A VALUE FRAMEWORK FOR INFORMATION AND COMMUNICATION TECHNOLOGY GOVERNANCE IN SOUTH AFRICAN HIGHER EDUCATION INSTITUTIONS

by

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A VALUE FRAMEWORK FOR INFORMATION AND COMMUNICATION TECHNOLOGY GOVERNANCE IN SOUTH AFRICAN HIGHER EDUCATION INSTITUTIONS

by

Christian Peter Johl

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TITLE OF PROJECT: A Value Framework for Information and Communication Technology Governance in South African Higher Education Institutions

DECLARATION:
In accordance with Rule G4.6.3, I hereby declare that the above-mentioned thesis is my own work and that it has not previously been submitted for assessment to another University or for another qualification.

SIGNATURE: 

DATE: December, 2013

Abstract

The public higher education sector in South Africa is governed by an act of Parliament which defines the governance organs and mechanisms required within institutions and the sector. This doctoral thesis begins by contextualising ICT governance within the levels of systemic governance in South Africa that have relevance to this study. It then continues by advancing the understanding of the state of Information and Communication Technology (ICT) governance in public higher education institutions in South Africa by investigating the level of pervasiveness, the level of ICT process maturity and the alignment of ICT to the institutional processes within these institutions. Subsequently, this thesis results in the production of a contextually appropriate value framework that contributes towards an understanding of the need for the improvement of ICT governance.

A survey of the extant literature on governance, ICT governance, and the frameworks and standards associated with governance indicates that the methodological approach currently favoured in ICT governance research is predominantly interpretive and based on surveys and interviews. This study leans towards a Design Science approach paradigm using surveys for the qualitative data collection process. The empirical research data was gathered from the highest ranking ICT officers at public higher education institutions in South Africa.

This study makes contributions on a number of levels – from the first known measurement of ICT pervasiveness within the context of higher education, to the measurement of ICT process maturity and the measurement of the alignment of ICT and institutional processes, to the design of a value framework that breaks down governance into layers indicating which governance organs are appropriate at the relevant layers and which governance mechanisms can be used to address governance at each layer of governance. This study therefore makes a contribution to the ICT domain for development research by demonstrating praxis for the improvement of ICT governance implementation in the public higher education sector in South Africa.

This study makes both method design and practical contributions to the ICT body of knowledge at various stages of the research process. These contributions include reflection on and analysis of the data gathering approaches that occur within the public higher education sector and in the complex environment of institutional autonomy and academic freedom; the use of Agency Theory to support the ‘governance intent’ transfer between the layers of

governance in the value framework and the synthesis of the improvement of ICT governance with value creation. The findings of this study further contribute to an understanding of the dynamics and interrelatedness of aspects of governance and management, while making a contribution to theoretical research by extending practical and empirical understanding of the ICT governance environment in the public higher education sector in South Africa.

Acknowledgements

I am indebted to many people for their help and support. This thesis represents nearly a decade of work for which I would like to publicly express my gratitude to the following:

- Renée, my wife who has stood by me over the past five years of focus on this study and has been my inspiration!
- My son Richard, my daughter Julia, her husband Les, and their son Tairell, who have given me a reason to study further
- The CIOs and ICT directors of the twenty-three public higher education institutions in South Africa for their participation in this study
- The University of Fort Hare for the opportunity to read for this degree
- Finally, to Rossouw von Solms and Stephen Flowerday, my promoters, who have so conscientiously guided me through this chapter of my life.

In January 1978 I registered at the erstwhile College for Advanced Technical Education (CATE) in Port Elizabeth which later became the Port Elizabeth Technikon. The University of Port Elizabeth and the Technikon later merged in 2004 to form the Nelson Mandela Metropolitan University (NMMU) at which I now find myself registered for a PhD to complete the cycle where I started it some 36 years ago.

'Life-long learning!'

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Introduction

1 General Area of Research

1.1 General Introduction

Information and Communication Technology (ICT) is pervasive. It has become embedded in all sectors, including public higher education institutions. Not only do the administrative functions of these institutions depend on ICT systems, but the academic function is also coming to depend more and more on the advantages provided by technology-based education systems (Misthry, Mkhize, & Harypursat, 2002). The dependency on ICT becomes even more imperative in our knowledge-based economy, where organisations are using technology in managing, developing and communicating intangible assets such as information and knowledge (Patel, 2003). Higher education has become more and more dependent on ICT as it is a facilitator of knowledge creation and communication. This then leads to the core of the introduction which is to discuss the role of ICT in public higher education institutions.

1.2 The Role of Information and Communication Technology

ICT has become crucial in the support, sustainability and growth of business in many organisations. This pervasive use of technology has created a critical dependence on ICT that calls for a specific focus on ICT governance (Van Grembergen, 2004). ICT has become an integral part of doing business today, as it is fundamental to the support, sustainability and growth of organisations (King III Code, 2009). ICT cuts across all aspects, components and processes of business and is therefore not only an operational enabler for an organisation, but also an important strategic asset which can be leveraged to create opportunities and to gain competitive advantage. The risks involved in ICT have become significant, therefore ICT governance has been dealt with in detail in the King III Code for the first time. The King III Code associates ICT governance with the confidentiality, integrity and availability of the functioning of the system, as well as possession of the system, authenticity of system information, and assurance that the system is usable and useful. The issues of unauthorised use, access, disclosure, disruption or changes to the information system also feature prominently in the ICT governance requirements in the report. All entities in South Africa must “apply” the code or explain the non-application thereof (King III Code, 2009). It is therefore imperative that institutions understand the application requirements and implement them with a best practice governance framework. *Information and Communication Technology (ICT) is the standard nomenclature used throughout this study as the communication aspect of ICT is deemed integrated with the advent of the convergence of*

data, voice and video.

1.3 Corporate and ICT Governance

COBIT, one of the most well-known and used ICT best practice frameworks defines ICT governance "as the set of responsibilities and practices exercised by senior management of the enterprise designed to establish and communicate strategic direction, ensure realization of goals and objectives, mitigate risk, and verify that assigned resources are used in an effective and efficient manner" (IT Governance Institute, 2003, p. 6).

Van Grembergen and De Haes (2005) propose ICT governance as the organisational capacity exercised by the board, executive and ICT management to control the formulation of ICT strategy and to ensure the fusion of business and ICT where the primary focus is on the responsibility of the board and executive management.

The tight linkage between ICT and organisational processes means that the ICT unit cannot bear sole or even primary responsibility for the effective use of ICT. Getting more value from ICT is thus an increasingly important organisational competency. Leaders throughout an organisation must develop this competency, which is that "effective ICT governance is the single most important predictor of the value an organization generates from ICT" (Weill & Ross, 2004, p. 3).

1.4 ICT Governance in Public Higher Education Institutions

The effect that ICT has on systems is not limited to financial transaction processing systems and the resulting financial audits; ICT is pervasive and is found to be used in every aspect of the public higher education environment. The Vice President of Cornell University discusses the pervasiveness of ICT in the higher education environment, stating that "IT has forced its way into all facets of our institutions, it has displaced other priorities and caused us to change the way everyone on campus works. It has spawned entirely new academic disciplines. It has opened new approaches and new ideas in almost every established field" (McLure, 2003, p. 6).

Governance requirements in public higher education institutions in South Africa are currently guided by the legal frameworks applicable to the sector. This includes the Higher Education Act 101 of 1997 (South Africa, Department of Education, 1997) and the Institutional Statute. A Standard Institutional Statute is published in terms of Act 101 but this statute can be amended or enhanced to provide for institutional requirements. The statute must be approved

by the national Minister of Education either by proclamation or by Parliamentary process. The Standard Institutional Statute makes no specific mention of ICT governance but allows for additions to be made.

Student systems used in the public higher education environment cover all aspects of student administration from registration to examination, finance and even residence administration. The most commonly used administration system used in the public higher education environment in South Africa is the Integrated Tertiary Software System (ITS), which is used by at least fifteen of the twenty-three public universities in South Africa for at least a part of their administration system. Some of the larger institutions make use of all of the modules available in this system, while others only make use of one or more. Most computers in the higher education environment are connected on local area networks and also to a wide area network. Prior to mergers as contemplated in the amendment to Act 101 of 1997 and as promulgated in 2003 (Government Gazette, 2002), many institutions had multi campuses, requiring significant investment in ICT to provide the required services. Subsequent to the mergers this technology investment has needed to be significantly increased to ensure that all students have similar services on all campuses. Remote campuses remain a challenge with connectivity.

The Tertiary Education Network (TENET) owned by the public higher education institutions and research councils of South Africa provides connectivity and the many other services required. In the latest connectivity initiative by the Department of Science and Technology (DST) and the Council for Scientific and Industrial Research's (CSIR) Meraka Institute (an institute within the CSIR), only the larger institutions in major cities are currently connected to the new ten Gigabits per second fibre optic backbone network. This network forms the new connectivity infrastructure for higher education institutions in South Africa. The network is not owned by the higher education sector, but by the CSIR and is maintained by TENET for and on behalf of the CSIR. The higher education environment requires ICT to be pervasive and lead the country in the implementation and use of ICTs to provide business and scientific advantage through research and education. Consequently, it is the higher education sector that needs to be leading the country towards increased competencies in terms of skills and education (Martin, 2009).

The investment in the technologies needed to provide higher education with the required advantage is substantial and yet there is no legislation in place to require any form of

governance of the ICTs in public higher education in South Africa. The situation is similar in Australia where the ICT governance standard AS 8015-2005 was published by the Standards Australia but not enforced by legislation (Standards Australia, 2005).

As ICT becomes more critical for organisational survival in addition to enabling growth, ICT strategy committees need to broaden their scope. Not only should they offer advice on strategy when assisting the board of directors of public companies in its ICT governance responsibilities, but they should also focus on ICT value, risks and performance (IT Governance Institute, 2003).

The effects and value of implementing a governance structure must be measured in some way to validate the requirement for governance. Frameworks such as ITIL (Information Technology Infrastructure Library), COBIT (Control Objectives for Information and Related Technology) and Val-IT (Governance of IT Investments) fall into the three categories of operational, tactical and strategic function (Microsoft, 2009) respectively. The Microsoft Operations Framework (MOF) also falls into the operational framework category. These frameworks provide for what needs to be achieved in terms of effective ICT governance.

1.5 The Structure of the Study Defining the Area of Contribution

The structure in Figure 1-1 depicts the context within which governance and management function in the public higher education sector in South Africa. The focus of this project is to highlight the importance of ICT governance at the various governance levels in the public higher education sector in South Africa.

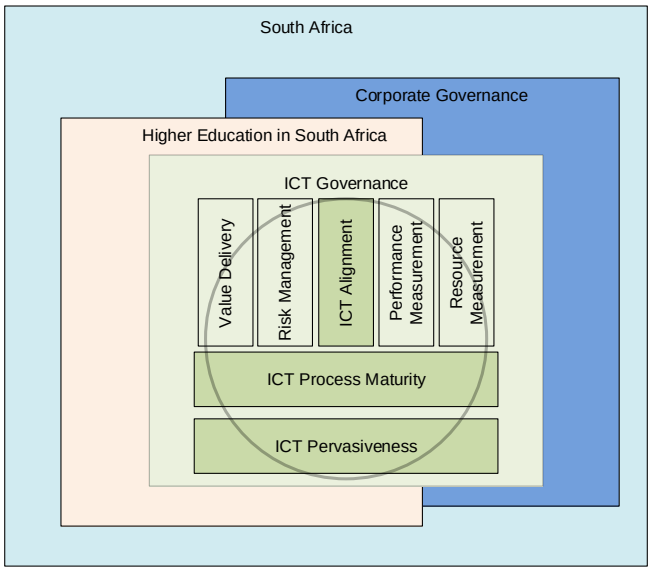


Figure 1-1: Governance Relationships in the Higher Education Sector in South Africa

Figure 1-1 provides a schematic representation of the structure of this study and the relationships between corporate governance and ICT governance in higher education in South Africa.

Within the broader context of the South African economy lie many sectors that are governed by ministries. Acts of Parliament regulate the activities within these ministries. There are also Acts of Parliament or best practice frameworks that cover functional areas outside the primary focus areas of the ministries. One such best practice framework is that covered by the requirements of the King III Code on corporate governance. The Code requires that corporate governance best practices are applied by all entities doing business in South Africa. The King III Code on corporate governance (King III Code, 2009) provides best practice corporate governance requirements that must be implemented on an "apply or explain" basis. This differs from the application of regulation in the USA, for example, where the Sarbanes-Oxley Act is applied as law and compliance is obligatory. The higher education sector in South Africa is subject to the requirements of the King III Code (2009), which state the best corporate governance practices that need to be implemented. In addition, there are underlying laws on financial procedures, such as the Auditing Profession Act 26 of 2005, which also require compliance.

Aspects of corporate governance are core to the theme of this study as they form the foundation for all other aspects of governance, including ICT governance (King III Code, 2009). Not all aspects of corporate governance are covered in this study, only those aspects relevant to ICT governance. Similarly, not all aspects of ICT governance are covered as this would broaden the scope of the study beyond its limitations. Figure 1-1 indicates the areas of governance that are covered in this study. The measure of ICT pervasiveness is fundamental to the study as it validates the need to govern ICT. ICT process maturity provides an overall measure of the maturity of ICT processes at institutions and as such is an indicator of ICT capacity. ICT alignment is one of the focus areas of ICT governance where the 'business', or 'institutional function' and ICT alignment are measured with a view to optimisation.

1.6 Statement of the Problem

The Department of Higher Education and Training (DHET) of South Africa does not specifically require public higher education institutions to implement ICT governance practices at institutions that fall within its ambit of control. Although the DHET does not have any specific ICT governance requirements for public higher education institutions the

King III Code is applicable to all public higher education institutions.

Current ICT governance structures in public higher education institutions are in place to obtain an appropriate balance between the management of ICT risk, value and cost, and are implemented by ICT management rather than being enforced by legal conformance requirements (South Africa, Department of Education, 1997, p. 12) (Pretorius, 2005).

The Higher Education Act 101 of 1997 allows for an Institutional Statute to be drafted and approved by the Minister in terms of the Act, while a Standard Institutional Statute applies until such time as this happens. The Statute provides for Governance Committees that are required in terms of the Act (South Africa, Department of Education, 2002). There is, however, no specific requirement for an ICT Committee of any nature to be established although other committees as required by the University's Council may be set up.

There is also no legal requirement in the Higher Education Act or the Standard Institutional Statute that ICT systems must conform to any standards or to ensure that ICT is governed appropriately. Nevertheless, some institutions have implemented structures in various ways in attempts to govern ICT, although this is in no way informed by legal requirements as is the case with financial audit procedures.

Other than legal compliance requirements, there are compelling reasons to apply good ICT governance practices wherever ICT is used. Posthumus and Von Solms (2005) conclude that almost every aspect of doing business somehow involves the utilisation of ICT systems and that these systems present both risks and opportunities.

The overall objective of ICT governance, therefore, is to understand the issues and the strategic importance of ICT, so that the enterprise can sustain its operations and implement the strategies required to extend its activities into the future. A key challenge for leadership is to make sustainability issues mainstream. Strategy, risk, performance and sustainability have become inseparable (King III Code, 2009). ICT governance aims at ensuring that expectations for ICT are met and ICT risks are mitigated. Both the risks and opportunities need to be governed (IT Governance Institute, 2003).

> Information technologies support every phase of higher education's mission. In recent years many universities and colleges have invested large sums to upgrade campus networks, administrative systems, research environments, course management systems and many other important areas. But on many campuses there is a growing

> concern that the best possible job in setting priorities for new ICT applications, collaborating across departmental boundaries and sharing expensive infrastructure is not being done. Many campuses have been hit with costly security breaches of their ICT environments that have resulted in compromises to the private information of thousands of individuals. In short, trustees, campus leaders, students, and the public are asking higher education to do a better job of managing its ICT investments. One path towards improving the current situation is to improve ICT processes (EDUCAUSE, 2006, p. 10).

The lack of a formally implemented best practice ICT governance structure leads to increased risk, misalignment of enterprise processes with ICT, resource inefficiencies and poor value delivery.

1.7 Research Question

How can recognised ICT governance practices be utilised to create a value framework for ICT governance in the public higher education sector in South Africa and how can this value framework contribute to better ICT governance and how can better collaborative ICT governance be implemented to ensure the optimal value of the ICT investment across the sector?

The following objectives were considered to address the research question above:

1.8 Objectives of the Study

1.8.1 Primary Objective

The primary objective of this research project is to produce a value framework that can be used to identify the value created in public higher education institutions in South Africa by implementing good ICT governance practices from the highest governing authority to the ICT functional environment.

Weill and Ross (2004) state that as ICT has become more important and pervasive, senior management teams are increasingly challenged to manage and control ICT to ensure that value is created. To address this issue, many enterprises are creating or refining ICT governance structures to better focus ICT spending on strategic priorities. McLure (2003) states that a number of variables, in combination and usually institutional specific, have a significant impact on what constitutes good governance and decision making: general

institutional characteristics, sources and levels of funding, leadership style, formality of planning, organisational culture, decision-making style, and type of ICT leadership structure are issues that need careful consideration.

1.9 Secondary Objectives

There is no defined direct manner in which to measure governance or governance effectiveness as governance metrics generally make use of indirect methods such as the measurement of process maturity. There are three secondary objectives defined and used in this study that make use of process maturity metrics to measure the relative governance effectiveness of ICT. These secondary objectives are the building blocks that contribute to meeting the primary objective.

1.9.1 Ascertain the Level of ICT *Pervasiveness* in Public Higher Education Institutions in South Africa

Enterprise resource planning (ERP) systems are usually large computer system installations deployed to facilitate functionality in more than one enterprise area, for example human resource systems, financial systems, sales systems and student systems in the case of the public higher education environment. In many cases the organisational processes do not match the processes that can be implemented by these computer systems and therefore either of them may require modification. This can result in portions of the ERP system not being implemented and only the other systems that satisfy user needs being used. This can result in system disintegration, another of the modern computer system maladies. In support of the primary objective this objective seeks to assess the breadth and depth of the application of ICT in the organisation which, in turn, can be used in the assessment of ICT value for the organisation.

1.9.2 Identify the ICT *Governance Practices* in Public Higher Education Institutions in South Africa

The fact that institutions are at various stages of ICT maturity almost certainly results in different governance practices. These governance practices were measured using the maturity model of COBIT version 4.1.

1.9.3 Ascertain the Level of *Alignment* of ICT to the Academic and Administrative Processes in Public Higher Education

The level of alignment of ICT to the business provides an indication of the relevance of ICT

and of the effectiveness of the ICT function. The more aligned ICT is to the business the more value is derived from it. Luftman and Brier (1999) provide twelve components of alignment to be considered. These are grouped into four domains, namely, Business Strategy, Organization Infrastructure and Processes, ICT Strategy, and ICT Infrastructure and Processes. These authors go on to say that organisations find it difficult to harness the power of ICT for their own long-term benefit, even though there is worldwide evidence that ICT has the power to transform whole industries and markets. The alignment of ICT to the organisation's processes will have an effect on its value to the organisation; thus, the value derived from alignment can also be used in the value assessment of the organisation. In this manner alignment supports the primary objective.

1.10 Significance of the Study

The value framework resulting from this study provides the public higher education sector in South Africa with information on ICT governance maturity, the level of pervasiveness of ICT in the education sector, as well as the level of alignment of ICT to the academic and administrative functions. The study spans the layers of governance from the DHET to the layer where the alignment of task and technology is required. The contribution of this study to the body of knowledge is novel as it is unique in terms of the measurement of ICT pervasiveness. It is also unique in the measures of ICT process maturity and business and ICT alignment in the public higher education sector. This provides a foundation for further study in any of the abovementioned areas. The study is also novel in that there is no evidence in available documented research of any attempt to understand governance, particularly ICT governance in more than a single layer or level. This study provides structured responses from highly experienced and qualified professionals within the scope of the public higher education sector in South Africa.

ICT governance is a function of corporate governance. ICT governance is essentially all about the board directives, policies and procedures that determine how an organisation will direct and control the use of its technology resources, so that these resources may successfully facilitate the realisation of the organisation's business goals (King III Code, 2009). It also includes the requirement to ensure that not only are the current technology resources optimally utilised, but also that new technology possibilities are continuously reviewed and engineered into policy and procedures to ensure that the advantage derived from technology innovation is constantly being exploited and optimised.

Flowerday and Von Solms (2005) assert that, today, most organisations are totally dependent on their information assets, which are generally stored, processed and communicated within information systems in digital format. These systems are enabled by modern ICTs.

Posthumus and Von Solms (2005) state that "IT has become widely integrated into most organisations but ICT issues remain a neglected topic at board level. The general failure by the board to effectively strategically direct and control ICT is derived from a lack of adequate skills and insight into ICT related issues at board level".

The ubiquitous and pervasive nature of ICT requires that specific governance attention is directed to ICT matters at the highest possible governance level in the public higher education sector. Governance controls in the financial area of an institution will only provide assurances on the balance sheet and risk logs of institutions, but specific governance controls on ICT issues can relate to more than just financial assurances. ICT governance facilitation at board or Council level can result in value creation that extends beyond the balance sheet to the areas required for the recognition and success of modern institutions.

The COBIT 4.1 Best Practice Framework version 4.1 (2007) defines five focus areas in which value can be leveraged in terms of good ICT governance practice. These are shown in the Figure 1-2.

Figure 1-2: COBIT 4.1 Focus Areas, (ITGI, 2007)

ICT investment costs are significant and much effort has gone into defining a way in which to express these as a standard financial indicator such as return on investment (ROI). Ataya (2003) states that, initially, most organisations' decision-making related to ICT relied on some form of ROI or on the derived internal rate of return (RRT) measures to evaluate projects. Using only ROI analysis in higher education can be problematic; a more coherent approach involves analysis on value of investment (VOI), which takes into account the qualitative benefits derived from ICT (EDUCAUSE, 2003). Currently, institutional governance in the public higher education sector is defined in the Higher Education Act, but the Act makes no mention of ICT governance. The updated version of the King III Code on corporate governance includes a chapter on ICT governance and has thus made it mandatory for all entities in the South African economy to consider ICT governance or explain the reasons for not doing so. This study produces a value framework that reinforces the merits of implementing a best practice framework both in the institutions and within the sector.

1.11 Research Philosophy

Any research has an underlying research paradigm that guides the way in which the research should be conducted (Collis & Hussey, 2009). There are several paradigms that exist; these paradigms can be distinguished by the philosophical assumptions on which they are based. This section discusses the research paradigm for this study. Figure 1-3 is used to illustrate this paradigm.

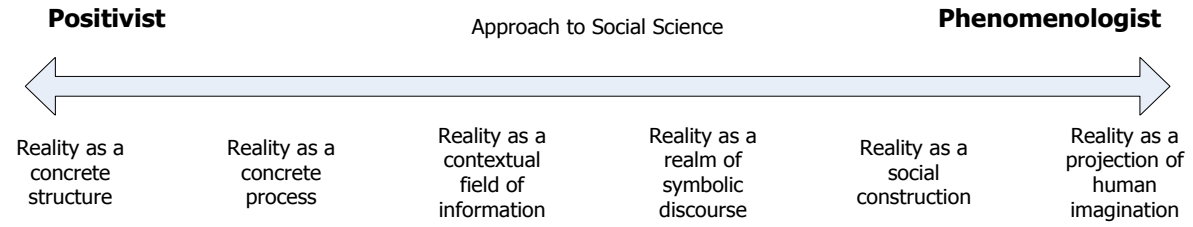


Figure 1-3: Typology of Assumptions on a Continuum of Paradigms,

(Morgan & Smircich, 1980, in Collis & Hussey, 2009, p. 61)

As illustrated in Figure 1-3, the positivistic and phenomenological or interpretive approaches are research paradigms at the extremes of a continuum, with several research paradigms combining elements from these two extremes in between. Collis and Hussey (2009) explain that few people operate purely within any one of these forms of research. Using a combination of the elements allows one to take a broader and often complementary view of

the research problem or issue.

This research project focuses on a value framework created by applying good governance principles from the highest governance level of the higher education environment in South Africa to the functional ICT level at individual institutions. This study leans towards a phenomenological approach (reality as a realm of symbolic discourse of the continuum represented in Figure 1-3), which is often linked to qualitative data collection, and is characterised as somewhat subjective (Collis & Hussey, 2009).

The research approach is based on inductive reasoning. This began with a formulated research question and specific observations gathered from surveys, from which trends were identified. This lead to general conclusions. For this research project these conclusions are value propositions that are formulated to create a value framework for ICT governance in the demarcated area of research.

1.12 Introduction to the Theoretical Foundation

A preliminary literature study was conducted in order to identify the methods available that could be used to assess the value of aligning ICT to the processes of the institution. In addition to this, this research project refers to *Task–Technology Fit Theory*, *Agency Theory*, *General Systems Theory* and the *Unified Theory of Use and Acceptance of Technology* as the basis from which to argue for a value structure through which ICT governance in the strategic areas of the COBIT model can be measured. Agency theory provides a basis from which higher education institutions operate, the 'principal' being the government and the 'institutions' being the agents. This relationship is defined in the preamble to the Higher Education Act where it is stated that it is desirable for higher education institutions to enjoy freedom and autonomy in their relationship with the State within the context of public accountability and the national need for advanced skills and scientific knowledge (South Africa, Department of Education, 1997).

1.13 Research Design

In conducting the research project the following process, as depicted in Figure 1-4, were adopted to solve the main problem and the objectives of the study.

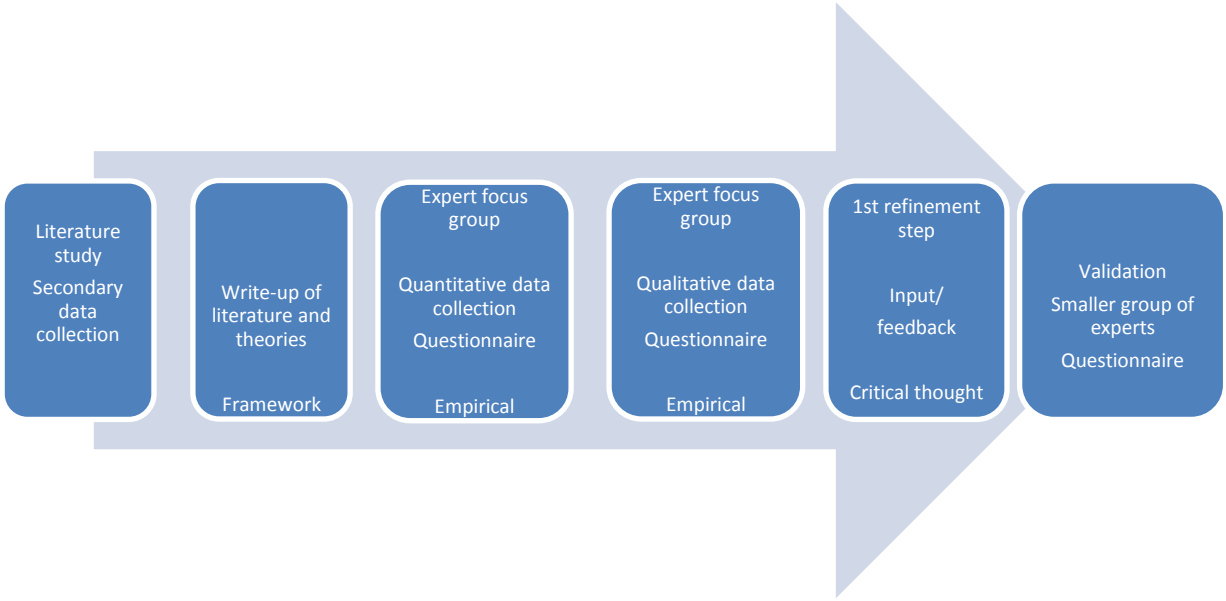


Figure 1-4: Research Process

1.14 Research Methodology

Data collection was carried out in the delimited area to determine the maturity of ICT governance and the value associated with its implementation using elements of COBIT 4.1 and Val-IT.

The primary data was obtained by means of surveys and interviews that were conducted with chief information officers and/or ICT directors of public higher education institutions in South Africa to ascertain the ICT governance structures in place at public higher education institutions and to rate their effectiveness and pervasiveness. Data was gathered using on-line survey tools.

The research instrument used in the survey is comprehensive questionnaires developed by the researcher based on information gained from the literature study. The population and sample body comprises a representative selection of the CIOs from at least ten of the twenty-three public higher education institutions in South Africa. The qualitative data from the web-based questionnaire is analysed using interpretive analysis techniques.

The secondary data was gathered through a literature study and best practice frameworks. This provides the required information on which a structure to evaluate the effectiveness of ICT governance in public higher education institutions is modelled.

The results of the literature study are combined with the results of the empirical study to develop an ICT governance value framework for public higher education institutions in South

Africa using the notion of inductive reasoning. These results are aligned to the principles of good ICT governance where the business/ICT alignment measures and risk factors are used to create the value framework.

The conceptual value framework for ICT governance in public higher education institutions is shown in Figure 1-5.

Governance in the public higher education sector starts at the DHET and is cascaded down to the functional level in each institution. At the RSA Educational Governance level (A) shown in Figure 1-5, specific public higher education sector governance requirements are defined in the Higher Education Act (South Africa, Department of Education, 1997). At the next layer of governance, Institutional Governance, level (B), the Act allows for institutions to be creative and add to the minimum governance requirements. Reporting relating to the overall governance of the public higher education institution must be submitted to the Department of Education annually (South Africa, Department of Education, 1997). This reporting requirement is the response to the Department of Education. Every layer of governance has governance compliance requirements towards the core of the framework and this in turn has compliance reporting as a response. Each compliance requirement has a value associated with it. These values of compliance contribute to the overall layered value framework.

Figure 1-5: Conceptual Value Framework for ICT Governance

The literature reviewed on ICT governance in higher education, including literature from EDUCAUSE, focuses primarily on the application of a governance framework within an institution of higher learning. This study, by contrast, investigates the value associated with the application of good ICT governance principles within and between the layers of governance in public higher education institutions. It also investigates the value of inter-institutional cooperative ICT governance within the system of education in South Africa. EDUCAUSE is a global non-profit association whose mission is to advance higher education by promoting the intelligent use of ICTs. This study provides the higher education sector in South Africa with a value framework to make the ***application of good ICT governance practices, from the highest layer of governance in the public higher education sector in South Africa to the institutional operational level of ICT application a new strategic imperative***.

1.15 Delimitation of the Study

The study is limited to a convenience sample of at least ten of the twenty-three universities within the public higher education sector in South Africa. The sample includes universities that have merged to form new institutions, those that have remained unmerged, as well as those that were historically disadvantaged. Also included in the study is an indication of those that are defined as universities of technology and comprehensive universities. The study only includes ICT governance matters that affect the governance of South African public higher education institutions.

1.16 Ethical Considerations

During the study, information was collected and, due to the nature and sensitivity of the information, the researcher adhered to a strict confidentiality code in order to protect the privacy of organisations and individuals. It was not envisaged that formal ethical clearance from the Nelson Mandela Metropolitan University (NMMU) would be required to conduct this study.

1.17 Outline of Chapters

Chapter one consists of the background and introduction to this study. It explains why research in this area is relevant and introduces the problem statement and research objectives. Chapter two sketches the context of public higher education in South Africa, including details on the institutions and their Institutional Statute provisions for ICT governance. The DHET funding structure and existing areas of governance are also highlighted for each institution. Chapter three focuses on the research design and methodology. Chapter four introduces the theories used to support the value framework. Chapter five deals with the survey on ICT pervasiveness and the validation of factors of pervasiveness, whilst chapter six discusses the survey relating to ICT process maturity. Chapter seven presents the survey on business and ICT alignment. In chapter eight the proposed ICT value framework is presented based on the research findings. Chapter nine covers the final survey on the validation of the ICT value framework. The final chapter is the conclusion which indicates whether the study outcome addresses the research problems and suggests area for further research.

1.18 Summary of findings

The comprehensive surveys utilised in this study provide results that indicate that ICT is indeed highly pervasive in the public higher education sector in South Africa. ICT process maturity, as well as business and ICT alignment, is poor, resulting in a less than optimal

value of investment (VOI) in ICTs. Survey results provide the foundation on which the value framework for ICT governance in public higher education institutions is built. The value framework shows that human resources (HR) and finance has their governance roots in the DHET, whilst ICT has its governance roots within institutions, resulting in ICT metrics not necessarily reaching the DHET. The value framework provides a structure in which aspects of governance, organs of governance and the mechanisms of governance can be identify at a more granular level. This can provide better governance opportunities which will thus improve ICT governance maturity, in turn resulting in better value realisation by institutions (Van Grembergen, 2004).

Chapter Two

Contextualising the Public Higher Education Sector in South Africa

2 Contextualising the Public Higher Education Sector in South Africa

2.1 Introduction

The purpose of this chapter is to introduce the public higher education system in South Africa to provide the context in which the study takes place. In the education system, the mechanisms that are defined by the DHET for direction, execution and control in the governance of the sector are described comprehensively to obtain an appreciation of the level of detail in the applicable Acts and Regulations. This is specifically done to provide a contrast between the governance requirements in the financial and human resources (HR) fields and to compare this to the absence of governance requirements in the emerging field of ICT.

The DHET (South Africa, Department of Higher Education and Training, 2010) aims to provide a higher education system that, on the demand side, must ensure that the skills needed to drive the country's economic growth and social development are delivered at an increasing rate, because available, quality skills will enhance both investment and service delivery. On the supply side, the system must serve a growing number of both young people and adults; it must provide different entry points into, and pathways through the learning system; it must provide quality learning wherever learning takes place, be it a college, a university or in the workplace; and, importantly, it must provide easy pathways across the different learning sites. The system that is developed must educate and train students to be able to work towards meeting the economic and social needs of the country. In practice, this means that people must be able to traverse from learning to work and from work to learning throughout their lives. Quality and good governance remain key pillars, while a strong interface with those sectors that provide an inflow into the higher education system and an outflow into society and the labour market must be maintained. The DHET has outlined the tasks that are described in the following section to address the requirements of the sector in the medium term (South Africa, Department of Higher Education and Training, 2010).

Multiple skills strategies are needed in the country's complex economy with its diverse sectors and labour market. The role of developing skills for rural development, for advanced technological capabilities, and for growing the economy needs to be massively developed (South Africa, Department of Higher Education and Training, 2010). The skills strategies must support the engine of the New Growth Path (South African Government, 2010), the value-added sectors with high employment and growth multipliers. Simultaneously, the new

highly skilled, scientifically based segments and expertise needed for employment and a sustainable livelihood for millions of under- and unemployed citizens must be addressed. The human resources needs of the country's development trajectory across the high and low skills continua in terms of technical expertise and appropriate knowledge, as well as experience and attitude need to be anticipated. Institutional linkages that are flexible and dynamic in meeting the differentiated and overlapping demands and opportunities for skills across segments, and which optimise conditions for individuals to make choices in line with their aspirations, are required. A policy and resource environment needs to be provided where providers of education and training are supported and are accountable as efficient and effective providers of these services, and in which public institutions are key partners, deriving their mandate from the broad national goals. The establishment of policy mechanisms with enabling incentives to create the flexibility that providers need in order to be immediately responsive and relevant to the complex dynamics of demand is required. Prior to April 2009, post-secondary school education was fragmented but the merging of the three pillars of human resources development planning, higher education, and training into a single department will, via effective linkages, build on the foundations laid by these previously separate components (South Africa, Department of Higher Education and Training, 2010). This chapter covers the governance-related goals of the DHET, followed by an introduction to the public higher education institutions in South Africa. Finally the funding and reporting mechanisms defined in legislation and regulations are presented to provide the overall governance structure in the sector, whilst also indicating the minimal ICT governance requirements.

2.2 DHET Governance Related Goal for the Next Five Years

This governance goal aims at improved capability and alignment of information, finance, governance and management in the post-secondary school environment, and simultaneously also the need to dramatically increase the number of learners that the system is able to accommodate over time and, in meeting this need, new institutions may very well be required (South Africa, Department of Higher Education and Training, 2010). The DHET also needs to significantly strengthen the systems that serve them so that the Department can increase their efficiency and effectiveness, measured in terms of learner and employer satisfaction. Central to the efficient and effective functioning of the envisaged systems will be a broad-based, well-resourced information system. It will help individuals to plan their careers better, while enabling learning institutions to align their programme offerings to the occupations strongest in demand. Establishing such an information system is a key national priority

(South Africa, Department of Higher Education and Training, 2010, p. 45). The first draft of the Higher Education and Training Information Policy was released for public comment in June 2012 (South Africa, Department of Higher Education and Training, 2012). Institutional efficiency requires improved capability and alignment of information, finance and governance all of which are inextricably linked to ICT at some level. It is important to understand the context of public higher education in South Africa for the purpose of this study and the rest of this chapter provides a brief history of each institution, whilst also giving details on the governance and operational aspects and mechanisms of the public higher education system. The next section introduces the changes in the public higher education landscape in South Africa over the last decade.

2.3 Public Higher Education Institutions in South Africa during the Last Decade

Prior to the mergers that characterised the public higher education sector in the last decade, thirty-six public institutions graced the sector landscape. Subsequently, universities, technikons and, in some cases, even teachers training colleges were merged to form new institutions. By the end of 2005 only twenty-three institutions remained, their configuration, or 'size and shape' have in many cases been changed. One of the characteristics of the mergers was the multi-campus nature of the new institutions. In August 1997, the then Minister of Education Professor SME Bengu had as his objective the transformation of the higher education system to reflect the changes that were taking place in South African society and the strengthening of the values and practices of the new democracy. The higher education system was to be transformed to redress past inequalities, to serve a new social order, to meet pressing national needs and to respond to new realities and opportunities. The third White Paper on higher education (1997) outlines the framework for change, that is, the higher education system must be planned, governed and funded as a single national coordinated system. This was aimed at overcoming the fragmentation, inequality and inefficiencies of the past, and the creation of a learning society targeting the release of the creative and intellectual energies of the entire county's people (South Africa, Department of Education, 1997). The public higher education institutions and their governance structures as defined in legislation and regulation are presented in the next section.

2.4 Introduction to the Institutions in South Africa

Public higher education institutions in South Africa have evolved over the decades from various types of institutions to become institutions that range in size from approximately 7 000 to 300 000 students and now exist in three categories: universities, universities of

technology and comprehensive universities which are a combination of the first two categories. The national plan for higher education states that policy must restructure the higher education system and its institutions to meet the needs of an increasingly technologically oriented economy (South Africa, Department of Education, 1997). There has been an increase in interest in technology in many higher education institutions in South Africa since 2000. In other countries, the interest in technology is related to national policy frameworks, rapidly changing ICT sectors and the impetus provided by funding bodies, but this is not the case in South Africa, where there are no specific technology-related policies in higher education explicitly steering practices, and where higher education institutions are spending more of their budgets on ICT infrastructure than in previous years (Council for Higher Education, 2006). An introduction to the institutions which highlights the age, specific governance structures, including ICT governance structures, follows.

2.4.1 University of Cape Town

The University of Cape Town (UCT) is South Africa's oldest university. It was founded in 1829 as the South African College, a high school for boys. UCT was formally established as a university in 1918. Over 23 500 students enrolled at UCT in 2009. UCT employs approximately 4 500 staff members, of whom 44% are academic and 56% are administrative and support staff (University of Cape Town website, 2011). UCT has published an institutional statute in terms of the Higher Education Act. The institutional statute (South Africa, Department of Higher Education and Training, 2002) does not have an ICT governance organ defined in it nor does it require any specific competencies of the external people appointed to Council (University of Cape Town website, 2011).

2.4.2 Stellenbosch University

Stellenbosch, the country's oldest town, has from very early on had a significant involvement in the history of education in South Africa. In 1873, the then Board of Examiners was replaced by the Examining University of the Cape of Good Hope. The University Act, which replaced the Victoria College with the University of Stellenbosch (SUN), came into effect on 2 April 1918. The decades since then have seen its student numbers grow fortyfold and more, from about 500 to some 22 000 (Stellenbosch University website, 2011).

Stellenbosch University has published an institutional statute in terms of the Higher Education Act (South Africa, Department of Higher Education and Training, 2011), but no ICT governance organ is defined in it (Stellenbosch University website, 2011).

2.4.3 University of the Witwatersrand

The origins of the University of the Witwatersrand (WITS) lie in the South African School of Mines, which was established in Kimberley in 1896 and transferred to Johannesburg as the Transvaal Technical Institute in 1904, becoming the Transvaal University College in 1906 and being renamed the South African School of Mines and Technology four years later. Full university status was granted in 1922, incorporating the College as the University of the Witwatersrand, with effect from 1 March 1922.

As is the case with the previous two institutions the institutional statute of WITS does not have an ICT governance organ defined in it (Government Gazette, 2002).

2.4.4 The University of the Free State

At the beginning of the previous century an institution of higher education in the Free State (then called the Orange River Colony), one of the provinces in South Africa, became a reality with the establishment of the Grey College School with only six (B.A.) students on 28 January 1904. Today, this proud institution is bursting at its seams with more than 30 000 students in seven faculties, namely, Economic and Management Sciences, Education, Health Sciences, the Humanities, Law, Natural and Agricultural Sciences and Theology.

The University of the Free State published its institutional statute on 27 August 2010. The Statute does not have an ICT governance organ defined in it; however, at least one member of Council is required to have competencies in the field of ICT (Government Gazette, 2010).

2.4.5 Rhodes University

University education in the Eastern Cape began in the college departments of four schools: St Andrew's, Grahamstown; Gill College, Somerset East; Graaff-Reinet College; and the Grey Institute in Port Elizabeth. Rhodes became a constituent college of the new University of South Africa in 1918. When the future of the University of South Africa came under review in 1947, Rhodes opted to become an independent university. The Rhodes University Private Bill was passed in April 1949 and Rhodes University (RU) was inaugurated on 10 March 1951. In terms of the Rhodes University Private Act, the University College of Fort Hare was affiliated to RU. This mutually beneficial arrangement continued until the government decided to disaffiliate Fort Hare from Rhodes. The Rhodes Senate and Council objected strongly to this, and to the Separate University Education Bill, which they condemned as interference in academic freedom. However, the two bills were passed, and Fort Hare's

affiliation to Rhodes came to an end in 1959.

RU has published a statute (Rhodes University, 2005). The statute does not have an ICT governance organ defined in it; however, a member of Council is required to have competencies in the field of Information Technology.

2.4.6 The University of Pretoria

The University of Pretoria (UP) has its origins in the establishment of the Pretoria Centre of the Transvaal University College in 1908. On 10 October 1930, an act of Parliament championed by General Jan Smuts gave rise to the Transvaal University College becoming the University of Pretoria (UP). The university currently has more than 50 000 students. It now offers courses in both English and Afrikaans (University of Pretoria website, 2011).

UP has published a statute (University of Pretoria, 2003). The Executive Director of Information and Communication Technology is a member of Senate. There is no specific ICT governance organ in the statute but the ICT department does have a governance framework which is used internally.

2.4.7 The University of Fort Hare

Situated in the Eastern Cape town of Alice on the former missionary station donated by the United Free Church of Scotland, Fort Hare has a long tradition of excellence and achievement of which it can be justly proud. Fort Hare came into existence in 1916 and is the oldest historically black university in South Africa. There are currently 11 700 students registered at the University which has campuses in Alice, Bhisho and East London. The East London campus was incorporated in 2005 having been a remote campus of Rhodes University.

The UFH institutional statute was promulgated in November 2010 and has no specific ICT governance organ defined (South Africa, Department of Higher Education and Training, 2010).

2.4.8 The University of the Western Cape

In 1959, Parliament adopted legislation establishing the University College of the Western Cape (UWC) as a constituent college of the University of South Africa for people classified as ‘coloured’. In 1970 the institution gained university status and was able to award its own degrees and diplomas. In 1983, through the University of the Western Cape Act of 1983, the

university finally gained its autonomy on the same terms as the established 'white' institutions.

UWC published its institutional statute in 1999 (Government Gazette, 1999). The statute makes no specific provision for ICT governance organs.

2.4.9 The University of KwaZulu-Natal

The University of KwaZulu-Natal (UKZN) was formed on 1 January 2004 as a result of the merger between the University of Durban-Westville (UDW) and the University of Natal. The UDW was established in the 1960s as the University College for Indians on Salisbury Island in Durban Bay. In 1971, the College was granted university status. The UDW became an autonomous institution in 1984, opening up to students of all races. Founded in 1910 as the Natal University College (NUC) in Pietermaritzburg, the University of Natal was granted independent University status in 1949 owing to its rapid growth in numbers, its wide range of courses and its achievements in and opportunities for research.

The two KwaZulu-Natal universities were among the first batch of South African institutions to merge in 2004 in accordance with the government's higher educational restructuring plans that would eventually see the number of higher educational institutions in South Africa reduced from 36 to 23. Confirmed by a Cabinet decision in December 2002, the mergers were the culmination of a wide-ranging consultative process on the restructuring of the higher education sector that began in the early 1990s. UKZN has five campuses in two major cities, four in Durban and one in Pietermaritzburg, with a total student population of approximately 42 000, 20% of whom are postgraduates, and a total staff complement of approximately 4 300.

The institutional statute was promulgated on 14 July 2006 (The University of KwaZulu-Natal, 2006), but does not define a specific ICT governance organ.

2.4.10 The North West University

The North West University (NWU) is a multi-campus university with a footprint across two provinces. NWU came into being on 1 January 2004 through the merger of two universities with very different histories, personalities and cultures: the Potchefstroom University for Christian Higher Education and the University of the North-West. The Potchefstroom campus is the largest and oldest NWU campus, with a history going back 141 years and with 35 000 students registered in 2008, including 18 800 students enrolled for distance programmes.

The institutional statute was promulgated on 14 July 2006 (Government Gazette, 2006); however, as is the case with many other public higher education institutions, there is no specific ICT governance organ defined in the statute.

2.4.11 University of Limpopo

The University of Limpopo (UL) is the result of a merger between the former Medical University of Southern Africa (MEDUNSA) and the University of the North, which occurred on 1 January 2005. MEDUNSA was established in 1976 to provide higher education and training facilities to the educationally disadvantaged in the fields of Medicine, Allied Health and Nursing Sciences, and Dentistry in order to meet the health needs of the country. The South African Parliament promulgated the University of the North Act (Act No. 47 of 1969) thus bringing to an end the College status as of 1 January 1970. The institutional statute was promulgated on 14 July 2006 (Government Gazette, 2010), but also does not specifically provide for any ICT governance organ. ICT is also not represented in the top management level structures.

2.4.12 Vaal University of Technology

The Vaal Triangle College for Advanced Technical Education opened its doors in 1966, then changed to become the Vaal Triangle Technikon (1979–2003) and then the Vaal University of Technology (VUT) from 2004. The institutional statute was promulgated in April 2013 and in this most recent statute there is no specific legislative requirement for members of Council to have the specific skills, as required in terms of the Standard Institutional Statute. Despite the requirement for Council to have a finance and HR committee, however, there is no requirement for Council to have an ICT committee (South Africa, Department of Higher Education and Training, 2013).

2.4.13 Mangosuthu University of Technology

The Mangosuthu University of Technology (MUT) was opened in 1979 and was then known as the Mangosuthu Technikon (Mangosuthu University of Technology website, 2011).

The institutional statute was repealed on 15 May 2009 leaving the Standard Institutional Statute as the statute of the institution (South Africa, Department of Higher Education and Training, 2009).

2.4.14 Central University of Technology

The Central University of Technology (CUT), formerly known as the Technikon Free State, opened its doors in 1981 with 285 students enrolled in mainly secretarial, art and design programmes. The university now has more than 11 000 registered students. The university statute was promulgated on 11 September 2008 (Government Gazette, 2008). There is no provision made in the statute for ICT governance. It is significant to note that that the Council is comprised of nine external members with a broad spectrum of competencies in the fields of education, business, agriculture, law, marketing, human resources management, with one member each; and two members each in the fields of finance and information technology.

2.4.15 Durban University of Technology

With approximately 23 000 students, the Durban University of Technology (DUT) is a university of technology. This institution is the result of a merger in April 2002 of two technikons, ML Sultan and Technikon Natal. It was named the Durban Institute of Technology and later became the Durban University of Technology in line with the rest of the universities of technology in South Africa. It is a multi-campus institution with campuses in Durban and Pietermaritzburg (Durban University of Technology website, 2011).

The university statute was promulgated on 20 January 2012 (South Africa, Department of Higher Education and Training, 2012). No specific provision is made in the statute for ICT governance and Council members need no specific competencies to be appointed.

2.4.16 Tshwane University of Technology

The Tshwane University of Technology (TUT) is a product of South Africa's first decade of democracy. TUT was established on 1 January 2004, with the merging of the former Technikon Northern Gauteng, Technikon North-West and Technikon Pretoria. TUT enrols approximately 60 000 students. The university statue was promulgated on 1 August 2007 (South Africa, Department of Higher Education and Training, 2012). The statute requires the Council to appoint two technical experts, but the field of technical expertise is not defined. No provision is made in the statute for ICT governance.

2.4.17 Cape Peninsula University of Technology

The history of the Cape Peninsula University of Technology (CPUT) goes back to 1920 when the foundation stone of the Longmarket Street building of the then Cape Technical College

was laid in Cape Town. After the promulgation of the Technikons Act in 1976, these colleges could offer higher education in selected fields of study. In 1993 the Technikons Act was promulgated, empowering technikons to offer degrees: bachelors, masters and doctoral degrees in Technology.

The institutional statute was promulgated on 17 May 2010 and makes particular reference to Council members being appointed by the membership committee with a broad spectrum of competencies in the fields of, although not limited to, education, business, finance, law, marketing, information technology (IT) and human resources (Government Gazette, 2010).

2.4.18 The University of Zululand

The University of Zululand (UNIZUL) was officially opened on 8 March 1961. University status was granted to the University College of Zululand in 1970. The university registered approximately 12 000 students during 2010 (University of Zululand website, 2011).

The institutional statute was promulgated on 12 October 2012 (South Africa, Department of Higher Education and Training, 2012). The statute provides for only three people with relevant experience and expertise and does not particularly define the areas of experience and expertise required; thus there is no specific ICT governance requirement in the Council structure. Also, most of the other institutional statutes provide for ten members in this category of Council member.

2.4.19 The University of Venda

The University of Venda (UNIVEN), situated at Thohoyandou in the Vhembe district of the Limpopo Province of South Africa, was established in 1982. UNIVEN is a traditional university that offers degrees in the humanities, social, natural and applied sciences.

The university statute was promulgated on 4 May 2005 and has no ICT governance requirements stated in it (Government Gazette, 2005). There is also no specific requirement for the external Council members to have ICT knowledge or skills.

2.4.20 The University of South Africa

Founded in 1873 as the University of the Cape of Good Hope, the University of South Africa (UNISA) spent most of its early history as an examining agency for Oxford and Cambridge universities and as an incubator from which most other universities in South Africa descended. In 1946 it was given a new role as a distance education university and today it

offers certificate, diploma and degree courses up to doctoral level. In January 2004, UNISA merged with the Technikon SA and incorporated the distance education component of Vista University (VUDEC). The combined institution retained the name University of South Africa (UNISA) unlike other merged institutions, which underwent name changes. UNISA has approximately 300 000 students enrolled and it qualifies as one of the world's mega universities.

The UNISA statute was promulgated on 3 February 2006 (Government Gazette, 2006). There is no specific ICT governance requirement in the statute; however the Council must have a specialist in the field of ICT as one of the nine specialist Council members appointed.

