitations of the framework, or express any critique that can lead to the improvement of the framework?

5. How applicable is this framework to your institution? Can it serve as a reference point to your institution?

APPENDIX C: FRAMEWORK DEVELOPMENT LIFECYCLE

Chapter 3: Framework Construction Phase (1 of 4)

Chapter 4: Framework Construction Phase (2 of 4)

Chapter 5: Framework Construction Phase (3 of 4)

Chapter 6: Framework Construction Phase (4 of 4)

Chapter 7: Framework Refinement Phase (1 of 2)
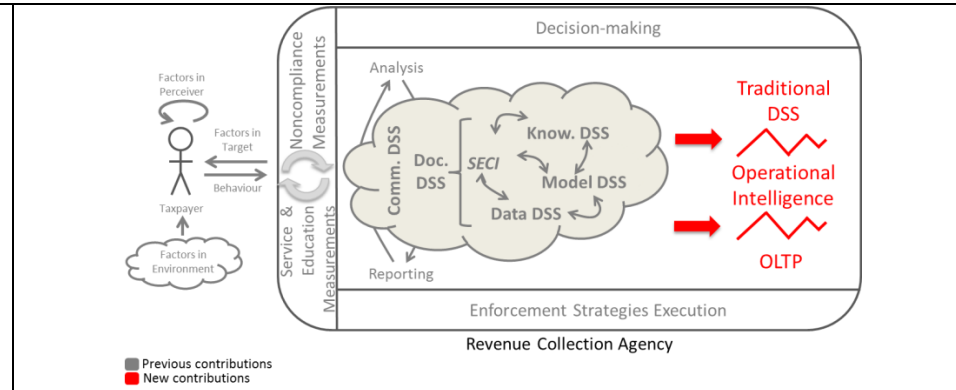
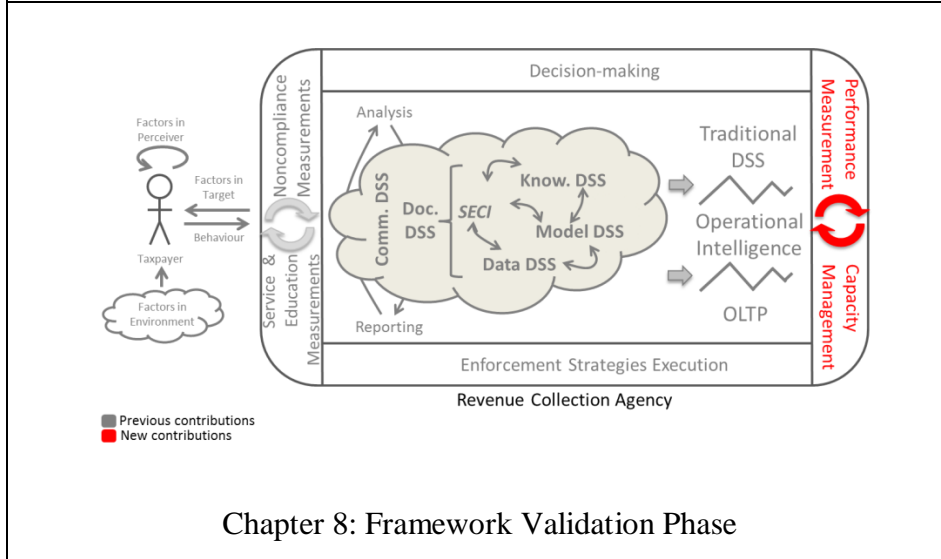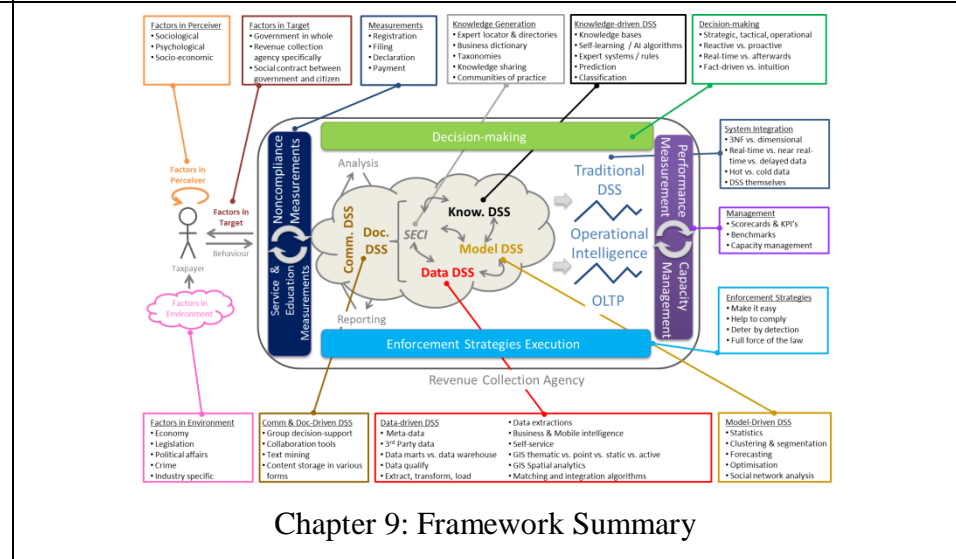Chapter 8: Framework Refinement Phase (2 of 2)

Chapter 8: Framework Validation Phase

Chapter 9: Framework Summary

APPENDIX D: EMPIRICAL STUDY PARTICIPANT FORM

RESEARCH BACKGROUND

	RESEARCHER INFORMATION	**SUPERVISOR INFORMATION**
Name:	Mr. E. Wessels	Prof. J.H. Kroeze
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STUDY INFORMATION

Objective:	To develop a conceptual decision-making framework aimed at addressing the tax gap.
Nature:	This study has a positive nature. The identities of participants will remain confidential.
Implications:	Possible alterations to existing decision-making frameworks within revenue collection agencies.
Duration of Study:	Until 1-October 2014 (Date of submission)
Safety & Health Implications:	None
Duration of Participation:	Completion of attached questionnaire or interview.

PARTICIPANT RIGHTS

The subject retains the right to decide to participate in the study. The participant's privacy or dignity will not by violated by using hidden cameras, one-way glass, microphones, sound recordings or any other research devices, without his/her permission. Hidden cameras, one-way glass, microphones, sound recordings or any other research devices, may be used where the participant's permission is implied by his/her presence and where it cannot be used elsewhere to their disadvantage. All information will be handled confidentially. The results of the study may be used for purposes of publication. Subjects will be provided with a copy of the Participant Information Form, as well as have its contents explained to them, before they consent to participating to the study.

PARTICIPANT PERMISSION FORM

DECLARATION

I,..…………………………………………….. hereby voluntarily grant my permission for participation in the project as explained to me by the researcher Eugene Wessels. The nature, objective, possible safety and health implications have been explained to me and I understand them. I understand my right to choose whether to participate in the project and that the information furnished will be handled confidentially. I am aware that the results of the investigation may be used for the purposes of publication. Upon signature of this form, you will be provided with a copy. The participant also has the right to withdraw their participation at any time.

Date: …………………………..

..…………………………………………..   ..…………………………………………..

Participant   Researcher: Eugene Wessels

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