2.4.21 The University of Johannesburg

The University of Johannesburg (UJ), one of the largest, multi-campus, residential universities in South Africa, seeks to achieve the highest distinction in scholarship and research within the higher education context. Born from the merger between the former Rand Afrikaans University (RAU), the Technikon Witwatersrand (TWR) and the Soweto and the East Rand campuses of Vista University in 2005, UJ's unique academic architecture reflects a comprehensive range of learning programmes, leading to a variety of qualifications, from vocational and traditional academic to professional and postgraduate, across the four campuses. The campuses vary in size and each has its own character and culture, contributing to the institution's rich diversity (University of Johannesburg website, 2011).

The UJ institutional statute was published on 27 August 2010 and is the only public higher education institution in South Africa that requires the office of the chief information officer (CIO) as an organ of ICT governance (Government Gazette, 2010).

2.4.22 The Nelson Mandela Metropolitan University

Nelson Mandela Metropolitan University (NMMU) opened on 1 January 2005, the result of the merging of the Port Elizabeth Technikon, the University of Port Elizabeth (UPE) and the Port Elizabeth campus of Vista University (Vista PE). This union of three very different institutions came about as a result of government's countrywide restructuring of higher education – intended to deliver a more equitable and efficient system to meet the needs of South Africa in the twenty-first century.

NMMU has approximately 25 000 students and approximately 2 500 staff members, based on seven campuses in the Nelson Mandela Metropole and George. The PE Technikon had its

roots in the country's oldest art school, the PE Art School founded in 1882. The institution later became the College for Advanced Technical Education (CATE). The University of Port Elizabeth (UPE), the country's first dual-medium residential university, came into being on 31 January 1964 with the adoption by Parliament of the University of Port Elizabeth Act 1 of 1964. Vista University (Vista PE) was founded on 1 January 1982 (Nelson Mandela Metropolitan University website, 2011).

The institutional statute was promulgated on 8 October 2007 (Government Gazette, 2011). The statute has no specific ICT governance requirements, but does require a Council HR and finance committee. There is however a requirement to appoint an information technology (ICT) specialist as a member of Council, along with HR and finance specialists.

2.4.23 Walter Sisulu University

Walter Sisulu University (WSU) is a university in the Eastern Cape Province, South Africa, with its seat in Mthatha. It came into existence on 1 July 2005 as a result of a merger between Border Technikon, Eastern Cape Technikon and the University of Transkei. The university registers approximately 25 000 students annually (Walter Sisulu University website, 2011).

The institutional statute was promulgated on 26 August 2008 (Government Gazette, 2008). The statute has no specific ICT governance requirements in terms of an ICT Council committee, despite there being a requirement for an HR and finance committee of Council, but there is a requirement to appoint an ICT specialist as a member of Council.

2.4.24 Summary of the Institutional Statute and Governance

Table 2-1 shows a summary of the ICT governance organs legislated in the statutes of the twenty-three public higher education institutions. The Standard Institutional Statute requires, in addition to the Council comprising other defined categories of Council members, that ten members with a broad spectrum of competencies in the fields of education, business, finance, law, marketing, ICTs and human resource management be appointed by the Council (South Africa, Department of Education, 2002). The institutional statutes that individual institutions have compiled do not necessarily include the quantity and defined skills categories of Council members as the Standard Institutional Statute requires. This can affect the capacity of the Council to deal with issues that may arise in these specialised categories and can also affect the composition of the Council committees that may be required. In some cases specific Council governance committees are defined in the institutional statutes, but in most

cases the creation of Council committees is left to the discretion of Council.

Institution Name	Own Statute	Year Promulgated	ICT Specialist on Council	Finance Specialist on Council	HR Specialist on Council	ICT Governance Organs Required (Council Committee)	Finance Governance Organs Required (Council Committee)	HR Governance Organs Required (Council Committee)
University of Cape Town	Y	2002	N	N	N	N	N	N
Stellenbosch University	Y	2011	N	Y	N	N	N	N
University of Witwatersrand	Y	2002	N	N	N	N	N	N
University of the Free State	Y	2010	Y	Y	Y	N	N	N
Rhodes University	Y	2005	Y	Y	Y	N	N	N
University of Pretoria	Y	2003	N	Y	Y	N	Y	Y
University of Fort Hare	Y	2010	N	N	N	N	Y	Y
University of the Western Cape	Y	2005	N	N	N	N	N	N
University of KwaZulu-Natal	Y	2006	Y	Y	Y	N	Y	N
North West University	Y	2006	N	N	N	N	N	N
University of Limpopo	Y	2010	Y	Y	Y	N	Y	Y
Vaal University of Technology	Y	2013	N	N	N	N	Y	Y
Mangosuthu University of Technology	N	2003	Y	Y	Y	N	Y	Y
Central University of Technology	Y	2008	Y	Y	Y	N	Y	Y
Durban University of Technology	Y	2012	N	N	N	N	Y	Y
Tshwane University of Technology	Y	2012	N	Y	N	N	Y	Y
Cape Peninsula University of Technology	Y	2010	Y	Y	Y	N	Y	Y
University of Zululand	Y	2012	N	N	N	N	Y	Y
University of Venda	Y	2005	N	N	N	N	N	N
University of South Africa	Y	2006	Y	Y	Y	N	Y	Y
University of Johannesburg	Y	2010	Y	Y	Y	Y	Y	Y
Nelson Mandela Metropolitan University	Y	2011	Y	Y	Y	N	Y	Y
Walter Sisulu University	Y	2008	Y	Y	Y	N	Y	Y

Table 2-1: Summary of Institutional Statutes and Legislated ICT Governance Organs in Public Higher Education Institutions in South Africa

Table 2-1 summarises the content of institutional statutes in terms of the Council committees required to cover specific governance needs and/or Council members with specialised skills. In some cases the statutes do not specify the type of skills required in Council members in this category, but a broad indication is given that specialised skills are required. Only if specific skill requirements or specific Council committee roles are stated, is the indicator in Table 2-1 captured as existing legislatively in the statute.

The Higher Education Act provides for institutional statutes to be drawn up to ensure that matters that are not covered by specific laws are still regulated by legislation. Only UJ makes provision for the office of the CIO in terms of ICT governance. Seven public higher education institutions require, at most, two of their Council members to have specialised ICT skills. Only a single institution is governed by the Standard Institutional Statute, whilst the rest have purposefully created statutes to cover their specific requirements. The first statute was promulgated in 2002 while the most recent statute was enacted into law in 2013.

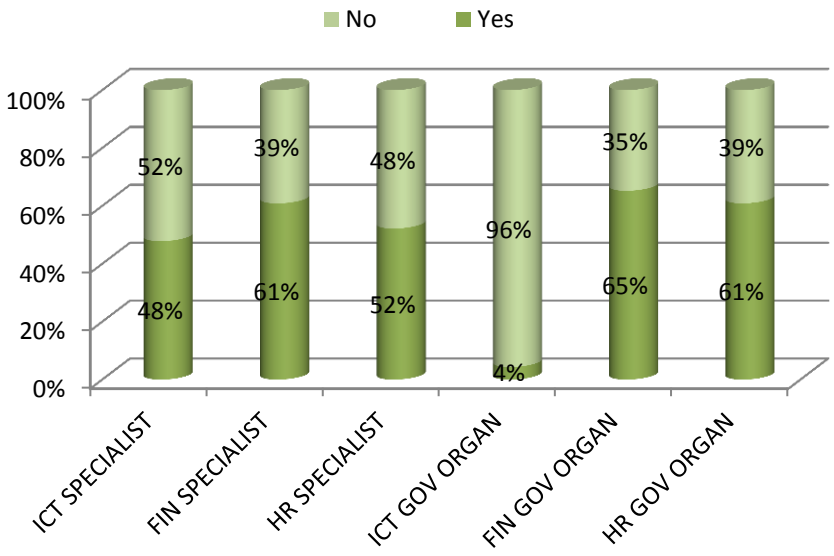


Figure 2-1: Percentage Council Member Skill and Governance Legislated in ICT, HR and Finance in Public Higher Education Institutions in South Africa

Figure 2-1 indicates the percentage of institutions that have legislated for the requirement to have specialists in the areas of ICT, finance and HR on Council. Also indicated is the legislated requirement to have a Council committee in the same three functional areas. The Standard Institutional Statute requires specialists on Council but the creation of committees is left to the discretion of the Council. No institutions legislatively require ICT Council committees. Only a single institution has legislated for the office of the CIO as an ICT governance mechanism. No institutions have legislated for the creation of an ICT governance organ in the form of an ICT governance committee of Council. There is also no need expressed in the Standard Institutional Statute to create HR or finance governance committees of Council and yet approximately 65% of institutions have nevertheless included the need to create them in their statutes. The absence of the legislated need to create HR and finance committees of Council but the inclusion of these two governance committees is one of the fundamental reasons for this study as it is an indicator of the perception of value by

these governance committees. The link between the existence of governance legislation and the corresponding higher level of ICT process maturity is further demonstrated in this study.

The next section investigates the laws governing the higher education sector in more detail.

2.5 Laws Governing the Higher Education Sector

Higher education institutions in South Africa are generally established by statute in terms of an Act of Parliament (Pityana, 2004). The Higher Education Act 101 of 1997 (South Africa, Department of Education, 1997), as amended, governs both public and private higher education institutions. The purpose of the Act is to regulate higher education; to provide for the establishment, composition and functions of a Council on Higher Education (CHE); to provide for the establishment, governance and funding of public higher education institutions; to provide for the appointment and functions of an independent assessor; to provide for the registration of private higher education institutions; to provide for quality assurance and quality promotion in higher education; to provide for transitional arrangements and the repeal of certain laws; and to provide for matters connected therewith (South Africa, Department of Education, 1997).

Public higher education institutions are governed by their own institutional statutes which are approved by the minister of education. Prior to institutions having their own statutes, a Standard Institutional Statute published in terms of the Higher Education Act (South Africa, Department of Education, 2002) applies. The University Council is the highest governance structure and consists of ministerial nominees, various representatives of public interests, including key institutional stakeholders. In South Africa, higher education institutions are guaranteed academic freedom in terms of the Bill of Rights (1996). The concept of academic freedom is described by Russel (1993, pp. 1-2) in his seminal writings to have often caused confusion because it comes from a medieval intellectual tradition which pre-dates most of the current meanings of the word ‘freedom’. In addition, because universities were originally seen as quasi-ecclesiastical institutions, the claims of universities to academic freedom have always been rooted in an intellectual tradition created to defend the autonomy of the medieval church. Lord Jenkins, quoted in Russel (1993), defines academic freedom as “the freedom within the law to question and test received wisdom, and to put forward new ideas and controversial or unpopular opinions without placing themselves in jeopardy of losing their jobs or privileges they may have at their institutions”. Higher education institutions also enjoy autonomy in their relationship with the State within the context of public accountability

and the national need for advanced skills and scientific knowledge (South Africa, Department of Education, 1997). Higher education itself is not free but every effort, within the available resources, is made to extend access to higher education to all academically qualifying prospective students. The structures required by the Act are discussed below.

2.5.1 Council on Higher Education

The Council on Higher Education (CHE) is established in terms of Chapter 2 of the Higher Education Act (South Africa, Department of Education, 1997, p. 10) to advise the Minister on aspects of higher education, arrange and coordinate conferences, publish information regarding developments in higher education, promote the access of students to higher education institutions and to create a permanent Higher Education Quality Committee (HEQC). The advice from the HEQC to the minister includes advice on quality promotion, research on the structure of the higher education system, the planning of the higher education system, the mechanism for the allocation of public funds, student financial aid, student support services, the language policy and governance of higher education institutions and the higher education system. The selection of the members of the CHE must be undertaken in such a manner to ensure that the functions of the CHE are performed professionally and that membership is broadly representative of the higher education system. Members must have deep knowledge and understanding of the higher education system and appreciate the role of the higher education system in reconstruction and development and that due attention is given to representation on the grounds of race, disability and gender. The CHE and HEQC must comply with the policies and criteria formulated by the South African Qualifications Authority (SAQA) in terms of the South African Qualifications Authority Act No. 58 of 1995 (South Africa, Department of Higher Education and Training, 1995). CHE activities are reflected on its website (www.che.org.za).

2.5.2 The South African Qualifications Authority (SAQA)

The South African Qualifications Authority (SAQA) defines itself as an organisation that is a juristic person with a board comprising twelve members appointed by the minister of education after consultation with the minister of labour. The members are nominated by identified national stakeholders in education and training. SAQA's role is to advance the objectives of the National Qualifications Framework (NQF), oversee the further development of the NQF and coordinate the sub-frameworks. SAQA must advise the ministers of education and labour on NQF matters in terms of the NQF Act. The Board is required to

perform its tasks after consultation and in cooperation with all bodies and institutions responsible for the education, training and certification of standards that will be affected by the NQF. It must also comply with the various rights and powers of bodies in terms of the Constitution and Acts of Parliament.

The office of SAQA is responsible for implementing the policies and decisions of the Board. In 1998 SAQA published the National Standards Bodies (NSB) Regulations whereby provision was made for the registration of National Standards Bodies and Standards Generating Bodies. In 2005, and in line with the recommendations of the NQF Study Team appointed by the ministers of Education and Labour, the NSBs were allowed to complete the second cycle and were then disestablished. Their qualifications scrutiny function was taken on by specially convened consultative panels. The consultative panels consist of subject matter experts as well as qualifications experts and their role is to evaluate qualifications and standards from the perspective of the sector for which the qualifications or standards have been developed using SAQA criteria. The standards generating bodies and task teams are responsible for generating standards and qualifications and recommending them to the Standards Setting Directorate. In terms of the NQF Act, the Quality Councils, will, amongst other things, develop and manage their sub-frameworks, and make recommendations thereon to relevant ministers, ensure the development of qualifications or part qualifications as are necessary for their sectors, which may include appropriate measures for the assessment of learning achievement and recommend qualifications or part qualifications to the SAQA for registration.

SAQA must develop and implement policy and criteria, after consultation with the quality committees (QCs) for the development, registration and publication of qualifications and part-qualifications, which must include the relevant sub-framework that must be identified on any document relating to the registration and publication of a qualification or part-qualification (South Africa, Department of Higher Education and Training, 1995). SAQA must ensure that each sub-framework has a distinct nomenclature for its qualification types which is appropriate to the relevant sub-framework and consistent with international practice. It must register a qualification or part-qualification recommended by a QC if it meets the relevant criteria and it must develop policy and criteria, after consultation with the QCs, for assessment, recognition of prior learning and credit accumulation and transfer.

The Education and Training Quality Assurance (ETQA) regulations were also published in

1998 and provided for the accreditation of Education and Training Quality Assurance bodies (South Africa, Department of Higher Education and Training, 1995). These bodies are responsible for accrediting providers of education and training standards and qualifications registered on the NQF, monitoring provision, evaluating assessment and facilitating moderation across providers, and registering assessors. The ETQA responsibilities of SETAs will remain according to the mentioned SAQA regulations, until such time as the minister of labour publishes new regulations replacing the existing regulations, thereafter the responsibilities will reside with the Quality Council for Trade and Occupations (QCTO).

In respect of professional bodies SAQA must develop and implement policy and criteria for recognising a professional body and registering a professional designation for the purposes of this Act, and after consultation with statutory and non-statutory bodies of expert practitioners in occupational fields and with the QCs it must recognise a professional body and register its professional designation if the relevant criteria have been met (South Africa, Qualifications Authority, 2011).

2.5.3 The National Qualifications Framework

The National Qualifications Framework (NQF) is a comprehensive system approved by the minister for the classification, registration, publication and articulation of quality-assured national qualifications. In short, the NQF is the set of principles and guidelines by which records of learner achievement are registered to enable national recognition of acquired skills and knowledge, thereby ensuring an integrated system that encourages life-long learning (South Africa, Qualifications Authority, 2011).

2.6 Public Higher Education Institutions

Chapter 3 of the Higher Education Act (South Africa, Department of Education, 1997, p. 20) allows the Minister of Education to establish public higher education institutions in one of two ways. The first is to consult with the CHE, appropriate money for the purpose of establishing a new institution, and then place a notice in the *Government Gazette* establishing the new institution. The second manner in which a public higher education institution may be created is through an Act of Parliament. Once the Act is signed the institution is deemed to be a public higher education institution governed under the Higher Education Act. This Act stipulates that the notice establishing the new institution must state the date of establishment, the type and name of the institution, as well as the physical address of the institution. Higher education institutions are juristic persons under the Act. The minister may, after consulting

with the CHE and the governing structures of a public institution and after the placing of notices in the newspapers circulating in the applicable languages in the areas in which the education institution provides higher education, and after notice in the gazette, declare any institution providing higher education as a public higher education institution. If the education institution is privately owned then the consent of the owner and the minister of finance are required. Once established the public higher education institution becomes subject to the laws applicable in terms of the Higher Education Act.

2.7 Governance of Public Higher Education Institutions

Chapter four of Act 101 of 1997 as amended covers the requirements for institutional governance structures. Every public higher education institution may have a chancellor as the titular head, but must have a Council, a senate, a principal, a vice-principal, a student representative Council (SRC), an institutional forum and any other structures determined by the institutional statute (South Africa, Department of Education, 1997). Only one of the statutes promulgated by the institutions requires an ICT governance organ. The Council of a public higher education institution must govern the public higher education institution according the Higher Education Act, any other applicable laws and the institutional statute. The Council must consist of the principal, the vice principal(s), not more than five persons appointed by the minister, members of the senate elected by the senate, academic employees of the institution elected by such employees, students of the public higher education institution elected by the students representative Council, employees other than academic employees elected by such employees and such additional persons as determined by the institutional statute. At least sixty percent of the Council must be made of persons who are not employed by, or students of the public higher education institution (South Africa, Department of Education, 1997). The members of Council must be persons with knowledge and experience relevant to the objects and governance of the public higher education institution concerned. Subject to the policy determined by the minister, Council in conjunction with senate must determine the language policy of the institution.

The senate of a public higher education institution is accountable to the Council for the academic and research functions of the public higher education institution. It must consist of the principal, vice-principal(s), academic employees, other than academic employees, members of Council, members of the student representative Council and such members that may be determined by the institutional statute (South Africa, Department of Education, 1997). The majority of members of a senate must be academic employees of the public higher

education institution concerned. Committees of Council and senate may appoint persons that are not members of these committees to perform function on their behalf. They may also establish joint committees. The composition, manner of election, function, and procedure at meetings and dissolution of committees and joint committees are determined by the institutional statute, rules, or an act of parliament. The principal of a public higher education institution is responsible for the management and administration of a public higher education institution. The institutional forum includes stakeholder representatives from management as determined by the institutional statute or an act of parliament, the Council, the senate, the academic employees, employees other than academic employees, the students and any other category as determined by the institutional statute. The institutional forum must advise the Council on issues affecting the institution including, the implementation of the Higher Education Act, race and gender policies, the selection of candidates for senior management positions, code of conduct mediation and dispute resolution procedures and the fostering of an institutional culture which promotes tolerance and respect for fundamental human rights and an appropriate environment for teaching and learning and research.

The Council of a public higher education institution may make an institutional statute, subject to section 33 to give effect to any law relating to the public higher education institution and to promote the effective management of the institution in respect of matters not expressly prescribed by any law. The institutional statute or institutional rules in connection with the composition of the senate may not be amended or repealed without *consultation* with the senate and the academic functions of a public higher education institution including the studies, instruction and examinations of students and research may not be made, amended or repealed without the *concurrence* of senate. The composition of the SRC may not be amended or repealed without *consultation* with the SRC. Disciplinary measures and procedures may not be made without *consultation* between both the senate and the SRC. The institutional statute must be approved by the minister.

The Council of a public higher education institution must appoint its employees and determine the conditions of service, disciplinary provisions, privileges and function of the employees in terms of applicable labour law. Academic employees may only be appointed after consultation with senate. The student's representative Council, composition, manner of election, term of office, functions and privileges are determined by the institutional statute (South Africa, Department of Education, 1997).

2.8 Funding of Public Higher Education Institutions

The Education White Paper three (South Africa, Department of Education, 1997) outlines the program for the transformation of higher education and states that a new funding framework would be required to facilitate the transformation of the higher education system. These transformation goals included those of more equitable student access, improved quality of teaching and research, increased student progression and graduation rates, and greater responsiveness to social and economic needs. The funding framework would have function as a mechanism which will help steer the higher education system towards the achievement of the goals of transformation, be integrated with the other steering mechanisms of student enrolment planning and overall institutional planning.

A further requirement of the 1997 White Paper was that the government funds allocated to higher education institutions would be divided into block grants and earmarked grants. Block grants are undesignated grants which may be spent at the discretion of the Council of each institution, and earmarked grants are funds which may only be used for specific purposes designated by the minister. The Higher Education Act of 1997 gives the Minister the power to determine what proportions of the higher education budget are to be allocated to block and earmarked grants. The minister also determines annually, within the context of the Medium Term Expenditure Framework (MTEF), what the allocations to various sub-categories of the block and earmarked grants should be (South Africa, Department of Higher Education and Training, 2010). The present version of the higher education funding framework was approved by the ministers of education and finance at the end of 2003. It was introduced in phases over a three-year period 2004/05 to 2006/07, to ensure that the higher education system was not destabilised by rapid changes in the government income of individual universities. This migration strategy ended after the allocation to institutions of funds for the 2006/07 financial year. The funding framework has now been implemented in full since the 2007/08 financial year.

The Higher Education Act (South Africa, Department of Education, 1997) requires the minister to, after consulting with the CHE and with the concurrence of the minister of finance, determine the policy for the funding of public higher education institutions and the notice must be published in the *Government Gazette*. The minister must allocate public funds on a fair and transparent basis. The New Funding Framework (NFF) requires the minister to make an annual statement on the following forward determinations (South Africa, Department of Higher Education and Training, 2003).

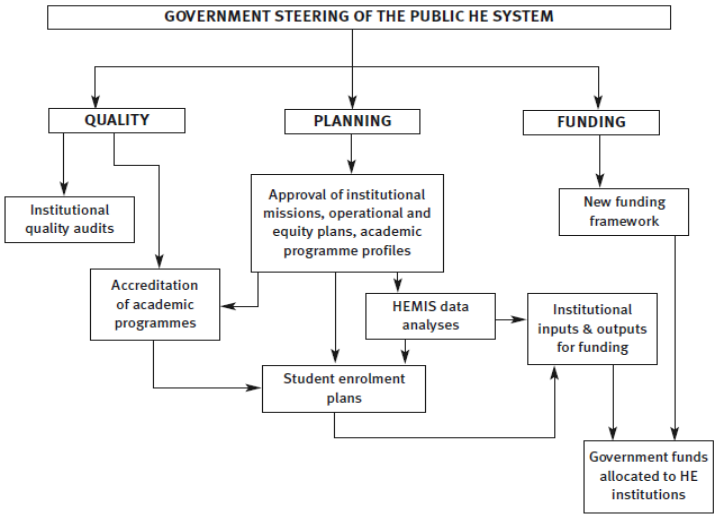


Figure 2-2: South African Government Steering Mechanisms of the Public Higher Education System (Department of Higher Education and Training, 2010)

This statement should include a forecast of the grant totals likely to be available for distribution to the public higher education system for the next triennium, a forecast of the public higher education system's likely totals of outputs and of planned student inputs, details of how the data required for input, output and institutional factor calculations will be determined, details of the input and output weightings, and of the various benchmarks to be employed in the calculation of block grants, details of how unallocated proportions of output block grants will be redistributed and how institutional factor grants will be calculated, as well as an account of the implementation of the framework, and of the steps taken to ensure that the public higher education system is not destabilised. The latest period 2009/2010 to 2011/2012 is used as the latest available reference period in this work. The MTEF has block grant and earmarked grant allocations. Block grants are for teaching inputs, institutional factors, teaching outputs and for research outputs. Earmarked grants are for the National Student Financial Aid Scheme (NSFAS), interest and redemption on loans, improving infrastructure and output efficiencies, clinical training of health professionals, national institutes, foundation programmes, veterinary sciences earmarked grants, multi-campus earmarked grants, teaching development grants and research development grants.

2.8.1 The Teaching Input Grant

The teaching input grid consists of aggregations of educational subject matter categories (CESM categories), which are subject to weightings by funding group and by course level. These grids distinguish between the teaching inputs of all contact and distance programmes

up to and including honours level. For the purposes of teaching input funding, all distance masters and doctoral programmes are given the same weightings as contact programmes and these are shown in Table 2-2.

Funding Group	CESM Categories included in funding group
1	07 – Education, 12 – Law, 18 – Psychology, 19 – Public Administration and Services
2	04 – Business, Economics and Management Studies, 05 – Communication and Journalism, 06 – Computer and Information Sciences, 11 – Languages, Linguistics and Literature, 17 – Philosophy, Religion and Theology, 20 – Social Sciences.
3	02 – Architecture and the Built Environment, 08 – Engineering, 10 – Family Ecology and Consumer Sciences, 15 – Mathematics and Statistics
4	01– Agriculture and Agricultural Operations, 03 – Visual and Performing Arts, 09– Health Professions and related Clinical Sciences, 13 – Life Sciences, 14 – Physical Sciences

Table 2-2: CESM Categories included in Funding Groups (Department of Higher Education and Training, 2010)

Table 2-2 is applied to the corresponding un-weighted full time equivalent (FTE) students in that cell, thus generating weighted teaching input units for the particular cell. The total of weighted teaching input units for an institution will be the sum of the input units of all the grid cells.

Funding Group	Undergraduate and Equivalent		Honours and Equivalent		Masters and Equivalent		Doctoral and Equivalent	
	Contact	Distance	Contact	Distance	Contact	Distance	Contact	Distance
1	1.0	0.5	2.0	1.0	3.0	3.0	4.0	4.0
2	1.5	0.75	3.0	1.5	4.5	4.5	6.0	6.0
3	2.5	1.25	5.0	2.5	7.5	7.5	10.0	10.0
4	3.5	1.75	7.0	3.5	10.5	10.5	14.0	14.0

Table 2-3: Weighting Factors for Teaching Inputs (Department of Higher Education and Training, 2010)

The teaching input unit total currency allocation is an indicator of the 'size and shape' of the institution. The size and shape is a reflection of the number of full time equivalent (FTE) students as well as the areas of study categories defined in the CESM categories.

The annual growth rate in the number of enrolments as well as the enrolments per CESM category are controlled by the DHET. Teaching input grants are weighted according to CESM categories and FTE values. Full-time students contribute more than part-time students to the income grant allocation. Institutions that enrol students outside the approved numbers do not qualify for a subsidy. The table inTable 2-3 indicates an example of the weighted teaching input units for 2011/2012. It is important that institutions manage their size and shape to ensure that they are fully funded. The example shows universities that have managed enrolment to within 2,1% at best and to within 30,7% at worst. The shortfall or excess of students enrolled results in a budget shortfall which is not covered by the DHET or a budget excess which needs to be refunded to the DHET should the enrolments not take place. The accuracy with which institutions manage enrolments is a contributor to the efficiency of the institution. Small deviations from enrolment targets do not have a significant influence on governance but deviations as large as 30% underfunding will clearly contribute negatively to both the management and governance of institutions.

	Generated for 2011/2012 by projected 2009 FTE student enrolments	Approved target total for 2011/2012	Generated total less target total	
			Unfunded (thousands)	Unfunded percentage
Cape Peninsula University of Technology	50,4	49,3	-1,1	-2,3
University of Cape Town	51,1	54,0	2,9	5,3
Central University of Technology	18,4	16,4	-1,9	-11,6
Durban University of Technology	33,8	35,6	1,7	4,8
University of Fort Hare	15,1	12,6	-2,5	-19,7
University of Free State	49,2	45,8	-3,3	-7,3
University of Johannesburg	77,9	68,9	-9,0	-13,1
University of KwaZulu-Natal	66,3	82,7	16,4	19,8
University of Limpopo	37,4	36,5	-0,9	-2,4
Mangosuthu University of Technology	13,6	14,0	0,4	3,2
Nelson Mandela Metropolitan University	32,9	37,5	4,7	12,4
North West University	51,2	57,1	5,9	10,3
University of Pretoria	92,7	94,6	2,0	2,1
Rhodes University	13,1	12,6	-0,5	-4,2
University of South Africa	124,4	97,1	-27,3	-28,1
University of Stellenbosch	60,8	52,0	-8,8	-17,0
Tshwane University of Technology	71,9	74,7	2,8	3,7
Vaal University of Technology	26,3	25,6	-0,8	-3,1
University of Venda	16,4	15,2	-1,2	-7,7
Walter Sisulu University	44,4	34,4	-1,0	-29,0
University of the Western Cape	29.8	31.6	1.7	5.4%
University of the Witwatersrand	59.5	61.7	2.3	30.7%
University of Zululand	19.2	17.2	-1.9	-11.1%

Table 2-4: Weighted Teaching Input Units 2011/2012 (Thousands), (Department of Higher Education and Training, 2010)

The effect of underfunding will be especially evident in the poor provisioning of ICT resources. There is also no specific funding provided for ICT assets which have to be funded out of institutional grant funding.

2.8.2 The Teaching Output Grant

The current funding framework requires teaching output grant allocations to be determined on the basis of an actual weighted total of teaching outputs produced by each institution and a normative weighted total of the teaching outputs that each institution should have produced in

accordance with the benchmarks laid down by the minister. All completed certificates, diplomas and degrees, up to and including non-research masters degrees, are recognised as teaching outputs for the purposes of the calculation of actual teaching output grants. No differentiation is made between the teaching outputs of distance and contact programmes. The table in Table 2-5 lists the weightings for teaching outputs for the year 2011/2012.

1st certificates and diplomas of 2 years or less	0,5	1st Diplomas and Bachelor's Degrees: 3 years	1,0
Postgraduate and post diploma diplomas	0,5	Professional 1st Bachelor's Degree: 4 years and more	1,5
Honours degrees and higher diplomas	0,5	Postgraduate bachelor's degrees	1,0

Table 2-5: Weightings for Teaching Outputs 2011/2012 (Department of Higher Education and Training, 2010)

Normative totals for the 2010/11 financial year are based on the actual totals generated by each institution's 2008 head count student enrolment, using the benchmarks set out in Table 2-6. The benchmarks indicate what proportion of a university's head count enrolment in a given academic year is expected to graduate in that year. For example, if a university had in 2008 a total of 10 000 students enrolled in three-year undergraduate qualification, then it is expected to produce 10 000 x 0.225 = 2 250 graduates in 2008 in those qualifications.

	Contact %	Distance %
Undergraduate: up to 3 years	22,5	13,5
Undergraduate: 4 years or more	18,0	9,0
Postgraduate: up to honours	54,0	27,0
Postgraduate: up to masters	29,7	22,5

Table 2-6: Ministry Benchmark Graduation Rates for 2011/2012 (Department of Higher Education and Training, 2010)

The normative and actual totals of teaching outputs will be used to divide the MTEF provisional allocation for teaching outputs for 2010/11 between an amount for actual teaching

outputs and an amount for teaching development. This is shown in Table 2-7.

	Degree Credits: 2007		Teaching Development Funds	
	Total	**Share of total %**	**2009/2010 allocation on new formula**	**Actual 2009/2010 allocation: rands (millions)**
Cape Peninsula University of Technology	16 461	4,47	19	0
University of Cape Town	14 507	3,94	16,7	0
Central University of Technology	6 067	1,65	7	0
Durban University of Technology	12 740	3,46	14,7	0
University of Fort Hare	5 689	1,54	6,6	0
University of Free State	12 753	3,46	14,7	15,7
University of Johannesburg	23 807	6,46	27,5	9,9
University of KwaZulu-Natal	20 930	5,68	24,1	3,1
University of Limpopo	10 946	2,97	12,6	0
Mangosuthu University of Technology	5 586	1,52	6,4	4,6
Nelson Mandela Metropolitan University	12 419	3,37	14,3	0
North West University	24 487	6,64	28,2	0
University of Pretoria	27 981	7,59	32,3	3,8
Rhodes University	4 389	1,19	5,1	0
University of South Africa	63 159	17,14	72,8	229
University of Stellenbosch	15 108	4,10	17,4	0
Tshwane University of Technology	30 668	8,32	35,4	12,8
Vaal University of Technology	8 719	2,37	10,1	7,6
University of Venda	7 789	2,11	9	11,7
Walter Sisulu University	14 563	3,95	16,8	29,2
University of the Western Cape	9 132	2,48	10,5	7,4
University of the Witwatersrand	1 4391	3,91	16,6	4,9
University of Zululand	6 225	1,69	7,2	1,7

Table 2-7: Teaching Development Funds on Current and New Allocation Mechanisms 2009/2010 (Department of Higher Education and Training, 2010)

Totals of the actual weighted teaching outputs (B) and of the normative weighted teaching outputs (M) of all institutions are calculated. The amount available for actual teaching outputs for the system is then determined as (B ÷ M) × teaching output allocation. The total available for teaching development for the system is the balance remaining after the amount for actual

teaching outputs has been deducted from the total MTEF teaching output allocation. An institution's currency (rand) allocation for actual teaching outputs is determined as: [(Institutional weighted total of teaching outputs) ÷ (system's weighted total of actual teaching outputs)] × (currency (rand) total for actual teaching outputs calculated in Table 2-7 above). Only those institutions whose actual weighted totals of teaching outputs are less than their normative weighted teaching output totals receive teaching development funding. An institution's teaching development grant is determined in this way: [(Institutional shortfall between actual and normative teaching output totals) ÷ (total of all teaching output shortfalls)] × (rand total for teaching development).

2.8.3 The Research Output Grant

Current policies require research output grant allocations to be determined on the basis of an actual weighted total of research outputs produced by each institution and a normative weighted total of the research outputs which each institution should have produced, in accordance with benchmarks laid down by the minister. Doctoral and research masters graduates and publication units are recognised as research outputs for the purposes of calculating research output grants. The weightings to be applied to these three categories of outputs are set out in the table in Table 2-8.

Publication units	1
Research masters graduates	1
Doctoral graduates	3

Table 2-8: Weightings for Research Outputs 2010/2011 (Department of Higher Education and Training, 2010)

The normative and actual totals of research outputs are used to divide the MTEF's provisional allocation for research outputs for 2010/11 between an amount for actual research outputs and an amount for research development. Totals of the actual weighted research outputs (A) and of the normative weighted research outputs (N) of all institutions are calculated. The amount available for actual research outputs for the system is then determined as: (A ÷ N) multiplied by total research output allocation. The total available for research development for the system is the balance remaining after the amount for actual research outputs has been deducted from the total MTEF research output allocation. An institution's allocation for actual research outputs is determined as: (Institutional weighted total of research outputs) ÷ (system's weighted total of actual research outputs)] × (rand total for

actual research outputs calculated.) Only those institutions whose actual weighted totals of research outputs are less than their normative weighted research output totals receive research development funding. An institution's research development grant is determined by: [(Institutional shortfall between actual and normative research output totals) ÷ (total of all research shortfalls)] × (rand total for research development calculated).

2.8.4 Institutional Factor Grants

Provision is made in the MTEF for a "single institutional factor" grant to be distributed to institutions. This grant is currently distributed to institutions in accordance with the shares which they have of the total of additional teaching input units generated by three factors: the proportion which an institution has of students from disadvantaged backgrounds, the size of its FTE student enrolment and whether it is required primarily as a result of a merger to operate on more than one official campus (the multi-campus factor). From 2010/11 the only institutional factors included in the block grants will be those of disadvantage and size. The multi-campus factor will from 2010/11 become an earmarked grant.

Earmarked multi-campus allocations for the period 2010/2011 to 2011/2012		
	2010/2011	2011/2012
Cape Peninsula University of Technology	16,2	16,2
University of Johannesburg	15,6	15,6
University of KwaZulu-Natal	22,4	22,4
University of Limpopo	7,8	7,8
Nelson Mandela Metropolitan University	14,5	14,5
North West University	33,7	33,7
Tshwane University of Technology	14,2	14,2
Walter Sisulu University	23,6	23,6

Table 2-9: Earmarked Multi-Campus Allocations for Merged Institutions (rand millions) (Department of Higher Education and Training, 2010)

The table in Table 2-9 indicates the earmarked multi-campus allocations to merged institutions. Institutions that incorporated campuses of other institutions were not deemed to have merged.

2.8.5 Foundation Programme Grants

The Ministerial Statement on University Funding (2010) states that the appropriateness of the

current foundation programme model and policy will be reviewed by the DHET in the 2011/12 financial year and recommendations in this regard will feed into the funding review process. This financial allocation forms part of the DHET's earmarked funding category for which provision is made for R146 million in 2009/10, R185 million in 2010/11 and R177 million in 2011/12 (2010, p. 3).

2.8.6 Infrastructure and Efficiency Funding

The DHET has for the period 2010/2011 to 2011/2012 allocated a budget for improving institutional infrastructure and student output efficiencies. The Ministry of Education decided that this amount had to be used in ways that would lead to increases in the numbers and quality of graduates in engineering, life and physical sciences, teacher education and the health sciences. Improved provision had also to be made for students in official student residences. One of the conditions laid down by the DHET was that each university had to contribute funds from its own resources to approved projects. Institutions with strong balance sheets would be expected to contribute up to 50% of the cost of approved projects. The contributions of other institutions would fall in the range of 10 to 40%, depending on the Department's assessment of their balance sheets.

2.8.7 Clinical Training Grants

The DHET has for the period 2010/2011 to 2011/2012 allocated a budget for clinical training grants. The DHET's Health Sciences Review Committee has recommended to the minister that a revised formula be used to distribute these clinical training grants. The main recommendations are that the list of programmes eligible for these grants should be expanded to include programmes in nursing and clinical programmes offered by universities of technology and comprehensive universities and that the formula used for allocating these funds should be revised. The formula should, however, continue to be based on the head count totals of students in programmes which require students to have access to the patients, staff and facilities of provincial hospital services.

2.8.8 Veterinary Sciences

The DHET has made provision for moving the allocations made for veterinary sciences from the block grant to the earmarked category of funding. Increased amounts were allocated to institutions that offer veterinary sciences to meet the operational costs of clinical veterinary training in the absence of contributions from the Department of Agriculture. The increased

amounts are intended to function as incentives for the institutions to change the equity profiles of their students and to improve the distribution of veterinary specialisations through institutional cooperation and to increase the number of veterinary science graduates.

2.8.9 Summary of Institutional Grants

Funding to public higher education is extremely tightly controlled by the DHET as can be understood from the conditions stated above. The funding formula and mechanisms have evolved over the years to ensure that the growth of institutions is limited in terms of 'size' and 'shape'. Despite the absolute control of grant allocations to public higher education institutions by the DHET and feedback in terms of spending required in terms of the reporting regulation (South Africa, Department of Education, 2007), there is no requirement to report on ICT spending. All other categories of capital spending including library books and buildings require detailed reporting.

2.9 Appointment and Functions of an Independent Assessor

The CHE must appoint an independent assessment panel consisting of at least three suitable persons who have knowledge and experience of higher education, are not members of the CHE and comply with any other requirements determined by the CHE. Members of the panel are appointed for a period of not more than two years, and may be reappointed. The minister may, from the independent assessment panel, appoint an assessor who is independent in relation to the public higher education institution concerned to conduct an investigation at that institution after consulting the Council of the institution concerned, if practicable. Cases where an independent assessor may be appointed include situations that involve financial or other maladministration of a serious nature, or where the effective functioning of the public higher education institution has been seriously undermined or the Council of the institution has failed to resolve such circumstances or the appointment is in the interests of higher education in an open and democratic society. The independent assessor is required to conduct an investigation at the public higher education institution concerned and report the findings to the minister who will publish the report in the *Government Gazette*.

2.10 The Institutional Statute

The Standard Institutional Statute applies to every public higher education institution that does not have its own unique institutional statute until such time as the Council of that institution formulates its own institutional statute under section 32 of the Higher Education Act 1997 (South Africa, Department of Education, 1997).

2.10.1 The Institution

In terms of the institutional statute the institution consists of the Chancellor, the Council, the Senate, the Principal, two or more officers as the Council may determine each of whom is called vice-principal, or such other title as the Council may determine, one or more registrars as determined by the Council, the SRC, the institutional forum, the faculties, the departments, the schools and such other academic structures of the institution as may be determined by the Council, the academic employees of the institution, the non-academic employees of the institution, the students of the institution, the convocation of the institution, and such other offices, bodies or structures as may be established by the Council. The institution is a juristic person as contemplated in section 20(4) of the Higher Education Act. It may confer degrees and honorary degrees and award diplomas and certificates in its own name as contemplated in section 65B and 65C of the Act. The ability of individual institutions to formulate their own organizational structures in terms of an institutional statute are reflected on in the next section.

2.10.2 Structures Defined in the Standard Institutional Statute

2.10.2.1 The Chancellor

The Chancellor is the titular head of the institution and confers all degrees and awards all diplomas and certificates in the name of the institution.

2.10.2.2 The Council

Subject to the Higher Education Act 101 of 1997 (South Africa, Department of Education, 1997) and the institutional statute the Council governs the institution. The Council makes the rules for the institution and establishes Council committees, their composition and function. It appoints all employees and in the case of academic employees only after consultation with senate. It determines, after consultation with senate, the student admission policy, the entrance requirements and number of students in respect of higher education programs. It determines and provides student support services after consultation with the SRC. The Council also makes the institutional statute and is the employer in terms of the Basic Conditions of Employment Act (South Africa, Department of Manpower, 1997). It determines, after consultation with the senate, which academic structures are required and the functions of each structure, in order to ensure efficient governance, determines tuition fees, accommodation fees and any other fees payable by students as well as accommodation fees payable by employees. It approves the annual budget of the institution. The Council retains

responsibility for any functions delegated or assigned to anyone to perform. The Registrar as contemplated in section 26(4)(b) of the Act is the secretary to Council and acts as an electoral officer. Council must appoint an executive committee, an audit committee, a finance committee, an employment conditions committee, a planning and resource committee, a Council membership committee and such other committees as the Council may determine. At least sixty percent of the committees must be persons who are not employees or students of the university. Neither the Higher Education Act nor the Standard Institutional Statute currently requires an ICT governance or similar committee. The new draft reporting regulations published as notice 1002 of 2012 (South Africa, Department of Higher Education and Training, 2012, p. 23) indicate that there will be a requirement to implement an ICT governance framework and that reporting on ICT governance will be required although the format of the report is not stipulated. There is also an indication that there will be a specific requirement to report on significant ICT investment and also on ICT risk.

2.10.2.3 The Senate

Subject to the Act, the senate is accountable to the Council for all the teaching, learning, research and academic functions of the institution and all other functions delegated or assigned to it by the Council. The organization and superintendence of instruction and examinations, and of lectures and classes, vests in the senate and the senate, if delegated to do so by resolution of Council, may make or amend any rule relating to the curriculum for, or to the obtaining of, any degree, diploma, certificate or other qualification, but may do so only after consulting the relevant faculty board. If delegated to do so by resolution of the Council, Senate may make or amend any Rule relating to the manner in which students are to be examined, determine what standard of proficiency is required to be attained in any mode of assessment that may be used in order to satisfy the requirements for the obtaining of each degree, diploma, certificate or other qualification. Senate advises the Council on disciplinary measures and Rules concerning students and may make recommendations to the Council regarding the faculty to which each academic department, school or other academic structure belongs and may make recommendations to the Council regarding the establishment and disestablishment of faculties, academic departments, schools and other academic structures. It determines, in accordance with any relevant deed or gift, and after consultation with the principal, the conditions applicable to any scholarships and other academic prizes and determines the persons to whom scholarships and academic prizes are awarded. Senate may establish committees to perform any of its functions, may appoint persons who are not

members of the senate as members of such committees and may for this purpose deem a single person to be a committee (South Africa, Department of Education, 1997, p. 25). It determines the functions of its committees as well as the procedure of meetings of these committees and may make standing orders on procedures and delegation of powers for the better carrying out of its functions, which it may delegate but must take note of any action taken by a committee in exercising its delegated powers or functions when such committee reports its actions to the next meeting of the senate.

2.10.2.4 The Faculty Board

The faculty board is appointed by senate to regulate the activities of the faculties as determined by senate. Its composition is determined by senate.

2.10.2.5 The Institutional Forum

The institutional forum consists of two members of Council who are not employees or students of the institution, two members of management, two members of senate, two members representing the academic employees, two members representing the non-academic employees, two members from each sufficiently represented employees organisation, two students designated by the SRC and one or more members co-opted by the institutional forum for the specific purpose of assisting the institutional forum in respect of any specific project.

2.10.2.6 The Students Representative Council (SRC)

The students of the institution are represented in matters that may affect such students by the SRC, on which only registered students are eligible to serve. It is responsible for liaison with the Council, the senate, the management, the general public, other institutions, SRCs of other institutions, national or international student organisations, unions and news media. The SRC is the umbrella organisation for all student committees, clubs, councils and societies, granting or withdrawing recognition of such student committees, clubs, councils and societies as it deems appropriate, the coordination and supervision of the use of student's facilities and all matters pertaining to them, in conjunction with the institution's management, the convening and conducting of all authorised meetings of the student body and to be the managing body in all general referenda and petitions organised by the students within the rules. The SRC regulates the appointment of such office-bearers and establishing of such committees as it deems necessary, organises and promotes extramural activities among students, keeps account of all moneys paid over to it by the Council and any other moneys which may accrue to it in its capacity as representative of the students. It also allocates or disburses such funds

for use by students, and makes grants to approved student clubs, committees, societies and councils. The SRC bears the responsibility for the preservation of order at student functions, and the ensuring of good conduct at other approved meetings of students, the coordination of student involvement in all community projects initiated by it, bears the responsibility for all student publications, recommends to the Council rules to determine the conduct of its affairs and is the final decision-making body in all matters falling within its jurisdiction.

2.10.2.7 Convocation

The convocation consists of the principal, the vice-principal(s), the registrar(s), academic employees on the permanent staff of the institution, professor's emeriti and other retired academic employees and all persons who are or become graduates or diplomates of the institution and such other persons as the Council may determine. Matters discussed at meetings of convocation are decided by convocation.

2.10.2.8 Management and Senior Management

The Council determines the members of management in terms of section 31(2)(a) of the Higher Education Act (South Africa, Department of Education, 1997), and the members of senior management in terms of section 31(1)(a)(iii) are the principal, the vice-principal(s), the registrar(s), the deans of faculties and the administrative positions equivalent to the positions of the deans of faculties. The principal is the 'chief executive officer' of the institution. The principal is responsible for the day-to-day management and administration of the institution and has all the powers necessary to perform these functions. The principal reports to the Council. The principal is an ex officio member of all the committees of the Council and the senate. The Council may assign additional functions, and grant additional powers and privileges to the principal. When the principal is absent or unable to carry out the duties, the vice-principal designated by the Council takes over or the Council may appoint an acting principal.

2.10.2.9 Employees

Subject to section 34 of the Higher Education Act, the Council appoints employees according to the staffing policies of the institution as determined in the rules. The conditions of employment, including the determination and review of salaries of employees and all other forms of remuneration are approved by the Council according to the institution's policy as determined in the rules which may be amended from time to time by the Council. All

employees of the institution are subject to continuous evaluation in the performance of their duties.

2.10.2.10 Students

A person may be permitted by the Council to register as a student only if he or she satisfies the legal requirements, if any, for admission to study at the institution and, further, satisfies any other requirements for admission that may be determined by the Council and laid down in the rules. The requirements for admission of a student to faculties are set out in the rules and may be changed by the Council after consultation with the senate. A student is registered for one year or for such shorter period as the Council may determine in general or in a particular case.

2.10.2.11 Donors

The institution may receive monies and equipment of any sort from donors to assist the institution in providing quality education. The institution may recognise and register certain donors as determined in the rules.

2.11 Governance Matters Relating to the Human Resources of Public Higher Education Institutions.

The Standard Institutional Statute requires the Council of an institution to appoint members to the Council committees which include an executive committee, an audit committee, a finance committee, an employment conditions committee, a planning and resource committee, a Council membership committee and such other committees as required. There is currently no requirement to appoint an ICT governance committee of Council.

2.12 Concluding Remarks on the Structure of the Public Higher Education System in South Africa

The structure of the public higher education sector in South Africa, the demarcated area of this study, has been described in terms of formation, history and structure. The current requirements of the Higher Education Act and the associated reporting requirements in the regulation are explicit in terms of what needs to be governed, the structures required for governance and what reporting is required in terms of the governance cycle. The structures and mechanisms that are in place in public higher education show that there is currently no requirement to govern ICTs and related infrastructures. The public higher education sector is very well governed in most functional areas within the institutions as described above. The DHET needs to keep track of a lot of data that has to be accurate, as the funding model

depends on it. Financial, personnel and other data such as student enrolment and success data moves between institutions and the DHET at predefined governance intervals and according the rules laid down by the DHET in terms of legislation and regulations.

Large sums of state money are spent on public higher education and there is therefore a requirement for accountability and this can only be achieved through proper governance structures. As ICT continues to play an ever increasingly important role in public higher education institutions, and as it becomes more pervasive, and the cost to provide ICT systems and services also increases sharply, it is essential that the governance of ICT is also improved to ensure that value is created from the innovative potential inherent in the ICT domain. None of the current formal governance legislation and regulations described above makes any mention of ICT governance. The rest of the study focuses on researching the status of ICT governance in the public higher education sector and providing a value framework that can be used to understand the governance, and particularly the ICT governance issues in this sector in South Africa, which in turn can provide the support necessary to implement or strengthen ICT governance in an institution or between relevant elements of the system of education. The next chapter provides details on the research methodology that was followed in this study.

Chapter Three

Research Design and Methodology

3 Research Design and Methodology

3.1 Introduction

An introduction and background to this study was provided in chapter one. This chapter provides a detailed description of the philosophical paradigm in which the study takes place and also covers the research design, the research methods, population sampling, data collection methods, data analysis and the measures employed to ensure the trustworthiness and reliability of the data.

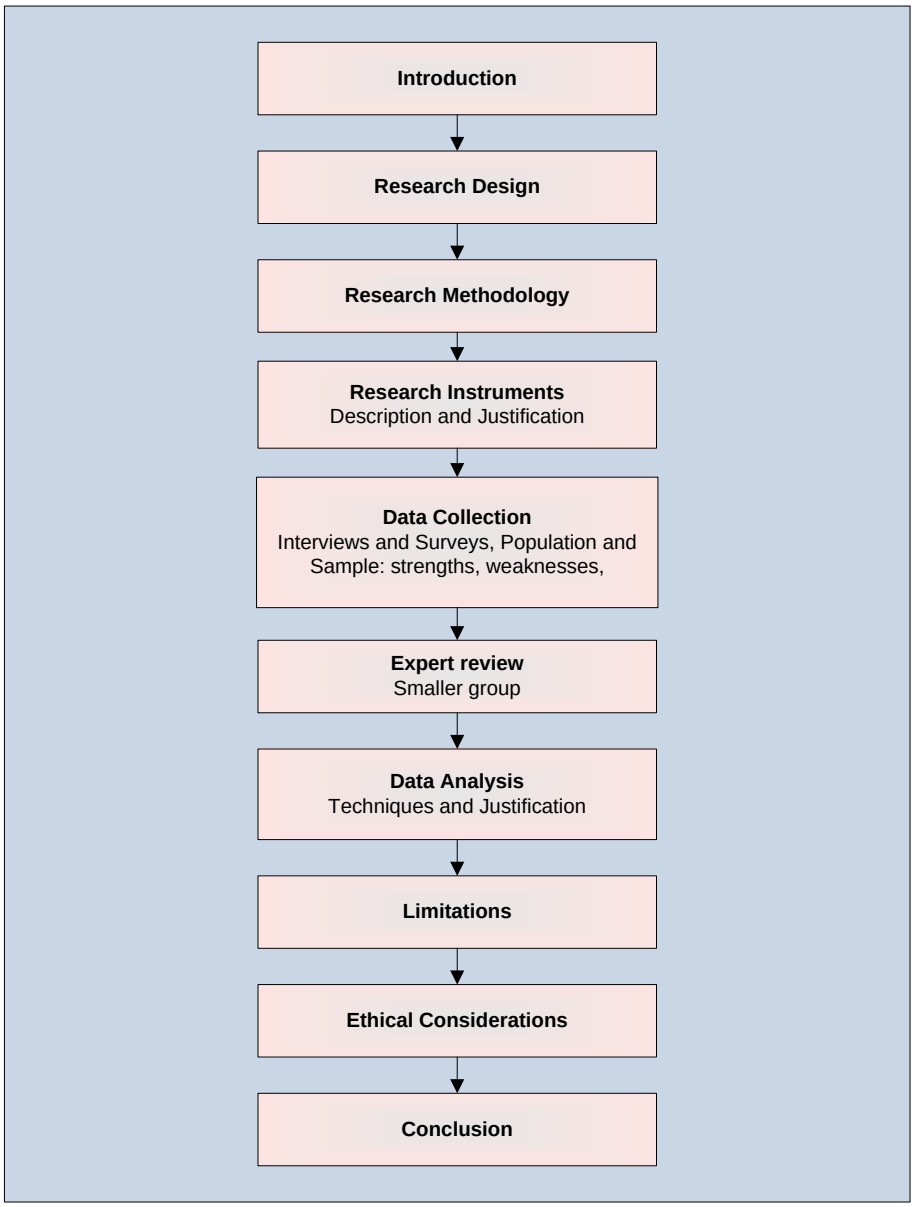


Figure 3-1: Research Design Chapter Layout

This chapter also provides the link between the research design and the research objectives and is structured to include elements recommended by Hofstee (2006) shown in Figure 3-1.

The primary objective of this study is to produce an ICT value framework that can be used to identify the value created by the implementation of ICT governance best practices in higher education institutions in South Africa. This value framework, its 'layers of governance' and the inhibitors to governance transfer between the layers of governance are addressed. This is done in terms of the organs of governance as well as their mechanisms to implement and transfer governance 'intent' or the governance mandate between the layers to ensure the maximum residual ICT governance at the functional level.

The secondary objectives are, firstly, to identify ICT governance practices in South Africa by specifically evaluating the ICT governance maturity at institutions; secondly, to ascertain the level of pervasiveness of ICT; and thirdly, to assess the alignment of the ICT processes to the business processes of the individual public higher education institutions.

3.2 Research Design

Any research has an underlying research paradigm that guides the way in which the research should be conducted (Collis & Hussey, 2009). The 'research onion' design process proposed by Saunders, Lewis and Thornhill (2003) was followed to cover the aspects of this research project in terms of the research paradigm, the research design, the research approach, the data collection methods and the data analysis techniques used in the study. There are several paradigms that exist, which can be distinguished by the philosophical assumptions on which they are based. Saunders, Lewis and Thornhill (2009) state that research philosophy relates to the development of knowledge and the nature of that knowledge and that the main research philosophies are positivism, interpretivism, realism and pragmatism. Positivism originated in the natural sciences and stresses the belief that social reality is singular and objective and not affected by the investigation of it. Interpretivism concentrates on exploring social complexity with the purpose of gaining interpretive understanding (Collis & Hussey, 2009). This section discusses the research paradigm selected for this study.

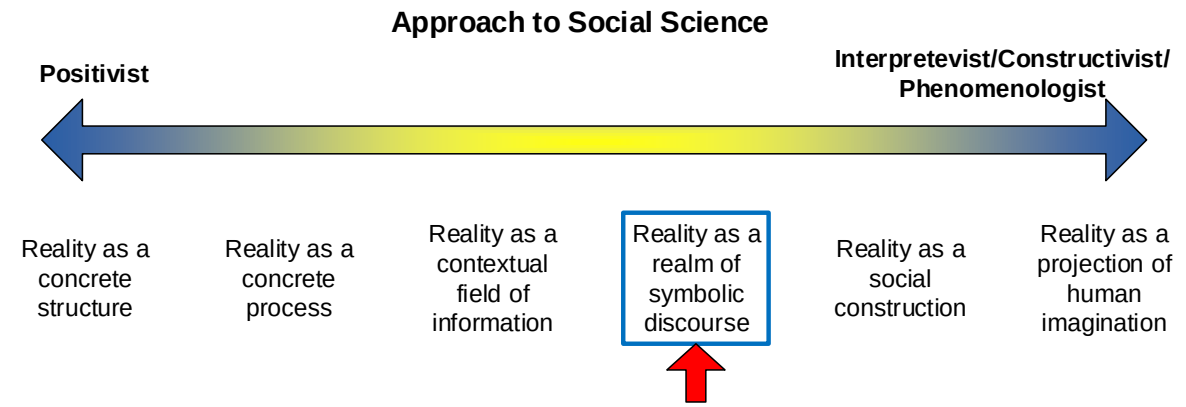


Figure 3-2: Typology of Assumptions on a Continuum of Paradigms (Morgan & Smircich, 1980, in Collis & Hussey, 2009, p. 61)

As illustrated in Figure 3-2, the positivistic and phenomenological or interpretive approaches are research paradigms at the extremes of a continuum, with several research paradigms combining elements from these two extremes in between. Collis and Hussey (2009) explain that few people operate purely within any one of these forms of research. Using a combination of the elements allows one to take a broader and often complementary view of the research problem or issue.

This research project focuses on a value framework created by applying good ICT governance principles from the highest governance level of the higher education environment in South Africa to the functional ICT level at individual institutions. This study leans towards an interpretivist approach (reality as a realm of symbolic discourse on the continuum represented in Figure 3-2), which is often linked to qualitative data collection, and is characterised as somewhat subjective (Collis & Hussey, 2009). This study does, however, include elements of the positivistic research paradigm due primarily to the context of this study and the structured research instruments used in the collection of data in the surveys.

The epistemological framework includes the open system characteristic of the higher education sector in South Africa and its cybernetic character involving governance, specifically ICT governance. The term ‘cybernetics’ is derived from the Greek noun *kubernetes* which is associated with ‘pilot’ or ‘rudder’ and was defined by Wiener (1965). The field of cybernetics came into being when concepts of information, feedback and control were generalised from specific applications, like engineering, to systems in general, including living organisms, abstract intelligent processes and language (Skyttner, 2005, p. 76). Cybernetics is a trans disciplinary approach for exploring regulatory systems, their structures,

constraints, and possibilities, also relevant in 'social systems' that have a feedback loop. Shortly after cybernetics emerged as an independent area of its own it became part of General Systems Theory (GST) and for practical purposes the two areas were integrated within the wider domain of problems that became the concern of systems science (Skyttner, 2005, p. 76).

3.2.1 Research Approach

The approach is based on inductive reasoning. This begins with formulated research questions and specific observations gathered from public higher education institutions and from which trends were identified. This lead to theories and general conclusions. For this research project these conclusions are value propositions that are formulated to create a value framework for ICT governance in the demarcated area of research. Four surveys address the areas of relative ICT pervasiveness, validation of the ICT pervasiveness factors, ICT governance maturity and business/ICT alignment. This information was obtained from the highest ranking ICT officer at each participating institution. Additionally, secondary-level audited financial data, available from the DHET was requested and provided. A literature review provides secondary information on the topics of intra-system governance discussed in chapter 8, institutional governance as well as ICT governance discussed in chapter 4, all of which provides the context for the study.

Online academic library resources available to the South East Academic Library Systems (SEALS) consortium covering many journals across multiple disciplines and online books on sites such as Springerlink were accessed to search for academic work relating to the measurement of ICT pervasiveness. The first survey on ICT process maturity measures the maturity level of ICT processes by the highest ranking ICT officer at the institution. This is measured against the COBIT 4.1 standard by assigning a value between zero and five to each of the 34 primary processes. The primary processes are listed in Annexure C. The second survey measures the alignment between the business and ICT processes using a framework developed by Luftmann and Brier (1999). The third survey provides an indication of the phenomenon of relative ICT pervasiveness. The results are intended to measure the extent to which ICT has become ubiquitous in the higher education sector in South Africa.

A fourth survey covering a wide scope of factors that affect pervasiveness targets the highest ranking ICT officer at responding institutions. The factors devised are not, however, able to be verified through literature review processes as the content in this area of specialisation is

extremely limited. Nevertheless, Karaiskos (2009) provides a basis on which to map the factors and the results of this mapping are presented later in this study. The range of factors are extremely diverse and so are their measures, such that a process of 'normalisation' of each factor is undertaken to ensure that the responses can be measured and presented without weighting any of them specifically.

The range of the measurement of each of the factors contributing to pervasiveness is converted to a standard range between zero and five using the normalisation rules defined for this purpose. These rules are further explained by the normalisation process relating to bandwidth, for example, having responses ranging from 0,1 megabits per second to ten gigabits per second needed to reflect a 'five' for the maximum bandwidth and a 'fraction of the maximum' for the rest of the measures. Certain questions require responses between zero and five whilst others require responses between zero and four. These are also normalised by expressing the responses firstly as a fraction, with the numerator being the specific institutions' response, and the denominator being the response with the largest value of the institutional responses.

The final list of factors all have responses ranging between zero and five and this is done to ensure that all factors carry the same weight and that no single factor is made more important than any of the others. Finally, the 'normalised' institutional responses are summed and then expressed as a percentage to provide the percentage relative ICT pervasiveness of each institution. The pervasiveness factors identified in this study are validated by compiling them into a set of questions requiring responses that range between 'strongly disagree – disagree – neutral – agree – strongly agree' and carrying weighting of -2, -1, 0, +1, +2, respectively and were sent to the top ICT official at all public higher education institutions to assess the relevance of each question to the measure of relative pervasiveness. The number of responses for each level of agreement is multiplied by the aggregated factor value returned in order to produce an 'agreement indicator' that can range between -32 and +32. Each of the 50 responses on the pervasiveness survey is calculated using the method above, thus providing the aggregated response per factor of pervasiveness measured. All response factor aggregates greater than zero are accepted as factors contributing to ICT pervasiveness.

3.3 Design Science Research

The approach to this research work is based on the principle of design science research from which the knowledge and understanding of a design problem and its solution are acquired in the building and application of an artefact, and the knowledge generated by this research also informs us on how an artefact can be improved, is better than existing solutions, and can more efficiently solve the problem being addressed (Hevner & Chatterjee, 2010). Associated with every research problem is a research paradigm. The design science research (DSR) paradigm is an important research paradigm in the Information System (IS) domain and involves the construction of a wide range of socio-technical artefacts, such as decision support systems, modelling tools, *governance strategies*, methods for IS evaluation, and IS change interventions (Gregor & Hevner, 2013, p. 337). The inclusion of governance strategies in the range of artefacts available for construction within the DSR paradigm is the main reason for its selection for this research project.

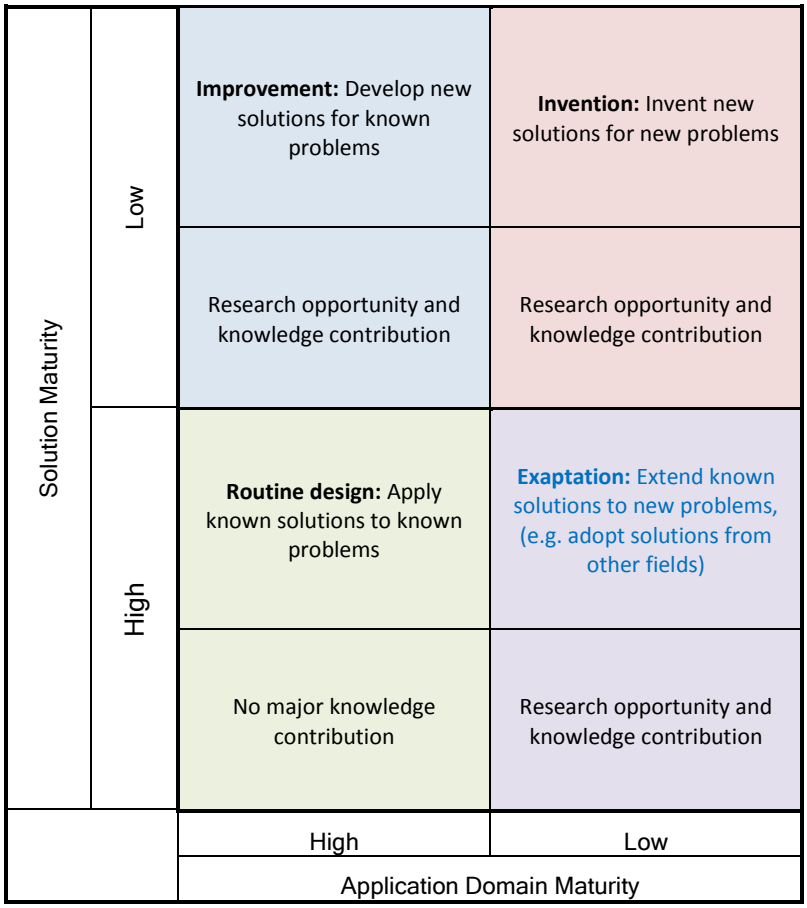


Figure 3-3: Design Science Research (DSR) Contribution Framework (Gregor & Hevner, 2013)

The four quadrants of the DSR contribution framework as well as their opportunity for research and knowledge contribution are shown in Figure 3-3. Gregor and Hevner (2013) describe the quadrants as follows:

The *invention* quadrant is reserved for artefacts that can be described as *rare* and *a radical breakthrough,* and could thus be described as *new solutions for new problems*. Inventions are rare and research in this quadrant is associated with little understanding of the problem context and no effective artefacts being available as solutions.

The *routine design* quadrant caters for the use of existing artefacts that can be used to address an opportunity or question. A new artefact is created in this study and thus the study cannot be placed in the *routine design* quadrant.

The goal of DSR in the *improvement* quadrant is to create better solutions in the form of more effective and efficient products, processes, services, technologies or ideas. Consequently, owing to the new value framework research output of this study, it does not reside in this quadrant either.

The identification of the quadrant into which the ICT governance framework or artefact resulting from this study fits is based on the definition associated with the *exaptation* quadrant of the DSR contribution framework. Solutions to problems related HR and financial governance are known and consistently implemented; however, the known solution to the problem of poor value identification from the implementation of ICT governance best practices is not being applied through legislation or regulation in the public higher education environment. This study can therefore be categorised into the *exaptation quadrant* of the DSR knowledge contribution framework. Guidelines for DSR are described below and are mapped to the chapters of this study in Figure 3-4.

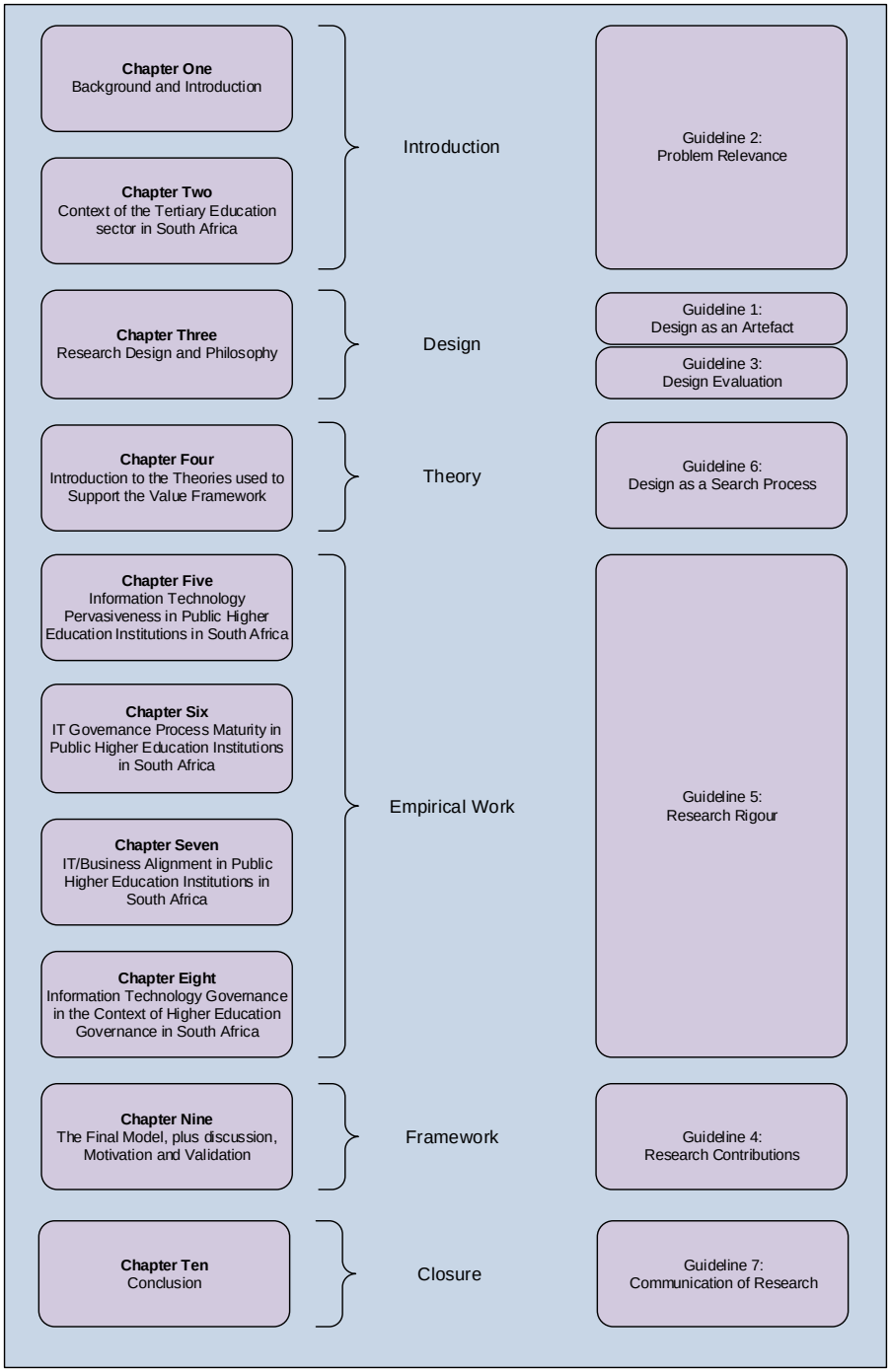


Figure 3-4: Design Science Research Approach (Hevner, March, Park & Ram, 2004)

Hevner et al., (2004) state that the discipline of Information Systems is characterised by two main paradigms – behavioural science and design science – and that whilst the behavioural science paradigm seeks to develop and verify theories that explain or predict human or organisational behaviour, the design science approach seeks to extend the boundaries of human and organisational capabilities by creating new and innovative artefacts. Hevner et al. (2004) go on to say that the result of DSR in Information Systems is, by definition, a

purposeful ICT artefact created to address an important organisational problem. It must be described effectively, enabling its implementation and application in an appropriate domain. Hevner et al. (2004) propose seven guidelines to manage this research process.

3.3.1.1 Guideline 1: Design as an Artefact

The artefact that results from this study provides a reference for further research in the measurement of ICT pervasiveness, ICT process maturity and ICT/business alignment in organisations, particularly public higher education institutions. It also provide the framework for ICT governance with particular focus on the 'layers of governance' that need to be addressed by structures, policy and procedures.

3.3.1.2 Guideline 2: Problem Relevance

The relevance of the problem is described in the introductory chapter of this study to cover the requirements of the King III Code (2009), as well as the absence of ICT governance requirements in public higher education legislation in South Africa. This results in a new and important functional area in higher education being left largely to its own devices or being covered as a consequence of other standard audit procedures that are not necessarily covered by standard audit legislation applicable to public higher education institutions in South Africa. There is a requirement in terms of the King III Code (2009) to implement an ICT governance framework, but this can be avoided by Councils of higher education institutions by simply deciding against its implementation by giving valid reasons for its non-adoption. Cost of implementation could suffice as such a reason.

3.3.1.3 Guideline 3: Design Evaluation

This guideline requires the utility, quality and efficacy of the artefact to be rigorously demonstrated by means of well-executed methods. The design of the pervasiveness survey that contributes to the pervasiveness element of the artefact is a relatively new concept as there are no other such measures found to have been undertaken after an extensive search of journals and books available through the South East Academic Library Systems (SEALS) consortium including, Science Direct, Springerlink and EBSCO host, amongst others. SEALS subscribes to many online journals, electronic books and other services that provide academic reference material. A study by Karaiaskos (2009) contributed in terms of the categorisation of the broader areas of pervasiveness. The second contribution to the artefact is designed by the researcher from the relevant laws governing the South African public higher education sector. The design evaluation method used in Hevner et al., (2004, p. 12) is descriptive having used

information from the knowledge base that in this particular case is made up from the relevant laws and reporting requirements applicable in the public higher education sector in South Africa.

3.3.1.4 Guideline 4: Research Contributions

This study contributes one artefact. This artefact is the value framework for ICT governance in public higher education institutions in South Africa. The first contribution to this artefact is the mechanism, foundational measurement and validation of ICT pervasiveness in public higher education institutions in South Africa. The second contribution to this artefact is the measurement of the ICT process maturity of these institutions using 34 COBIT 4.1 primary processes as the mechanism of measurement. A limited number of public higher education institutions in South Africa have measured ICT process maturity using commercial companies, but the evaluation of such maturity has not been undertaken before in the sector as part of a research project. The third contribution to the artefact produced from this research project is the measurement of the alignment of business and ICT processes in public higher education institutions in South Africa. The ICT governance value framework that is produced from this study can be used by institutions and governing authorities to understand and improve ICT governance and provides both the context and the content for structuring ICT governance in the institutions involved. The framework also contextualises ICT governance into 'layers' and provides possible mechanisms for overcoming the loss of the initial ICT governance 'intent' or mandate that is passed between the layers of governance to the functional layer. The objective of this framework is to ensure that the 'root' of governance is firmly grounded at the most relevant level in the framework and the optimal governance intent or mandate is passed through the layers of governance to the functional layer.

3.3.1.5 Guideline 5: Research Rigour

The construction of the pervasiveness element of the artefact was an iterative process, being refined though three stages of circulation for improvement to the highest ranking ICT officer at the public higher education institutions in South Africa. The scope of the measurements was refined after each iteration in the process and irrelevant measures were removed. During the process the normalisation of the measures took place to be able to compare the un-weighted measures with each other. The scales associated with the measures are not all based on the same type of measurements. An example of this is a question in the pervasiveness survey that requires information on the bandwidth available at institutions. The answer is in megabits per second per month and this is not be the same as a response on a scale of zero to

5. Subsequently, the responses are transformed or normalised to a scale of zero to 5. The final responses are summed and converted to a percentage. The final stage of ensuring rigour here is to go back to the respondents with a survey and ask them to confirm that each factor identified in the first pervasiveness survey did in fact have *some* influence on ICT pervasiveness. The iterative process employed assures the rigour required making certain that the final framework is evaluated and that all inputs provided through refinement are relevant.

3.3.1.6 Guideline 6: Design as a Search Process

The solution required in this study is the recognition that ICT governance and the consequential formalisation of a best practice framework in the public higher education sector in South Africa are required as much as the already formalised financial and HR governance in the sector. The connection between financial, HR and ICT governance is extensively explored in current legislation to ensure that the new foundation on which financial governance finds itself, that is, ICTs and systems, is governed well enough to ensure that the results of transactions across the scope of ICT systems are dependable and reliable. It can be concluded that, owing to the complexity of modern systems, ICT governance needs to be formalised.

3.3.1.7 Guideline 7: Communication of Research

The final stage of this research project is communicated through two papers, one covering the level of ICT governance maturity in the higher education sector and the second covering the multi-layered nature of the ICT governance framework as the artefact resulting from this research. The thesis will also be available on the Internet via the NMMU web portal. The public higher education sector, including the DHET, will also receive the research reports. This concludes the design science summary and leads to the discussion on the research instruments in the next section.

3.3.2 Research Instruments

The first research instrument to be utilised in this study is a comprehensive online survey on the COBIT 4.1 framework. The survey is appended as Annexure C and required all questions to be answered. The responses were not validated to ensure that they are within any norms, allowing some freedom in the responses. The respondents were required to indicate the institution that employs them and the assurance given that only the aggregated responses would be published. The first section of the survey required 24 responses. The first specific objective of the survey is to measure the ‘level of importance’ associated with each of the 34

primary COBIT 4.1 processes. The second specific objective is to ascertain if the ICT leaders in the public higher education sector have the same view in terms of which of the 34 primary processes are primary or secondary enablers in each of the five focus areas of the COBIT 4.1 framework. This portion of the survey required 170 responses. The final section of the survey required responses to ascertain the level of maturity of the 34 primary processes at each responding institution and required 34 responses. The survey was designed using the COBIT 4.1 framework and all responses were required in terms of the COBIT rankings of ICT process maturity ranging from: 1 – non-existent, 2 –initial or ad-hoc, 3 – repeatable but intuitive, 4 – defined, 5 – managed and measured, and 6 – optimised. The range is scaled to be able to properly represent the responses graphically as between zero and 5.

The second survey sought information on business and ICT alignment. This is based on Luftman and Brier's (1999) six components of alignment maturity, namely, communication, metrics, governance, partnerships, technology and human resources practices. The levels of measurement range from level one without process or not aligned at all, level two beginning process, level three establishing process, level four improving process and level five optimised processes or complete alignment. The factors associated with each of the above components are adapted to cater for the South African higher education environment. The survey targeted both ICT and management leaders in the institutions, thus reflecting the 'view' of alignment from both sections of the institutions.

The third survey is the survey on relative ICT pervasiveness in the public higher education sector in South Africa. It should be noted that the measures of pervasiveness are relative to the highest measure for each factor. There is no absolute measure as this would imply that there could be no improvement possible. This survey was constructed by the researcher to include as many factors that can affect pervasiveness in the sector. These factors are categorised according to the factors published in a study by Karaiskos (2009). Karaiskos defines pervasiveness with three dimensions, namely, ubiquity, unobtrusiveness and context awareness. These are further classified into a second dimension with cognitive factors having performance expectancy and effort expectancy as secondary factors, an affective dimension with a secondary factor of perceived enjoyment, a third dimension of social factors being made up from social influence and personal innovativeness and the final dimension of facilitating conditions with a single secondary factor of perceived monetary value being associated with it. Karaiskos's (2009) research model is shown in Figure 3-5.

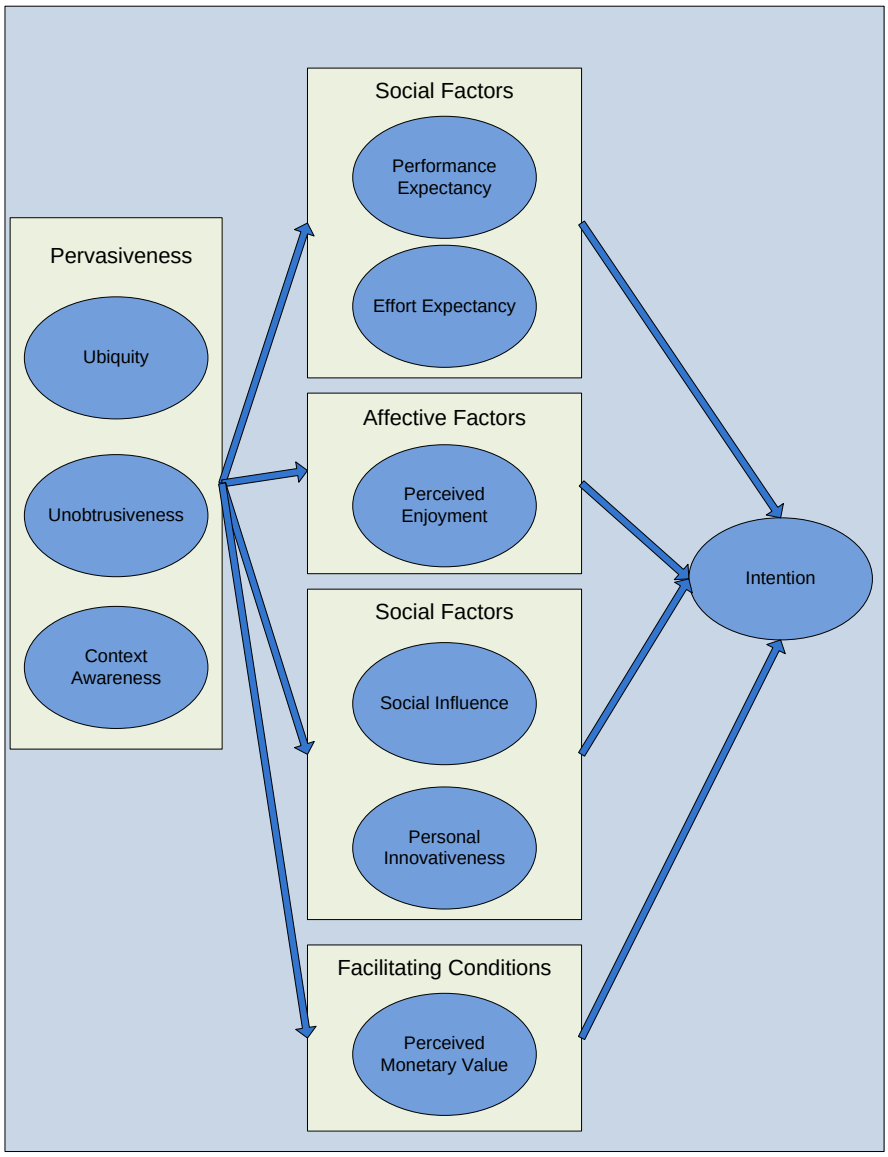


Figure 3-5: Pervasiveness Dimensions and Factors (Karaiskos, 2009)

The pervasiveness survey is made up of 55 questions that were mapped to the Karaiskos (2009) dimensions after the online surveys had been completed, as well as to the higher education functions required in terms of the Higher Education Act. The table in Figure 3-6 shows a sample of six of the mappings. The sample is random and shown only for explanatory purposes. The complete listing is appended as Annexure F.

Factors	Pervasiveness factors HE RSA	HE RSA factor classification	Pervasiveness factors Karaiskos	Second-tier factors Karaiskos	Rationale HE RSA
14	Does your institution provide laboratory computers for students to access the Internet?	Access	Cognitive factors	Performance expectancy	Improved throughput
15	How many laboratory computers provided by your institution were available to students during 2010? Include all open access laboratory computers, i.e. computers that any student can use at any time that the lab is open.	Access	Cognitive factors	Performance expectancy	Improved throughput
25	Does your institution provide Internet access to students in the residences?	Access	Cognitive Factors	Performance Expectancy	Improved Throughput
43	Are lecturers at your institution required to have competencies in information technology?	Competency	Cognitive factors	Performance expectancy	Improved throughput
18	Does your institution provide any type of wireless connectivity to those students who have their own computers?	Connectivity	Cognitive factors	Performance expectancy	Improved throughput
19	What is the BACKBONE bandwidth capacity that connects your institution to the Internet? (If yours is a multi-campus institution, the HIGHEST CONNECTION bandwidth of all access points) Please give the answer in megabytes	Connectivity	Cognitive factors	Performance expectancy	Improved throughput

Figure 3-6: Extract of Mappings of Karaiskos to Higher Education Factors of Pervasiveness South Africa

The objective of the pervasiveness survey in this study is to ensure that the need to govern ICT *formally* is supported by the relative levels of pervasiveness discovered through the survey. If the levels of ICT pervasiveness returned in the survey were relatively low it could imply that ICT is not in use in all aspects of public higher education and that ICT may then not need to be formally governed. The converse would then apply if the levels of ICT pervasiveness returned in the survey were relatively high. The pervasiveness survey has been designed to measure the level of ICT pervasiveness relative to other responding institutions and is not an absolute measurement.

3.3.3 Research Data

3.3.3.1 Secondary Data

Secondary data was acquired through a comprehensive literature study. This included data from previous studies by Karaiskos (2009) and EDUCAUSE, as well as audited statistical data from the DHET. Books, journals and electronic resources were also consulted. The online resources included all resources available to the SEALS. This is one of the five library consortiums in South Africa servicing the Eastern Cape Province (Thomas & Fourie, 2006). Other online resources such as Science Direct, Springerlink and EBSCO amongst others were also used extensively.

3.3.3.2 Primary Data

The primary data was acquired through five comprehensive online surveys administered through the commercial Survey Monkey system. These surveys are appended as Annexures A to D and are listed:

Annexure A: ICT Pervasiveness Survey	58 responses required
Annexure B: Validation of Pervasiveness Factors Survey	55 responses required
Annexure C: COBIT 4.1 Survey	241 responses required
Annexure D: ICT Alignment Survey	42 responses required
Annexure E: Final Value Framework Validation Survey	24 responses required

The survey system used ensured that each respondent could only see their own contribution and the download of data was done in spreadsheet format to minimise the possibility of capture errors. The ICT governance survey is based on the COBIT 4.1 framework that has been around for more than a decade. Although COBIT 5 is available, COBIT 4.1 was the version of COBIT in use at the time the survey was conducted in 2011. The ICT alignment survey was formulated from a Luftman and Briers (1999) framework which is well known and respected and has been around for some time.

The ICT pervasiveness survey was formulated and validated by the highest ranking ICT official at public higher education institutions in South Africa. Research data on the topic of ICT pervasiveness has been extremely difficult to find despite the many research sources available. ICT as a tool or an enabler is a relatively new business phenomenon having grown

out of the automation of financial and HR systems over the past few decades and the need to automate them.

The final source of data used is a spreadsheet provided by the DHET with audited financial data for the period 2004 to 2010. The data is compiled by the Higher Education Management Information System (HEMIS) office of the DHET. The data is also available in the annual reports of public higher education institutions.

3.3.4 Research Data Analysis

The positioning of this research on the continuum described in Figure 3-2 leans towards being interpretivist and therefore predominantly qualitative. The type of data collected with the surveys is well suited to an interpretive style rather than a purely qualitative analysis. This particular data is therefore interpreted and presented to support the research questions.

3.4 Limitations

The data in all five surveys is provided by the most senior ICT official at each responding institution and, in the case of the alignment survey, also by the registrar of the institution. There are no other persons in the structure of these institutions who would have the necessary knowledge and experience to be able to respond more accurately than people in these positions. A limitation could exist if the incumbents were newly appointed from other environments but appointments at this level usually come with the requisite experience and qualification. Limitations in the methodology itself are minimal as the DSR methodology is well structured and elements of the methodology are well defined. Researchers define the design science outcome as an artefact in the form of a construct, model, method or an instantiation (Hevner et al., 2004). Ostrowski and Helfert (2011) contend that activities such as focus groups, semi-structured interviews and workshops will still be involved as the main facilitators in the act of artefact design. Their study indicates that in 78% of all case studies, the researchers gathered relevant information for artefact construction from literature and practitioners in the field. The artefacts resulting from the COBIT 4.1 and the business/ICT alignment surveys are based on tested frameworks but the study on ICT pervasiveness in the higher education sector in South Africa is dependent on both the scope and validity of the ICT pervasiveness survey. Seasoned ICT practitioners who are in all cases the most senior ICT official at in the institutions were engaged to complete the surveys, thus reducing the risk of poor quality data and thereby improving the validity of the responses.

3.5 Ethical Considerations

Ethics, also known as moral philosophy, is a branch of philosophy that involves systematising, defending and recommending concepts of right and wrong conduct. There are many ethical issues to be taken into serious consideration for research, including research in the social sciences. Sociologists need to be aware of having the responsibility to secure the actual permission and interests of all those involved in the study. They should not misuse any of the information discovered, and there should be a certain moral responsibility maintained towards the participants. There is a duty to protect the rights of people in the study, as well as their privacy and sensitivity. The confidentiality of those involved in the observation must be carried out, keeping their anonymity and privacy secure.

The NMMU policy on research ethics subscribes to the principles of scientific responsibility and critical involvement, integrity and honesty, human dignity and of freedom of expression including freedom and transparency – principles which interact with one another, and which should always be understood in terms of their interrelationship and mutual coherence (Nelson Mandela Metropolitan University, 2013). In the research context these principles find expression in the relationship between the researcher and NMMU, the research community, society, the environment, the participants in the research, and the sponsors/clients of the research (Nelson Mandela Metropolitan University, 2013). Research has been undertaken in the context of the above policy and assurances given to participants was honoured. The undertaking to only publish aggregated data or data in which institutional identity is anonymous has been respected. The data responses returned to institutions that responded only revealed the relative position of the respondent in each case and this information has been limited to the responding institution.

3.6 Conclusion

This chapter has provided a detailed description of the philosophical paradigm in which the study takes place and also covers the research design, the research methods, population sampling, data collection methods, data analysis and the measures employed to ensure trustworthiness and reliability of the data. This chapter also provides the link between the research design and research objectives. This chapter has also covered design science as a research approach (Hevner et al., 2004). The positioning of the study in terms of the continuum in Figure 3-2 was identified as being that of ‘reality as a realm of symbolic discourse’. This leans towards a qualitative analysis requirement and the data is analysed using the interpretive techniques explained above. Literature and collaboration play an

important role in constructing/producing/developing an artefact (Ostrowski & Helfert, 2011). The artefact resulting from this study was produced in collaboration with most of the highest ranking ICT officers of the twenty-three higher education institutions and is unique in the South African higher education context.

Even though the scope of the pervasiveness survey can be broadened to include newly identified factors of pervasiveness, those identified have been validated by the highest ranking ICT officer at the responding institutions. Many research projects require theories to anchor the research work properly. These theories need to be relevant and should relate to the most important scholarship pertaining to the various facets of the research problem being solved (Hofstee, 2006).

This study focuses on systems and systems hierarchies with particular reference to the way the governance cycle spans systems and subsystems or layers within the public higher education system in South Africa. The primary theories relevant in this study are Agency Theory, which emanated from the seminal papers of Alchian and Demsetz (1972) and supported by the contribution of Eisenhardt (1989), and General Systems Theory (GST) first proposed by Von Bertalanffy (1969). The relevant theories are discussed in detail in the next chapter.

Chapter Four

Theoretical background towards the Value Framework

4 Theoretical background towards the Value Framework

4.1 Introduction

The objectives of this chapter are firstly to provide an association between the current governance structures of the public higher education system discussed in chapter two and the theoretical principles associated with public higher education governance in South Africa, specifically ICT governance, and, secondly, to provide some theoretical background to the value framework that is developed as the major contribution of this study. International ICT governance standards such as ISO/IEC 38500 and best practice frameworks such as the IT Governance Institute's COBIT 4.1 best practice frameworks are considered in order to ascertain the impact that these have on ICT governance practices in public higher education in South Africa.

Governance relationships are then explored in terms of General Systems Theory (GST), Agency Theory and the Universal Theory of the Acceptance and Use of Technology (UTAUT), to develop an ICT governance value framework for the public higher education sector in South Africa. The rationale for this investigation is provided by the current requirements of the Higher Education Act and the associated reporting requirements contained in the reporting regulation, which are explicit on what needs to be governed, both in terms of the structures required for governance and reporting in terms of the governance cycle. Financial, personnel and other data such as student data moves between institutions and the DHET at predefined governance intervals according to the rules laid down by the latter in terms of legislation and regulation.

The green paper on higher education clearly articulates that a comprehensive and enabling ICT infrastructure must be put in place for all post-schooling providers (South Africa, Department of Higher Education and Training, 2012). None of the current formal governance legislation and regulations in the public higher education sector makes any mention of ICT governance. There is, however, a proposed new regulation R1002 (South Africa, Department of Higher Education and Training, 2012, p. 26) that is currently published for comment which does make reference to the requirement for an ICT governance committee of Council and requires that an ICT governance framework is adopted. This requirement is moderated by the 'apply or explain' principle associated with the implementation of the King III Code of good practice (King III Code, 2009), which also applies to public higher education institutions. It is therefore still possible that the Council of a public higher education

institution could decide not to implement the requirements of chapter five of the King III Code which covers ICT governance, and explain its reasons for not doing so.

The Finance and HR disciplines are older and more entrenched than the ICT discipline which has only surfaced as an area of innovative interest over the past two or three decades. The potential for innovation in this young and dynamic discipline compared to the older and more entrenched disciplines reflects in the possible benefits that can be achieved through the implementation of ICT best practice frameworks. This is the primary motivating factor for the development of this value framework for the public higher education sector in South Africa. This value framework is built on core principles such as codes of best practice and hierarchical power relationships within and across systems, thus the rest of this chapter includes discussions on the King III Code of practice, Agency Theory, GST and the UTAUT to provide the foundational substance of the value framework. Discussions on the King III Code are included as the Code applies to all entities in South Africa and therefore also applies to public higher education institutions. GST is used to support opinions within the system of education, while Agency Theory is used to support the hand-over of governance intent or mandate within the system of public higher education. The UTAUT is used to validate positions put forward in terms of how governance relates to ICT and business alignment.

4.2 Defining Governance and Specifically ICT Governance

Governance concerns the exercise of power in entities. Corporate governance is defined by the Organization for Economic Co-operation and Development (OECD, 2004) as the system by which business corporations are directed and controlled. The corporate governance structure specifies the distribution of rights and responsibilities amongst different participants in the corporation, such as the board, managers, shareholders and other stakeholders, and spells out the rules and procedures for making decisions on corporate affairs. By doing this it also provides the structure through which the company objectives are set, and the means of attaining those objectives and monitoring performance.

Van Grembergen (2004) defines ICT governance as consisting of the organisational leadership, structures and processes that ensure that organisations' ICT sustains and extends their strategy and objectives. This definition is contrasted with the definition by the IT Governance Institute (ITGI) (2003), which defines enterprise governance as a set of responsibilities and practices exercised by the board and executive management with the goal of providing strategic direction, ensuring that objectives are achieved, ascertaining that risks

are managed appropriately and verifying that the enterprise's resources are used responsibly.

Weill and Ross (2004) place ICT in an organisational context as one of the six key assets – human, financial, physical, intellectual property, ICT and relationships – that must be *governed to create value*. To provide a better understanding of governance, the origins of governance are reviewed and presented in the following section.

4.3 The Origins of Governance

Clarke (2008, p. 2) states that "the development of corporate governance is bound intimately with the economic development of industrial capitalism: different governance structures evolved with different corporate forms designed to pursue new economic opportunities or resolve new economic problems". The early forms of corporate governance were generally put in place to define the rules of business when ownership and management separated. In early days businesses were owned and managed by individuals but, once this became impractical due to the size and capital requirements for maintaining business functions, other means of ensuring continued existence emerged. The reasons to govern were normally financially based, as without proper financial governance the continued existence of business entities would not be possible. Clarke (2008, p. 3) continues by saying that, as the multi-unit business enterprise grew in size and diversity and its managers became more professional, the management of the enterprise became separated from its ownership. This separation required a means of bridging between 'ownership' and 'management' and this 'bridge' became known as governance. This bridge or connection between ownership and management essentially defines the rules of engagement between the two parties.

Agency Theory is used in this study to expound upon this bridge and how interaction takes place between owners and management to ensure the continued existence of the entity, whatever it may be. Frentrop (2003) in Clarke (2008) reflects on the first recorded instance of a non-financial company with a diffuse share capital as being the Dutch East India Company, which was established in the early seventeenth century with more than 1 000 investors. This company was rapidly confronted by the key governance issues. Clarke (2008) states further that the need for additional capital was driven by the inexorable technological advances and the expansion of markets in the nineteenth century and this resulted in an increase in the scale and complexity of enterprises.

Roe (1994) offers the view that in the nineteenth century the pattern for constructing the largest American enterprises was one where entrepreneurs would found a business, make it

succeed, go public, issue new stock or sell the founders' stock; this often caused stock to diffuse into the hands of many shareholders. Governance has clearly been in the financial domain and, indirectly and to a lesser extent, in the HR domain. Prior to the advent of computers businesses were run by people and for people and to their advantage, either individual or collective, but since the advent of computers a technological element has been introduced to the domain in that a varying reliance on computers has emerged and needs to be included in stakeholder debates and decision-making processes.

If one uses a modern stock exchange as an example, it cannot function without its computer system. The quantity and speed of information processing has increased to the point that manual function of this and many other systems such as banks has become impossible. Peterson (2004) states that amidst the challenges and changes of the twenty-first century, involving hyper-competitive market spaces, electronically enabled global network businesses, and corporate governance reform, ICT governance has become a fundamental business imperative and is a top management priority because it is the single most important determinant of ICT value realisation. In contrast to the nearly 300 years of 'formal' corporate governance that has informed primarily the financial and human resources aspects of enterprises, the phenomenon of ICT governance has only emerged in the past three decades and is therefore immature and not yet recognised in many cases as an imperative for success in modern organisations.

In response to this need for governance structure, organisations have worked towards developing best practice frameworks and standards in an effort to contribute towards the formulation of explicit knowledge that can be used for further reference in both business and in further research. The public higher education sector in South Africa also needs to realise value from the implementation and use of ICT systems and should therefore also take notice of such best practices. The development and structure of some of these best practice frameworks and standards are reviewed below.

4.4 ICT Governance Standards and Best Practice Frameworks

The Australian standard for Corporate Governance of Information and Communication Technology (AS 8015 of 2005) was used to create the International Standard for Corporate Governance of Information and Communication Technology (ISO/IEC 38500). The ISO/IEC 38500 governance standard is a high-level, principles-based advisory standard that has responsibility, strategy, acquisition, performance, conformance and human behaviour as its

six principles (International Standards Organization, 2008). Corporate governance is defined in the standard as "the system by which the current and future use of ICT is directed and controlled" (International Standards Organization, 2008). The standard also states that the corporate governance of ICT involves evaluating and directing the use of ICT to support the organisation and monitoring its uses to achieve plans and concludes by stating that it includes the strategy and policies for using ICT within organisations. A diagrammatic representation is shown in Figure 4-1.

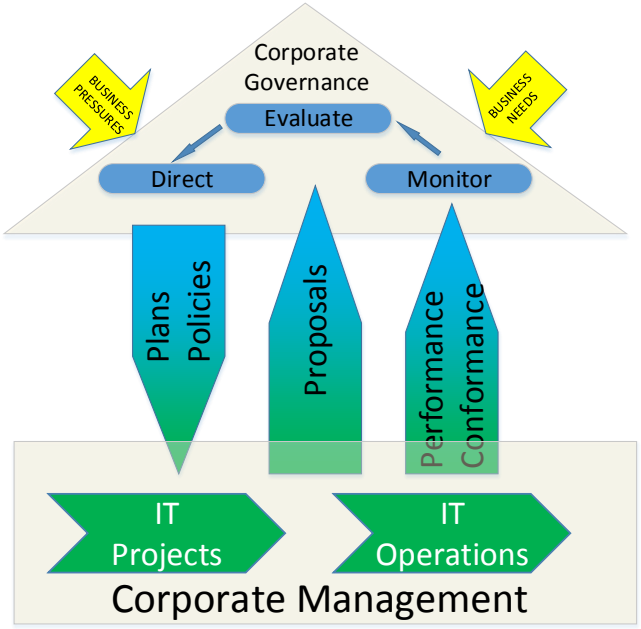


Figure 4-1: ISO/IEC 38500 Framework (Corporate Governance of ITIL ISO/IEC 38500 Case Study, September, 2008)

The guiding principles of the ISO/IEC 38500 standard express preferred behaviour to guide decision making and the statement of each principle refers to what should happen, but does not prescribe how, when or by whom the principles should be implemented, as such aspects are dependent on the nature of the organisation (International Standards Organization, 2008). A summary of the six principles of the ISO 38500 standard follows.

- The first principle is that individuals and groups within the organisation understand and accept their responsibilities in respect of both the supply of, and the demand for, ICT and that those with responsibility for actions also have the authority to perform those actions.
- The second principle requires that the organisation's business strategy take into account the current and future capabilities of ICT and that the strategic plans for ICT

satisfy the current and on-going needs of the organisation's business strategy.

- The third principle requires that ICT acquisitions are made for valid reasons, on the basis of appropriate and on-going analysis, with clear and transparent decision making, while there is appropriate balance between benefits, opportunities, costs and risks, in both the short term and the long term.
- The fourth principle is to ensure that ICT is fit for purpose in supporting the organisation, providing the services, levels of service and service quality required to meet current and future business requirements.
- Principle five requires conformance with all mandatory legislation and regulations, whilst policies and practices are clearly defined, implemented and enforced.
- The final principle suggests that ICT policies, practices and decisions demonstrate respect for human behaviour, including the current and evolving needs of all the 'people in the process'.

Many of these principles are evident in some way in the King III Code on corporate governance in South Africa. The King III Code includes ICT governance for the first time only in the third iteration of the Code, because initially information systems were used as enablers to business, but have since become pervasive in the sense that they are built into the strategy of the business. It is this pervasiveness of ICT in business today that mandates the governance of ICT as a corporate imperative (King III Code, 2009). Some of the reasons given in the King III Code for the inclusion of ICT governance in the code are that ICT is integral to a business to ensure it is sustained and grown, that ICT creates competitive advantage, that there is significant investment in ICT, that automation has created enormous reliance on ICT and, finally, that the emergence of e-trading has increased reliance on ICT systems (King III Code, 2009).

The King III Code has seven principles that govern ICT:

1. The board should be responsible for ICT governance.
2. ICT should be aligned with the performance and sustainability objectives of the company.
3. The board should delegate to management the responsibility for the implementation of an ICT best practice framework where this effectively formalises the need to adopt and implement an ICT best practice framework in which management is made responsible for the implementation of all the structures, processes and mechanisms of

the framework. Also significant in this section is the requirement to appoint an individual responsible for the management of ICT, often referred to as a chief information officer (CIO), who should be a suitably qualified and experienced person with access to, and who interacts regularly on, ICT governance matters with the board or appropriate board committee or both, as well as with executive management.

4. The board should monitor and evaluate significant ICT investments and expenditure. This can be achieved by clarifying business strategies and objectives and the role of ICT in achieving them, as well as measuring and managing the amount spent on and the value received from ICT.
5. ICT should form an integral part of the company's risk management programme. One of the key issues around ICT risk is the risk of ICT disaster and the code requires that management should regularly demonstrate to the board that the company has adequate business resilience arrangements in place for disaster recovery.
6. This principle concerns the information assets that the board should ensure are governed effectively. Information management initiatives are often driven by external regulations, requirements and concerns about data privacy, information security and legal compliance. In addition, the King III Code requires that formal processes be in place to achieve compliance with external regulations and legislation. The King III Code states that '*information records are the most important information assets as they are evidence of business activities'*. The King III Code requires that the board should ensure that there are systems in place for the management of information assets by ensuring the availability of information and information systems in a timely manner, by implementing a suitable information security management programme and by ensuring that all sensitive information is identified, classified and assigned appropriate handling criteria and that processes are established to continuously monitor all aspects of information.
7. The final principle in the King III Code for ICT governance is that both a risk committee and an audit committee should assist the board in carrying out its ICT responsibilities.

Despite the King III Code for ICT governance detailing many requirements in terms of information assets, the principle of application across all entities in South Africa remains one of 'apply or explain', significantly weakening the need to implement ICT governance best practices.

Another ICT governance initiative aimed at the improvement of ICT governance was established by the IT Governance Institute in 1998 to advance international thinking and standards in directing and controlling an enterprise's ICTs. It states that effective ICT governance helps ensure that ICT supports business goals, optimises business investment in ICT, and appropriately manages ICT-related risks and opportunities (IT Governance Institute, 2003). The Control Objectives in Information and Associated Technologies (COBIT) 4.1 best practice framework provides the control objectives that define the ultimate goal of implementing policies, plans and procedures, and the organisational structures designed to provide reasonable assurance that business objectives are achieved and undesired events are prevented or detected and corrected (IT Governance Institute, 2003).

Although COBIT version five was launched in 2012 all surveys associated with this study were designed and conducted using the COBIT 4.1 best practice framework, well before the launch of the latest version 5, of COBIT. For this reason, the entire study is conducted using COBIT 4.1. There are five focus areas in the COBIT 4.1 best practice framework which is shown in Figure 4-2. Performance measurement is essential for ICT governance and includes setting and monitoring measurable objectives of what the ICT processes need to deliver (process outcome) and how to deliver it (process capability and performance) (IT Governance Institute, 2003, p. 6).

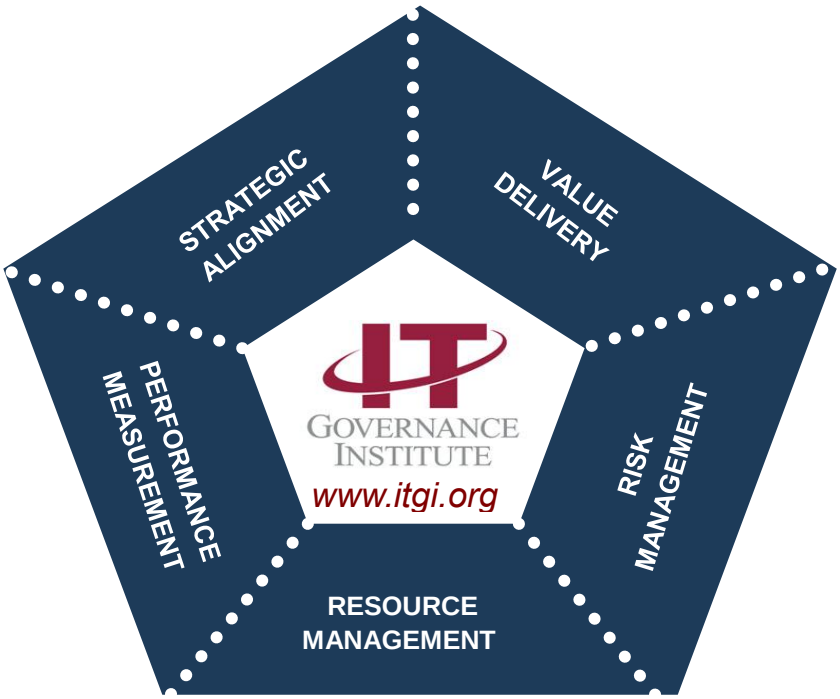


Figure 4-2: COBIT 4.1 Focus Areas

These five focus areas as defined in the COBIT framework are:

1. *Strategic alignment* which focuses on ensuring the linkage of business and ICT plans, defining maintaining and validating the ICT value proposition and aligning ICT operations with enterprise operations
2. *Value delivery* which is about executing the value proposition throughout the delivery cycle and ensuring that ICT delivers the promised benefits against the strategy, concentrating on optimising costs and proving the intrinsic value of ICT
3. *Resource management* which is about the optimal investment in, and the proper management of, critical ICT resources such as applications, information, infrastructure and people, where key issues relate to the optimisation of knowledge and infrastructure
4. *Risk management,* which requires risk awareness by senior corporate officers, a clear understanding of the enterprise's appetite for risk, understanding of compliance requirements, transparency about the significant risks to the enterprise and embedding of risk management responsibilities into the organisation
5. *Performance measurement* which tracks and monitors strategy implementation, project completion, resource usage, process performance and service delivery, using, for example, balanced scorecards that translate strategy into action to achieve goals measurable beyond conventional accounting (IT Governance Institute, 2003).

The COBIT framework has seven information control criteria, namely:

1. *Effectiveness* which deals with information being relevant and pertinent to the business process as well as being delivered in a timely, correct, consistent and usable manner
2. *Efficiency* which concerns the provision of information through the optimal use of resources
3. *Confidentiality* which concerns the protection of sensitive information from unauthorised disclosure
4. *Integrity* which relates to the accuracy and completeness of information as well as to its validity in accordance with business values and expectations
5. *Availability* which relates to information being available when required by the business process now and in the future
6. *Compliance* which deals with complying with the laws, regulations and contractual

arrangements to which the business process is subject, that is, externally imposed business criteria as well as internal policies

7. *Reliability* which relates to the provision of appropriate information for management to operate the entity and exercise its fiduciary and governance responsibilities.

The COBIT 4.1 best practice framework defines the maturity of processes as ranging between zero and five where

- *zero* means that the process is *non-existent* or that there is a complete lack of any recognisable processes
- *one* indicates that processes are *initial or ad hoc* or that the enterprise has recognised that issues exist and need to be addressed
- *two* represents processes that may be *repeatable* but *intuitive* in that similar process are followed by different people undertaking the same task.
- the maturity level of *three* is achieved when processes are *defined* and have been standardised, documented, and communicated through training
- maturity level *four* is achieved when processes are *managed* and *measurable* and compliance is checked and action taken to improve if the process if it is not working effectively
- the optimised state of *five* is achieved when processes have been refined to a level of good practice measured externally and allowing the enterprise to adapt quickly if required.

The COBIT framework represents a widely consulted and refined framework that is used in this study to ascertain the level of ICT process maturity and to compare the levels of importance of the 34 primary processes defined in the framework. The COBIT ICT best practice framework can be used in any environment, as one of the objectives of the framework is to optimise process and alignment of ICT with the business and the next section covers the public higher education environment as the 'business'.

4.5 Governance and Management in the Context of Higher Education

Posthumus (2009) states that due to the pervasive nature of ICT in business, in terms of facilitating business strategy and in some cases even influencing business strategy, it is crucial that boards of directors pay more attention to ICT. It is, however, to be noted that in South Africa the first referral to any type of ICT governance requirement is made in the King

III Code on corporate governance (2009) where an entire chapter is dedicated to ICT governance only in the third iteration of the report. The best practice principles of the King III Code (2009), including the chapter on ICT governance, are to be implemented on an 'apply or explain' basis leaving a certain amount of inherent risk with the governance authorities in that depending on the ability of the entity to implement the codes of practice of the King III Code, the success or failure of the entity would be affected.

Chapter six of the King III Code on corporate governance (2009) refers to the requirement for compliance with applicable laws requiring that directors should sufficiently familiarise themselves with the general content of relevant laws, rules, codes and standards to be able to adequately discharge their fiduciary duties in the best interests of the company and their duty of care, skill and diligence. Included in this duty is to make use of the rights and protection that the law presents in the best interests of the company. Whilst there are laws such as the Companies Act 71 of (2008) and the Auditing Profession Act 26 of (2005) in the financial domain and the Access to Information Act 2 of 2000 and the Regulation of Interception of Communications and Provision of Communication-related Information Amendment Act 48 of (2008) that are relevant in some cases in the ICT domain, there is no law regulating ICT governance. Despite this, it would be possible to prosecute an entity for ICT governance-related failures to the point that it might suffer closure, even if governors or managers chose not to implement chapter five of the King III Code. This does not, however, create the space in which to *require* the implementation of chapter five of the King III Code merely for the gains that can be realised from the implementation of an ICT best practice framework.

A somewhat broader concept of governance is detailed in the book *Changing governance and management in higher education: The perspectives of the Academy,* in which Locke, Cummings and Fisher (2011) refer to Gallagher's (2001, p. 1) definition of the four concepts of governance, leadership, management and administration, and define them as follows: (a) governance is the structure of relationships that brings about organisational coherence, the authorisation of policies, plans and decisions, and accountability for their probity, responsiveness and cost effectiveness; (b) leadership refers to seeing opportunities, setting strategic directions, investing in and drawing on people's capabilities to develop organisational purposes and values; (c) management is the achievement of intended outcomes through the allocation of responsibilities and resources while monitoring their efficiency and effectiveness; and (d) administration is defined as the implementation of authorised procedures and the application of systems to achieve agreed results.

A second definition spanning both governance and management in *higher education* is provided by Marginson and Considine (2000) and also mentioned in Locke et al. (2011). This definition states that governance is concerned with the determination of value inside universities, their systems of decision making and resource allocation, their mission and purpose, the patterns of authority and hierarchy and the relationships of universities as institutions to the different academic worlds within and the worlds of government and business and community without. It embraces leadership, management and strategy.

In terms of the Higher Education Act 101 of 1997 (South Africa, Department of Education, 1997), the body contemplated in dealing with all academic issues is the senate of a public higher education institution. Its duties focus on the academic and research functions of the public higher education institution. The senate is however accountable to Council. Both the senate and the Council are organs of governance as indicated in Figure 8-5 on page 220.

4.6 Approach to Governance

The distinction between governance and management is referred to by Locke et al., (2011) in terms of the respective roles of the various participants/stakeholders in the governance and management of higher educational institutions play, with academics taking responsibility for academic matters and managers and external stakeholders for other matters. The authors continue, indicating that where such a division of labour has been established it might be said that an ideal of 'shared governance' may be achieved.

At the 'diffuse' end of the approach to governance continuum shown in Figure 4-3, the control group, or in the case of higher education South Africa, the Council, is made up of persons external to the institution, possibly with no particular interest in the institution and constituting at least 60% of the Council (South Africa, Department of Education, 1997).

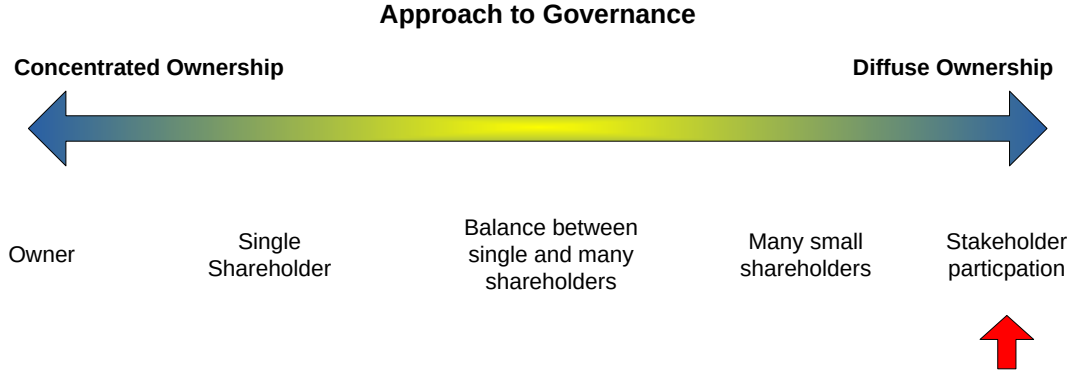


Figure 4-3: The Approach to Governance Continuum (informed by Clarke, 2008)

Internal stakeholders, made up of academic employees, employees other than academics and students, comprise the other 40% of Council membership. This means that up to 40% of the Council is made up of persons who are both governors and the governed. Each element of the constituencies has different levels of power.

The SRC usually has only one or two members on Council but can, if united in their objectives, practically wield the most power. For example, if all the students unite in their efforts to achieve something, it will generally be achieved if it is at all reasonable. Standoffs recorded in the annals of institutional history include an instance where nearly nine weeks of strike action came close to the abandonment of a teaching year. After this impasse was resolved the next demand was to make up for the lost lecturing time. This too was granted on the basis that academic staff were deemed to have been on 'holiday' for the period of strike action.

The paradigm of diffuse ownership in the approach to governance is the end of the continuum at which organisations, such as higher education institutions and other stakeholder-based organisations operate due to the nature of the rules governing them. There may be such a high level of intent to ensure full participation in the governance of the organisation that this very intent can destroy the ability to govern because of the breadth of participation. This horizontal dimension of governance finds its place on the continuum by virtue of the control groups involved in the governance of the organisation. The layers of governance in the vertical dimension referred to in Figure 4-4 appear to be uniquely identified in this study in that governance is usually referred to, as in the King III Code on corporate governance, as being mainly involving the establishment of structures and processes, with appropriate checks and balances that enable directors to discharge their legal responsibilities, and oversee compliance with legislation (King III Code, 2009).

The Cadbury Report on the financial aspects of corporate governance in the United Kingdom defines corporate governance as "the system by which companies are directed and controlled". Neither of the above definitions of corporate governance attempt to granulate governance to any "vertical degree". The King III Code describes the establishment of structures and processes, and in the context of governance and management this results in the structures that have been created in terms of the Higher Education Act. The structures and processes in place between the DHET and the functional worker all involve elements of governance. The diagram in Figure 4-4 describes the typical structures and processes in place

in the higher education sector in South Africa. The ‘governance’ and ‘management’ aspects of the context diagram are shown in Figure 4-4 to further assist in an understanding of the effect and implication of governance on the employee.

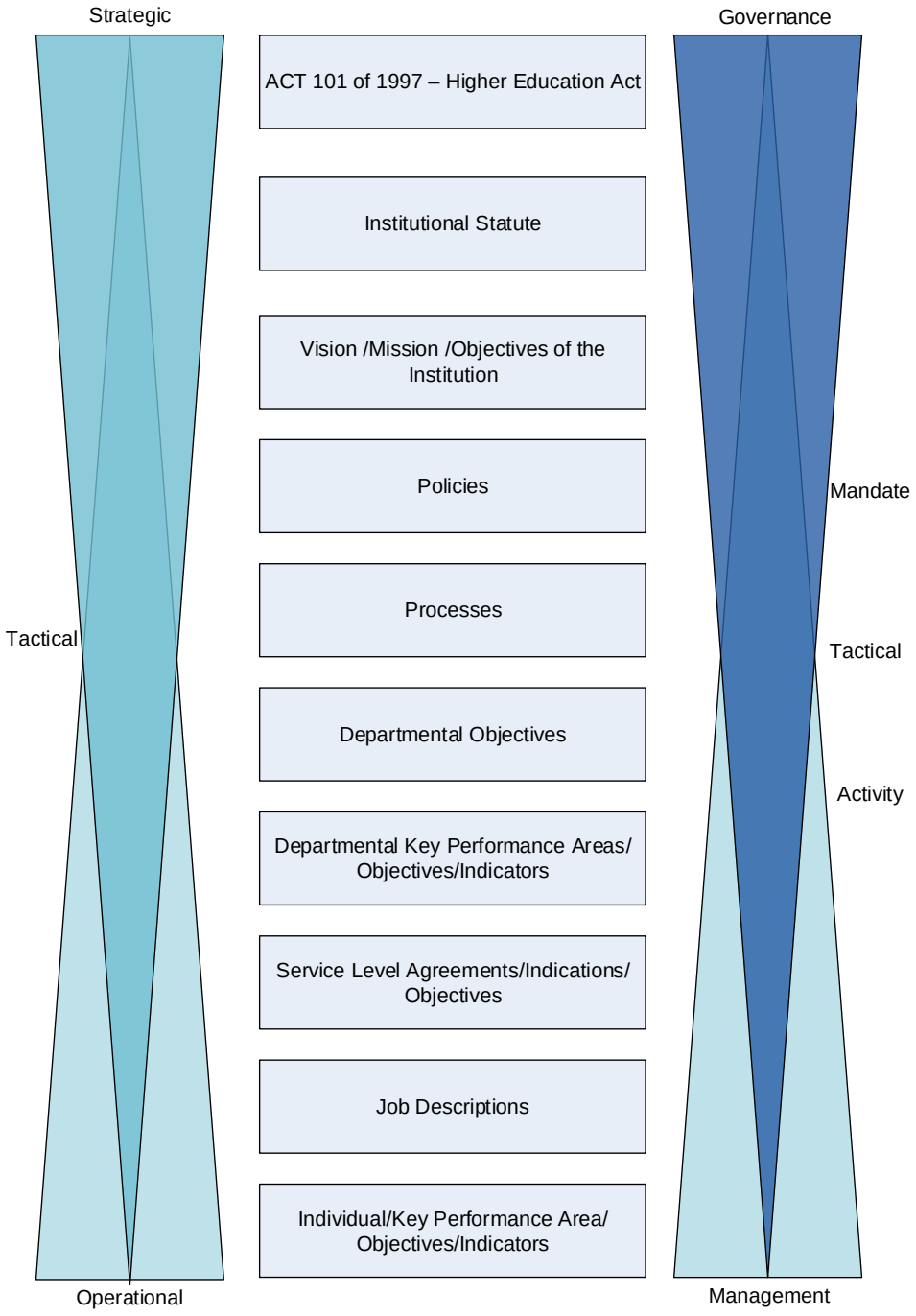


Figure 4-4: Governance Focus in the Context of Governance and Management in Public Higher Education in South Africa (Informed by Public Higher Education Structures)

4.7 Applied Governance at Functional or Worker Level

The analogy of a stiletto heel is used to describe the effect of governance on the different

structures and processes and, ultimately, on the employee who is involved at differing levels of organisational processes. The *governance to management* 'inverted triangle', shown in Figure 4-4, mimics the stiletto heel. A person wearing a stiletto heel can exert up to 80 times more pressure on a smaller area depending on the size of the heel and the person's mass; similarly the governance mandate that is translated into the policy and regulation that is exercised on people within the institution is also weighty. These policies and regulations formulated by the Council of a public higher education institution and applied by management would require every employee to have key performance areas in which they operate and in which the policies and regulations apply, and would define the parameters within which their operations may take place. Employees would be involved at different levels in the creation of policy, which in turn would apply to them as well.

The CIO, for example, would be involved in setting the strategic direction as stated in the EDUCAUSE quarterly (2006) by delivering services that are closely aligned with institution-wide goals and are seen as creating strategic value for their institutions. Duffy (2002) asserts that the CEO has singular responsibility for carrying out the strategic plans and policies that have been established by the board, and that the CEO should ensure that the CIO is included and accepted in the senior level decision-making processes. Thus, the CIO role is one of the roles that span the strategic, tactical and operational levels of an organisation and is thus crucial to the implementation of ICT governance in an organisation.

Each employee needs to be aware of all the structures and processes that are applicable in their area of function. Apart from the CIO, there are other roles that are specifically focused at the strategic level in the organisation. One such role is the CEO role. Along with other top managers CEOs define policy for approval by the board or, in the case of higher education in South Africa, by the Council. Policy compliance is the next step down in the structure and there would typically be someone employed to monitor policy compliance. In addition, ICT policy compliance will more than likely be monitored by an audit committee, which should include a senior ICT leader.

There is clearly an element of governance that is applied at different levels in an organisation and it is this phenomenon that this study seeks to expand upon, firstly by placing higher education governance on a horizontal continuum, as displayed in Figure 4-3, and by using Agency Theory to understand the layers of governance in the vertical dimension and explained later in this chapter.

4.8 Deriving Value from the Implementation of ICT Governance

The objective of any enterprise is to exist for the purpose or function for which it was created and to continue to exist into the future. Drucker (2003) explains that institutions of modern society were each created for a single specific purpose and that business exists to produce goods and services because it is an economic institution, hospitals exist to take care of the sick and universities exist to educate tomorrow's leaders and professionals. The measurement of the value that ICT creates has been questioned and surveys in recent years have revealed that between 20 and 70% of large-scale investments in ICT-enabled change is wasted, challenged or fails to bring a return to the enterprise (IT Governance Institute, 2003).

In addition to this, the standard ROI is extremely difficult to quantify as many of the ROIs are difficult to measure (Ataya, 2003). The VAL-IT Framework (2008), an initiative of the IT Governance Institute, designed to be able to integrate with the COBIT 4.1 framework, states that creating ICT-enabled value, by almost any measure, is not easy and that most enterprises exhibit one or more of the following symptoms: problems in delivering technical capabilities, limited or no understanding of ICT expenditures, business abdication of decision making to the ICT function, communication gaps between the ICT function and the business, questioning the value of ICT and major investment failure.

Van Grembergen (2004) also alludes to the issue of measuring the business value of IS/ICT investment; this has been the subject of considerable debate by many academics and practitioners. He indicates that difficulties in measuring benefits and costs are often the cause of uncertainty about the expected benefits of IS/ICT investments and, hence, are the major constraints to such investment. The 1960s to the 1980s dealt with ICT value creation in terms of the change from a paper-based system to a computer system. By contrast, applications of ICT in the higher education environment today deal with process improvements using ICT rather than pure ICT.

In modern systems implementation a piece of hardware such as a virtual server or networked disk array will span many applications and it is extremely difficult to associate a value with any given element or portion of the system. However, one way in which value can be measured in ICT is to implement an ICT best practice framework. An example of such a framework is the COBIT 4.1 framework referred to extensively in this study. This framework has a total of 249 processes of which 34 are primary processes. The measurement of an organisation's technology-mediated changes against this best practice framework will

initially provide a baseline of ICT governance maturity against which any future initiatives to improve governance, and thereby control, can be measured.

This will still not provide a measurement for the financial standards, but it will provide a reference for improvement. The use of ROI-type measurements is extremely difficult in quantifying value created by the implementation of ICT best practice frameworks. Ataya (2003) states in this regard that a new type of measurement, which he defines as "value of investment" (VOI), should be used to estimate the value generated by the implementation of good ICT governance practices.

The first part of this chapter has covered the concept of governance, its origins, governance standards and best practice frameworks with reference to applied governance and the value to be derived from the application of ICT governance best practices. In the balance of this chapter the public higher education department as a 'system' in the context of General Systems Theory (GST) (Von Bertalanffy, 1969), is discussed. Agency Theory (Alchian & Demsetz, 1972) is also used to provide support for a layered governance approach that is used in conjunction with GST. This provides the foundation for the value framework to be developed in chapter eight.

4.9 Agency Theory

Agency Theory emerged from the seminal papers of Alchian and Demsetz (1972) and Jensen and Meckling (1976). It explains the firm as a nexus of contracts among individual factors of production. Agency Theory explains how to best organise relationships in which one party, the principal, determines the work that another party, the agent, undertakes (Eisenhardt K. , 1985). Agency Theory is concerned with resolving two problems that can occur in agency relationships. The first is the agency problem that arises when (a) the desires or goals of the principal and agent conflict, and (b) it is difficult or expensive for the principal to verify what the agent is actually doing. The first problem here is that the principal cannot verify that the agent has behaved appropriately. The second is the problem of risk sharing that arises when the principal and agent have different attitudes towards risk. Again, the problem is that the principal and the agent may prefer different actions because of the different risk preferences.

Both theoretical and empirical research has developed in four key problem areas, namely, moral hazard, earnings retention, risk aversion and time-horizon. Agency Theory refers to persons and in the context of this work the theory refers to persons and entities within which the persons function or have influence.

4.9.1 Agency Theory in the Context of Higher Education in South Africa

Agency Theory is particularly useful in the context of this study as the layers of governance referred to in Figure 1-5 The Conceptual Value Framework for ICT Governance align with the concepts of this model.

In the context of higher education, 'moral hazard' as first proposed by Jensen and Meckling (1976), where the single owner of a firm consumes private perquisites rather than investing in the value of the business, allowing the business to decline, differs somewhat in the higher education sector in that the DHET does not define, for instance, the specific compensation levels of institutions. The Councils of institutions are 'free' to define compensation structures within the directives given by the DHET. The DHET does, however, provide guidelines and requires reporting in terms of reporting regulation R691 (South Africa, Department of Education, 2007). Jensen and Meckling (1976) propose a theory of the firm based upon conflicts of interest between various contracting parties, namely, shareholders, corporate managers and debt holders.

In the context of the higher education sector there are similar contracting parties, namely, stakeholders, institutional management and students, that are also debt holders but in a complex and interdependent manner as reflected in Figure 4-5.

Business, Alchian & Demsetz,(1972) and Jensen & Meckling, (1976)	Higher Education, South Africa, Higher Education Act 101, (1997)
Shareholders	Stakeholders
Corporate Managers	Institutional Managers
Debt Holders	Students (also debt holders)

Figure 4-5: Alignment of Agency Theory Groups between Business and Higher Education South Africa

The Higher Education Act requires stakeholder groups to be part of the governing structure of institutions. This effectively places students in a position of control over themselves. This is mitigated by the fact only two students represent the student population on the governing structure. McColgan (2001) states that certain costs of monitoring the agency relationship may also be imposed by legislative practices. This is the case in the higher education sector in South Africa as the Higher Education Act requires compliance with regulation R691 on

reporting (South Africa, Department of Education, 2007).

This is made more complex by the autonomy defined in the Bill of Rights of South Africa (South Africa, Department of Justice and Constitutional Development, 1996) that higher education enjoys. The Higher Education Act also only provides for the 'steering' of the higher education system and not direct control. The steering mechanisms are presented in Figure 2-2. The value framework presented in this study describes layers of governance and barriers to governance performance, as the governance layers are traversed towards the Functional ICT task technology function at the bottom of the structure. The structure is shown in Figure 8-4 and is discussed later in more detail. The first barrier to this performance is the span of control in which the DHET is required to function effectively. Twenty-three institutions report to a single national office, as there is currently no regionalisation of the public higher education sector and the CHE is the only statutory body required in terms of the Higher Education Act (South Africa, Department of Education, 1997).

4.9.2 Agency Problems

Eisenhardt (1989) defines two agency problems: the first is when the desires or goals of the principal differ from those of the agent and the second is the problem of risk sharing that arises when the principal and agent have different attitudes toward risk. These are now discussed in the context of the public higher education sector.

4.9.2.1 The Agency 'Principal's' Goals, Mandate or Governance Intent (As the DHET)

The DHET has a mandate from government to provide for quality public higher education. Governance structures or organs are defined in Chapter 4 of the Higher Education Act as the Council, senate, principal, vice-principal, students' representative council, institutional forum and other structures and offices that may be determined by the institutional statute (South Africa, Department of Education, 1997).

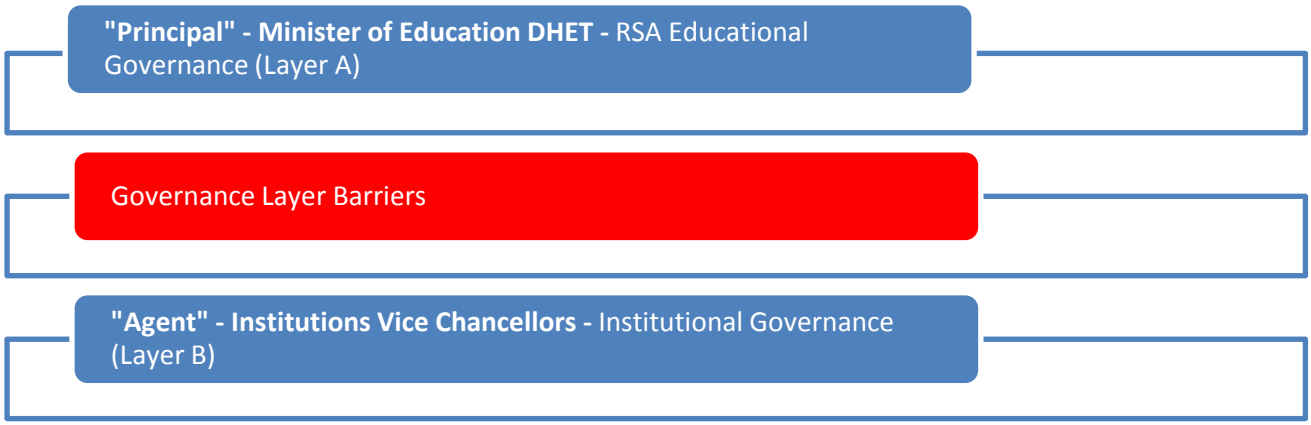


Figure 4-6: Governance Layers A and B as the 'Agency Principal' and 'Agent'

As the agency principal in the first two layers of governance indicated in Figure 4-6, the DHET has structured its resources to attain its goals through a strategic plan (South Africa, Department of Higher Education and Training, 2010), a funding framework (South Africa, Department of Higher Education and Training, 2003) as well as a white paper on education (South Africa, Department of Education, 1997) that clearly articulate the country's education requirements. The DHET strategic plan makes reference in paragraph 3.3.3.4 to support for universities in improving governance. This may or may not be intended to include ICT governance (South Africa, Department of Higher Education and Training, 2010). Governance matters of a corporate nature are covered in the Higher Education Act and the Standard Institutional Statute but ICT governance is not specifically mentioned.

4.9.2.2 The Agent (as the Institutions)

As the agency 'agents', the twenty-three public higher education institutions in South Africa are separate legal entities. They operate autonomously and are regulated only by the governance structures and requirements of the Higher Education Act. This is intended to encourage higher education institutions to enjoy freedom and autonomy in their relationship with the State within the context of public accountability and the national need for advanced skills and scientific knowledge (South Africa, Department of Education, 1997). The 'agents' or institutions need to submit an annual report to the DHET that covers the overall governance of the public higher education institution, a duly audited statement of income and expenditure and a balance sheet and cash flow statement, as well as any other information that the minister may require (South Africa, Department of Education, 1997). No other reporting requirements are required of the institutions by the minister of education. And there is no reporting requirement on ICT governance. This lack of any ICT governance standard

creates a problem as ICT governance is essentially left to individual institutions, which have to decide on the next layer of governance, that is, the institutional governance layer to be built into the institutional statute. An institutional statute needs to be defined by each individual institution should they wish to have a statute that differs from the Standard Institutional Statute. It is possible to include requirements for ICT best practice frameworks in the institutional statute. However, none of the South African institutions have included this requirement. Alignment of the strategic plans of the DHET and institutions is imperative to ensure the optimisation of the higher education system.

4.9.2.3 The Principal (as an Institution)

Figure 4-7 shows the 'principal' as the institution and the 'agent' as ICT governance within the institution. The institution is governed by the institutional council with the Vice Chancellor managing the institution strategically and operationally through the management structures.

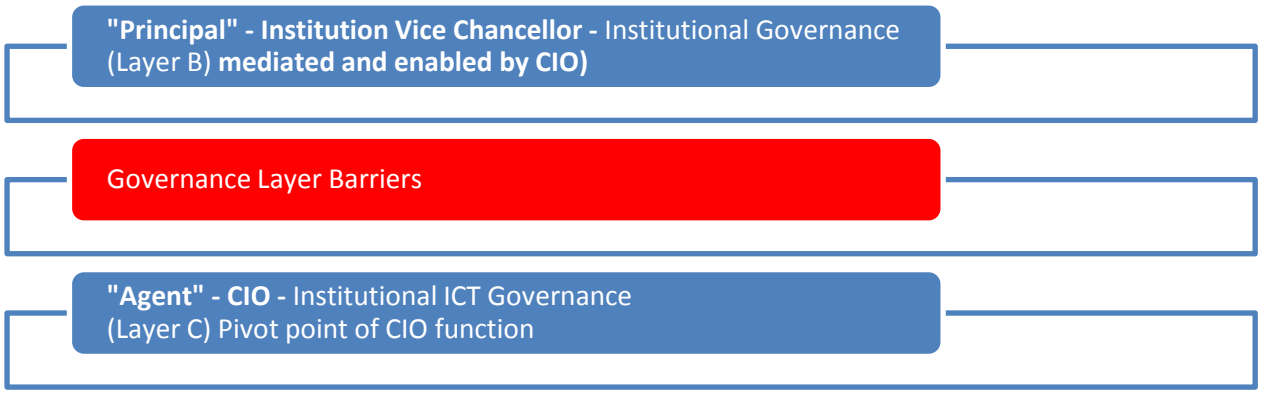


Figure 4-7: Governance Layers B and C as the 'Agency Principal' and 'Agent'

Each institution is an independent legal entity and is structured into faculties and administrative divisions or departments. In this layer the Council is the governance structure and the governance role is embodied in the Vice Chancellor on behalf of Council, while the CIO is the agent in the facilitation of institutional ICT governance. When strategic planning arrived on the scene in the mid-1960s corporate leaders embraced it as 'the one best way' to devise and implement strategies that would enhance the competitiveness of each business unit. True to the scientific management pioneered by Frederick Taylor, this one best way involved separating thinking from doing and creating a new function staffed by specialist strategic planners (Mintzberg, 1994).

ICT governance is a new concept that first emerged in Gartner's top nine management

priorities for 2003 and was ranked third (South Africa, Department of Higher Education and Training, 2010). If one considers that the strategic planning concept has been around for 50 years and has become commonplace in many organisations, the possibility of an eight-year old-concept being practised ubiquitously within in organisations that have no legal requirement for it may be small. 'Corporate governance' is practised in South Africa as a code of principles and practices defined in the King III Code (2009). The King III Code of principles and practices, implemented on a 'apply or explain' basis rather than as legislation, dedicates chapter five to ICT governance and requires: (a) that the board should be responsible for ICT governance; (b) that ICT should be aligned with the performance and sustainability objectives of the company; (c) that the board should delegate to management the responsibility for the implementation of an ICT best practice framework; (d) that the board should monitor and evaluate significant ICT investments and expenditure; (e) that ICT should form an integral part of the company's risk management; (f) that the board should ensure that information assets are managed effectively; and (g) that a risk committee and audit committee should assist the board in carrying out its ICT responsibilities (King III Code, 2009).

At worst all public higher education institutions could explain their way out of the need to implement the seven ICT governance (and other) principles of the Code and at best all institutions could include the ICT governance requirements of the King III Code into their statutes. At best all public higher education institutions could comply with the King III Code and in particular with the provisions of chapter five.

Governance at institutional level is normally allocated to an individual such as the registrar, whilst ICT governance is championed by the CIO or ICT director.

4.9.2.4 The CIO as the 'Agent'

When applying Agency Theory to the layers of governance introduced in this study, it is essential to understand the role of the CIO in the public higher education sector as this function contributes significantly to bridging institutional governance and ICT governance. Higher education has not been immune to technological transformation over the past few decades and many new technologies have been embraced to ensure agile and efficient institutions in a rapidly changing environment (EDUCAUSE, 2011).

The title of CIO was first introduced in the mid-1990s to describe a new type of Information Systems (IS) executive who had been elevated to a C-level position within forward-thinking

firms. They were given stewardship of the firm's entire information resources (Chun & Mooney, 2009). To lead the charge in addressing information and technology issues in a complex and rapidly changing environment many higher education institutions created the position of CIO (EDUCAUSE, 2011). The CIO role has evolved over the past decade into one responsible for providing the ICT *infrastructure* and capabilities to ensure *effective business operations*, thus the role of the CIO has become more strategic in nature, initiating and provoking business to change processes and strategies through the innovative use of ICT (Chun & Mooney, 2009). The CIO must manage upwards from the executive to the governing council or board, across the management structures to the co-executive leaders and downwards towards technology users to obtain the technology resources and influence necessary to carry out strategic technology plans. This includes knowing the key political figures and donors and their positions on important issues, as well as the organisation's supporters and adversaries (EDUCAUSE, 2011). The CIO must possess skills in both the technical and the business areas:

- Key *technology* issues include technical spending and budget allocation, ICT architecture and capabilities development, security, delivering value, relationship building, and governance.
- Key *business* issues, on the other hand, include managing shareholder wealth and performance and influencing executive peers to design and implement strategic initiatives (Chun & Mooney, 2009).

The CIO must be a visionary with the ability to generate a shared vision for the organisation's future, thus building a campus-wide vision for ICT is for the most part a consensus-building task that requires the CIO to have developed trust with the many campus constituencies. In addition, the CIO is required to contribute beyond ICT-specific initiatives by understanding institution-wide issues and participating in strategising solutions for them (EDUCAUSE, 2011).

The scope of influence and function of the CIO across the breadth and depth of the institutional structure as discussed in the section above is important for understanding the application of Agency Theory in the following sections, because the CIO is expected to function across both strategic and operational boundaries.

This now leads to the next section in which the agency 'principal' is the CIO facilitating the ICT governance function and the 'agents' are the governance organ heads of departments (HODs).

4.9.2.5 The CIO as the Agency 'Principal' in the ICT Governance Function

Figure 4-8 shows the principal as the CIO in the ICT governance function and the agents as the governance organ HODs.

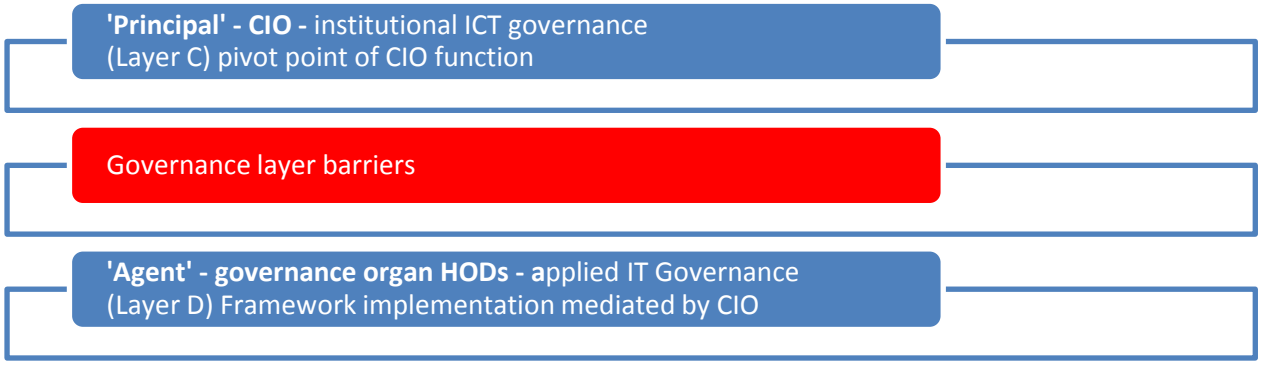


Figure 4-8: Governance Layers C and D as the 'Agency Principal' and 'Agent'

Governance organs and their functions and mechanisms of setup and operation are defined in the Standard Institutional Statute (South Africa, Department of Education, 2002).

Institutional ICT governance can be defined as the intention to govern ICT within the framework of institutional governance. COBIT, one of the most well-known and used ICT best practice frameworks defines ICT governance "as the set of responsibilities and practices exercised by senior management of the enterprise designed to establish and communicate strategic direction, ensure realization of goals and objectives, mitigate risk, and verify that assigned resources are used in an effective and efficient manner" (IT Governance Institute, 2003, p. 6).

The King III Code requires that the CEO appoint an individual responsible for the management of ICT, often referred to as a CIO. The CIO should be a suitably qualified and experienced person who should have access to, and interact regularly on ICT governance matters with the board or appropriate board committee or both, as well as with executive management. The CIO should serve as a facilitating bridge between ICT and the business and therefore, should

- understand the accountability and responsibility for ICT

- be business-orientated
- understand business requirements, the long-term strategy for the business of the company and translate this into efficient and effective ICT solutions
- have a strategic approach and facilitate the integration of ICT into business strategic thinking and development
- exercise care and skill to design, develop, implement and maintain sustainable ICT solutions to enable the achievement of strategic objectives (King III Code, 2009).

The essence of this layer of governance is the ability for the institution to provide for the logical and physical split between institutional governance and ICT governance. ICT governance requires specific attention and Peterson, in 'Strategies for information technology governance' (Van Grembergen, 2004), argues that ICT governance is certainly an essential element of the CIO's portfolio, although the CIO is not the primary stakeholder. However, ICT governance should be a shared responsibility and an enterprise-wide commitment towards sustaining and maximising ICT business value (Van Grembergen, 2004). This is precisely where the CIO will be challenged to align the risk attitude between a steering group and an implementation group dealing with the best practice framework implementation.

4.9.2.6 The Governance Organ HODs as the Agents in the Framework Implementation

The best practice framework adopted provides the basis from which the ICT governance structures are created and managed. All structures are populated with people and as such Agency Theory is used even at this level to reinforce the Agency Theory concept of how best to organise relationships in which one party (the principal) determines the work and the other party, the agent, undertakes the work (Eisenhardt M. K., 1989). It is at this juncture that the role of the CIO is exercised in becoming the bridge between the institutional ICT governors (the principal) and the groups (the agents) that implement the framework (King III Code, 2009).

At this level of governance the set of committees that regulate the ICT function at the university are defined and set up. However, the committees may not all function at this level, for example the ICT governance committee is ideally constituted by Council members and members of executive management, while the academic computing committee may be constituted by the deans and the ICT executive office. Other committees, such as the service continuity committee, may be made up of members of the operations staff along with the ICT staff.

4.9.2.7 The Governance Organ HODs as the Agency Principal in the ICT Framework Implementation

Figure 4-9 shows the *governance organ* HODs as the principal in the ICT best practice framework implementation and the *functional* HODs as the agent in the alignment of ICT to the business. ICT governance is perceived to be the responsibility of the senior ICT leader at institutions (EDUCAUSE Center for Applied Research, 2008). The desires or goals of the group of people working to apply ICT governance can differ greatly from those that accept to use the technology that is being provided. The best practice framework implementation needs to be driven by the CIO or other senior ICT leaders in the institution. At this level of implementation the knowledge of best practice frameworks is essential, as success or failure depends on the ability of the senior ICT leader to be able to connect the governance layers at the top of this structure with those below it. The senior ICT leader needs to play an extremely difficult role in ensuring that the appropriate technologies have been identified, work shopped, evaluated and approved by the users who ultimately decide whether to accept or reject the technology and systems provided.

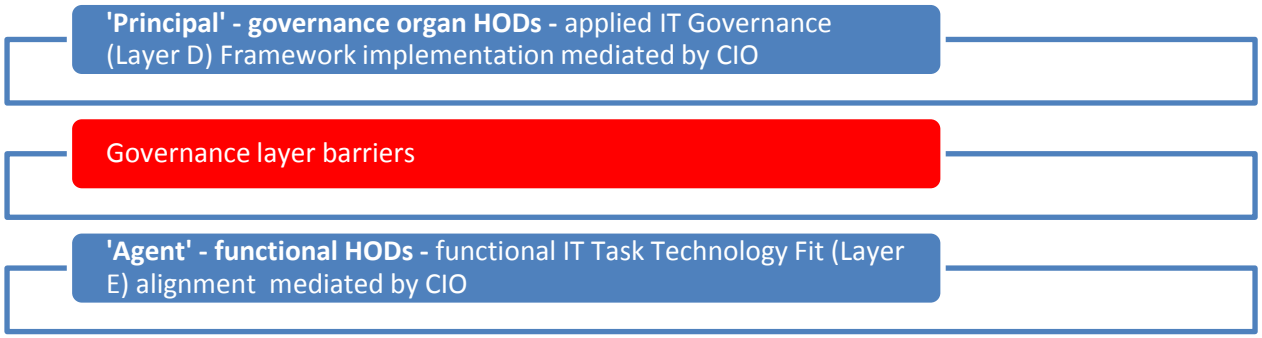


Figure 4-9: Governance Layers D and E as the 'Agency Principal' and 'Agent'

Institutions have organisational structures that are designed to meet their objectives and are generally structured into two groups, namely, academic and administration or non-academic. These divisions or departments act within the boundaries set by institutional policies and practices (South Africa, Department of Education, 2002). Policies are typically developed by units or departments and approved by the Council. It is imperative that Council members are suitably qualified and experienced in the areas required in the institutional statute. Many institutional statutes now include the requirement to have at least one Council member with expertise in the field of ICT. Paragraph (9)(i) of the Standard Institutional Statute indicates the need for the expertise of ten Council members with a broad spectrum of competencies in the fields of education, business, finance, law, marketing, ICTs and human resource

management (South Africa, Department of Education, 2002). Most institutions that have their own statute make similar provision.

4.9.2.8 Functional HODs as the Agents of ICT Task–Technology Fit or Alignment

There are differing views on the applicability of the role of functional HODs in the implementation of ICT governance; however, governance objectives such as the alignment of ICT with the business is clearly an ICT governance function as defined in the COBIT 4.1 framework (IT Governance Institute, 2011), as well as in the King III Code (King III Code, 2009). The agents at this level of governance are fully occupied with performing the work function whilst being guided in this task by the governance effort that has preceded this work function. This concept can be illuminated by the analogy of a game of soccer. The play that takes place on the field is governed by all that takes place off the field. There is no governor that plays the game and no player that governs whilst the game is being played. Every move that the player makes is guided by a tactical move designed to get past the opposition's defence and to score a goal. The philosophy of the entire club is played out in the game on the field. The club strategies, tactics and policies will have been invoked and of course the rules of the game of soccer are relevant. In the same manner, the users of the ICT system will play out their 'game' with the equipment that has been provided for them in terms of the rules, the policies, the strategies, the objectives and the vision and mission of the university. The players will, however, have an influence on policy and regulation and, similarly, those in the work environment who perform their relevant functional duties will also engage with policy makers and regulators in the process of governance improvement. In addition to Agency Theory the bottom two layers of the six-layer governance value framework shown in Figure 1-5 other theories are applicable and relevant so it is deemed necessary to expound on at least one other theory on each of these two layers. Both of these theories are discussed in the following sections.

4.9.2.9 Functional HODs as the Agency Principal in Technology Alignment

Figure 4-10 shows functional HODs as the principal in the alignment of ICT to the business and users as the agents at the layer of technology acceptance. In his initial research covering some 25 Fortune 500 companies, Luftman (1999) states that organisations need to ensure that decisions about deploying ICT are aligned with the organisation's strategic objectives, thus it can be said that ICT alignment and technology acceptance contribute to strategic alignment. Strategic alignment is also one of the five focus areas of the COBIT IT best practice

framework, thus it can be said that business–ICT alignment is an integral part of ICT governance.

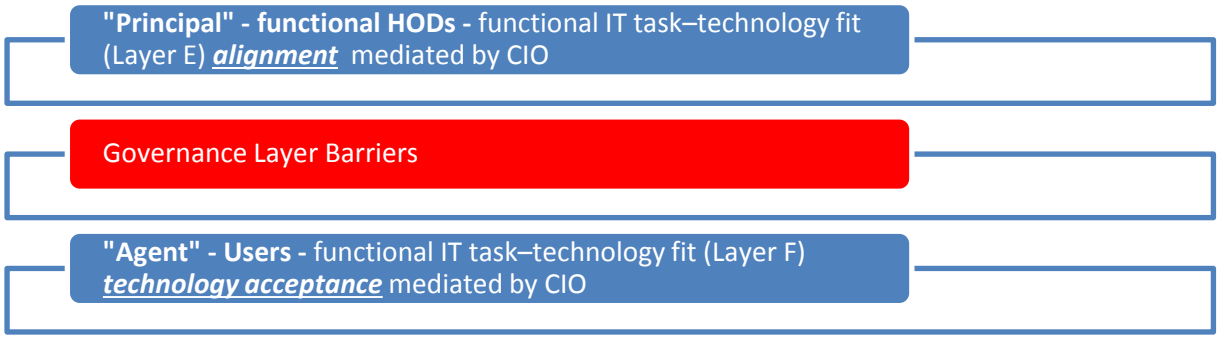


Figure 4-10: Governance Layers E and F as the 'Agency Principal' and 'Agent'

The last two layers in this ICT governance value framework deal with the alignment of technology with business requirements and technology acceptance by the users. The CIO needs to play a leading role in ensuring that the technology deployed must be acceptable to users and fit for purpose. The principal at this layer of governance is the functional HODs, and their governance role is to engage with the CIO in the alignment of ICT with the business of education. Once again, Agency Theory is applicable as there are people involved who do work for others. The group of people on this layer is the 'super user' category or the 'user leaders' of certain technologies or subsystems. The super users and the normal users can also have differing goals or desires and can also have a different attitude towards risk. The super users generally have ownership status in terms of module data or subsystems, whilst users generally only need to take ownership of single transactions.

4.9.2.10 Users as the 'Agents' in Technology Acceptance

The agents in this context are the stakeholders, staff and students of the institution and their acceptance of technology. This is the first point in the governance layers where people and technology meet at the functional level through system use. In this layer the level of governance influence has declined and the level of management influence has increased significantly. Management may have strategies in place and may have planned to implement these strategies in certain ways in its position as the principal in the agency relationship. However, these can fail if the agents do not implement the technology plan. It is thus important to ensure that as the governance mandate or intent 'flows' through the layers of governance that the desires, goals and purposes of the organisation are communicated effectively throughout the layers to ensure that risk is minimised and value is optimised.

Agency Theory has been used in this chapter to support the concept of layers of governance and how the governance mandate, or intent, is transferred from the legislated layer (South Africa, Department of Education, 1997) to the functional layer of the institution. Divisions and departments within an institution function interdependently with each other to achieve the objectives of the institution. Whilst Agency Theory has been used to define this hierarchical and interdependent relationship in terms of governance, it is also necessary to define relationships in terms of the 'bigger picture', which in the context of this study is the institutions within the public higher education system and how they interrelate to form part of a bigger system. General Systems Theory (GST) (Von Bertalanffy, 1969) is used to facilitate the discussion in the next section of the chapter in which these system relationships are further explored.

4.10 General Systems Theory

From an epistemological viewpoint this research project embraces systems theory. This widely used and interdisciplinary concept studies the properties of systems as a whole in order to learn and understand the behaviour of systems within their boundaries and, particularly with open systems, how they are influenced from outside their boundaries. Ludwig von Bertalanffy was born in 1901 near Vienna in Austria. He is credited as being the creator of GST – he coined the term, developed it in detail in his many writings and was a key part of the group that took it forward and spread the concept. He was awarded a PhD in Physics by the University of Vienna in 1926. Von Bertalanffy's work on GST arose as an extension of his ideas in biology, of the organism as a whole and its openness to its environment (Ramage & Shipp, 2009).

To summarise the concept, systems theory includes inputs, process and outputs and represents the transformation process (O'Brien, 2000). However, as pointed out by O'Brien (2000, p. 21), the "system concept becomes even more useful by including two additional components: feedback and control". The control element involves monitoring and evaluating feedback to determine whether a system is moving toward the achievement of its goal. It is, therefore, essential to define the system that can be influenced by this research and distinguish between its environment, environmental influences and subsystems. A system that controls the management of, primarily, alignment and risk can influence a subsystem; however, entropy occurs as governance objectives cannot traverse several systems without weakening as they pass through intermediaries.

Boulding (1956) refers to GST as the skeleton of science in that it aims to provide a framework or structure of systems on which to hang the flesh and blood of particular disciplines and particular subject matters in an orderly and coherent corpus of knowledge.

Associated with these concepts is the perspective that has been provided by Churchman (1971), who describes the nine characteristics of a system shown in Figure 4-11. The higher education system in South Africa is viewed in this study as an open system that is governed by the Higher Education Act 101 of 1997. The CHE has been established by the Higher Education Act as a juristic person to be a regulatory body for the higher education system in South Africa (South Africa, Department of Education, 1997). The Act defines the cooperative nature of governance requirements both within institutions, by defining in Chapter 4 of the Act the governance structures required in systems, and between institutions, where public higher education institutions are encouraged to cooperate with other institutions, even establishing regional structures to facilitate cooperation.

1	It is teleological (purposeful).
2	Its performance can be determined.
3	It has a user or users.
4	It has parts (components) that in and of themselves have purpose.
5	It is embedded in an environment.
6	It includes a decision maker who is internal to the system and who can change the performance of the parts.
7	There is a designer who is concerned with the structure of the system and whose conceptualisation of the system can direct the actions of the decision maker and ultimately affect the end result of the actions of the entire system.
8	The designer's purpose is to change a system so as to maximise its value to the user.
9	The designer ensures that the system is stable to the extent that he or she knows its structure and function.

Figure 4-11: Characteristics of a System (Churchman, 1971)

Churchman (1971) describes the characteristics of a system as indicated in Figure 4-11, which align with the structure and principles of the higher education system in South Africa. Thus, from an epistemological viewpoint, this research project embraces systems theory. This

widely used, interdisciplinary concept studies the properties of systems as a whole in order to learn and understand the behaviour of systems within their boundaries and, particularly with open systems, how they are influenced from outside their boundaries. The concept of a system serves to identify those manifestations of natural phenomena and processes that satisfy certain general conditions. In the broadest conception, the term connotes a complex of interacting components together with the relationships among them that permit the identification of a boundary-maintaining entity or process (Laszlo & Krippner, 1998). Churchman's (1971) characteristics of systems are interrogated to identify how the design of the higher education system aligns or differs from the characteristics described.

1. The first characteristic is to identify the purpose of higher education system, which is primarily to "establish a single coordinated higher education system which promotes co-operative governance and provides for programme-based higher education" (South Africa, Department of Education, 1997).
2. The second characteristic is the system performance that can be measured. The performance of the higher education sector as a system can be measured and one of the DHET's objectives stated in its strategic plan (South Africa, Department of Higher Education and Training, 2010) is to improve efficiency. Efficiency is defined in the *Merriam Webster Online Dictionary* as "the ratio of the useful energy delivered by a dynamic system to the energy supplied to it". Efficiency is a measure of performance and one such measure is the graduation rate and the graduation cost per student. The graduation cost per student at each institution is shown in Figure 6-33.
3. The third characteristic is that a system has users. The higher education system has primary users who make use of the opportunity to attain qualifications in the areas of learning that are offered by institutions. Institutions are funded according to certain Classification of Educational Subject Matter (CESM) categories. These categories and their funding rates are described in more detail in chapter 2.
4. The fourth characteristic of a system is that it has parts and that in and of themselves they have purpose. The higher education system is made up of institutions and each has a similar purpose, albeit in different geographic regions and areas of expertise.
5. The fifth characteristic is that the system is embedded in an environment. The higher education system is embedded in the environment of society and of the government as the next step up in the hierarchical structure within the environment. The first five

characteristics describe the system 'outwardly' whilst the last four characteristics describe the system 'internally' and focus on control aspects of the system.

6. The sixth to ninth characteristics of the higher education system relate to the governance aspects of the system.

The minister of higher education and his/her government department are the designers and decision makers in the higher education system and are therefore at the 'root of governance'. The root of governance is defined in the Higher Education Act and is clearly the source of governance intent within the system of higher education in South Africa. Systems theory includes inputs, process and outputs and represents the transformation process (O'Brien, 2000). This transformation process in the higher education system refers to the transformation of a student into a graduate. However, as pointed out by O'Brien (2000, p. 21), the "system concept becomes even more useful by including two additional components: feedback and control".

The control element involves monitoring and evaluating feedback to determine whether a system is moving toward the achievement of its goal. It is, therefore, essential to define the system that can be influenced by this research and distinguish between its environment, environmental influences and subsystems. A system of controls for the management of, primarily, alignment and risk can influence a subsystem and governance objectives cannot traverse several systems without weakening as they pass through intermediaries or inhibitors between the layers of governance. These layers of governance are presented in Figure 8-5. The number of layers of governance that need to be traversed between the DHET and work at the operational level is high and this can result in the governance objectives or intent expressed at the highest level being diminished towards operationalisation. The current system of feedback and control in the higher education sector is defined in the Higher Education Act (South Africa, Department of Education, 1997) and is governed mainly by the prescribed reporting requirements within regulation R691 (South Africa, Department of Education, 2007).

There is also a need for cooperative governance between the institutions that exist in the 'system' of education. In the context of autonomy this complicates the functioning of the system as there are intersystem dependencies in spite of the desired institutional autonomy contemplated in the Higher Education Act. Figure 6-1 shows three typical institutions in the open system of higher education in South Africa, illustrating the elements of cooperative

governance as well as inter-institutional cooperative governance. Working relationships between institutions are generally regionalised while governance initiatives generally include all institutions nationally.

The last of the theories to be discussed are the Unified Theory of the Usage and Acceptance of Technology (UTUAT) and the Task–Technology Fit (TTF) theories. These theories are often associated with each other in terms of the alignment of ICT to the business and Zhou et al., (2010) found that performance expectancy, task–technology fit, social influence and facilitating conditions have significant effects on user adoption. These are discussed in more detail in the next section.

4.11 Unified Theory of the Usage and Acceptance of Technology

The UTAUT theory, diagrammatically shown in Figure 4-12 aims to explain user intentions to use an ICT system and subsequent usage behaviour. The theory holds that four key constructs – performance expectancy, effort expectancy, social influence, and facilitating conditions – are direct determinants of usage intention and behaviour (Venkatesh, Morris, Davis, & Davis, 2003). Gender, age, experience, and voluntariness of use are posited to mediate the impact of the four key constructs on usage intention and behaviour (Venkatesh et al., 2003). The theory was developed through a review and consolidation of the constructs of eight models that earlier research had employed to explain ICT usage behaviour (theory of reasoned action, technology acceptance model, motivational model, theory of planned behaviour, a combined theory of planned behaviour/technology acceptance model, model of PC utilisation, innovation diffusion theory, and social cognitive theory). It is important to enlighten people on the use of technology and its value to the organisation; because the best technology can be implemented but still fail if the users are not convinced that its use is in the best interests of both themselves and the organisation. The level of acceptance of technology has some influence on the value of its implementation and this contributes to the ICT governance value framework envisaged.

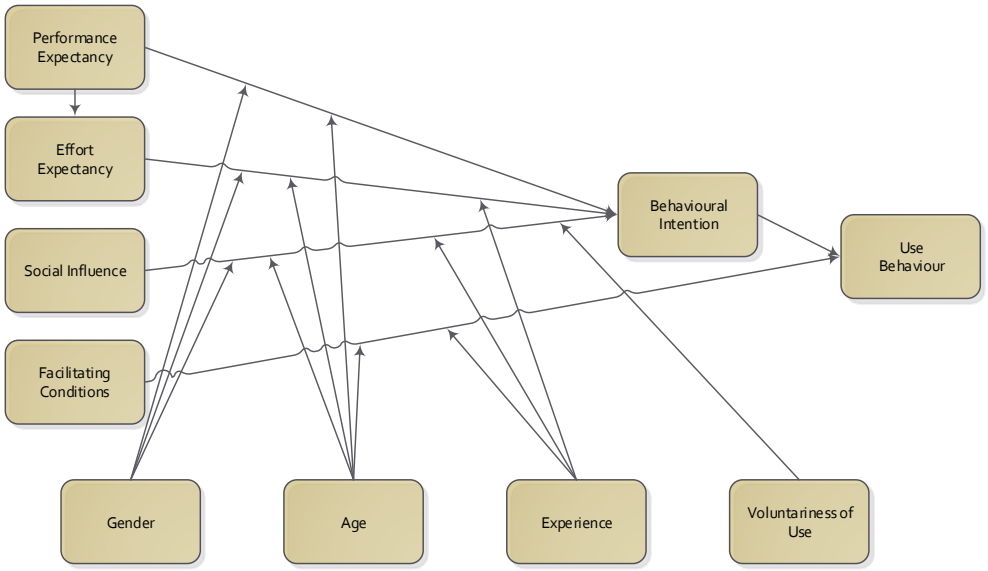


Figure 4-12: Unified Theory of Acceptance and Use of Technology

(Venkatesh et al., 2003)

4.12 Task Technology Fit Theory

Goodhue and Thompson (1995) highlight the importance of the fit between technologies and users tasks in achieving individual performance targets and resultant impacts from ICTs. Figure 4-13 represents the theory diagrammatically.

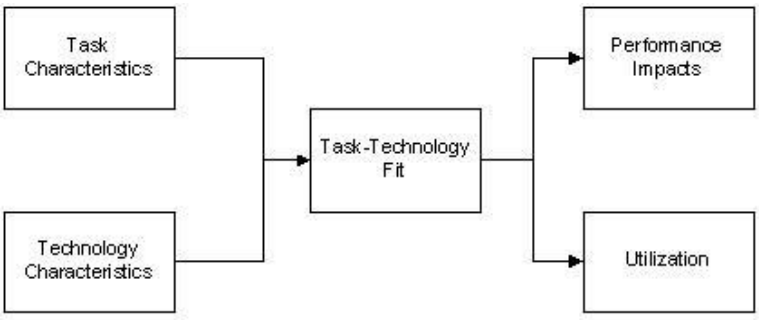


Figure 4-13: Task–technology Fit Theory Diagram

(Goodhue & Thompson, 1995)

They also suggest that task–technology fit, when decomposed into its more detailed components, could be the basis for a strong diagnostic tool to evaluate whether information systems and services in an organisation are meeting user needs. The five focus areas of the COBIT 4.1 model – strategic alignment, value delivery, risk management, resource management and performance measurement – are all implicit in the objectives of TTF theory. The strongest of these focus areas in terms of TTF theory is strategic alignment. Whilst

strategic alignment is a governance concept it is also a functional requirement. In as much as the provision of a road transport vehicle to be used to ship people across an ocean is useless, providing incorrect or misaligned ICT systems to users is similarly useless. It is important that the tools employed to do a job match the job that needs to be done. Accordingly, users who are required to perform transactions that produce receipts for payments received would not be given a large file server as the tool for capturing these transactions. The appropriate terminal or a computer correctly sized for the task would be supplied. Likewise, a costly, high-speed line printer would not be provided for this task if a small dot matrix 80 column printer would perform the required task just as well. It is crucial that the performance and the utilisation requirements are used to estimate the size of and to acquire the technology required for a particular job. The value of matching at this level is one of the factors that was applied when formulating the value framework that is the envisaged output of this research project.

The governance aspect of task−technology fit is alignment while the functional aspect revolves around the 'tool for the trade' or the correct equipping of the institution for business requirements. Goodhue and Thompson (1995) developed a measure of task–technology fit that consists of eight factors:

- *Quality* (currency, content and level of data)
- *Locatability* (when and where data is stored as well as ease of finding unknown data)
- *Authorisation* (ease of authorisation of data)
- *Compatibility* (data from different sources consistent)
- *Ease of use/training* (ease of performing user requirements and easy access to training)
- *Production timeliness* (meeting turnaround schedules)
- *Systems reliability* (dependability and consistency of uptime and access)
- *Relationship with users* (ICT understands the business, supports customer needs, availability of systems and ICT staff, SLA compliance).

These factors are not directly related to governance objectives but rather form the foundation of the functional systems that need to align to the business of public higher education. Thus from this point of view they contribute from the *bottom line of technology* to the business. If this *bottom line of technology* is inappropriate it is reasonable to assume that there will be a mismatch between technology and the business. This amounts to misalignment between

business and ICT and this is an element of ICT governance. It can therefore be stated that there are *aspects of governance* that span the domain of public higher education from the minister of higher education to the employees of an institution and that despite operational work being performed at all the layers mentioned above there is a larger focus on governance at the strategic level that at the operational level.

4.13 Conclusion

The objective of this chapter was to provide an association between the current governance structures of the public higher education system and the theoretical principles associated with public higher education governance, specifically ICT governance in the public higher education sector in South Africa. International ICT governance standards such as ISO/IEC 38500 and best practice frameworks such as the IT Governance Institute's COBIT 4.1 best practice frameworks were considered to ascertain the impact that these have had on ICT governance practices in public higher education in South Africa. Governance relationships were then explored in terms of Agency Theory, GST, UTAUT and the TTF theory to develop an ICT governance value framework for the public higher education sector in South Africa. The theories used in this study have been discussed in this section, accordingly providing the foundation for the study.

Whilst the focus of this chapter has been the discussion of the theories applicable to this study, the following chapter begins to identify how the application of ICT governance produces value. This value is not only value defined directly in terms of currency but also value that may be indirectly created such as the value of a degree conferred on a graduate.

The next three chapters deal with the surveys that have formed the basis of the search for information in order to determine the current status of ICT governance in the public higher education sector in South Africa.

Chapter Five

Information and Communication Technology Pervasiveness in Public Higher Education Institutions in South Africa

5 Information and Communication Technology Pervasiveness in Public Higher Education Institutions in South Africa

5.1 Introduction to Pervasiveness of ICT in the Public Higher Education Sector in South Africa

The primary purpose of exploring pervasiveness in this study is to present a founding mechanism of measurement of ICT pervasiveness in public higher education institutions in South Africa and to associate the concept of pervasiveness with the increased need to govern ICT in order to ensure its value contribution to the sector. This chapter provides the details on the first of three secondary research objectives designed to support the primary research objective, that is, *to produce a value framework that can be used to identify the value created in tertiary institutions in South Africa by implementing good governance practices from the highest governing authority to the ICT functional environment.* The second secondary research objective discussed in this chapter is the *ascertainment of the level of ICT pervasiveness in tertiary education institutions in South Africa.*

Literature on the measurement of pervasiveness in ICT is extremely limited. Pervasiveness is defined in the *Merriam-Webster dictionary* as "existing in every part of something: spreading to all parts of something". Ubiquity, on the other hand, is defined as "presence everywhere or in many places, especially simultaneously". Karaiskos (2009) defines the pervasiveness of an information system (IS) as "the extent to which an IS consists of interconnected technological artefacts, diffused in their surrounding environment, working together to ubiquitously support user tasks and objectives in a context aware manner". He continues by providing three founding dimensions of pervasiveness, namely, ubiquity, diffusion and context awareness. These founding dimensions and the definition of pervasiveness are compared in this chapter to the domain of ICT, rather than just an information system. This chapter therefore focuses on the pervasiveness of ICT in public higher education institutions in South Africa. This contributes to the overall study by substantiating the need for an ICT governance value framework. Firstly, the understanding of pervasiveness is discussed in terms of the Karaiskos (2009) nomological network of pervasiveness model, which itself is an adaptation of the Universal Theory of the Acceptance and Use of Technology (UTAUT) model devised by Venkatesh et al. (2003). This is followed by the presentation of the pervasiveness survey, as well as its validation which is done using an additional survey, and, finally, the report on the

findings. The chapter concludes with a summary and a discussion on the contribution that the work discussed in this chapter makes to the study.

5.2 Purpose of Exploring Pervasiveness in this Study

The purpose of exploring pervasiveness in this study is to present a founding mechanism for the measurement of ICT pervasiveness in public higher education institutions in South Africa. The concept of pervasiveness or ubiquity is reasonably new in the ICT environment, the first reference to it being made by Weiser (1991), who introduced the concept of ubiquitous computing and put forward a vision of people and environments augmented with computational resources that provide information and services when and where desired (Weiser, 1991). Weiser's vision described a proliferation of devices on varying scales, ranging in size from hand-held 'inch-scale' personal devices to 'yard-scale' shared devices. This proliferation of devices has indeed occurred, with commonly used devices such as hand-held personal digital assistants (PDAs), digital tablets and laptops, and wall-sized electronic whiteboards. It is this proliferation of devices and the exponentially increasing requirement for information that has resulted in the need to elevate the level of ICT governance practised largely at an institutional ICT departmental level without formal requirements to report or comply with legislation to that of the other more formalised and older disciplines such as finance and HR that have legislated compliance requirements. The method to achieve this is discussed in section 5.2.1 by using a survey designed to contribute towards an understanding of ICT pervasiveness in public higher education in South Africa.

5.2.1 ICT Pervasiveness Survey Methodology

Primary data was obtained through an online survey completed by the highest ranking ICT official of public higher education institutions in South Africa. The intention of the survey was to obtain information on the 55 factors identified in this study that are said to contribute in some way to the level of pervasiveness of ICT. An EDUCAUSE (2010) survey on the pervasiveness of ICT in education provided the seed thoughts on the factors that influence ICT pervasiveness in education. Factors subsequently identified were discussed at biannual meetings of the highest ranking ICT officials in South African public higher education institutions. A second survey was completed by the same highest ranking ICT officials to validate the factors more formally. This survey and its responses and the subsequent report are dealt with comprehensively in section 5.5.

Respondents were not selected by any particular criteria. All responses were voluntary and

even though, in the case of this survey, the researcher could identify institutions that responded, it was agreed that only aggregated data would be presented thus preserving the identity of the contributors from each other and the public. The maximum number of institutions that could, without undue influence, be encouraged to respond to the pervasiveness survey, was nine. Whilst less than 50% response rate from the pool of identified respondents could be taken as an insufficient sample from which to draw conclusion and generalisations, it can also provide the opportunity for responses to validation surveys and information seeking surveys to be mutually exclusive. Responses are random in that there were no target institutions in terms of any specific criteria. All surveys were addressed to all institutions. The responses, once analysed did cover the categories of institutions in RSA, where 50% of the comprehensive universities responded, 44% of the HDIs responded, 42% of the large and 50% of the small universities responded to the pervasiveness survey. The target sample for the survey can thus be defined as a 'convenience sample'.

The quantitative data obtained from the web-based questionnaire was analysed using interpretive analysis techniques. In contrast, the secondary data was gathered by means of a literature study which focused on the concepts of *pervasiveness* and *ubiquity*. These two terms are used interchangeably in many documents, but Karaiskos (2009) introduces ubiquity as a dimension of pervasiveness and this understanding is adopted in this study.

The overall objectives of this chapter are, firstly, to demonstrate that factors influencing pervasiveness, as defined by Karaiskos (2009) and indicated in Figure 5-1, are aligned with the classification of the factors influencing pervasiveness that are identified in this study. The second objective is to show how these first- and second-level factors *associate* with the objectives of the DHET as expressed in the DHET strategic plan (2010). The objectives of the DHET are to the improve efficiency of the public higher education system, to increase throughput and to improve on the cost of education per graduate. The categorisation of the factors influencing ICT pervasiveness is reflected in the model in Figure 5-1. This model has been adapted from the Venkatesh, et al. (2003) model known as the UTAUT by Karaiskos (2009) to focus on ICT pervasiveness. Both models show the factors or conditions present in the ICT environment that are influenced by the characteristics of the tasks to be performed, as well as the individual traits of the actor or person carrying out the tasks as intended in order to achieve the objectives. An extract of the details of the mappings are shown in Figure 3-6

and the entire mappings are attached as annexure F.

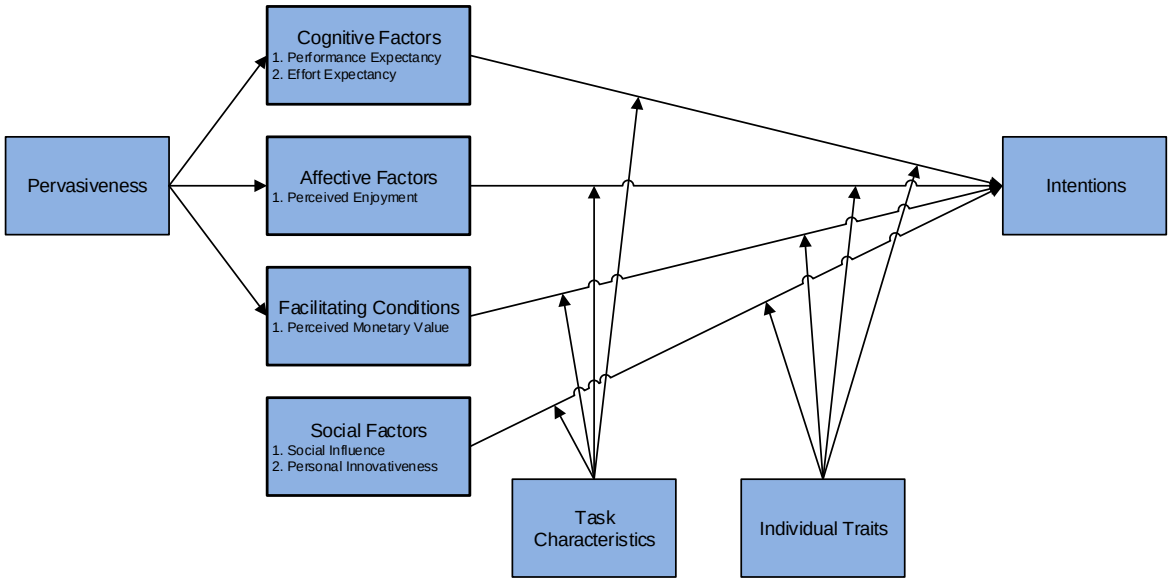


Figure 5-1: The Nomological Network of Pervasiveness (Karaiskos, 2009)

Empirical data from the survey is then presented along with the qualitative analysis to provide the public higher education sector in South Africa with the rationale to ensure that an ICT governance best practice framework is essential and that ICT governance can no longer be a question of choice. The medium-term strategies of the DHET include the requirement for improved efficiencies in a university system that is required to grow substantially in order to achieve a participation rate of 23% by 2030. This means that enrolments in the university system are set to increase from approximately 800 000 to 1,5 million (South Africa, Department of Higher Education and Training, 2010). The pervasiveness factors in this study are mapped to the pervasiveness categories as defined by Karaiskos (2009) and are also associated with the strategic goals of the DHET to indicate that an ICT pervasiveness thrust can contribute to the achievement of the DHET strategic goals. The block diagram of this mapping is shown in Figure 5-2, whilst more detailed mappings are shown in the diagrams that follow.

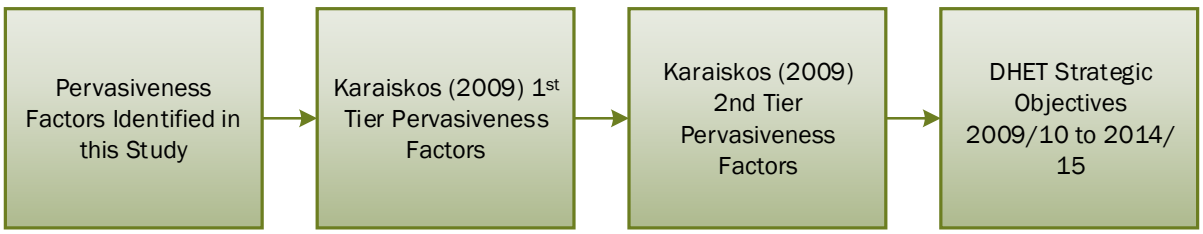


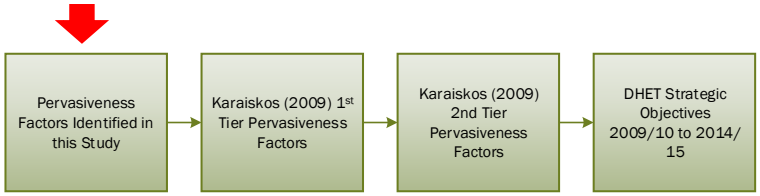
Figure 5-2: Process Flow of Pervasiveness Mapping

A Green Paper on Public Higher Education and Training (2012) was published by the DHET calling for comments on the proposals and intentions expressed in the plan. It is clear that the DHET recognises that ICT is increasingly becoming a critical ingredient for participation in a globalised world. It is also seen as being an indispensable infrastructural component of effective education provision, especially in the tertiary education sector. South Africa's particular challenge is to ensure that this infrastructure is extended equitably to all tertiary students. Currently, access is considered to be grossly uneven, however, making it impossible for distance education and other providers to fully harness the potential intellectual capacity in the country (South Africa, Department of Higher Education and Training, 2012).

5.2.2 ICT Pervasiveness in the South African Public Higher Education Sector

The pervasiveness of ICT in the public higher education sector in South Africa is introduced within the context of the need to find some way of measuring the extent to which ICT systems and services are deployed, available, used and depended upon. There are many factors that affect the pervasiveness of ICT in any environment, including the public higher education environment. The primary pervasiveness factors identified in this study and included in the ICT pervasiveness survey have been classified into eleven categories for the purpose of this study in order to provide an indication of the balance of factors across the categories that can influence ICT pervasiveness. These are shown in Figure 5-3. The categorisation of factors thus provides the quantity of factors influencing pervasiveness in each category. Whilst this categorisation may not contribute significantly to the research output of this study, it can guide future research to balance the factors across the categories in future surveys. The primary pervasiveness factors presented in Figure 5-3 through to Figure 5-13 are all associated with the survey on ICT pervasiveness in public higher education in South Africa.

Point of mapping reference Figure 5-3



Stages of pervasiveness factor mapping

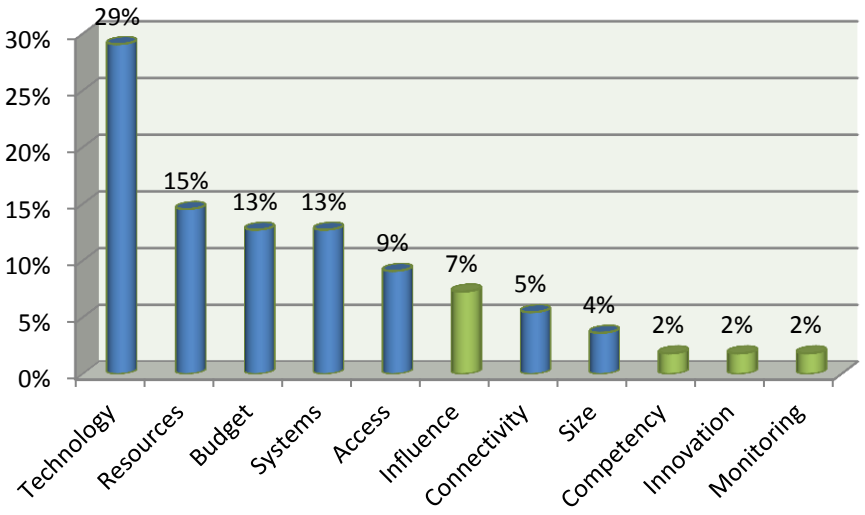


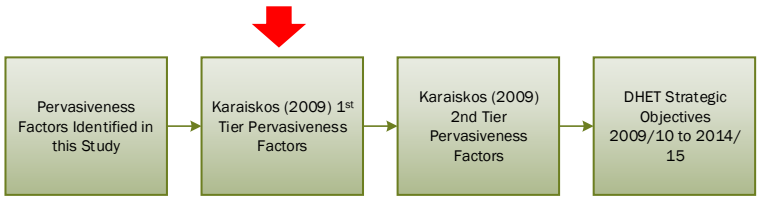
Figure 5-3: Primary Pervasiveness Factor Classification Categories

The comprehensive list of factors and their mappings is attached as Annexure B. It is significant that 87% of the factors identified are 'physical factors', which are shown in blue in Figure 5-3, whilst only 13% of the factors identified are 'abstract' in terms of the definitions used in this study − shown in Figure 5-3 in green. It could therefore be understood from Figure 5-3 that a focus on physical factors such as technology and systems could have a significant influence on any intention to improve ICT pervasiveness in a public higher education institution in South Africa. The factors were classified using the following guidelines:

- Technology factors are related to the *devices* that are deployed,
- Resources refer to sharing sites, disk space and other *services*.
- Budget factors take cognisance of the *financial* implications of ICT.
- Systems generally relate to *software systems* such as access control or electronic mail or the Internet.
- Access refers to the number of devices available to students and staff though which they can *gain normal access* to systems or services.
- Influence refers to the level at which the highest ranking ICT officer in the institution is able to freely and as part of normal function operate with policy makers and executive officers.
- Connectivity describes the *bandwidth* and other enabling *connections* to services.

- Size refers to the relative *sizes* of ICT services in comparison to other functional units within the organisation.
- Competency refers to the requirement for *academics* to have *relevant ICT skills.*
- Innovation reflects on the ability to introduce *new technologies* to support teaching, learning and research.
- Monitoring is included in the automation of *online asset identification* and tracking.

Figure 5-4 shows four groups of factors that Karaiskos (2009) defines in the first of the two dimensions of hi Point of mapping reference Figure 5-4 factors map to what appears to be the founding pervasiveness factors in public higher education in South Africa. The mapping of these factors shows that facilitating conditions and cognitive factors make up 89% of the first dimension factors contributing to pervasiveness in ICT in the public higher education sector. Social factors, which include the influence that can be exercised on the governing body of an institution, only make up 11% of the total number of factors. No 'affective' factors are mapped. In the context of the Karaiskos (2009) study, affective factors relate to the enjoyment of technology while in use. The use of technology in the educational environment is not necessarily synonymous with enjoyment, this being a possible reason for the absence of the inclusion of this as a factor that maps on ICT pervasiveness.



Stages of pervasiveness factor mapping

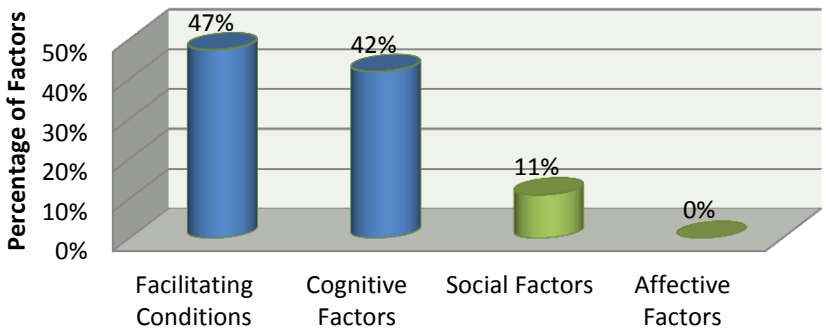


Figure 5-4: First Dimension Pervasiveness Factors Mapped to the Pervasiveness Factors Identified in this Study, Karaiskos (2009)

The second dimension mappings of the Karaiskos (2009) model to the factors identified in this study are shown in Figure 5-5 and reflect 89% of the factors relating to perceived monetary value and performance expectancy; 11% meanwhile can be attributed to social factors and personal innovativeness.

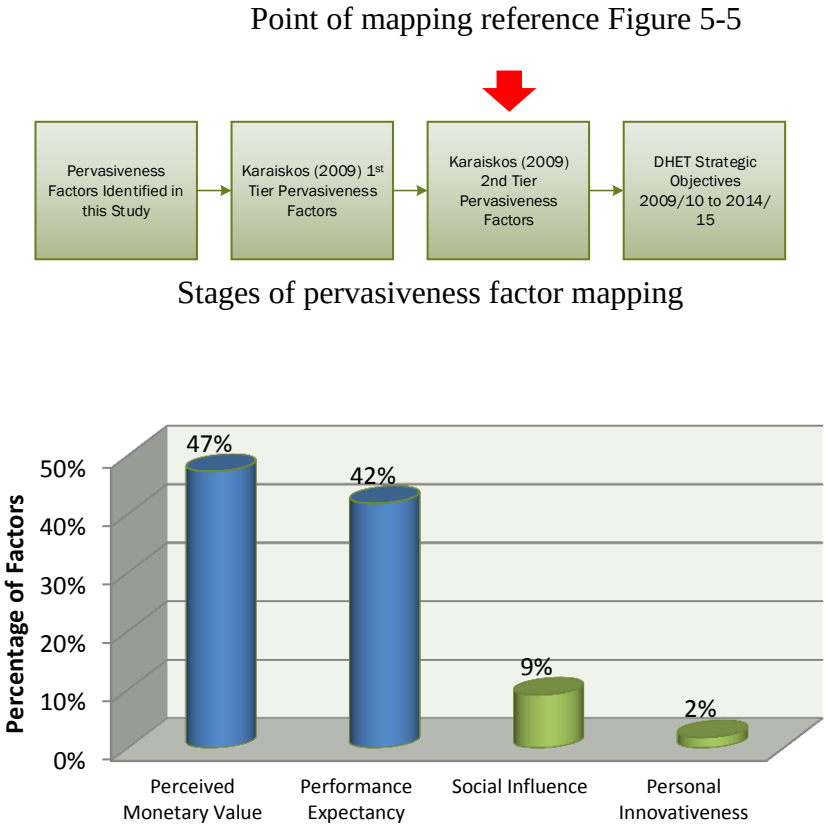
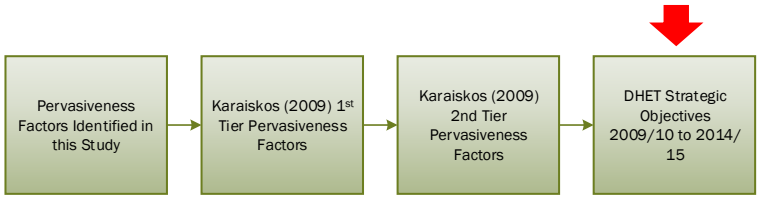


Figure 5-5: Second Dimension Pervasiveness Factors Mapped to the Pervasiveness Factors Identified in this Study (Karaiskos, 2009)

The third and final mapping across the factors of the Karaiskos (2009) model is aimed at associating the primary pervasiveness factors identified in this study, firstly with the Karaiskos (2009) factors and then ultimately with the DHET's strategic goals or imperatives enumerated in the DHET strategic plan (South Africa, Department of Higher Education and Training, 2010).

Point of mapping reference Figure 5-6



Stages of pervasiveness mapping

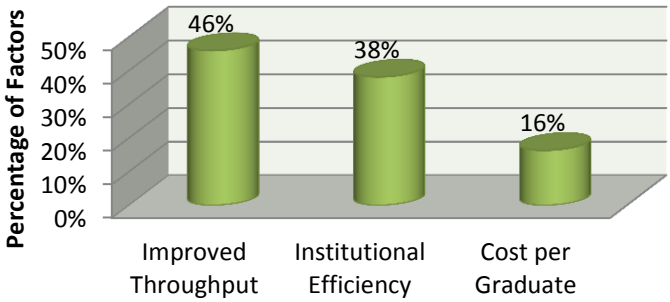


Figure 5-6: Categorisation of the Pervasiveness Factors in Higher Education South Africa, Association of Pervasiveness Factors with the DHET Strategic Objectives

The result of this mapping in Figure 5-6 shows that 46% of the factors associate with improved throughput, 38% with institutional efficiency and 16% with the cost per graduate.

The results of the survey also show that there are no ICT executives at public higher education institutions in South Africa reporting directly to the vice chancellor or principal of the higher education institution. The principal is responsible for the management and administration of a public higher education institution and as such is the individual charged with setting and implementing strategies (South Africa, Department of Education, 1997). Consequently, the positioning of the ICT structure and the office of the CIO within the institutional organogram can have a significant impact on the ability to implement ICT governance structures at a public higher education institution in South Africa. It can be seen in Figure 5-6 that ICT pervasiveness is closely associated with the DHET strategic objectives articulated in the strategic plan (2010).

Figure 5-7 shows the detailed mapping of the factors of pervasiveness identified in the study to the Karaiskos (2009) first- and second-tier pervasiveness factors and then also to the DHET strategic objectives. The objective of the detailed mapping is to provide an overall indication that improved throughput and institutional efficiency are the primary areas that

would benefit from an increase in ICT pervasiveness, with the cost per graduate still being significant.

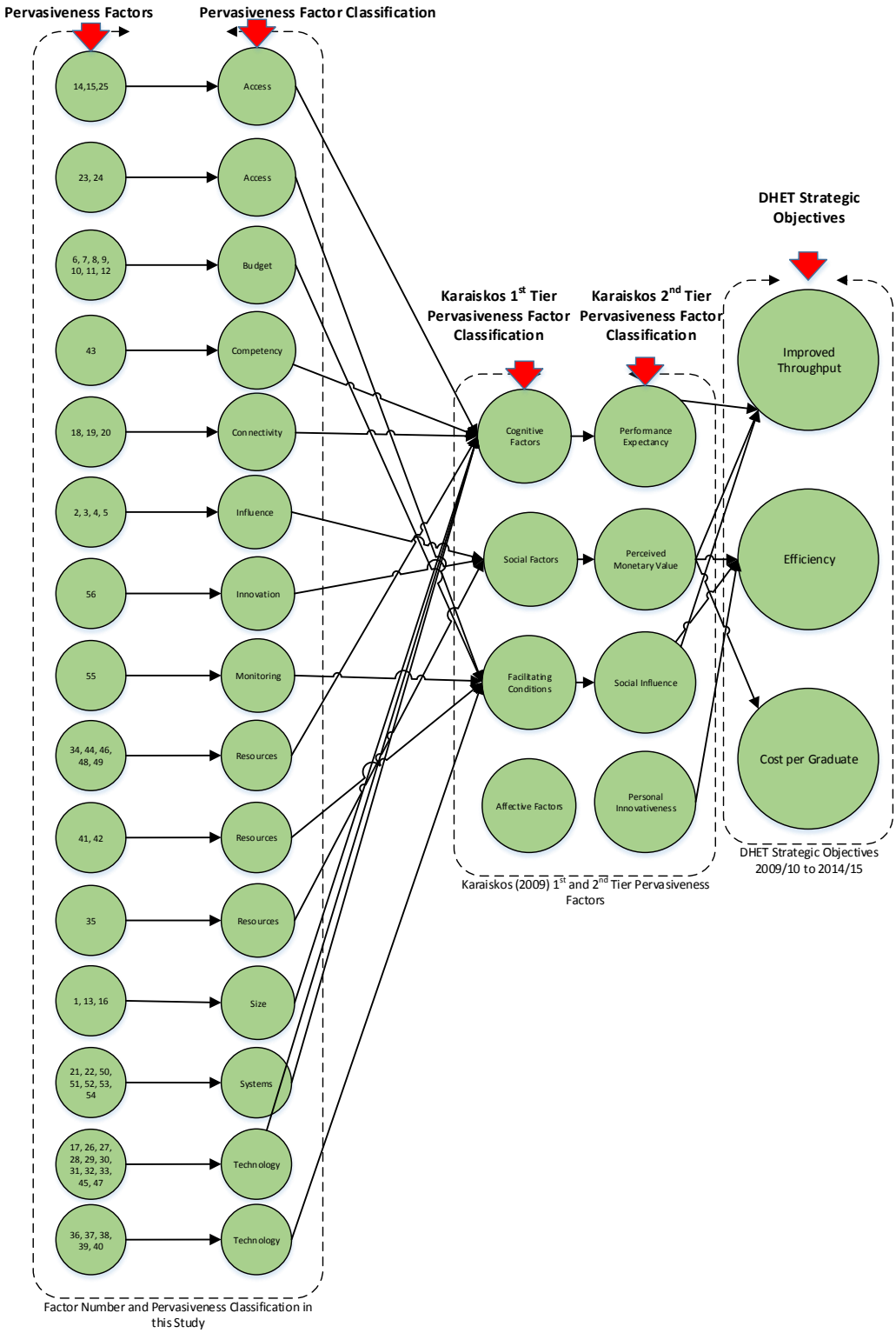


Figure 5-7: Diagram of the Pervasiveness Factor Mappings of the Study to Karaiskos (2009) and to the DHET Strategic Objectives 2009/10 to 2014/15

The mapping of the ICT pervasiveness factors identified in this study to the factors in the Karaiskos (2009) model provides a first attempt at grouping the factors to identify areas of ICT governance insufficiency. The responses to the survey on pervasiveness by the top ICT officials at public higher education institutions are presented in the next section.

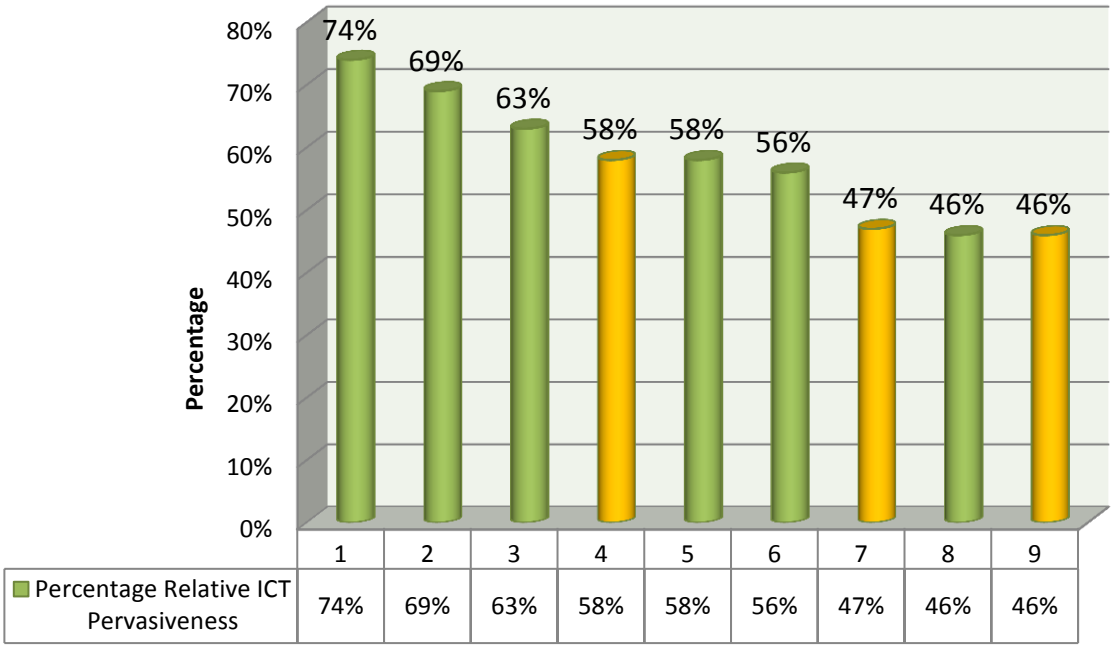


Figure 5-8: Percentage Relative ICT Pervasiveness in Higher Education Institutions in South Africa, Survey Results

Figure 5-8 reflects the percentage of the relative pervasiveness of ICT in the nine responding institutions. The survey response rate was 39%. Institutional responses are not named but respondents are numbered from one (1) to nine (9) to ensure that their anonymity is maintained.

To ensure consistency in the method of calculating the 55 measures, each factor is measured against the highest measure per factor to express the answer as a fraction of unity and to ensure the *relativity* of values to each other. The fractional factor measures are then multiplied by five to bring them all to the same level of reference, which ensures that there is no *weighting* associated with measures. Factors that have a response that result in a value other than between 0 and 5 are *translated* to measure between 0 and 5. An example of this is the Internet bandwidth factor that measures between 10 MB/s and 10 GB/s. The lower score of 10 MB/s is 0,001 * 5 = 0,005 and the highest score of 10 GB/s is 5. All these scores are added and multiplied by the factor required to express the final count as a percentage.

Many institutional factors can contribute to the percentage of relative ICT pervasiveness. Historically disadvantaged institutions are shown in yellow in Figure 5-8 with no apparent correlation in terms of the status of historical disadvantage and the percentage of relative ubiquity.

The age of institutions and the percentage of relative ICT pervasiveness were also checked in an attempt to find a correlation, but Figure 5-9 provides an indication that there is no apparent correlation. The inner axis of the percentage of relative ICT pervasiveness is the reference axis as this is indexed in descending order of the measure. The institutional age is shown on the outer axis.

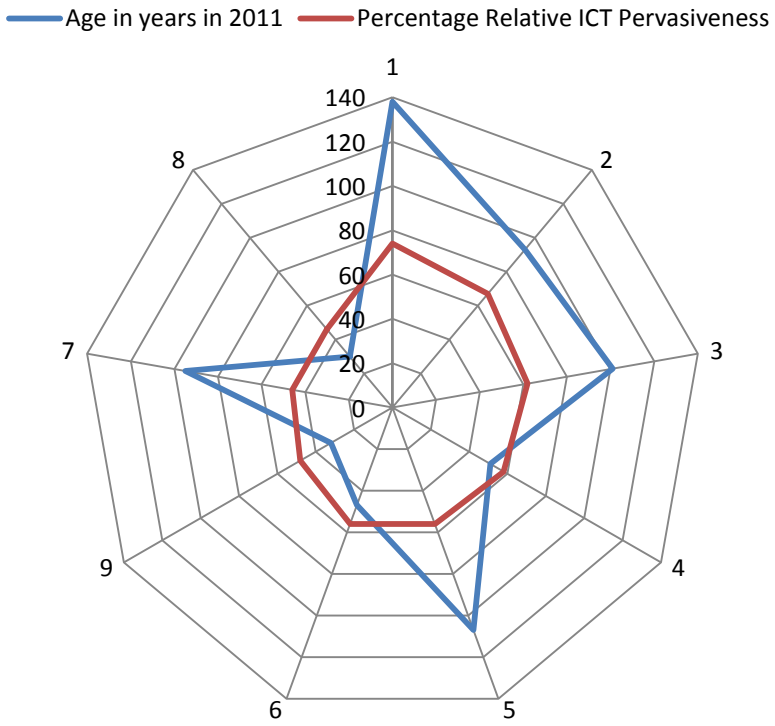


Figure 5-9: Percentage Relative ICT Pervasiveness and Institutional Age in Years

Institutions' identities have been withheld as agreed in the terms of reference for the completion of the survey.

Figure 5-3 to Figure 5-6 shows the stages of mapping, one stage at a time, from the factors of pervasiveness identified in this study through to the DHET strategic objectives. Section 5.3 provides details on the end-to-end mappings to show which primary pervasiveness factors

identified in this study *associate* with each of the three DHET strategic objectives (South Africa, Department of Higher Education and Training, 2010).

5.3 ICT Pervasiveness Factor Classification in the Higher Education Sector in South Africa

ICT pervasiveness factors, which were identified in this study in the public higher education institutions in South Africa, are mapped to the goals of the DHET as captured in the strategic plan 2010 to 2015 (South Africa, Department of Higher Education and Training, 2010). These include *improved throughput*, *efficiency* and *cost per graduate* and are shown in Figure 6-33. The DHET's strategic plan 2010 to 2015 contains a number of ambitious targets for improvement and these targets require the support of technology in every aspect of teaching and learning, research and administration.

The role played by technology and systems has grown in significance to such an extent that the concept of ***supporting*** teaching, learning, research and administration needs to be redefined to ***enabling*** teaching, learning, research and administration. *Support* has the sense of being static, while *enabling* connotes a sense of being dynamic and providing solutions virtually in advance of the requirement.

The mapping of ICT pervasiveness factors has been presented so far *at each stage* of the mapping in Figure 5-3 to Figure 5-6. The view from the institutional ICT pervasiveness factors of three strategic DHET goals is shown in Figure 5-11 to Figure 5-13. The process for achieving this new view of the mapping is shown in Figure 5-10.

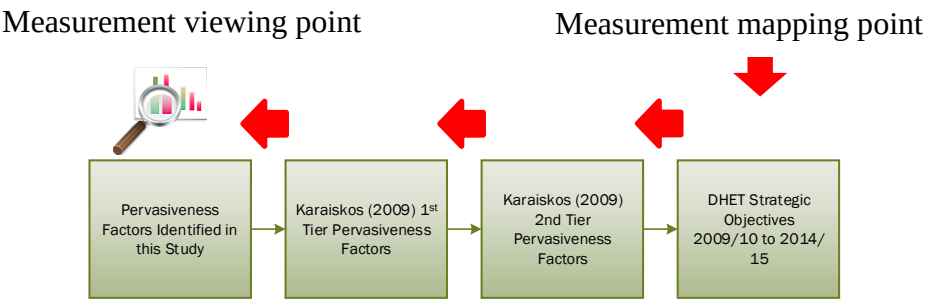


Figure 5-10: Stages of Pervasiveness Mapping between the Institution and DHET

The first of the three DHET strategic objectives targets − cost per graduate − and two of the eleven institutional ICT pervasiveness factor categories − *institutional size* and *budget* –

associate with this objective. The survey returns and subsequent mappings shown in Figure 5-11 indicate that six primary ICT institutional factors mapped to the *budget* category are the major contributors to this strategic objective, while three primary ICT institutional pervasiveness factors mapped to the *size* category are the minor contributors. The details of the number of factors per category are shown in Figure 5-11 alongside the category percentage values in square brackets.

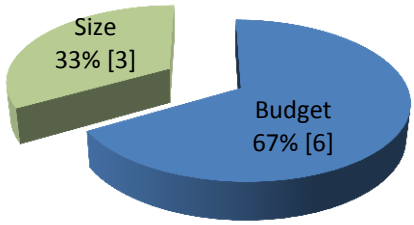


Figure 5-11: Institutional ICT Pervasiveness Factor Ratios Aligning to Cost per Graduate as a DHET Strategic Objective

The second of the three DHET strategic objectives targets − *efficiency* − and seven of the eleven institutional ICT pervasiveness factor categories − *systems, technology, access, influence, innovation, monitoring and resources* − associate with this objective. The survey returns and subsequent mappings shown in Figure 5-12 indicate the contributions of each category of institutional ICT pervasiveness factors to the DHET strategic objective of *efficiency*. Details of the number of factors per category are shown in Figure 5-12 alongside the category percentage values in square brackets.

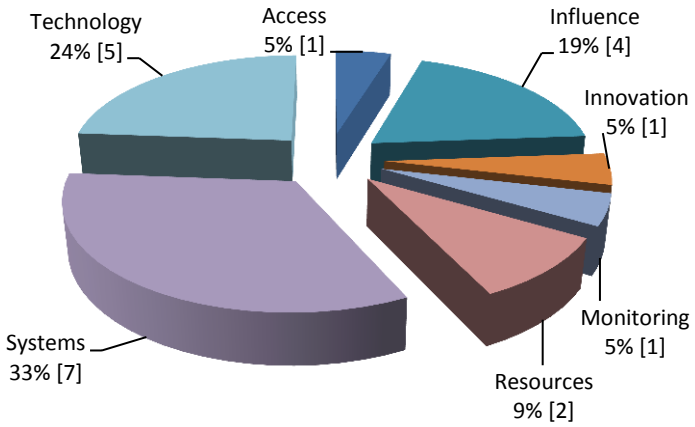


Figure 5-12: Institutional ICT Pervasiveness Factor Ratios aligning to Efficiency as a DHET Strategic Objective

The third of the three DHET strategic objective targets − *improved throughput* − and five of the eleven institutional ICT pervasiveness factor categories − *technology*, *resources*, *access*, *connectivity and competency* − associate with this objective. The survey returns and subsequent mappings shown in Figure 5-13 indicate the contributions of each category of institutional primary ICT pervasiveness factors to the DHET strategic objective of *improved throughput.* Details of the number of factors per category are shown in Figure 5-13 alongside the category percentage values in square brackets.

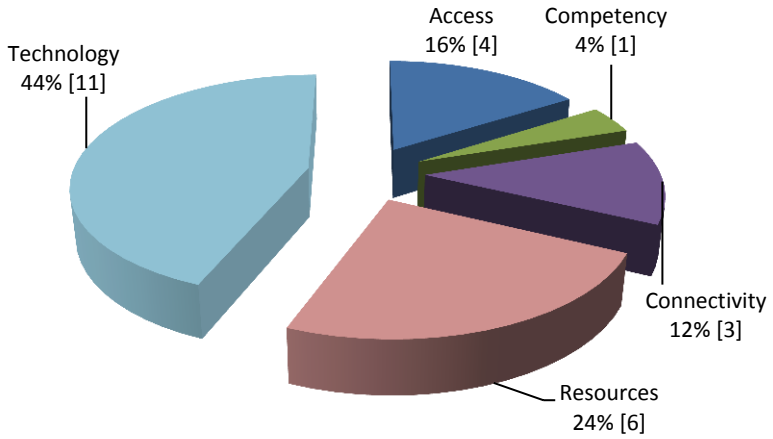


Figure 5-13: ICT Pervasiveness Factors Aligning with Improved Throughput as a DHET Strategic Objective

The various views of alignment between the goals and objectives of the DHET and the ICT pervasiveness factors identified and grouped by *classification* are shown in Figure 5-11, Figure 5-12 and Figure 5-13. The overall levels of *relative* ICT pervasiveness shown at responding institutions in Figure 5-8 vary between 46 and 74%. This is not an absolute measure of ICT pervasiveness as there is no single institution that has the highest measures of pervasiveness on each factor against which others can be measured. Pervasiveness is also associated with technological advancement and, as such, the maximum level of pervasiveness cannot be given a static value. The measure of 74% pervasiveness of an institution should therefore be read as '74% pervasive compared to the other institutions'.

5.4 Remarks on the Pervasiveness Survey and Responses

It is evident from the survey response data presented so far in this chapter that ICT is pervasive in public higher education institutions in South Africa and that there is a need to ensure that ICT 'enables' the functions required in the sector. The alignment of the ICT pervasiveness factors identified in this study to the goals of the DHET as identified in the

strategic plan 2010 to 2015 (South Africa, Department of Higher Education and Training, 2010) provides support for the need to ensure that improved governance of ICT in the sector assists in achieving the DHET goals defined in the strategic plan. With the concept of pervasiveness being relatively new, the questions in the ICT pervasiveness survey were refined through an iterative consultative process with the highest ranking ICT official at public higher education institutions. A further survey was formulated to test the support for each factor of pervasiveness that was used in the survey. The validation process and results of the validation survey are discussed from section 5.5 to the end of the chapter.

5.5 Survey on the Validation of the Pervasiveness Factors in this Study

The ICT pervasiveness factors identified in this study required some form of validation to provide assurance that they *would* influence ICT pervasiveness within the public higher education environment in some way. A further survey incorporating the 55 factors that were used in the primary ICT pervasiveness factors survey was constructed to evaluate support of the factors. The highest ranking ICT officer in public higher education institutions was approached to complete the survey. This survey commanded a 70% response rate with all measures of pervasiveness having a positive aggregate of between five and 24 on a scale between −32 and +32. See Table 5-1: Example of Pervasiveness Factor Response Aggregate Calculation for more detail on the method of calculation. If all 16 institutions had responded to a particular factor with ‘strongly disagree’, then the aggregated value would amount to −32 and, similarly, if all 16 responding institutions had responded to a particular factor with ‘strongly agree’ then the aggregated response would amount to +32. An example is given in

Table 5-1 where the aggregated response amounts to +12.

Institution Number	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Aggregate
n	-2					
n+1		-1				
			0			
			0			
			0			
				1		
					2	
				1		
				1		
				1		
					2	
					2	
					2	
					2	
			0			
n+x				1		
	-2	-1	0	5	10	**12**

Table 5-1: Example of Pervasiveness Factor Response Aggregate Calculation

Responses are grouped into levels of agreement, disagreement or neutrality and shown in Figure 5-14.

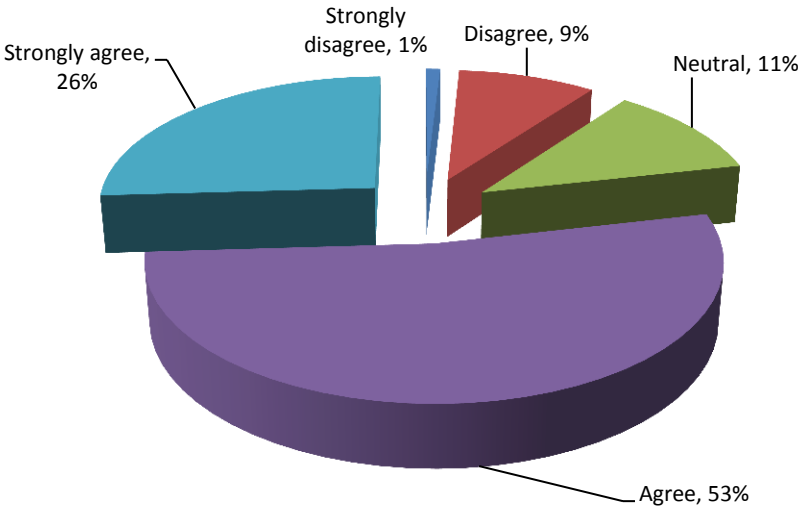


Figure 5-14: Percentage Agreement or Disagreement of ICT Pervasiveness Factors

The total percentage of respondents who agreed or strongly agreed is approximately 78%, whilst those who disagreed or strongly disagreed is less than 10%, with those being neutral around 11%. Significantly, the majority of respondents agreed. All factors with a positive aggregate are recognised in this study as having an influence on ICT pervasiveness. The individual ICT pervasiveness factor results are shown in Figure 5-15 and Figure 5-16. The responses are split into two graphs to provide improved presentation. It is no surprise that the highest aggregate response is associated with technology and students, and their blending into a learning environment. It is, however, a surprise to find that the lowest aggregate response is associated with academic staff and a requirement for formal certification in ICT.

5.6 Summary on ICT Pervasiveness and its Contribution to this Study

The purpose of exploring pervasiveness in this study is to present a founding mechanism for measuring ICT pervasiveness in public higher education institutions in South Africa and to associate the concept of pervasiveness with the increased need to govern ICT so as to ensure its value contribution to the sector. The concept of pervasiveness or ubiquity is reasonably new in the ICT environment, the first reference to it being made by Weiser (1991). Consequently, it required some form of validation or association with the COBIT 4.1 ICT best practice framework and the objectives of the DHET (South Africa, Department of

Higher Education and Training, 2010). Weiser's (1991) vision of a proliferation of devices has indeed occurred, with commonly used devices such as hand-held PDAs, digital tablets, laptops, and wall-sized electronic whiteboards now populating classrooms in public higher education institutions.

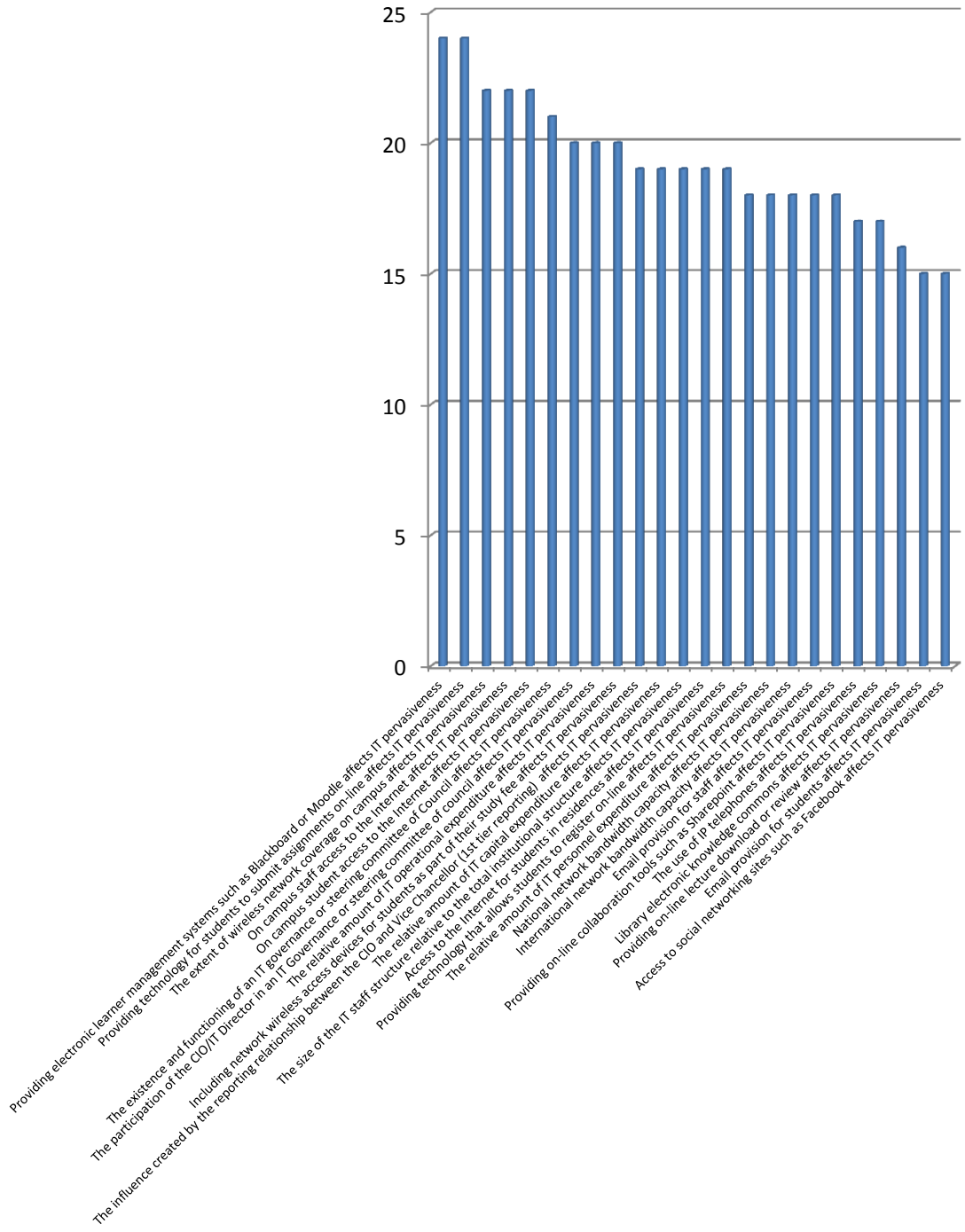


Figure 5-15: ICT Pervasiveness Factors with Aggregate Values 24 to 15

In addition to this students have access to video communication services that facilitate quick and simplified access to academic research resources anywhere and anytime. The assurance that public higher education institutions are pervasive in their use of ICT has been provided by the highest ranking ICT official at public higher education institutions through their responses to a survey engineered to solicit the required information.

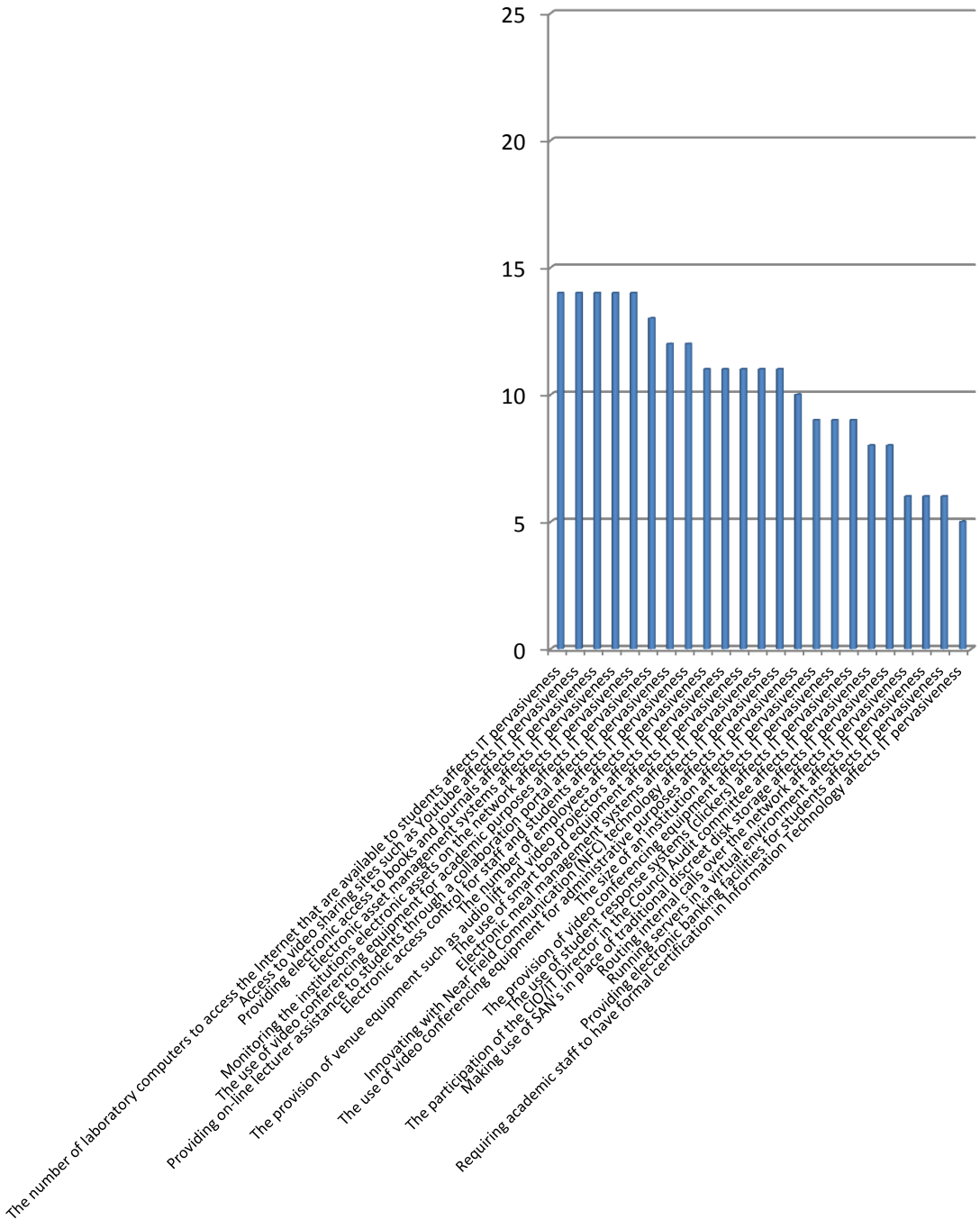


Figure 5-16: ICT Pervasiveness Factors with Aggregate 14 to 5

The factors investigated in the initial pervasiveness survey were evaluated by the highest ranking ICT official using a second survey to gain some assurance of relevance to the public higher education sector. These factors have been mapped to the work of Karaiskos (2009) to achieve some level of association with this new work and, finally, this was mapped to the strategic objectives of the DHET (2010). Mapping to the strategic objectives of the DHET provides assurance to the DHET that improved pervasiveness can lead to improvement in terms of its primary objectives of improvement of efficiency, throughput and cost per graduate. The high level of relative pervasiveness of ICT in public higher education in South Africa and the differential levels between the highest and lowest being in the order of 25% indicate both the need to invest in pervasive ICT at the less technological institutions and also to ensure that ICT is governed in order to generate better value from its application. There is loose correlation between the results of the relative pervasiveness survey results shown in Figure 5-8 and the results of the COBIT maturity level survey in Figure 6-3 indicating that institutions that are highly ICT pervasive are also more mature in their processes.

The high levels of ICT pervasiveness measured at public higher education institutions in South Africa also indicate that strong ICT governance is indeed required to ensure value delivery. The survey results showed that ICT is embedded in university processes and that university Councils should therefore focus more on ICT governance best practices. This can contribute to the transformation of ICT in the public higher education environment from a *supportive* role in the reactive sense, to an *enabling* role in the proactive sense.

This chapter explored the pervasiveness of ICT in order to present a founding mechanism for measuring ICT pervasiveness in public higher education institutions in South Africa and to associate the concept of pervasiveness with the increased need to govern ICT in order to ensure its value contribution to the sector. The primary ICT pervasiveness factors identified in the study were also endorsed by the highest ranking ICT officials as contributing to pervasive ICT.

The next chapter covers the measurement of *ICT process maturity* in the context of public higher education institutions in South Africa. This is aimed at providing a baseline to inform the sector on the current status of ICT process maturity.

Chapter Six

Information and Communication Technology Process Maturity in Public Higher Education Institutions in South Africa

6 Information and Communication Technology Process Maturity in Higher Education Institutions in South Africa

6.1 Introduction

This chapter provides details on the second of three secondary research objectives designed to support the primary research objective, that is, *to produce a value framework that can be used to identify the value created in tertiary institutions in South Africa by implementing good governance practices from the highest governing authority to the ICT functional environment.* The second secondary research objective discussed in this chapter is *the identification of the ICT governance practices in tertiary institutions in South Africa.*

In 1997, the South African National Department of Education published a white paper on the transformation of the higher education sector. This was intended to ensure that the sector would meet the criteria for the higher education agenda of the country. Governance of the higher education sector in South Africa is defined in an act of parliament governing the sector, the Higher Education Act 101 of 1997. The Act defines the governance organs required for the sector. Whilst the corporate governance requirements are well defined and practised, there is no formally espoused requirement for the governance of information and/or information and communication technology (ICT). In this chapter the maturity levels of ICT governance are investigated using the COBIT 4.1 framework developed by the Information Systems Audit and Control Association (ISACA). Nine of the twenty-three public higher education institutions in South Africa participated in a survey requiring 241 responses each. The empirical results of this survey on the level of ICT process maturity are presented and discussed. This provides data leading to a better understanding on how to achieve higher levels of ICT process maturity and the benefits that are associated with these improved levels.

Since 2000 there has been increased interest in ICT in many higher education institutions in South Africa, driven by a move towards 'the knowledge society', a society for which ICT is considered a basic requirement (IT Governance Institute, 2003). In other countries, the interest in technology is related to national policy frameworks, rapidly changing ICT sectors and the impetus provided by various funding bodies. This is not the case in South Africa, where there are no specific technology policies in higher education that explicitly steer such practices.

Despite this, higher education institutions are spending more of their budgets on ICT

infrastructure than they did in previous years, in the face of poor ICT infrastructure nationally and in higher education (IT Governance Institute, 2003). The objective of this chapter is to highlight the findings of a study on ICT governance in public higher education institutions in South Africa. More specifically, this chapter focuses on the ICT governance maturity levels within these South African public higher education institutions.

ICT governance maturity is essentially the state of functionality or the efficiency of ICT processes, ranging, as they do, from non-existent to optimised. This chapter, firstly, introduces the public higher education system in South Africa as an open system and then provides insight into the legislation governing this sector. This is followed by a review on the theoretical foundation of ICT governance relevant to the topic, after which the empirical findings resulting from the surveys completed by the respondents on ICT governance maturity are discussed. The empirical data resulting from this study provides the public higher education sector in South Africa with information on ICT governance maturity levels.

Finally, this chapter also covers the existing governance structures in place in the public higher education sector in South Africa and, by using the empirical findings of the research conducted, shows the need to ensure that ICT best practice frameworks are in place to ensure the best return on investment or the value of such investment (Ataya, 2003).

6.2 Transformation of ICT in Public Higher Education Institutions in South Africa during the Last Decade

The focus of chapter five was aimed at exploring ICT pervasiveness in public higher education institutions in South Africa in order to present a founding mechanism for measuring relative ICT pervasiveness. Subsequently, a mechanism was presented that found the relative levels of pervasiveness to be between 46 and 74%, thus substantiating the fact that ICT is indeed pervasive in public higher education institutions in South Africa.

The restructuring of the sector has added a new dimension to this dependence, where ICT is also needed to provide high bandwidth connectivity and shared ICT resources between newly merged institutions, as well as other services highlighted by associations such as EDUCAUSE amongst others. EDUCAUSE is a non-profit association and the foremost community of ICT leaders and professionals committed to advancing higher education. Worldwide membership of EDUCAUSE includes over 1 800 colleges and universities, as well as over 300 corporations serving higher education, other associations, state agencies and

other non-profit organisations (EDUCAUSE 2012). The EDUCAUSE top ten technology issues for 2011 also indicate that the rise in the strategic importance of teaching and learning with technology has moved beyond the data centre and institutional administrative systems, to become part of the daily life of faculty and students.

The number of courses taught online and in blended technology mediated modes continues to increase (EDUCAUSE, 2011). This pervasive use of technology has created a critical dependence on ICT that calls for a specific focus on ICT governance (Van Grembergen, 2004). The King III Code of good governance practice (2009) states that ICT has become an integral part of doing business today, as it is fundamental to the support, sustainability and growth of organisations. All registered business entities in South Africa, including higher education institutions, must 'apply' the code, or else explain their non-application thereof (King III Code 2009).

Weill and Ross (2004) state that as ICT has become more important and pervasive, senior management teams have been increasingly challenged to manage and control ICT in order to ensure that value is created. To address this issue, many enterprises are creating or refining ICT governance structures in order to focus ICT spending more effectively on strategic priorities. McLure (2003) states that a number of variables, in combination and usually institutional-specific, now have a significant impact on what constitutes good governance and decision making. These include general institutional characteristics, sources and levels of funding, leadership style, formality of planning, organisational culture, decision-making style and type of ICT leadership structure. These are all issues that need careful consideration.

It is generally understood that collegiality in the public higher education sector in South Africa also plays a role in the ability to implement governance structures. Whilst academic endeavour aims to explore the widest range of issues specific to an area of interest or research and thereby provide the optimal solution, management endeavour aims to implement technology or services as quickly and efficiently as possible, and then to measure their efficiency. The Organization for Economic Co-operation and Development (OECD) provides its view on this matter by stating that "the concept and emphasis of university research, and the disciplinary basis of traditional university structures, are in conflict with the instrumental, market-based, and bottom line oriented approach to knowledge in the industry" (OECD, 2000, p. 167).

This has perhaps not always been the case in terms of ICT governance; when ICT was perceived as simply 'plumbing' for the enterprise, it was easy to determine the extent of the ICT governance requirements without consultation with, in particular, the academic fraternity. As the scope of ICT has grown to meet the ever-changing challenges facing business, so too has the awareness, understanding, capability and expectations of non-technical business leaders (OECD, 2004). ICT is no longer merely a supporting tool for business, but a fundamental component of company strategy in such roles as operations, internal audit, compliance and decision support (Van Grembergen, 2004).

The green paper on higher education published in January 2012 indicates plans for further transformation of the higher education sector in South Africa. Here also it is stated that ICT is increasingly becoming a critical ingredient for participation in a globalised world, as well as being an indispensable infrastructural component for effective education provision, especially in the post-schooling sector (South Africa, Department of Higher Education and Training, 2012). From the abovementioned facts it is clear that the role of ICT has evolved and has become a critical component of institutional strategy. As a result of this integration of ICT into institutional strategy, it becomes increasingly important to ensure that all aspects of ICT governance are investigated, and for the purpose of this study this investigation begins in the next section.

6.3 Theoretical Foundation

ICT governance requires that the scarce resources of technology capacity be diligently distributed across an organisation for overall business success. In other words, it stipulates that ICT cannot be allocated merely on the basis of individual team needs, but rather on the basis of collective organisational goals (O'Reilly, 2011). Within the public higher education sector in South Africa there is no requirement to ensure any collective objectivity towards ICT governance, and it is within this context that the origins of corporate governance and the relatively newer concept of ICT governance are to be explained.

6.3.1 Corporate and ICT Governance

The broader topic of corporate governance is not reviewed in depth in this chapter; suffice it to say that ICT governance is a function of corporate governance (King III Code, 2009). ICT governance is essentially all about the board directives, policies and procedures that determine how an organisation directs and controls the use of its technology resources, so

that these resources may successfully facilitate the realisation of the organisation's business goals (South Africa, Department of Higher Education and Training, 2010). It also includes the requirement to ensure that not only are the current technology resources optimally utilised, but that new technology possibilities are continuously reviewed and engineered into policy, procedures and systems.

Flowerday and Von Solms (2005) assert that many companies today are totally dependent on their information assets, which are in most cases stored, processed and communicated within information systems in digital format. These systems are facilitated by modern ICTs.

Posthumus and Von Solms (2005) state that "ICT has become widely integrated into most organizations, but ICT issues remain a neglected topic at board level. The general failure by the board to effectively and strategically direct and control ICT is derived from a lack of adequate skills and insight into ICT-related issues at board level". In as much as the Council is responsible for the governance of an institution, it is also responsible for inter-institutional cooperative governance, as defined in Chapter 4 of the Higher Education Act (South Africa, Department of Education, 1997). This chapter states that public higher education institutions may cooperate with each other in any manner to achieve the optimal utilisation of resources and the performance of their functions; and they may also establish regional or national structures to assist and facilitate this cooperation.

Bodies set up in terms of this cooperative governance requirement include Higher Education South Africa (HESA), which has all twenty-three vice chancellors on its board of directors, and the Association of South African University Directors of Information Technology (ASAUDIT), with an executive elected by the chief information officers or ICT directors of institutions, as mandated by the vice chancellors. Both of these bodies operate as not-for-profit companies in terms of the Companies Act 71 of 2008.

6.3.2 The Higher Education Environment as a System

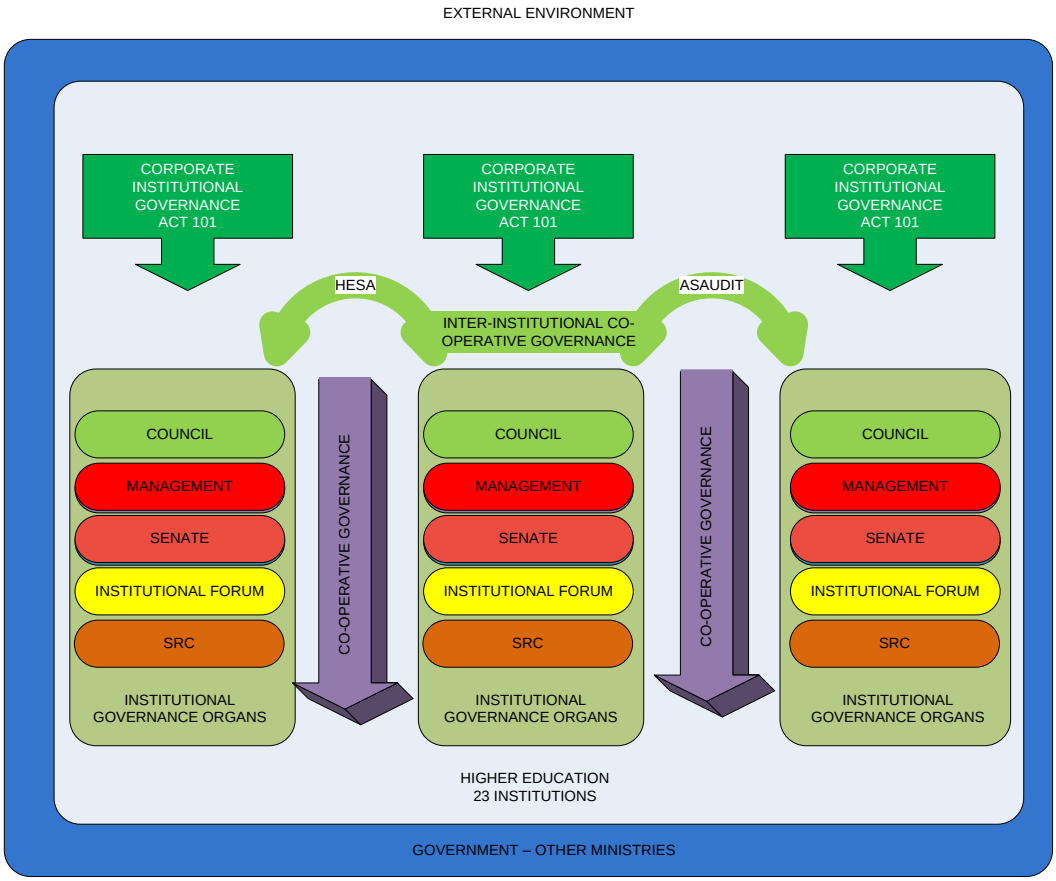


Figure 6-1: Higher Education as an Open System (compiled from Higher Education Act 101 of 1997, HESA and ASAUDIT)

The governance structures required in public higher education institutions are defined in the Higher Education Act and they are shown in Figure 6-1. The Act prescribes both the membership and the method of constituting the governance organs. The optional cooperative governance relationship facilitated between institutions through the structures of ASAUDIT and HESA is also shown. A new 'co-operative governance model', as defined by Cloete and Kulati (2003), now defines cooperative governance as a shift of the locus of power from 'centralised control' to 'steering', in which governments provide the broad regulatory framework and, through the use of instruments, such as planning and funding, these institutions are 'steered' to produce the outputs that governments desire.

Steering is seen as an interactive process between government and institutions. "Co-operative governance requires that decision-making processes at the systemic, institutional and departmental levels are transparent, and that those taking and implementing decisions are

accountable for the manner in which they perform their duties and use resources" (South Africa, Department of Education, 1997, p. 13).

This model of cooperative governance encourages institutional autonomy within the framework of the Higher Education Act, but the governance report (annual report), as required by reporting regulation R691 (South Africa, Department of Education, 2007) promulgated in terms of the Act, is required six months after the year end. This does not contribute to effective control.

The Higher Education Act is the core regulatory influence on sound governance practices in the higher education sector in South Africa. The Act (South Africa, Department of Education, 1997, p. 2) aims to "[r]egulate higher education; to provide for the establishment, composition and functions of a Council on Higher Education; to provide for the establishment, governance and funding of public higher education institutions …". The preamble in the Act envisages that a "single coordinated higher education system, which promotes co-operative governance and provides for program-based higher education" be established.

The Act also defines the governance structures required, as well as their composition (South Africa, Department of Education, 1997). The upper levels of the diagram in Figure 4-4 indicate that the areas of maximum focus relate to governance and that there is lesser focus on management. At the strategic level, the institution's strategies are defined and policies devised that promote successful management function. At the tactical level, the policies are transformed into processes that are used to execute the tasks required in order to function as an organisation.

Service-level agreements play a key role in ensuring that service objectives are measured and met. The level of steering or governance decreases as the functions move from the strategic level, through the tactical level to the functional management level. The intensity of the role of management also decreases with movement – from the functional role of management – upwards to the strategic or governance level. Functions at the operational level are performed within the framework provided by policy through governance structures. Formulation of policies and the creation of structures are in many cases guided by standards.

6.3.3 ICT Governance Theoretical Foundation

As corporate ICT infrastructure increased in size and complexity from the early 1960s, corporations recognised the need for better mechanisms to assess the role played by ICT and its alignment to key corporate initiatives. The role that ICT plays in organisations has evolved from a purely supportive role, usually in the financial, HR and sales areas, to become a strategic enabler. This has often occurred through the implementation of new technologies that could provide strategic advantage. This change of ICT focus led to the adoption of best practices and what began as a series of best practices evolved over a period of time into the field now known as ICT governance. Many ICT best practice frameworks have been defined and used to assist enterprises in the assurance of value in their ICT investments. As most of the existing frameworks are complementary, with strengths in different areas, a hybrid approach is often taken (Symons, 2005).

There are a number of prominent existing frameworks. In June 2008, the International Standards Organization (ISO) published an ICT governance standard, ISO/IEC 38500:2008 E. This standard was developed from the Australian Standard AS 38500. Another best practice framework was developed by the Information Systems Audit and Control Association (ISACA) and was called the Control Objectives in Information Technology (COBIT). The COBIT 4.1 framework maps fully with the six areas of the ISO/IEC 38500:2008 E standard, which are Responsibility, Strategy, Acquisition, Performance, Conformance and Human Behaviour. In addition to these two frameworks, the Information Technology Governance Institute (ITGI) was established in 1998 in recognition of the increasing criticality of ICT to enterprise success. The ITGI conducts research on global practices and perceptions of ICT governance for the business community. This institute aims to help enterprise leaders understand how effective governance can make ICT successful in supporting the enterprise's mission and goals.

In this study COBIT version 4.1 (2003) was used because the study commenced prior to the release of COBIT version five in 2012. Moreover, most the public higher education institutions in South Africa have some knowledge of the COBIT version 4.1 framework or have implemented it to some extent as the framework of choice for their institutions.

The process focus of COBIT 4.1 is illustrated by a process model that subdivides ICT into four domains and 34 processes in line with the responsibility areas of plan, build, run and

monitor, providing an end-to-end view of ICT (IT Governance Institute, 2011). These domains are shown in Figure 6-2. This end-to-end view of ICT reveals the dependencies, reliability requirements and possible investment costs of ICT.

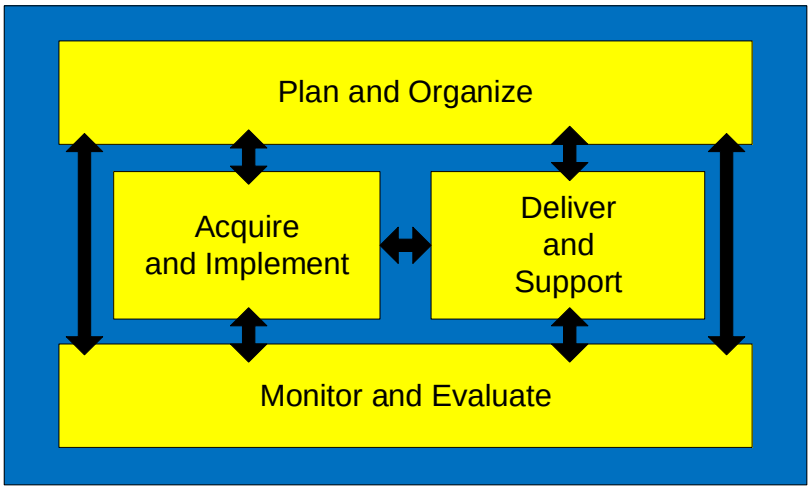


Figure 6-2: The Four Interrelated Domains of the COBIT IT Best Practice Framework (ITGI, 2007)

ICT investment costs are significant and much effort has gone into defining a way in which to express such costs as a standard financial indicator, such as return on investment (ROI). Ataya (2003) states that, initially, most organisations' decision-making related to ICT and relied on some form of ROI or on the derived internal rate of return (IRR) measures to evaluate projects.

Using only ROI analysis in higher education can be problematic; a more coherent approach involves analysis of the value of investment (VOI), which takes into account the qualitative benefits derived from ICT (EDUCAUSE, 2003). Qualitative benefits, such as risk reduction, improved resource utilisation and improved business/ICT alignment, are benefits that can be achieved through the application of an ICT framework such as COBIT in the higher education sector. The restructuring of the higher education sector in South Africa over the last decade has highlighted the need to improve ICT governance to ensure that the qualitative benefits that can be created by the new structures are achieved. The EDUCAUSE (EDUCAUSE, 2011) top ten technology issues also indicate that the rise in the strategic importance of teaching and learning with technology has moved beyond the data centre and institutional administrative systems and has become part of the daily life of faculty and students. Accordingly, academics are faced with increasing demands to provide access to

online learning material and this has led to the number of courses taught online and in blended technology mediated modes to increase (EDUCAUSE, 2011). This pervasive use of technology has created a critical dependence on ICT that calls for a specific focus on ICT governance (Van Grembergen, 2004).

The application of an ICT best practice framework such as COBIT 4.1 is similar in both corporations and the higher education sector. While corporations refer to business/ICT alignment, the typical terminology used in the higher education sector in South Africa is institutional/ICT alignment, where institutional refers to the core functions in the sector, that is, teaching and learning, research and community engagement. A more generic term used in later iterations of the COBIT framework is that of enterprise/ICT alignment.

In the COBIT 4.1 framework, governance is defined as "the set of responsibilities and practices exercised by senior management of the enterprise designed to establish and communicate strategic direction, ensure the realization of goals and objectives, mitigate risk, and verify that assigned resources are used in an effective and efficient manner" (IT Governance Institute, 2003, p. 6).

De Haes and Van Grembergen (2005) propose that ICT governance is the organisational capacity exercised by the board, executive and ICT management in order to control the formulation of ICT strategy and to ensure the fusion of business and ICT, where the primary focus is on the responsibility of the board and the executive management.

A very close relationship between enterprise and ICT goals has become apparent from the above. The tight linkage between ICT and organisational processes means that the ICT unit cannot bear sole or even primary responsibility for the effective use of information and ICTs. It is therefore imperative that leaders throughout the organisation should develop this competency, that is, that "effective ICT governance is the single most important predictor of the value an organisation generates from ICT*"* (South Africa, Department of Education, 1997, p. 3).

The increasingly strategic role that ICT plays in organisations today and its high level of pervasiveness makes it critical to ensure that it is properly governed in order to realise value from its use. It can be said that organisations can no longer function in the global world today without being adequately ICT enabled. This is also true for public higher education in South

Africa where one of the primary pervasiveness factor indicators or measures, namely, bandwidth to a campus, has grown from 100 KB/s in 2000 to 10 GB/s in 2012.

6.3.4 ICT Governance in Public Higher Education Institutions

Governance requirements in public higher education institutions in South Africa are currently guided by the legislative frameworks applicable to the sector. These include the Higher Education Act 101 of 1997 (South Africa, Department of Education, 1997) and the institutional statute. A Standard Institutional Statute (South Africa, Department of Education, 2002) is published in terms of the Higher Education Act, but this statute can be enhanced to provide for institutional requirements as well.

The investment in the technologies needed to provide higher education with the required advantage is substantial and yet there is no legislation in place to require any form of ICT governance in the public higher education sector in South Africa. The situation is similar in Australia, where although the ICT governance standard, AS 8015-2005, was published by the Standards Australia, it is not enforced by any legislation (Standards Australia, 2005).

As ICT becomes more critical for enterprise survival, in addition to enabling growth, ICT strategy committees need to broaden their scope. Not only should they offer advice on strategy when assisting the board in its ICT governance responsibilities, but they should also focus on the ICT value, risks and performance (IT Governance Institute, 2003). Although most public higher education institutions in South Africa have some form of ICT governance or ICT strategic committee in place, the role of these committees varies in nature from ICT *steering committees* that focus on ensuring *conformance* with policy to those that participate in *policy creation* and *strategic thought leadership* to shape the future with enabling ICT innovation. There are also those structures that monitor the *performance* of both *governance* and *management* initiatives.

6.3.5 Reasons for ICT Governance in the Higher Education Sector in South Africa

The South African Department of Higher Education and Training (DHET), through the Higher Education Act, does not specifically require higher education institutions to implement ICT governance practices. However, the King III Code is applicable to all registered entities in South Africa and therefore also applicable to public higher education institutions.

The Standard Institutional Statute provides for governance committees which are required in terms of the Higher Education Act (South Africa, Department of Education, 2002). However, there is no specific requirement for an ICT committee of any nature to be established, although other committees, as required by the University Council, may be set up.

There are, however, compelling reasons, other than legal compliance requirements, to apply good ICT governance practices wherever ICT is used. Posthumus and Von Solms (2005) make the point that almost every aspect of doing business somehow involves the utilisation of ICT systems; and that these systems will present both risks and opportunities. Accordingly, both the risks and opportunities need to be monitored and therefore the implementation of an ICT oversight committee appears to be a practical mechanism for providing the necessary skills and insight to support technology based decision making and to address strategic ICT-related issues (Posthumus & Von Solms, 2005).

ICT supports every phase of the higher education mission. On many campuses, there is a growing concern that the best possible job in setting priorities for new ICT systems, collaborating across departmental boundaries and sharing expensive infrastructure is not being done. While ICT may be enjoying varying levels of priority within some institutions, it has not enjoyed priority status between these institutions. "One path towards improving the current situation is to improve the ICT processes" (EDUCAUSE, 2006, p. 10). The lack of any formally implemented best practice ICT governance structure leads to increased risk, the misalignment of enterprise processes with ICT, resource inefficiencies and poor value delivery. In view of this, the implementation of an ICT best practice framework, such as COBIT, may assist in providing a structured and well-informed response to the need to create value (IT Governance Institute, 2003).

"Information systems were used as enablers to business, but have now become pervasive, in the sense that they are built into the strategy of the business. The pervasiveness of ICT in business today mandates the governance of ICT, as a corporate imperative" (King III Code, 2009, p. 17). The current level of ICT process maturity in the South African public higher education sector is unknown; accordingly ascertaining this level could assist further in the understanding of ICT governance and ICT process maturity and how these may contribute to value creation. If the ICT process maturity level is identified as being low, this could provide the motivation for defining guidelines or frameworks to assist in improving the level.

The maturity level of ICT in an organisation provides a way to predict future ICT and the resultant organisational performance. It therefore becomes imperative that the governance implementation process be measured and evaluated (De Haes, 2007). That being the case, a comprehensive survey was designed and then administered online to ascertain the ICT governance maturity level of a sample section of the public higher education sector in South Africa. The findings of this survey, which was based on COBIT 4.1, are presented and discussed in the following section.

6.4 COBIT 4.1 Survey Methodology

In this part of the research process all twenty-three public higher education institutions in South Africa were invited to participate. This included institutions across the range of university types in South Africa, such as universities of technology, traditional universities and comprehensive universities. An online survey, using the COBIT 4.1 framework, already in use at some level in most public higher education institutions in South Africa, was conducted to obtain data from the most senior ICT official at the institution. This person was selected to ensure that the responses were all submitted by persons operating at a similar strategic level in the institutions and who function in both governance and management roles. Ten responses were received: 47% of the universities, 25% of the universities of technology and 50% of the comprehensive universities responded. In terms of institutional size, 50% of the small institutions and 42% of the large institutions responded. The survey collected data on the COBIT 4.1 process maturity levels and was set up using the range of levels of process maturity provided for in COBIT 4.1. These levels are enumerated below and were used to provide assurance that guided by the survey introduction and requirements for completion, the responses would be consistent with institutional circumstances and that they would be similar if responded to again under similar circumstances. The survey was conducted online using the commercial Survey Monkey toolset and invitations to respond were sent to all institutions. Refer to paragraph 5.2.1 for the discussion on the survey methodology which applies to the three information seeking surveys. The 34 high-level or primary processes cover all four domains of the COBIT 4.1 framework and this method of assessing ICT governance maturity has been well refined by international contributors attached to the IT Governance Institute (2003) during its lifetime. The levels of process maturity in the COBIT 4.1 best practice framework range from: non-existent (0), initial/ad hoc (1), repeatable but intuitive (2), defined (3), managed and measurable (4), to optimised (5). To complete and

submit the survey, the respondents were required to select one maturity option in a column from each line listing the 34 primary processes.

6.5 COBIT 4.1 Process Maturity Survey Results and Discussion

During the time in which this study was conducted there was no legislative requirement to implement an ICT best practice framework in any enterprise in South Africa, including the public higher education sector. By contrast, higher education institutions, primarily in America, which responded to an EDUCAUSE (2006) survey conducted in 2006, indicated that, on average, 62% of the top ICT persons at the institutions report to one of the deputy heads of the institution or the second layer from the CEO or institutional head. This differs from the South African public higher education system in that only one institution has formalised the office of the CIO in the institutional statute. This position is included alongside the older and more entrenched functions such as finance and human resources. The finance and HR roles are driven by legislation in areas such as labour law, tax and financial reporting, thus forcing compliance in these areas. Enterprises, including public higher education institutions, are largely dependent on ICT, as it is pervasive, required and critically important to success in a global or *connected* context, but governance and reporting in the ICT domain are optional.

In contrast, only 11% of the respondents in this survey indicated that the most senior ICT official at the institution reports directly to the vice chancellor, although, the most senior financial and HR persons do serve as Council members, some with voting rights, and some without. This is certainly not the case for the most senior ICT official, as none of the respondents in this survey serve directly on Council in any capacity whatsoever. On the other hand, the most senior ICT official at 78% of South African higher education institutions does sit on an ICT steering committee of Council.

This indirect influence on ICT strategy has had only a limited effect on the implementation of ICT governance practices or the implementation of frameworks – resulting in the limited development of expertise in the area of ICT governance. Nevertheless, South African public higher education institutions have all been exposed to the COBIT framework in varying degrees. In this study it was considered important to make use of a globally recognised framework that was known to the survey participants and that covered the full scope of ICT governance maturity. The reason for this was to assess the maturity level of ICT governance,

to create a shared understanding of ICT and its purpose and impact on institutions, and to increase oversight and accountability for ICT. The COBIT 4.1 framework also aligns fully with the International Standards Organization's ICT governance standard, ISO 38500: 2008.

6.5.1 COBIT 4.1 Process Maturity Survey Results

The survey collected comprehensive information on the COBIT 4.1 maturity levels of the 34 primary processes. The most senior ICT official at the institution was required to respond to the survey in order to ensure that the responses were all submitted by persons operating at a similar level. Of the twenty-three institutions in South Africa, nine responded to this survey, thus giving a response rate of 43%.

The COBIT 4.1 framework survey (appended as Annexure C) provides the importance levels associated with each of the 34 primary processes. The COBIT survey is divided into seven sections. The first section requires 34 responses in order to ascertain the level of importance that the institutions associate with each of the 34 primary COBIT 4.1 processes. The responses received from the institutions were contrasted with the framework measures provided. The second to sixth sections each dealt with the 34 processes as being primary or secondary enablers in each of the five COBIT 4.1 focus areas.

The second to sixth sections were set up to include a stage of in-between primary or secondary measures in order to be able to assess the level of certainty towards the primary or secondary nature of the processes. The final section, requiring 34 responses, sought to ascertain the maturity level of the 34 COBIT 4.1 primary processes.

This chapter also deals with the survey responses in terms of the ICT governance maturity levels of the 34 primary processes, the importance levels of the processes and how these compare to the COBIT framework levels. In addition, the primary or secondary status of the COBIT-defined processes and how these compare with the survey responses is considered.

6.5.2 COBIT 4.1 Process Maturity Survey Results International Perspective

The Association of South African University Directors of Information Technology has formalised the collaborative ICT structure that has been in place between institutions over the past two decades by forming a non-profit company on 6 January 2011. This company is called ASAUDIT. ASAUDIT has concluded a collaborative agreement with the Council of Australian University Directors of Information Technology (CAUDIT). The agreement

encourages international collaboration on ICT matters and it also provides for reciprocal research to be conducted.

The agreement between these two organisations has provided these survey findings with an international perspective. There are 56 research and higher education institutions in Australasia, 36 of which are universities or universities of technology, to which this survey was addressed. In the current study, seven universities or universities of technology completed the COBIT 4.1 process maturity survey (19,5% response rate). A comparison of the average ICT process maturity of Australian institutions and South Africa institutions is presented in Figure 6-4.

6.5.3 Aspects of ICT Governance Process Maturity

Ten South African responses to the ICT process maturity level survey are shown in Figure 6-3. Institutions six to 10, as shown in Figure 6-3, are historically disadvantaged institutions (HDI). HDIs are those institutions that were part of a former bantustan homeland under the previous apartheid government. As may be seen, 16 years after the promulgation of the Higher Education Act and 19 years after the commencement of an all-inclusive democracy in 1994, these institutions still have the lowest levels of ICT governance maturity.

ICT governance in the public higher education sector in South Africa has been practised by institutions in varying ways and to various degrees. The Higher Education Act (South Africa, Department of Education, 1997) requires and defines institutional or corporate governance structures, but it does not require any specific ICT governance structures. Consequently, the CIOs and ICT directors of the twenty-three institutions create their own ICT governance structures that remain largely isolated within the individual institutions.

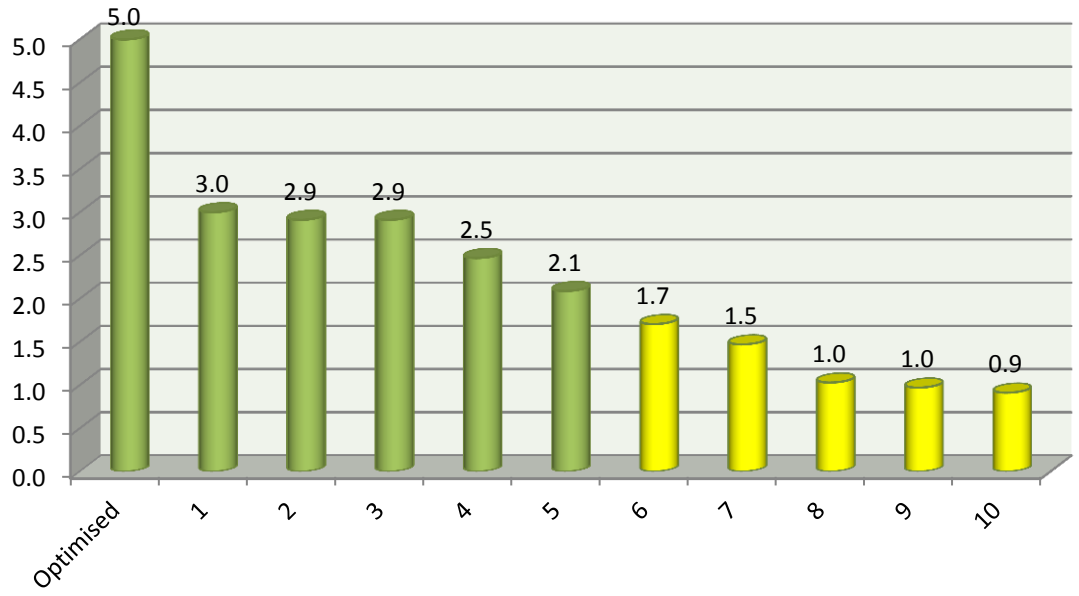


Figure 6-3: SA Universities ICT Governance COBIT Maturity Level including Historically Disadvantaged institutions

These governance structures were generally set up as a result of audit recommendations. The COBIT framework has five focus areas, strategic alignment, risk management, performance measurement, value delivery and resource management, and all of these have been addressed individually by institutions to varying degrees at the ICT departmental level. In some cases, the institutional governing Council has required a Council steering or an ICT governance committee to be set up to ensure that ICT is appropriately governed within the institution. This is in line with the best practice principles of the King III Code, which are to be implemented on an 'apply or explain' basis.

Despite the more than two years that have passed since the King III code was published, there has been little change in ICT governance practices in the public higher educational sector.

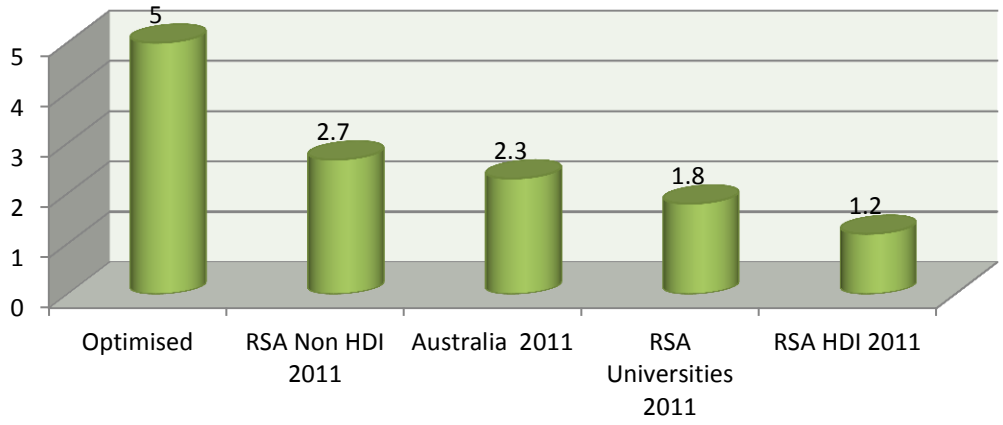


Figure 6-4: ICT Average Process Maturity Levels 2011

The survey data collected and presented in Figure 6-4 indicates that the average level of ICT process maturity in the public higher education sector in South Africa, measured using the COBIT 4.1 best practice framework, is 1,8 on a scale of 0 to 5 (Johl, Von Solms, & Flowerday, 2013). This is significantly below the Australian average of 2,3, as shown in Figure 6-4, and the 2008 world average ICT governance maturity level, which is also 2,3, as measured by EDUCAUSE (2008).

An ICT governance maturity level of 3 indicates that ICT processes have matured to the point of being properly defined and becoming systemic. Levels of ICT governance maturity below 3 indicate that there is only a limited structure to ICT processes and that this increases risk across all areas of the business. This is important, as one of the focus areas of the COBIT 4.1 framework is risk management.

6.5.3.1 ICT Personnel Costs

Another of the COBIT 4.1 focus areas is resource management, which includes HR management. The HR cost of ICT staff is specifically measured by the Department of Higher Education and Training (DHET), and is recorded by the Higher Education Management Information System (HEMIS). The average ICT personnel cost for the last seven years, expressed as a percentage of the total personnel cost for the twenty-three institutions for the period 2004 to 2010, is shown in Figure 6-5.

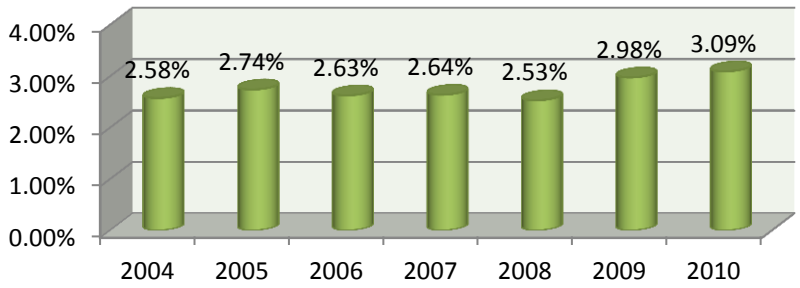


Figure 6-5: Seven-year Average ICT Personnel Cost as a Percentage of Total Personnel Cost for 23 South African Public Higher Education Institutions (DHET Hemis Office Jan 2012)

The graph in Figure 6-6 shows the seven institutions that responded to the survey together with their financial data for the year 2010.

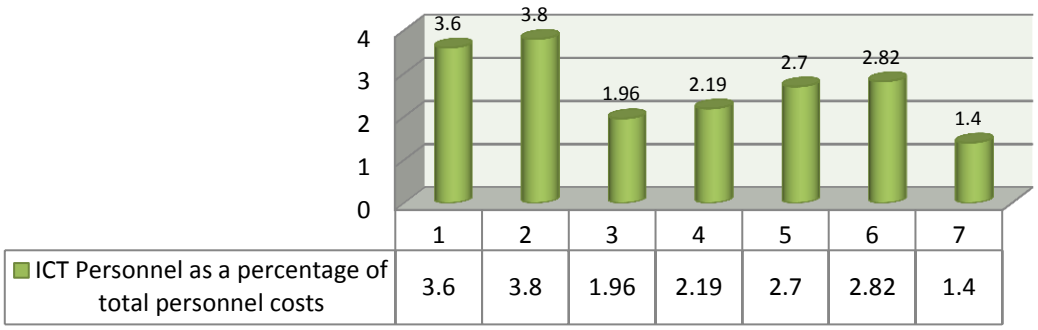


Figure 6-6: Percentage ICT Personnel Cost as a Percentage of Total Personnel Cost per Institution (Survey Data)

Year-on-year personnel costs are stable compared with both operational and capital costs in the sector. ICT personnel cost, as a percentage of total personnel cost, varies between 1,4 and 3,8%. The 3,8% relates to the smallest institution, whilst the 1,4% relates to the second smallest institution, which is an HDI that is currently under administration and had a zero capital budget for 2010. All the institutions whose ICT personnel budget as a percentage of the total personnel budget is above 2%, fund ICT consciously and consistently – and not consequentially.

6.5.3.2 Institutional Ages and ICT Governance Process Maturity

Figure 6-7 compares the ICT governance maturity level with the age factor of the institution. The age factor is derived from the age of the institution as a fraction of a century in order to be able to compare it with the other variables on a single graph. The age of the institution in

the case of merged institutions is taken as the age of the oldest institution that was merged to form the new one. The HDI institutions are shown as numbers six to nine on the horizontal axis in Figure 6-7 and, with the exception of one HDI, number 6, which is nearing its centenary, all the other HDIs are relatively young and their ICT governance maturity level is also relatively low.

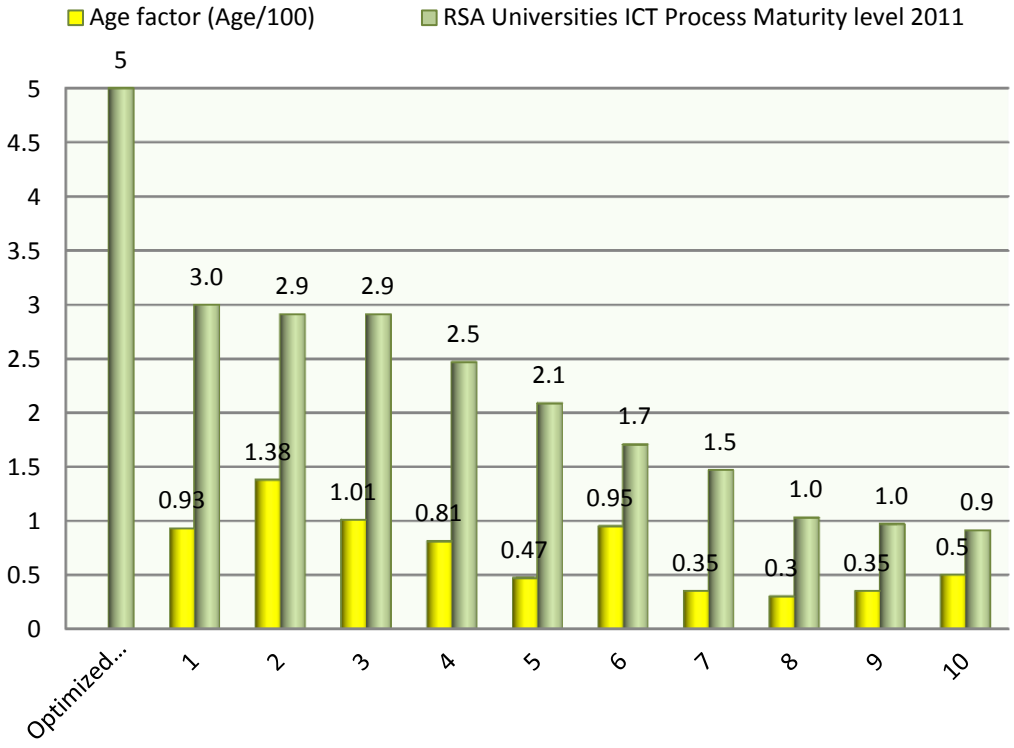


Figure 6-7: ICT Process Maturity and Institutional Age Factor (ICT Process Maturity Data, Survey; Institutional Age, Institutional Websites History)

It can thus be demonstrated that there is a general informal correlation between the age of institutions and the ICT governance maturity level.

6.5.3.3 ICT Governance Process Importance Levels

The COBIT 4.1 best practice framework classifies each of the 34 primary processes into one of three importance levels, namely, low, medium or high. Respondents were requested to indicate the importance level assigned to each primary process by their institution. These were grouped into the four domains defined in the COBIT 4.1 framework, the first of which is the 'planning and organising' domain shown in Figure 6-8. It is evident that institutions perceive seven of the ten processes in this domain as more important than does the COBIT 4.1 framework. The areas of strategic planning, risk management and project management

are also three of the areas in public higher education institutions that enjoy considerable attention as they are usually given some focus in annual audit processes.

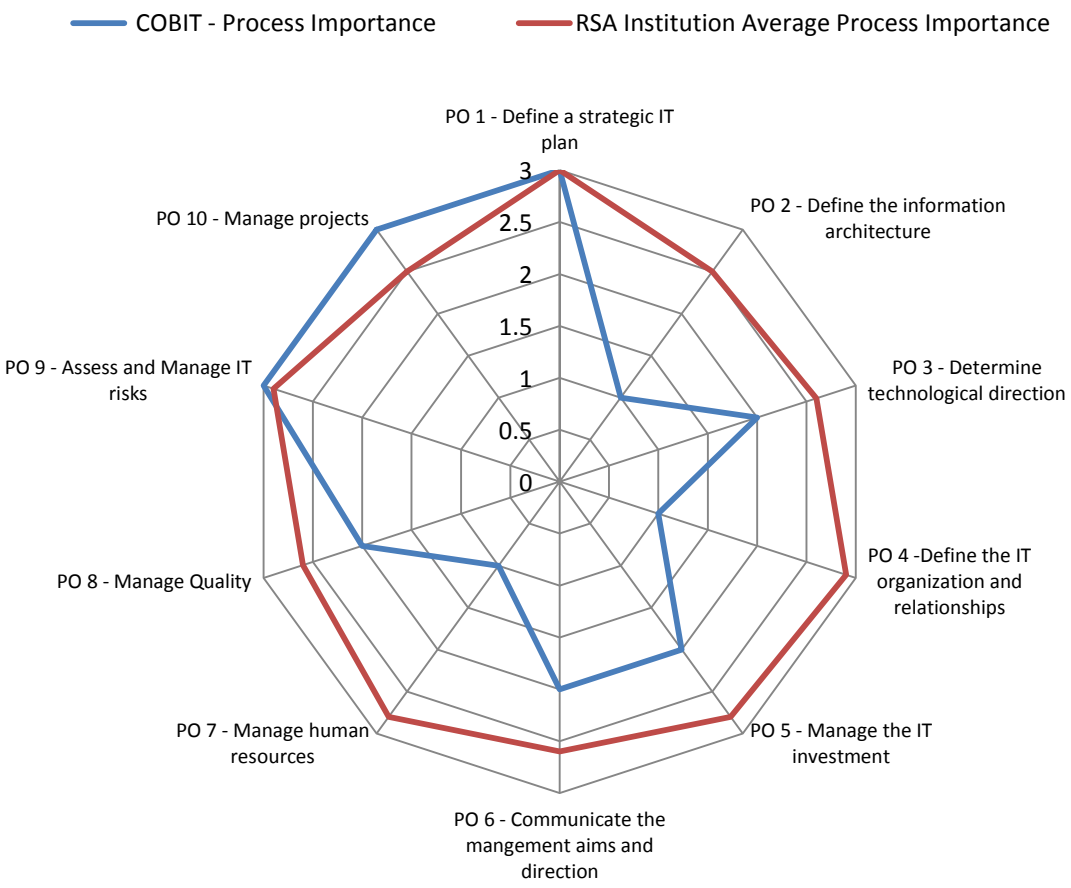


Figure 6-8: COBIT 4.1 and Institutional Average Process Importance, Plan and Organise Domain

Defining the information architecture, managing human resources and defining intra-organisation and ICT relationships display the greatest differences between the institutional average responses and the framework-defined value of importance, as these are areas that do not necessarily enjoy as much attention as the other areas in the management structures of ICT at public higher education institutions.

The second domain in the COBIT 4.1 framework is the ‘acquire and implement’ domain. The responses relating to this domain differed from the first, in that most of the institutional process averages are similar to those identified in the COBIT 4.1 framework. The change management process is the only process in this domain that is rated as ‘highly important’ in both the COBIT 4.1 framework and the institutional responses. Furthermore, ‘acquire and

maintain technology infrastructure' and 'enable operation and use' are two processes that differ most in terms of importance in this domain. These two processes are two of the processes in this domain that have also possibly been brought into focus by audit activity rather than specific attention on ICT governance best practices.

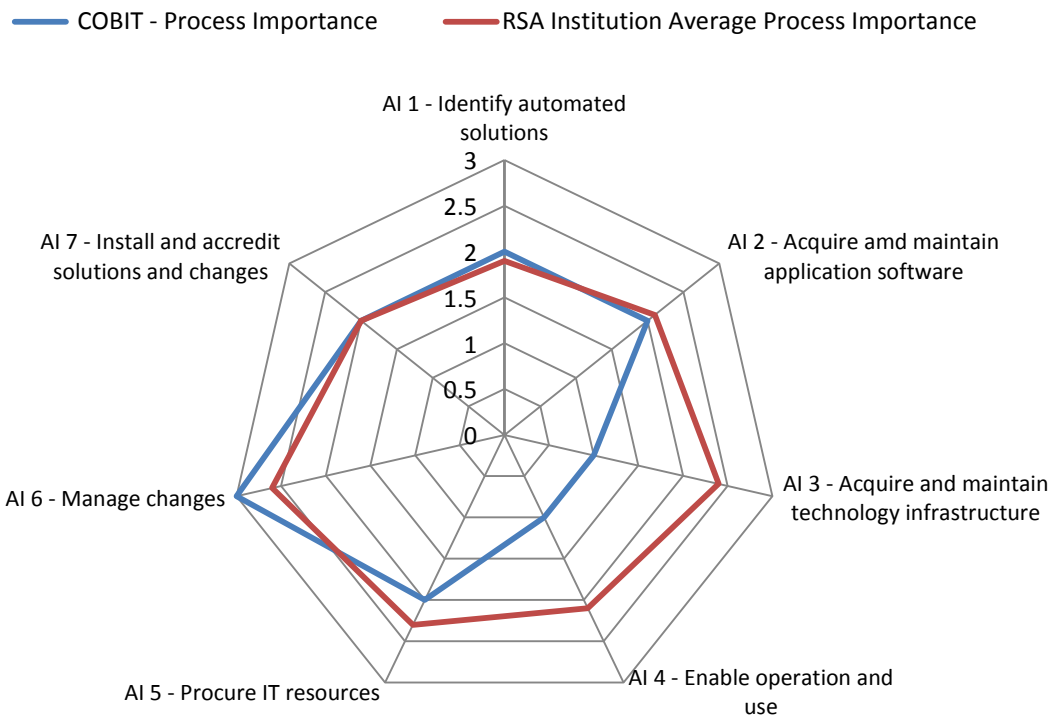


Figure 6-9: COBIT 4.1 and Institutional Average Process Importance, Acquire and Implement Domain

The 'delivery and support' domain is probably the most active of the four domains in the framework, as the processes it encompasses require maximum day-to-day effort from most employees. Only two of the processes in this domain are defined in the COBIT 4.1 framework as being at a higher level than the average process importance level of the responding institutions and these two processes are also defined at the maximum level of importance defined in the framework. The processes of 'ensuring system security' and 'managing data' are at the core of any business, as without data existing and being secure businesses could not function.

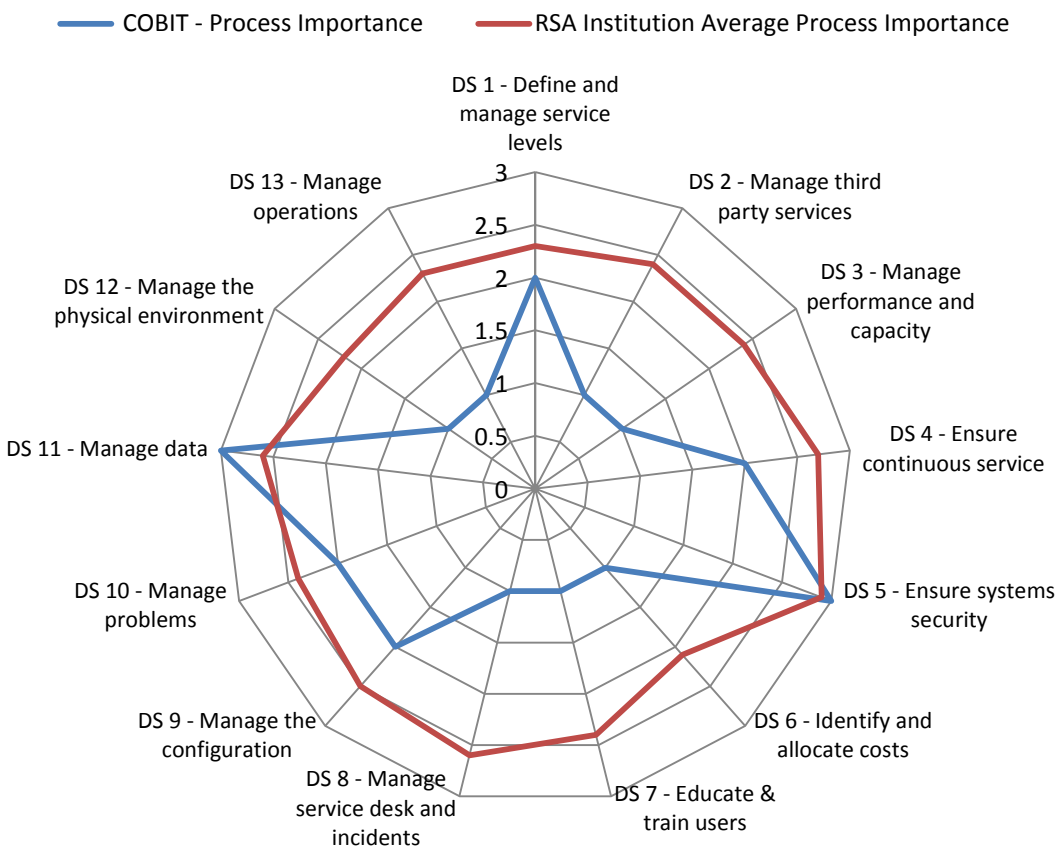


Figure 6-10: COBIT 4.1 and Institutional Average Process Importance, Delivery and Support Domain

There are also large deviations in many of the processes between the importance level defined in the COBIT 4.1 framework and the average importance levels reported by respondents. The 'monitor and evaluate' domain is the fourth and final domain in the COBIT 4.1 framework. This is clearly seen as the most important domain in the framework as three of the four processes are rated at the highest level of importance. Respondents to the survey also rated these importance levels closest to those defined in the framework.

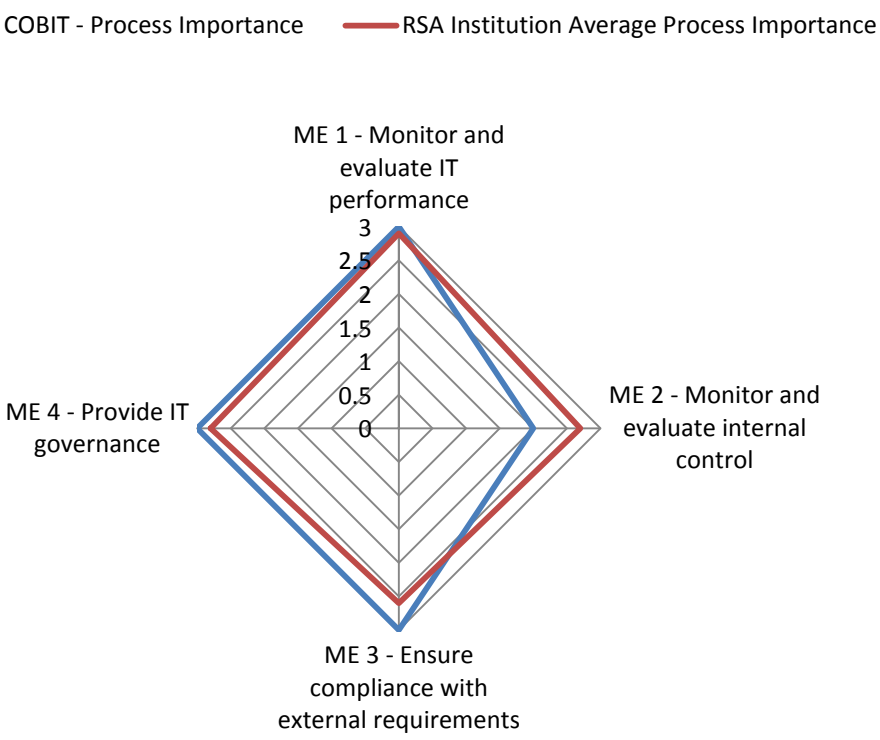


Figure 6-11: COBIT 4.1 and Institutional Average Process Importance, Monitor and Evaluate Domain

Process importance levels defined in the COBIT 4.1 best practice framework give an indication of the overall recognition of the importance of each of the four domains in the framework. The average importance levels defined in the framework are shown in Figure 6-12 and are compared to the average importance levels reported by respondents in the survey.

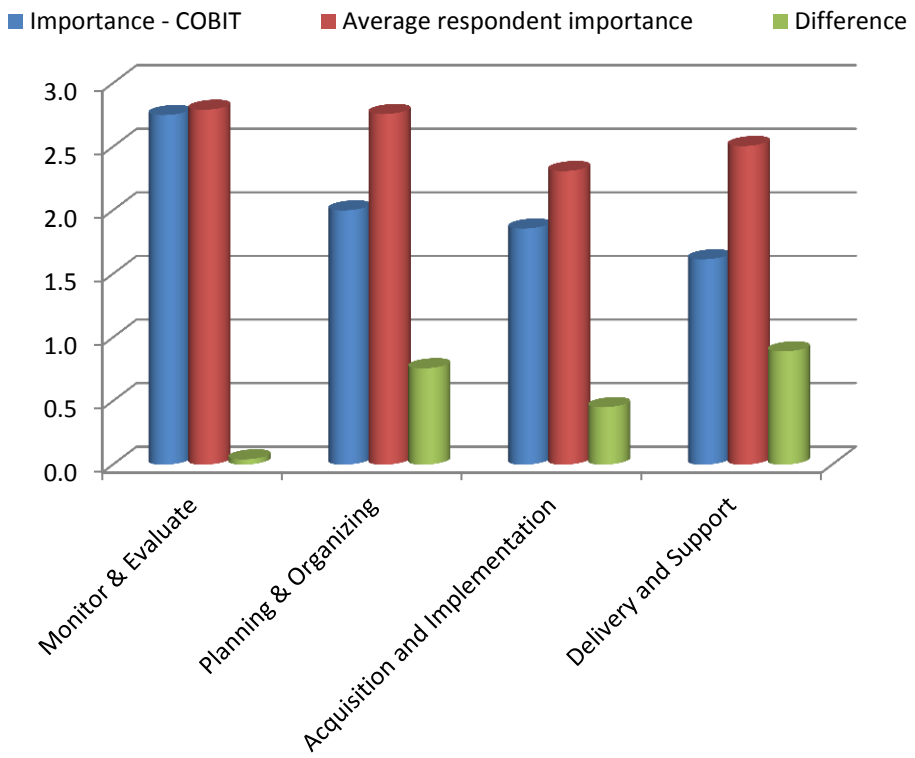


Figure 6-12: Comparison of Average Process Importance Levels of the COBIT 4.1 Framework and Survey Responses

6.5.4 COBIT 4.1 Process Maturity Survey Findings per Maturity Level

The findings of the surveys associated with this study are presented as the first of such research done in South Africa, although a similar study has been undertaken in America under the auspices of EDUCAUSE (2008). The responses in Figure 6-13 have been formulated to reflect the percentage of institutions that have an overall ICT process maturity according to the maturity levels of; zero is non-existent process, one is initial/ad-hoc, two is repeatable but intuitive, three is defined, four is measured and managed and five is optimised. The number of institutions participating in the EDUCASE survey totalled 438 (EDUCAUSE Center for Applied Research, 2008), while those participating in the public higher education survey in South Africa numbered ten out of a possible 23.

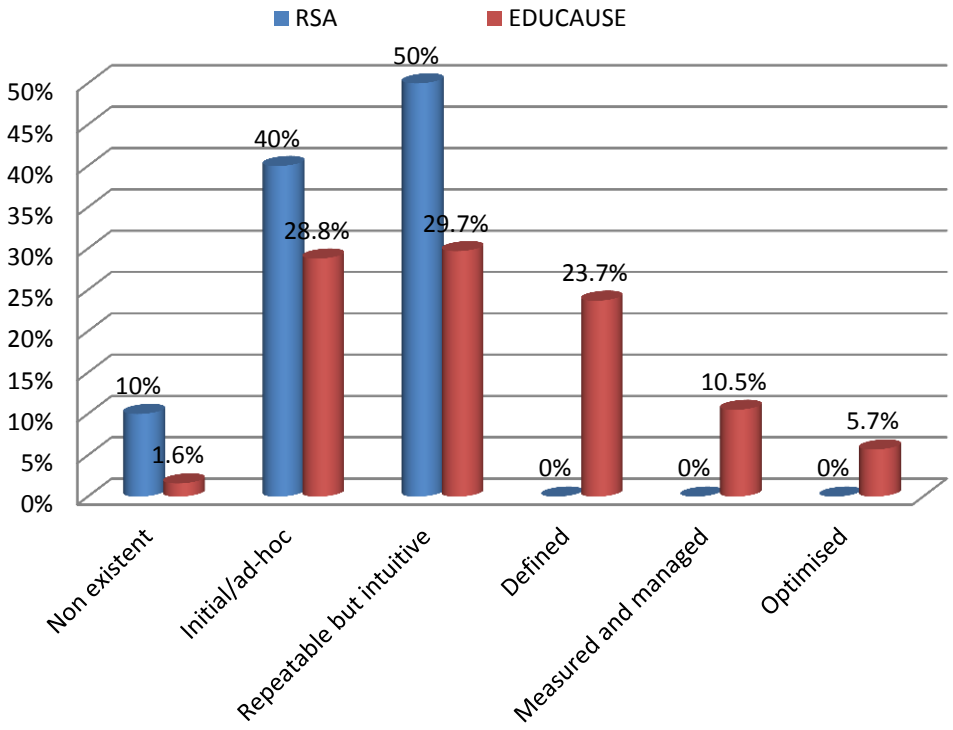


Figure 6-13: Average Overall Institutional Process Maturity per Maturity Level

The overall averages of the public higher education institutions in South Africa are significantly lower than those in the EDUCAUSE survey. There are no processes, whose maturity averaged across the South African public higher education institutions, which lie in the top three process maturity categories. This can be attributed to the absence of an ICT governance requirement in terms of legislation or regulation that would apply to public higher education institutions in South Africa. The first stage of ICT governance maturity improvement was initiated by the creation of an ICT governance special interest group in the form of a working committee of the Association of South African University Directors of Information Technology in May 2009.

6.5.5 Detailed COBIT 4.1 Survey Findings per Domain at the Measured and Managed Maturity Level

The COBIT 4.1 process maturity survey conducted online and completed by twelve institutions was intended to interrogate the South African public higher education ICT leaders' views on ICT process maturity and the relative importance of the 34 primary processes. In terms of the ITGI, ICT processes can also be primary, secondary or not applicable in the context of each of the five focus areas of the COBIT framework (IT

Governance Institute, 2007). Each process is rated in terms of importance as either *low*, *medium*, *high* or *not applicable*. Institutions were not supplied with the COBIT 4.1 defined ratings when responding to the survey to ensure that respondents were not influenced in their responses.

The 34 COBIT 4.1 primary processes are grouped into four domains namely, *planning and organising* with ten primary processes, *acquisition and implementation* with seven primary processes, *delivery and support* with thirteen primary process and *monitoring and evaluation* with four primary processes. The graphs in Figure 6-14 to Figure 6-17 reflect the average levels of importance based on the responses received from the institutions compared to the COBIT 4.1 defined levels of importance. The first group of responses for the COBIT 4.1 *planning and organising* domain is reflected in Figure 6-14.

Figure 6-14 to Figure 6-17 shows the processes in the four COBIT 4.1 domains, where the first bar indicates the number of institutions that have their individual processes at the *managed and measured* level of ICT process maturity, the second bar indicates the COBIT 4.1 defined process importance level, the third bar indicates the responding institutions' average response level and the last bar indicates the difference between the COBIT 4.1 levels of process importance and the average responses from institutions. This *difference* element is expanded upon in Table 6-1. It is evident from the survey responses that there are processes in the public higher education sector in South Africa that are deemed by respondents to be as important as in the COBIT 4.1 framework. In addition, some are deemed by public higher education in South Africa to be more important than those defined in the COBIT 4.1 framework. There are also processes that are defined by the South African public higher education sector as being less important than does the COBIT 4.1 framework.

As an example, the first process of *defining a strategic plan* is rated as important by the respondents as the framework rating. This is also the only process deemed to be at the highest level of importance that is also associated with a formalised reporting requirement in terms of the annual reporting regulation R691 (2007), which is required in terms of the Higher Education Act (South Africa, Department of Education, 1997). It also has 20% of the respondents of the ICT process maturity survey processes at the *measured and managed* level of process maturity. This is shown in Figure 6-14 in the first blue bar as a 2, and not as 20%, to allow for better resolution reference on the graph.

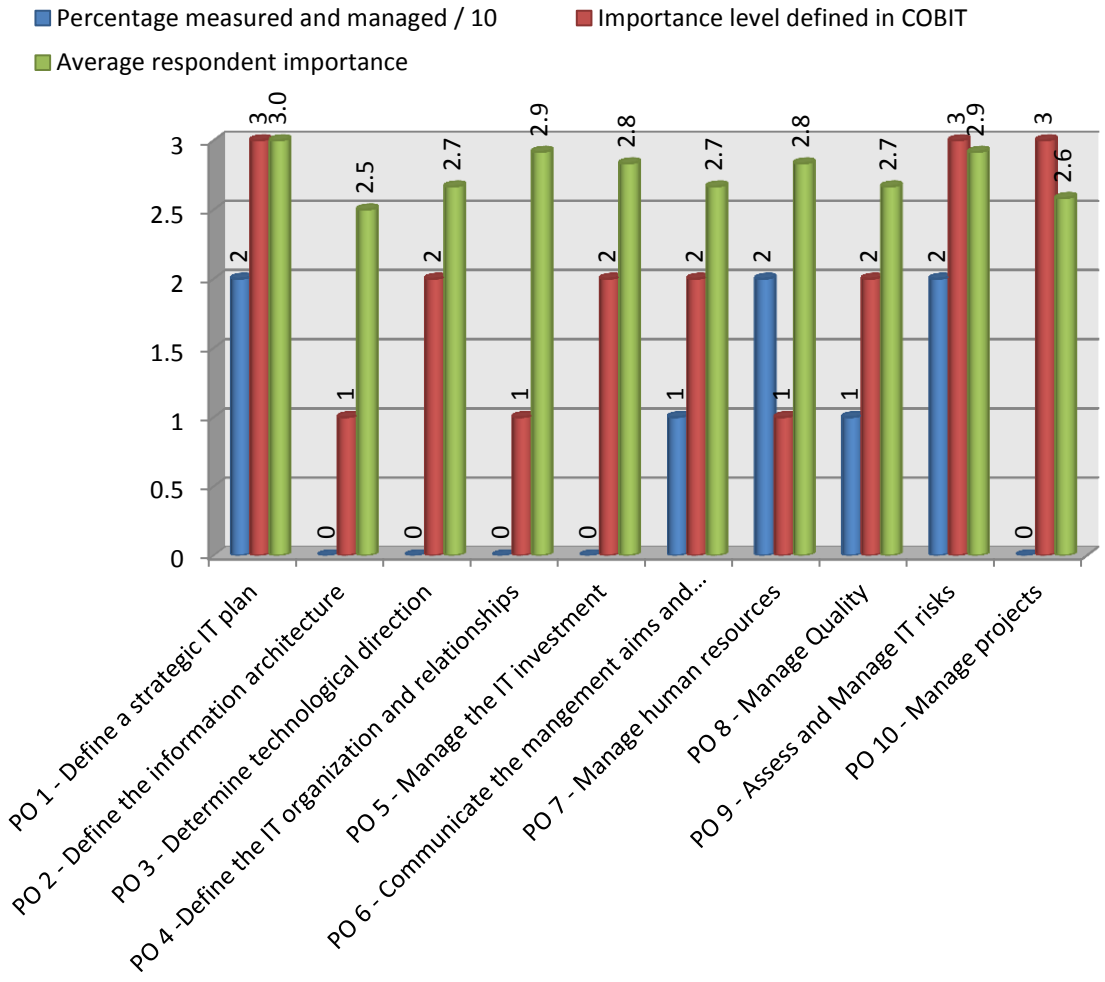


Figure 6-14: COBIT 4.1 and Institutional Average Process Importance of the Plan & Organise Domain

Figure 6-14 reflects the *planning and organising* process domain of the COBIT 4.1 framework, comparing the COBIT 4.1 defined importance levels with the average process importance level of the respondents. The *planning and organising* domain has 50% processes in the *measured and managed* level of process maturity. Three or 30% of the processes in this domain have a COBIT 4.1 process importance level of 3 and the average COBIT level of importance is 2 on a scale of 0 to 3. The average respondent level of importance in the *planning and organising* domain is 2,8.

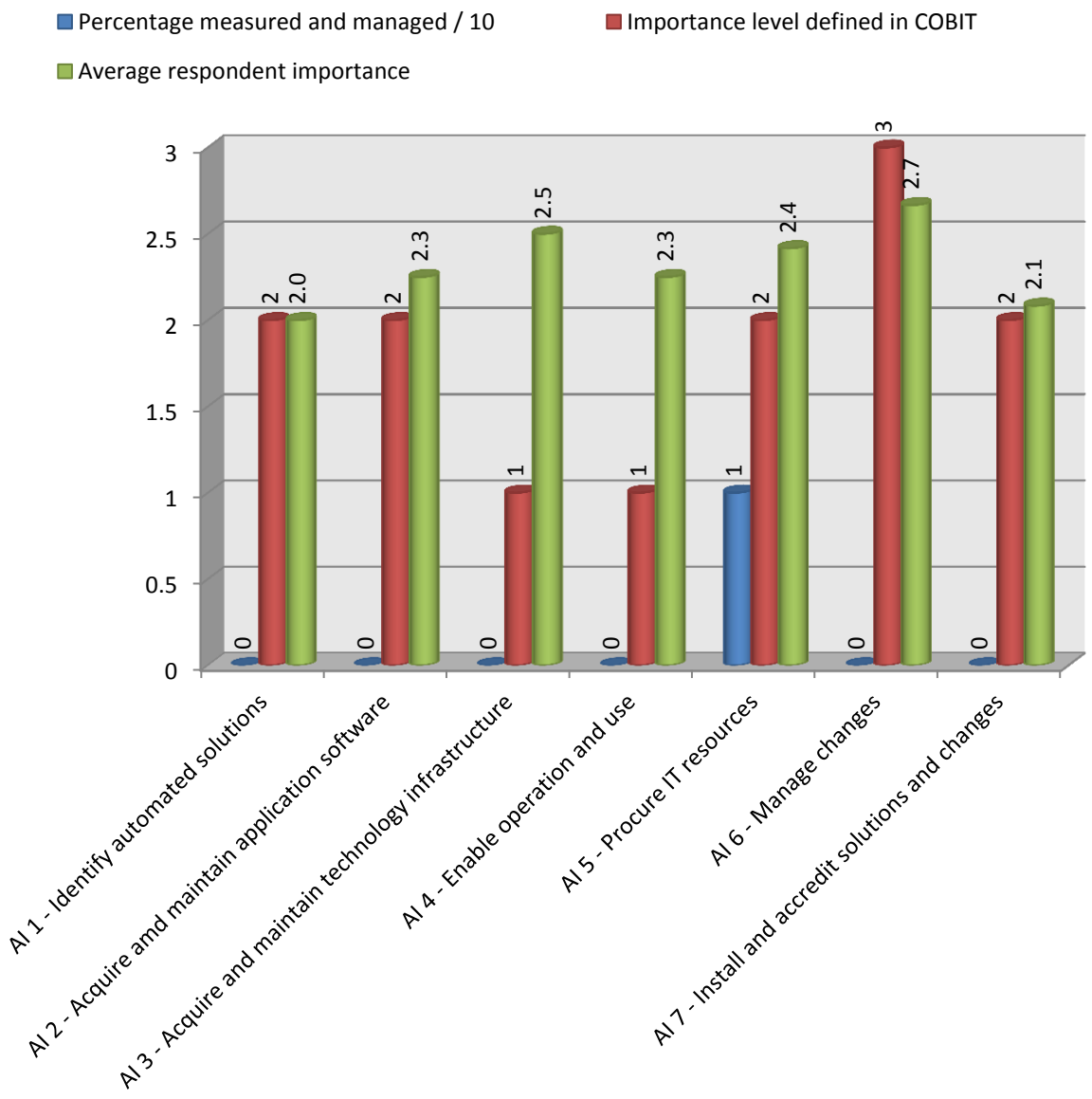


Figure 6-15: COBIT 4.1 and Institutional Average Process Importance of the Acquire and Implement Domain

Figure 6-15 shows the *acquisition and implementation* process domain in which only 14%, or one of the seven processes, is at the *measured and managed* level of process maturity. Only one or 14% of the processes in this domain has an importance level of 3, meaning that the processes in this domain are perceived as being less important than those in the *planning and organising* domain. This lower level of importance also reflects in the single process within this domain that has an institution at the *measured and managed* level of process maturity. The average COBIT 4.1 level of importance is 1,3, while the average respondent level of importance is 2,3.

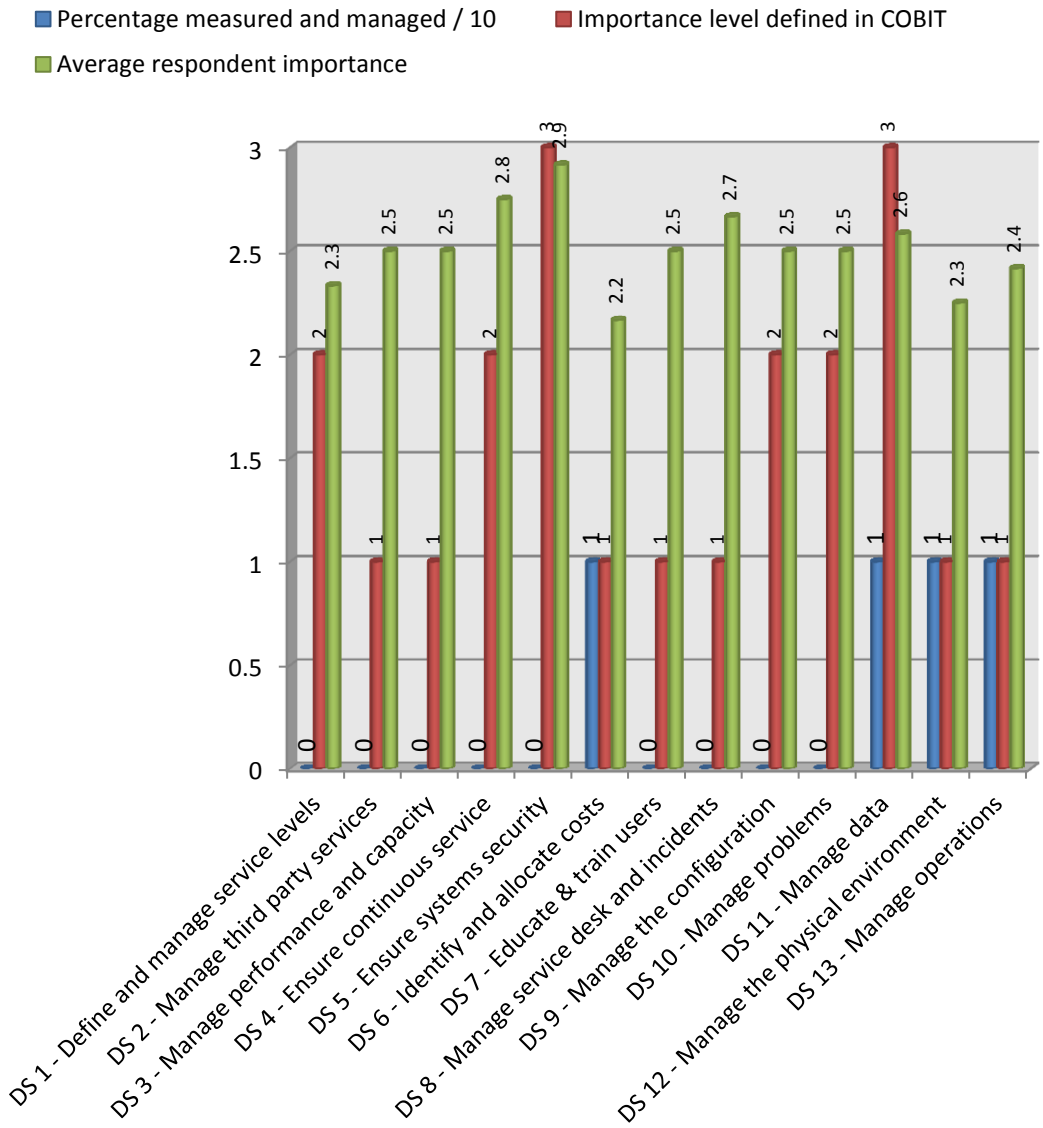


Figure 6-16: COBIT 4.1 and Institutional Average Process Importance of the Delivery & Support Domain

The deliver and support COBIT 4.1 domain is shown in Figure 6-16 in which four of the 13, or 31% of the processes, are at the measured and managed level of process maturity. Only two of the 13, or 15% of the processes, are rated at the level high importance in terms of the COBIT 4.1 framework, while the average COBIT level of importance is 1,6. In contrast, the average respondent level of importance is 2,5.

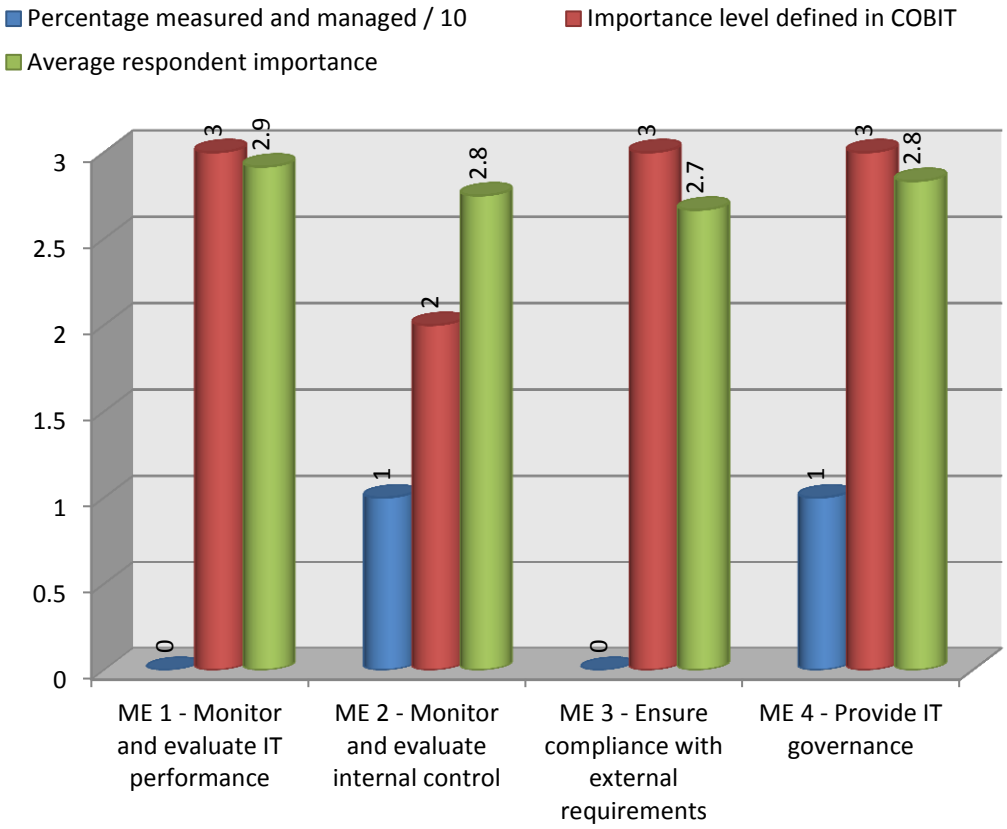


Figure 6-17: COBIT 4.1 and Institutional Average Process Importance of the Monitor & Evaluate Domain

The *monitor and evaluate* domain shown in Figure 6-17 has two of the four, or 50% of institutions' processes, at a *measured and monitored* level of maturity. This domain also has 75% of its processes at the level of *high importance* in terms of the COBIT 4.1 framework, while the average COBIT level of importance is 2,75. The average respondent level of importance is 2,79.

The four domains differ in terms of the number of processes per domain, as well as the number of processes at varying levels of importance. The difference between the *target* governance level of process importance and the *actual* level of process importance from the survey responses is ascertained using the statistical method of measuring the *standard deviation* of the difference between the COBIT and respondent measures of process importance. Table 6-1 shows these values and indicates that the *monitoring and evaluation* domain has the smallest difference between the COBIT-defined values and the institutional responses. This is followed by the *acquisition and implementation* domain, then the *delivery and support* domain and finally by the *planning and organising* domain. Consequently, it was

found that higher education rates most processes higher than the level that they are defined at in the COBIT 4.1 framework.

	Average importance level defined in COBIT	Average respondent importance	Standard deviation of difference between COBIT and respondent average levels
Plan and Organize	2.00	2.76	0.7988
Acquisition and Implementation	1.86	2.31	0.6750
Delivery and Support	1.62	2.51	0.6765
Monitor and Evaluate	2.75	2.79	0.4835

Table 6-1: Difference between the COBIT 4.1 Average Process Importance Level and the Respondent Average

The twelve graphs in Figure 6-18 to Figure 6-30 reflect the institutional process maturity levels within the four domains of all six of the maturity levels, but only processes with the two highest maturity levels are discussed in terms of applicable legislation or regulation to provide an association between processes that are required by law or regulation in the public higher education environment in South Africa. Only twelve COBIT 4.1 primary processes were reported at the *measured and managed* process maturity level, whilst none were reported at the *optimised* process maturity level.

The next section presents these 12 high level, or primary, COBIT 4.1 processes with a process maturity level of *measured and managed.*

6.5.6 Detailed COBIT 4.1 Survey Findings per Individual Process at the Measured and Managed Maturity Level

The first process to be presented is process P01, *define a strategic plan*.

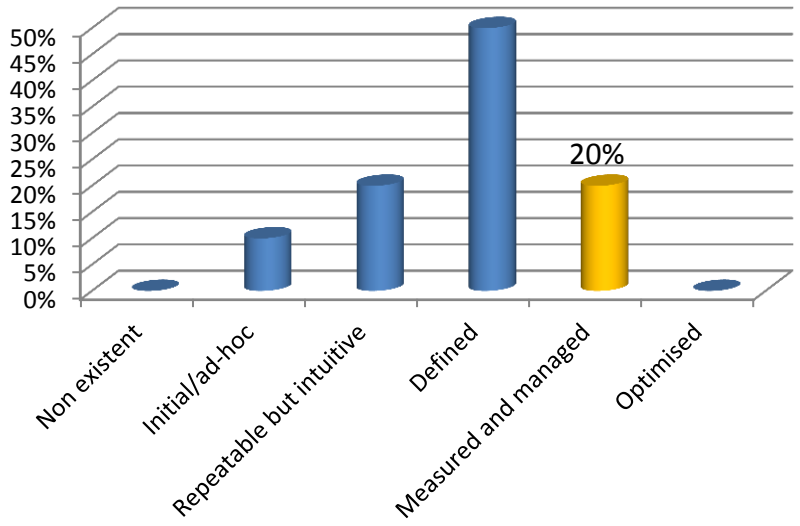


Figure 6-18: 'Process PO 1 – Define a Strategic Plan' Average South African Public Higher Education Institution ICT Process Maturity Levels

Strategic planning had its origins around 1965 (Mintzberg, 1994). Institutions in the public higher education sector actively practise strategic planning and this can be seen from the absence of *non-existent* processes in the first bar of the graph in Figure 6-18.

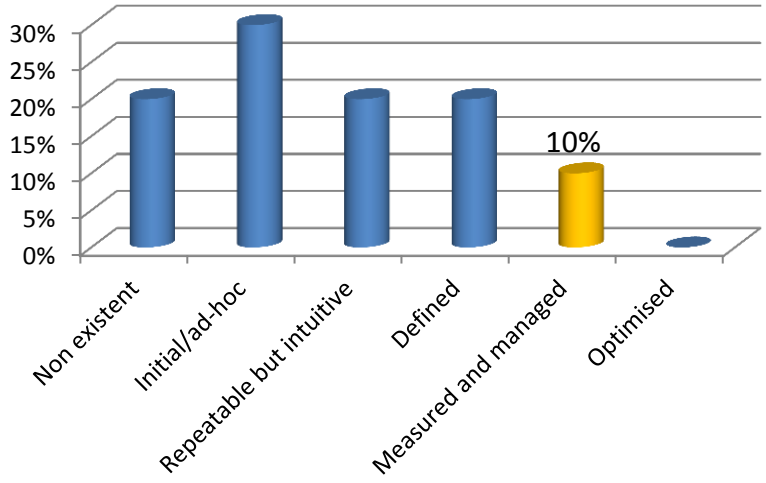


Figure 6-19: Process PO 6 – 'Communicate the Management Aims and Direction' Average South African Public Higher Education Institution ICT Process Maturity Levels

All divisions, including the ICT division, are included in the strategic planning process that is required in terms of regulation R691 and evidence of this practice is reflected in the 20% *measured and managed* processes found across the responding institutions. Accordingly, ICT governance or steering committees exist in 78% of the responding institutions. This

committee also ensures that the approved ICT management aims and direction are communicated to the institutions' stakeholders. The processes of just one of the institutions, or 10% of responding institutions, have matured to the *measured and managed* stage. This is due to the requirement in the Higher Education Act to set up governance and management structures.

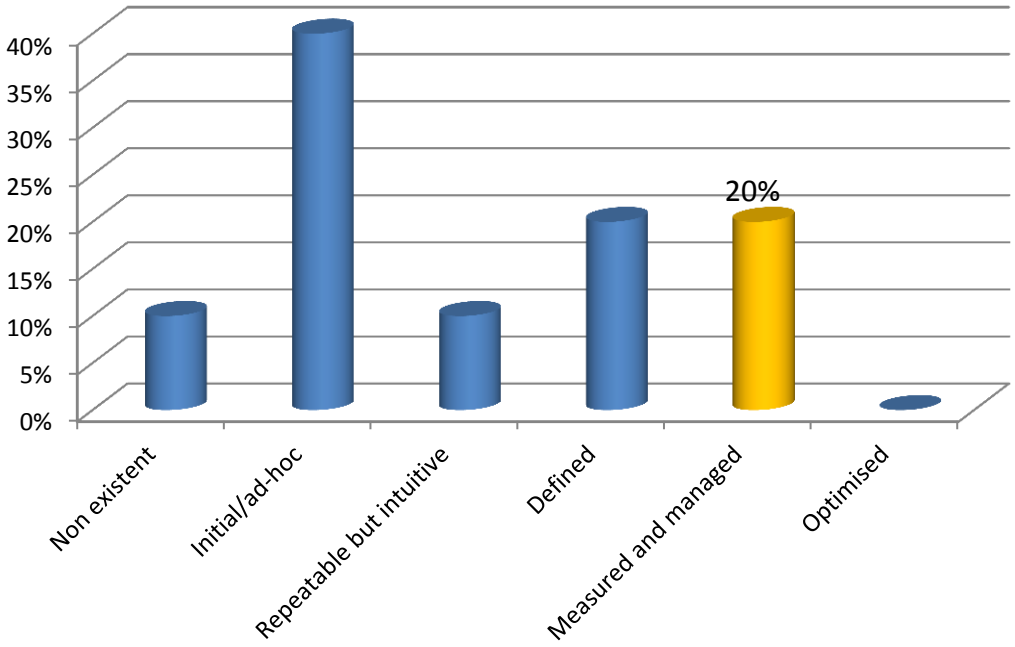


Figure 6-20: Process PO 7 – 'Manage Human Resources' Average South African Public Higher Education Institution ICT Process Maturity Levels

HR management is one of the older disciplines in the work environment and as such one would expect this process to be highly mature. However, no respondents reported that the HR management process at their institution was at the *optimised* level. Some of the larger institutions have a dedicated ICT staff section that deals exclusively with the personnel matters of the ICT division. The number of ICT staff at responding institutions varies from 20 at the smaller institutions to 250 at the largest one. As indicated in Figure 6-20, this process does however have one of the highest numbers of respondents at the maturity level of *measured and managed*, most likely due to the inherent requirement for formalised personnel management in terms of tax and labour laws such as the Basic Conditions of Employment Act (South Africa, Department of Manpower, 1997). In terms of reporting regulation R691 (South Africa, Department of Education, 2007) contained in the Higher Education Act (1997), ICT personnel costs are required to be specifically reported. The graph in Figure 6-21

shows the trend of ICT personnel funding as a percentage of total personnel costs between 2004 and 2010.

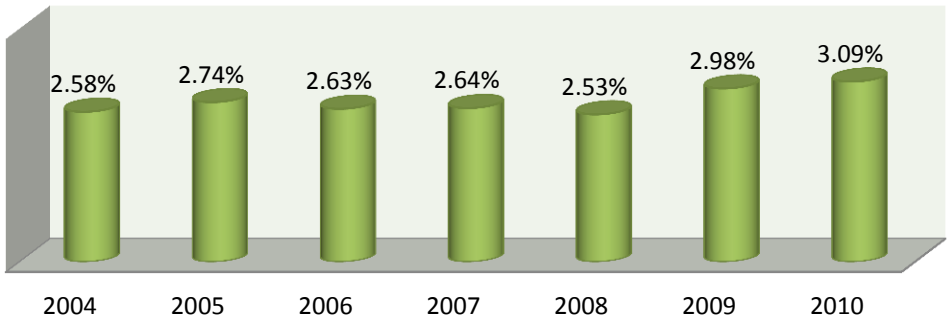


Figure 6-21: Average Annual ICT Personnel Cost as a Percentage of Total Personnel Costs in Public Higher Education Institutions in South Africa (DHET, 2011)

The graph in Figure 6-20 provides evidence to show that the HR process is managed, as the DHET also requires reporting on ICT staff costs.

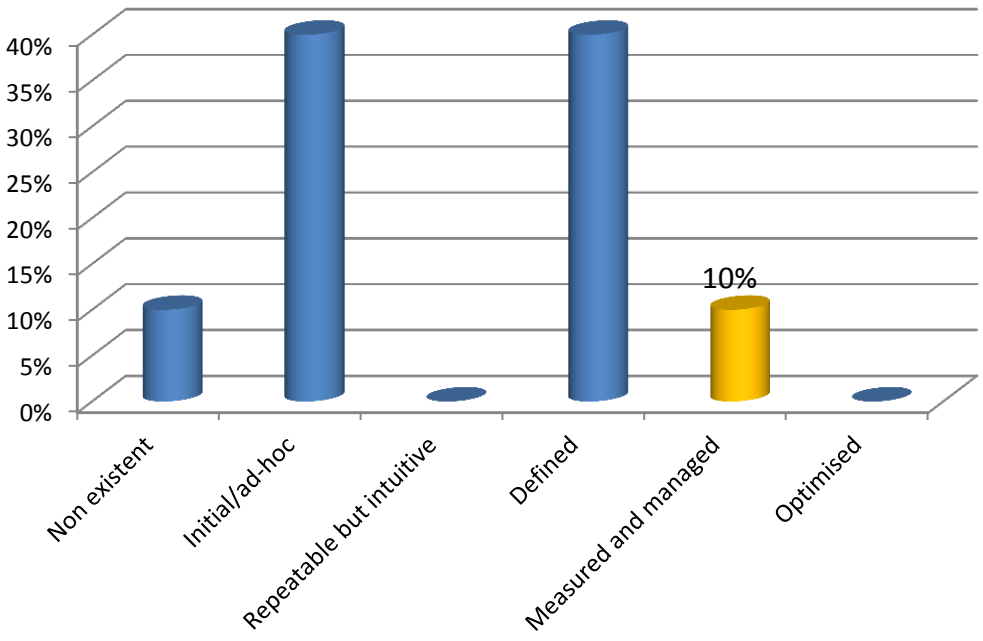


Figure 6-22: Process PO 8 – 'Manage Quality' Average South African Public Higher Education Institution ICT Process Maturity Levels

The Council on Higher Education (CHE) is a statutory body established by the Higher Education Act (South Africa, Department of Education, 1997) to advise the Minister of Education on all matters pertaining to higher education. The CHE also has responsibility for

establishing a quality assurance system for higher education through a Higher Education Quality Committee (HEQC). In June 1999, the CHE (South Africa, Department of Higher Education, 1995) set up the interim HEQC to investigate how best to establish a national quality assurance system for the country. The management of quality is formalised by the Higher Education Act through the HEQC. This effort reflects in Figure 6-22.

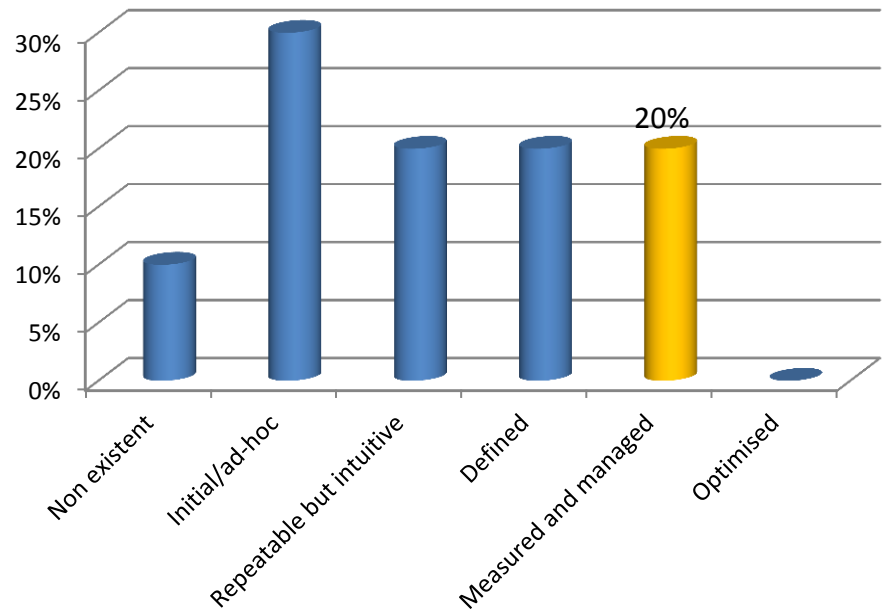


Figure 6-23: Process PO 9 – 'Assess and Manage IT Risks' Average South African Public Higher Education Institution ICT Process Maturity Levels

Figure 6-23 reflects that the 'measured and managed' maturity level of ICT risk management is 20% and that the legal requirement in terms of the reporting regulation R691 (2007), as defined in the Higher Education Act (South Africa, Department of Education, 1997), is again associated with higher level maturity. ICT risk in terms of internal controls is specifically mentioned in the King III Code in paragraph 3.1.6 (South Africa, Department of Education, 2007). Paragraph 3.1.6 is required in terms of the King III Code on corporate governance relevant at the time of promulgation. The King III Code on corporate governance has an entire chapter dedicated to ICT governance but this code is implemented on an 'apply or explain' basis (King III Code, 2009).

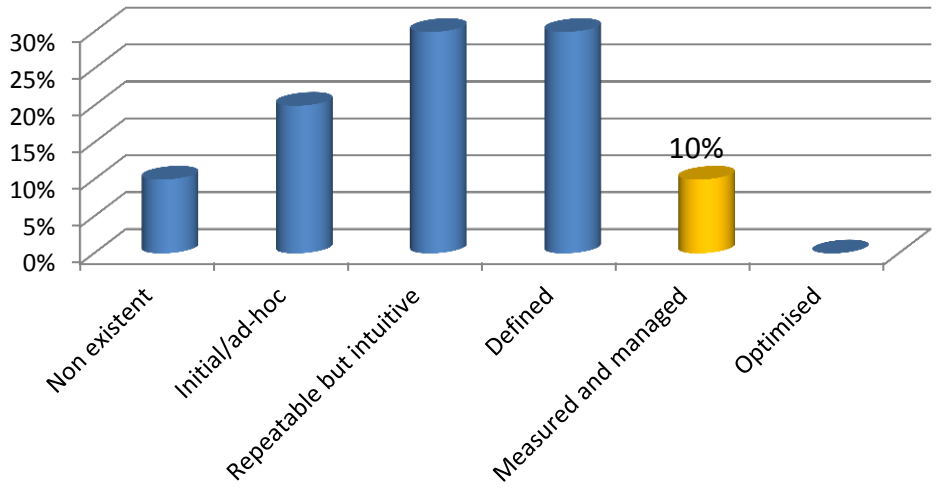


Figure 6-24: Process AI 5 – 'Procure ICT Resources' Average South African Public Higher Education Institution ICT Process Maturity Levels

Procurement processes in higher education institutions are governed by the Broad Based Black Economic Empowerment Act 53 of 2003 (South Africa, Department of Trade and Industry, 2003) and indirectly by the Auditing Profession Act 26 of 2005 (South Africa, Department of Finance, 2005). Despite the association of this process with legal compliance requirements, only 10% of public higher education institutions in South Africa have *measured and managed* process maturity in the area of ICT procurement, as shown in Figure 6-24. In some cases larger institutions have dedicated ICT procurement officers.

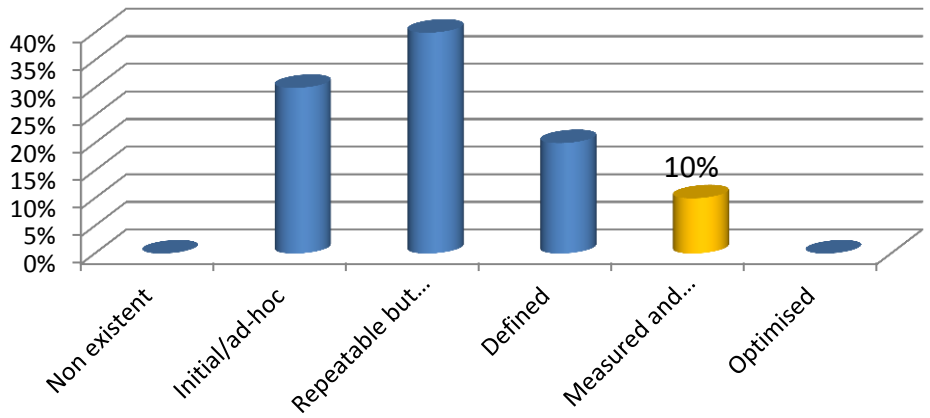


Figure 6-25: Process DS 6 – 'Identify and Allocate Costs' Average South African Public Higher Education Institution ICT Process Maturity Levels

Figure 6-25 shows that 0% of institutions responding to the survey had process maturity

levels of *measured and managed*. In public higher education institutions in South Africa it is not common practice to claim back overhead costs from departments and, as such, ICT costs often only reflect in the centralised ICT department budget. Financial costing, however, is an integral part of the financial management of institutions and as such is required in terms of audit procedures as well as reporting regulation R691 (South Africa, Department of Education, 2007). Personnel and operating costs have to be reported in terms of the regulation, but ICT capital costs are not specifically required to be reported.

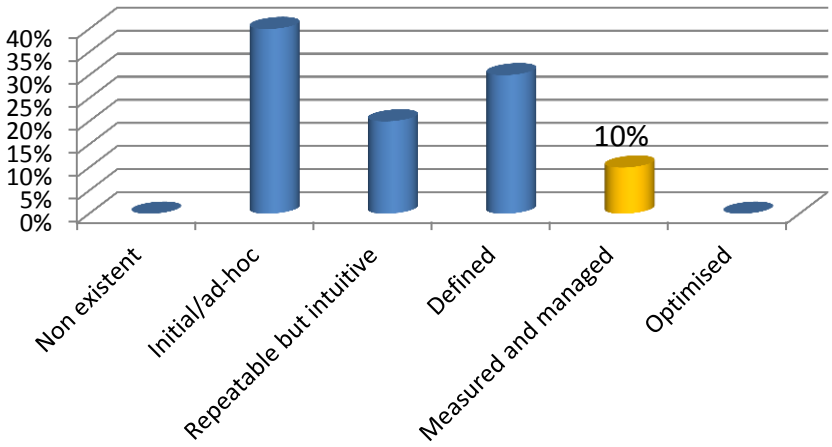


Figure 6-26: Process DS 11 – 'Manage Data' Average South African Public Higher Education Institution ICT Process Maturity Levels

Figure 6-26 shows that none of the responding institutions have process maturity at the *non-existent* level and that 10% of responding institutions were at the *measured and managed* maturity level. This is possibly associated with the nature of the education sector in that data is captured on sophisticated electronic systems that run in virtual environments which have high availability and automated change-over with high bandwidth and capacity. The data, once stored, is relatively safe with lower risk of attack from hackers compared with, say, banking systems data.

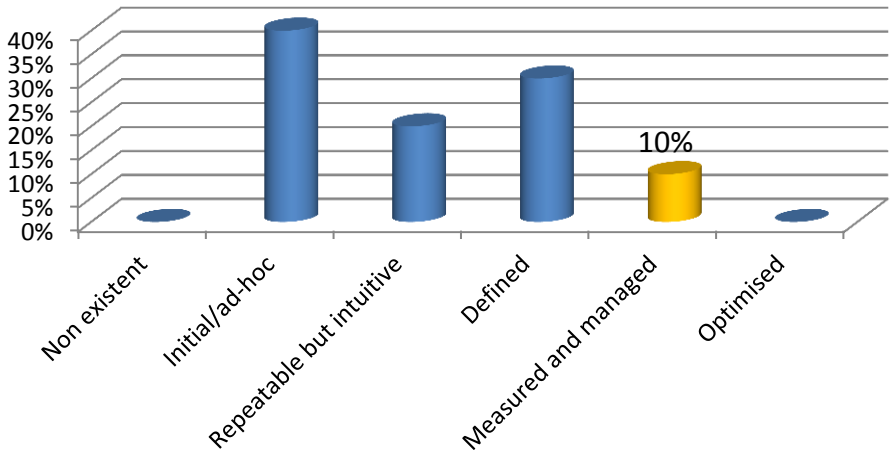


Figure 6-27: Process DS 12 – 'Manage the physical environment' average South African public higher education institution ICT process maturity levels

Figure 6-27 indicates that 10% of the responding institutions are at the *measured and managed* level of process maturity. Once again, securing the computer server environment is required in terms of regulation R691 and is also an audit requirement.

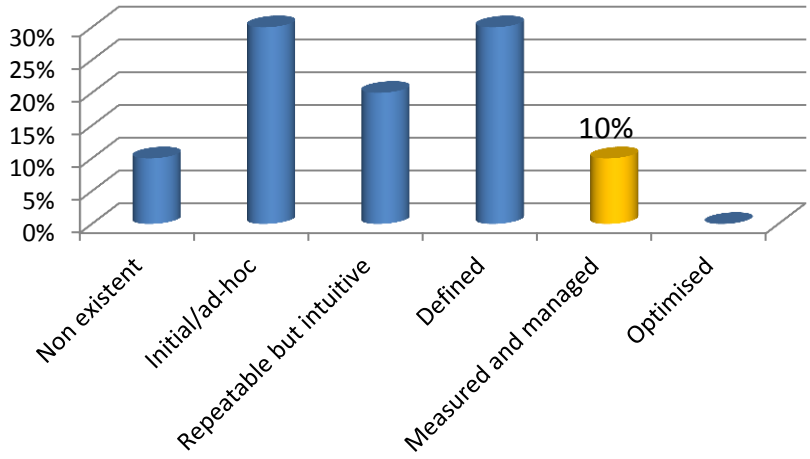


Figure 6-28: Process DS 13 – 'Manage Operations' Average South African Public Higher Education Institution ICT Process Maturity Levels

Figure 6-28 reflects that 10% of institutions have processes in the ICT operations sector that are at a *measured and managed* maturity level. Over the past five years, public higher education institutions in South Africa have attempted to implement the ITIL operations best management practices. For this purpose, funds have been made available through various funding initiatives and this is a contributing factor to the 10% *measured and managed* process maturity level of this process.

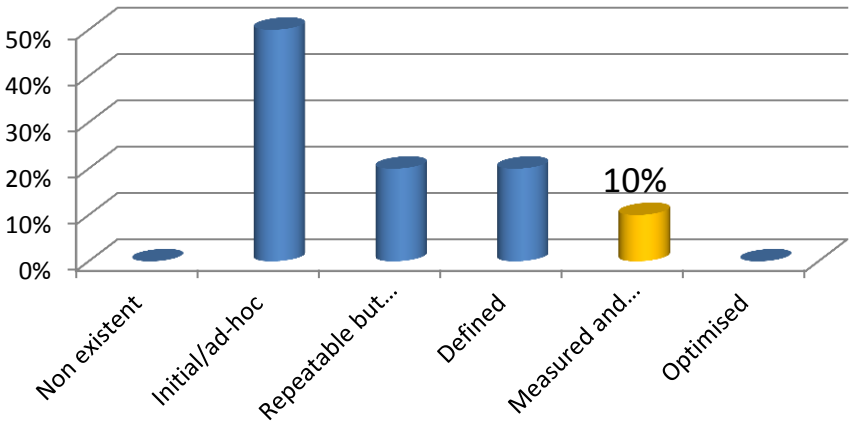


Figure 6-29: Process ME 2 – 'Monitor and Evaluate Internal Control' Average South African Public Higher Education Institution ICT Process Maturity Levels

Figure 6-29 shows that 10% of the responding institutions have internal control processes at the *measured and managed* level of maturity. Reporting regulation R691 (South Africa, Department of Education, 2007, p. 27) requires that any systems supporting financial transactions must "receive close scrutiny and procedures must be designed and implemented to minimize the risk of fraud or error". Once again the requirement by regulation R691 (South Africa, Department of Education, 2007) to ensure that internal control processes are monitored and evaluated is associated with process maturity at the *measured and managed* process maturity level.

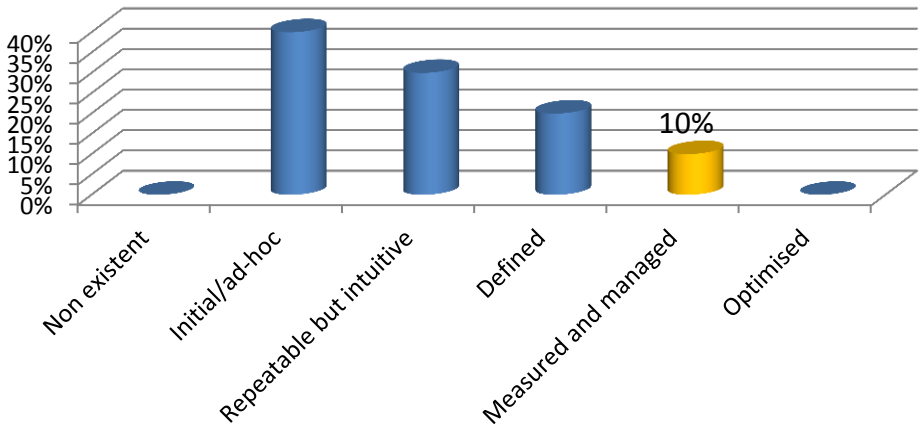


Figure 6-30: Process ME 4 – 'Provide ICT Governance' Average South African Public Higher Education Institution ICT Process Maturity Levels

Figure 6-30 represents the provision of ICT governance of the structures within the public

higher education sector in South Africa, of which 10% of responding institutions have processes at the maturity level of *measured and managed*. Regulation R691 requires specific governance structures to be set up in institutions and encourages, through the King III Code corporate governance best practice framework, the application of Chapter 5 of the framework which deals with ICT governance. The 'apply or explain' nature of the King III Code has possibly been a contributing factor to 10% of institutions achieving the *measured and managed* level of process maturity for this process.

Twelve of the processes in which institutions have achieved a measured and managed process maturity level have been discussed. It is significant that all of these processes are associated with legislation, or regulation originating from legislation. Responding institutions did not report the remaining 22 processes at maturity levels above *defined*. The summary of the relevant legislation or regulation is presented in Table 6-2.

It can therefore be concluded that *legislation and regulation have contributed* to the elevation of the maturity of the twelve processes that have been reported at the maturity level of *measured and managed*.

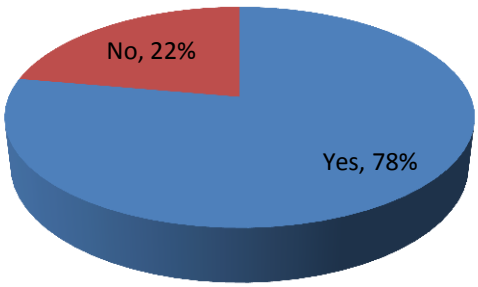


Figure 6-31: Responses from South African Public Higher Education Institutions on the Existence of an ICT Governance or Steering Committee of Council

The pie chart in Figure 6-31 indicates that, despite there being no legislated requirement for ICT governance, 78% of responding institutions have ICT governance or steering committees of Council. The activities of this committee contribute to overall ICT governance effectiveness. Institutions have set up ICT governance committee structures over a period of time without centralised governance encouragement, resulting in somewhat sporadic governance implementation when viewed overall.

			Act 101, Regulation R 691	HEQC	BBBEE	Auditing Professions Act	Basic Conditions of Employment Act
COBIT 4.1 Domains	Planning & Organising	PO 1 - Define a strategic IT plan	■				
		PO 2 - Define the information architecture					
		PO 3 - Determine technological direction					
		PO 4 -Define the IT organisation and relationships					
		PO 5 - Manage the IT investment					
		PO 6 - Communicate the management aims and direction	■				
		PO 7 - Manage human resources	■				■
		PO 8 - Manage quality		■			
		PO 9 - Assess and manage IT risks	■			■	
		PO nine - Manage projects					
	Acquisition & Implementation	AI 1 - Identify automated solutions					
		AI 2 - Acquire and maintain application software					
		AI 3 - Acquire and maintain technology infrastructure					
		AI 4 - Enable operation and use					
		AI 5 - Procure IT resources			■	■	
		AI 6 - Manage changes					
		AI 7 - Install and accredit solutions and changes					
	Delivery & Support	DS 1 - Define and manage service levels					
		DS 2 - Manage third party services					
		DS 3 - Manage performance and capacity					
		DS 4 - Ensure continuous service					
		DS 5 - Ensure systems security					
		DS 6 - Identify and allocate costs	■			■	
		DS 7 - Educate & train users					
		DS 8 - Manage service desk and incidents					
		DS 9 - Manage the configuration					
		DS 10 - Manage problems					
		DS 11 - Manage data	■			■	
		DS 12 - Manage the physical environment	■			■	
		DS 13 - Manage operations				■	
	Monitoring & Evaluation	ME 1 - Monitor and evaluate IT performance					
		ME 2 - Monitor and evaluate internal control				■	
		ME 3 - Ensure compliance with external requirements					
		ME 4 - Provide IT governance	■			■	

Table 6-2: Summary of COBIT 4.1 Processes that have Maturity Levels of Measured and Managed

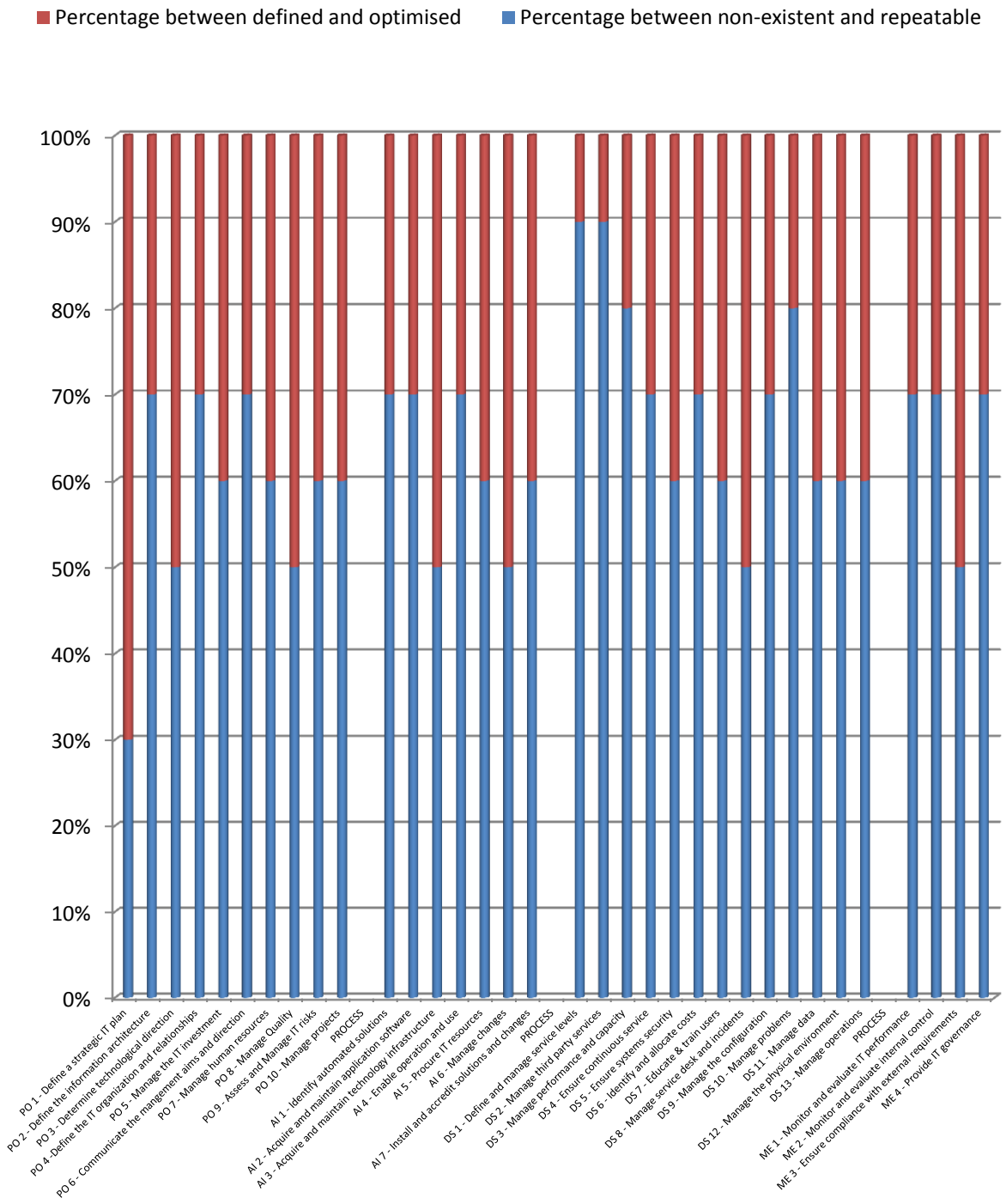


Figure 6-32: COBIT 4.1 Processes Showing ICT Process Maturity Below and above the mid-way Maturity Point

The first three COBIT 4.1 maturity measures are summed and contrasted with the sum of the

last three COBIT 4.1 maturity measures, which are reflected as the sum of 100% on the graph in Figure 6-32. Only the strategic planning process indicated in the first bar in the graph in Figure 6-32 is over 50% towards being optimised. Within the public higher education sector in South Africa this process is led by the *business* and ICT participates in the process. Most of the other processes are ICT-specific processes. Strategic planning, as mentioned earlier, surfaced around 1965 (Mintzberg, 1994) long before the concept of ICT emerged in the early eighties. This supports the findings of the survey, which show that this process has 70% of the responses within the higher maturity half of the responses, as it has had time to mature. It can be concluded from the above that where legislation or regulation of the business environment takes place, there are improved levels of ICT process maturity evident and, conversely, where no legislation or regulation is applied, the levels of ICT process maturity are lower. Consequentially, one way in which to increase the likelihood of achieving the strategic objectives of the DHET is to improve the legislation or regulation that applies to public higher education institutions, particularly in the area of ICT.

6.5.7 Linking the DHET Strategic Framework to ICT Governance Process Maturity

The medium term strategic framework of the DHET (South Africa, Department of Higher Education and Training, 2010, p. 58) refers to the fourth strategic priority in terms of broadening access to post-secondary education and improving the public higher education throughput rate by 20% by 2014. The mission statement of the DHET strategic plan (2010, p. 22) addresses the issue of efficiency in the higher education system by stating the following:

> The department will undertake this mission by reducing the skills bottlenecks, especially in priority and scarce skills areas; improving low participation rates in the post-school system; correcting distortions in the shape, size and distribution of access to post-school education and training; and improving the quality and ***efficiency*** in the system, its sub-systems and its institutions [author's emphasis].

Cost per graduate is an indicator that allows a measure of comparison between higher education institutions in South Africa. The average cost per graduate per higher education institution between the years 2000 and 2009 is shown in Figure 6-33 (South Africa, Centre for higher education transformation, 2012).

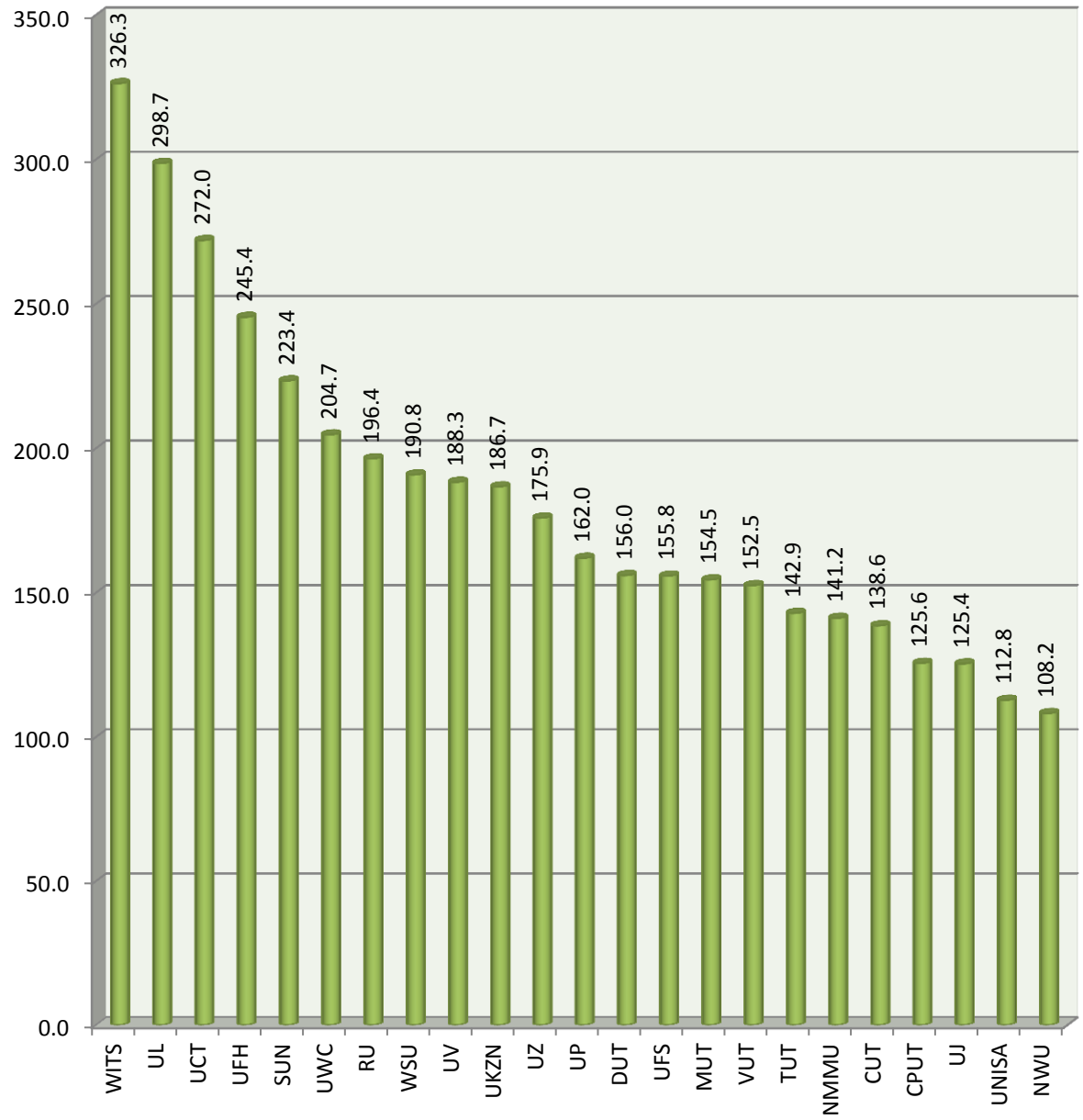


Figure 6-33: Average 2000 to 2009 Cost per Graduate per South African Higher Education Institution in 000 Rand (Centre for Higher Education Transformation Public Website)

There are many factors that contribute to the average cost per graduate in South African public higher education institutions shown in Figure 6-33, and it is not the intention in this study to provide a comprehensive list of them. Suffice it to say that the programme and qualification mix has an influence on the cost per graduate. One of the indicators extrapolated from the Centre for Higher Education Transformation data (2012) is the stability of the cost per graduate over the ten-year period between 2000 and 2009. This is measured using the

statistical analysis technique of standard deviation, the results of which are displayed in Figure 6-34.

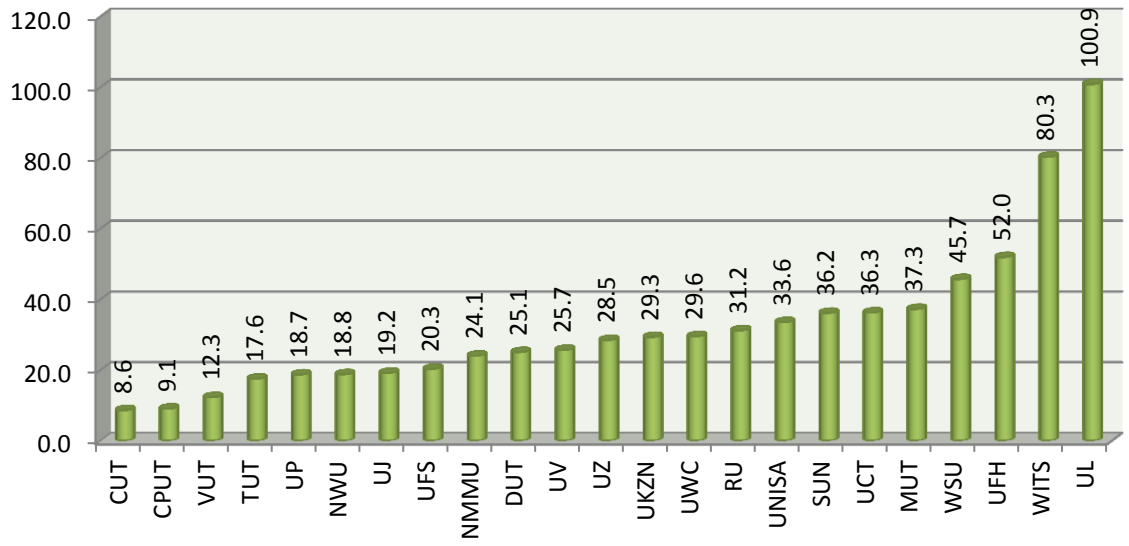


Figure 6-34: Standard Deviation of Ten-year Average Institutional Cost per Graduate per Annum indicating Stability of Cost over Nine Years

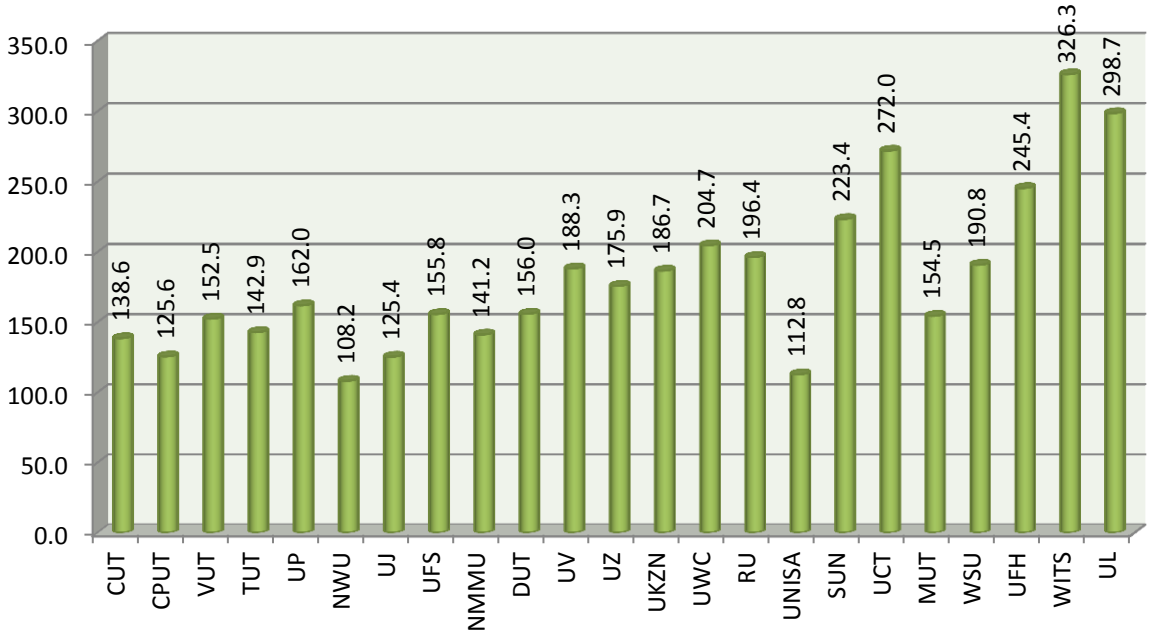


Figure 6-35: Average 2000−2009 Cost per Graduate per Annum of South African Higher Education Institutions in 000 Rand (Centre for Higher Education Transformation Public Website)

There is a trend apparent in the graphs in Figure 6-34 and Figure 6-35. This trend indicates a loose correlation between the stability of funding over the ten-year period and the cost per graduate. UNISA is one notable exception as its relative cost per graduate stability indicator places it among institutions with a cost per graduate at the top end of the cost scale. It is, however, the only exclusively distance education institution in the public higher education sector in South Africa.

The ten institutions that provided ICT governance maturity levels by responding to the online surveys are mapped to the cost per graduate stability indicator and the results are shown in Figure 6-36. The cost per graduate stability indicator in Figure 6-36 is divided by ten to allow for better reference resolution on the graph. There is a clear trend can be identified, indicating that the institutions with higher ICT governance maturity are those with better levels of graduate cost stability, with three exceptions. These three exceptions are all HDIs. The loose correlation with exceptions that is seen in Figure 6-36 needs further investigation to understand whether this loose correlation is merely coincidence or whether there is a valid explanation. This is not pursued further in this study but does provide opportunity for further research.

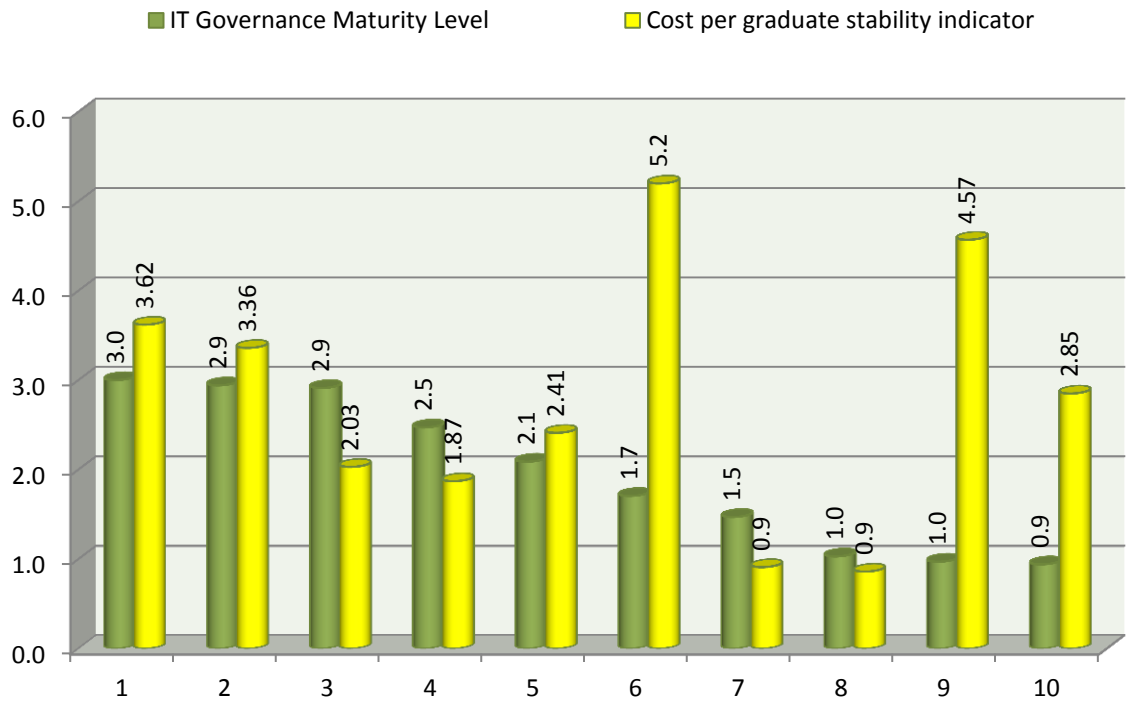


Figure 6-36: ICT Process Maturity Levels and the Cost per Graduate Stability Indicator

Associated with this cost per graduate stability indicator is the contribution that state funding makes to the running costs of public higher education institutions in South Africa. The graph in Figure 6-37 shows the percentage of state contributions between the years 2004 and 2010.

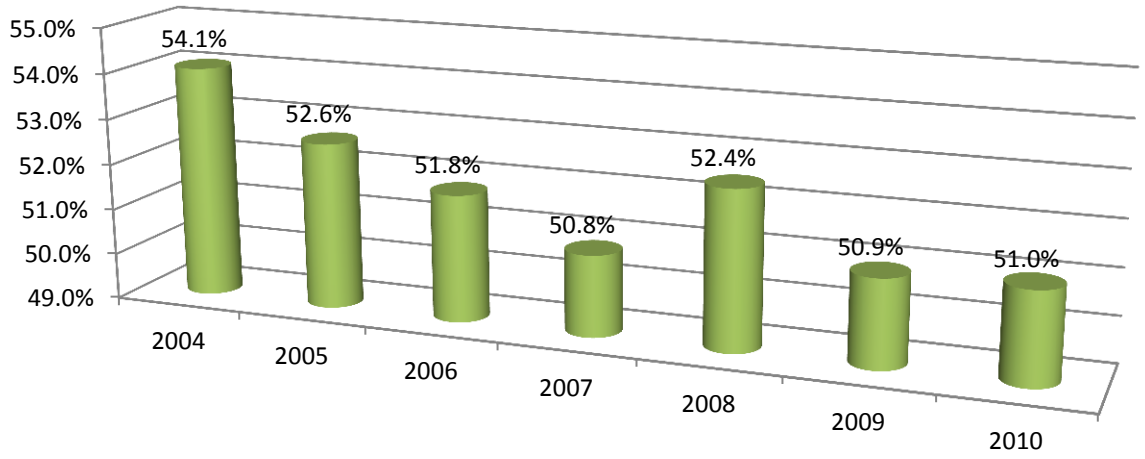


Figure 6-37: Percentage State Funding of Total Income of Public Higher Education Institutions in South Africa

Public higher education institutions have had to increase their third stream income to compensate for this decrease in state funding. It is evident from this invidious position that the cost per graduate needs to be improved in order to maintain quality in the presence of ever-increasing pressure to accommodate more students in the higher education system with fewer available resources.

6.6 Discussion

It can be debated that higher education institutions in South Africa have not focused on ICT governance in as dedicated a manner as they have focused on financial and HR matters. One of the reasons for this is that ICT is a relatively new phenomenon, only having emerged from the data-processing environment since the early eighties. Another reason is that, according to law, the finances of institutions need to be audited; moreover, HR matters are also regulated by law.

The King III Code (2009) now requires that an ICT best practice framework be adopted, but this requirement is moderated by the choice that the Code allows. ICT matters are, therefore,

not regulated by law in the same manner as financial and HR matters are regulated and this renders the implementation of ICT best practice frameworks and practices as a matter of choice. The highest level of ICT governance maturity of 3 on a scale of 0 to 5 at a South African public higher education institution means that ICT processes at the best-governed institution are only in the beginning stage of being defined.

At worst, and most commonly, such processes are non-existent or initial/ad hoc. ICT systems encompass not only processing, storing and communicating the entire institution's financial and business systems; they are also used extensively for teaching, learning and research. Furthermore, according to the survey, dependence on administrative ICT systems averages 90%, as almost all the work done by administrators requires ICT in one form or another.

Furthermore, academics are making more use of ICT systems and are, on average, 76% dependent on some form of ICT system. Currently, ICT personnel costs averaged 2,71% of the total institutional budget over the period 2004 to 2010, which translates into approximately R800 million for the year 2010. Also, ICT capital and operational expenditure is not specifically made available in the DHET financial data. This is yet another indicator that the DHET has not yet recognised the critical need to implement or enforce sound ICT governance practices in the higher education sector.

The absolute dependence on ICT, the increased cost and the need to mitigate the risk associated with ICT systems are just three of the reasons that make the formalisation of ICT governance essential in the higher education sector. From this study, it may thus be concluded that the current levels of ICT governance do not correlate with the critical role that ICT plays in the higher education sector in South Africa. This situation certainly calls for government intervention of one form or another.

6.7 Conclusion

A high level of ICT governance maturity is essential to ensure that ICT is aligned with the business or enterprise and that it delivers value, its performance is measured, its resources are properly allocated and its risks are mitigated (IT Governance Institute, 2003). The five focus areas of the COBIT 4.1 best practice framework cover the ICT governance requirements of any business or institution. Accordingly, the COBIT 4.1 average ICT governance maturity level of 1,8 on a scale of 0 to 5 in South African public higher education institutions indicates that ICT governance in the sector has been neglected or that it has, perhaps, not yet enjoyed

the focus it requires.

The EDUCAUSE COBIT 4.1 average ICT governance maturity level of 2,3 measured in 2008 is an indicator that the formalisation of ICT governance does improve maturity levels. EDUCAUSE has focused on ICT governance for many years and it advocates the use of best practice frameworks to improve ICT governance maturity. The King III Code now also requires ICT governance to be included in corporate governance (King III Code, 2009). According to this survey, ICT governance maturity is lowest in HDIs in South Africa. Despite the 16 years that have passed since the promulgation of the Higher Education Act in 1997, the overall maturity of ICT governance in the public higher education sector in South Africa remains low.

ICT personnel costs in institutions with higher maturity levels average 3% of the total personnel budget, whilst institutions with smaller ICT personnel budgets and lower staff capacity tend to have even lower ICT governance maturity levels. Older institutions also tend to have higher ICT governance maturity levels, whilst the younger ones, despite in some cases having relatively large ICT budgets, are not as mature in their ICT governance practices. Van Grembergen (2004) states that high levels of ICT governance can be achieved by acknowledging that ICT forms part of corporate governance and by setting up an ICT best practice framework with corresponding best practices. It is essential that such interventions address the specific issues associated with HDIs in order to ensure that ICT governance is improved and that it moves towards a common goal across the higher education sector in South Africa.

Chapter five covered the exploration of pervasiveness to present a founding mechanism of measurement of ICT pervasiveness in public higher education institutions in South Africa. It also associated the concept of pervasiveness with the increased need to govern ICT in order to ensure that it contributes value to the sector. The primary ICT pervasiveness factors identified in the study were also endorsed by the highest ranking ICT officials at public higher education institutions as being contributors to pervasive ICT.

This chapter covered the measurement of *ICT process maturity* in the context of public higher education institutions in South Africa. This is aimed at providing a baseline to inform the sector on the current status of ICT process maturity.

Chapter seven targets the setup and administration of a survey to ascertain the alignment of the business or enterprise with ICT. A version of the Luftman and Brier (1999) business and ICT alignment model, adapted minimally for use in the public higher education sector, is used in the survey.

Chapter Seven

ICT and Business Alignment in Public Higher Education Institutions in South Africa

7 ICT and Business Alignment in Public Higher Education Institutions in South Africa

7.1 Introduction to Business and ICT Alignment

Chapter five commenced with the exploration of ICT pervasiveness and, in the absence of a measurement mechanism, one was devised to measure relative ICT pervasiveness. The chapter concluded with measures of relative ICT pervasiveness ranging between 46 and 74%. Chapter five thus determined that ICT *is indeed pervasive in public higher education institutions in South Africa*. Chapter six sought to ascertain the level of maturity of the ICT processes. The Information Technology Governance Institute (ITGI) developed the COBIT 4.1 best practice framework that was used to measure the level of ICT process maturity. This was done by measuring the maturity level of the 34 high level or primary processes. The average level measured in responding public higher education institutions (n = 10) in South Africa is 1,8 on a scale of zero to 5. This is an indication of the relatively low level of ICT process maturity in public higher education in South Africa. As ICT has been proven to be pervasive in chapter five and ICT processes have been found to have relatively low maturity in chapter 6, it is important to determine how well ICT is utilised within these public higher education institutions in terms of achieving the business, or enterprise, goals. For this reason the alignment between business and ICT goals needs to be determined.

This chapter provides the details on the third of three secondary research objectives designed to support the primary research objective, that is, *to produce a value framework that can be used to determine the value created in tertiary institutions in South Africa by implementing good governance practices.* The third secondary research objective discussed in this chapter is *the ascertainment of the level of alignment of ICT to the academic and administrative processes in public higher education in South Africa.*

7.2 The Rationale for Business and ICT Alignment

ICT systems are relatively new to the business world, only having contributed significantly over the past few decades. The alignment between business processes and supporting software systems is currently a top research issue, having been mentioned for the first time in the late 1970s. Since then many studies and research have been conducted, highlighting the alignment concerns (Aversano, Grasso, & Tortorella, 2012). The concept of business and ICT alignment addresses how much ICT and business systems are in harmony with one another. There are divergent views on how to achieve ICT and business alignment.

Sage (2006) states that ICT and business alignment can be achieved through the use of an enterprise architecture (EA), which is a continuously applied methodology for aligning the strategies of the business with its ICT strategies, This results in alignment along cognitive, social and behavioural dimensions. An example of an EA is the Zachman Framework for Enterprise Architecture which is a structured taxonomy of EA concepts that organisations should consider in the development of their own EA (Zachman, 2013). The Zachman framework does not contain practice or methodological implications, but gives a higher-granularity perspective on EA elements, presented in a 36-cell matrix of six EA elements from six audience perspectives. The COBIT 4.1 best practice framework has EA as one of its high level or primary processes.

Collins et al. (2007) are of the view that 'ICT and business alignment is a collaborative process that business people and ICT organizations go through to create an environment in which investment in ICT and delivery of ICT services reflect business priorities, whether sourced internally or externally; and in which business priorities are influenced by understanding of ICT capabilities and limitations'. ICT has become integral to the way in which organisations operate and survey responses in this study indicate that administrative dependence on ICT in public higher education institutions averages 90%, with some respondents indicating full administrative dependence on ICT systems. Kaplan and Norton (2006) are the creators of the 'balanced scorecard' strategic alignment approach that has four perspectives, *financial, customer, internal process and learning and growth,* which are driven by continuous improvement through aligning people, systems and culture. Strassmann (1997) articulates alignment as the capacity to demonstrate a positive relationship between information technologies and accepted measures of performance, while Chen (2010) concludes that achieving alignment leads to improved organisational performance. EA frameworks, such as the Zachman EAF and the balanced scorecard strategic alignment approach by Kaplan and Norton (2006), are valuable tools that support various elements of alignment.

The COBIT 4.1 best practice framework contributes to these alignment needs by making a link to the business requirements, organising ICT activities into a generally accepted process model, identifying the major ICT resources to be leveraged, and by defining the management control objectives to be considered (IT Governance Institute, 2007). The business orientation of COBIT consists of linking business goals to ICT goals, providing metrics and maturity models to measure their achievement, and identifying the associated responsibilities of

business and ICT process owners. The COBIT 4.1 framework has ten of the 34 primary processes, focusing on the strategic alignment of ICT with the business (IT Governance Institute, 2011) and a single sub-process PO1.2 (IT Governance Institute, 2011) that deals *specifically* with ICT and business alignment. The relevant ten primary processes, their level of process importance and whether they are primary, secondary, or not defined in the framework as enablers at all, are shown in Table 7-1.

COBIT 4.1 Domains	Importance Level is H (High), M (Medium), L (Low)	Process Importance Level	The Strategic Alignment IT Governance Focus Area
COBIT 4.1 Primary Processes	P = Primary Enabler, S = Secondary Enabler		
Plan and Organise			
P01	Define a Strategic IT Plan	H	P
P02	Define the Information Architecture	L	P
P04	Define the IT Processes, Organisation and Relationships	L	S
P10	Manage Projects	H	P
Acquire and Implement			
AI1	Identify Automated Solutions	M	P
AI6	Manage Changes	H	-
AI7	Install and Accredit Solutions and Changes	M	S
Deliver and Support			
DS1	Define and Manage Service Levels	M	P
DS3	Manage Performance and Capacity	L	S
Monitor and Evaluate			
ME1	Monitor and Evaluate IT Performance	H	S

Table 7-1: COBIT 4.1 Strategic Alignment Focus Area Primary Processes and Importance Levels (COBIT 4.1, p. 170)

Luftman (2003), however, focuses his attention on alignment only, using his model that has been validated and applied through studies of over 50 of the global top 2000 organisations. This provides more depth in the focus area of ICT and business alignment from the strategic level to the functional level in most areas that affect alignment. This cross-section of *strategic to functional alignment measures* is the primary reason that Luftman's model is considered in conducting this survey. This chapter thus focuses on the survey based on the Luftman (2003) model and the survey responses from both the business and ICT respondents to assess the level of ICT alignment maturity with the business or enterprise.

7.3 Business and ICT Alignment Maturity Components and Criteria

The Luftman (2003) model for ICT and business alignment maturity has six *components* that need to be assessed, namely, Communications, Competency/Value Measurement, Governance, Partnership, Scope and Architecture, and Skills. These six components of ICT and business alignment and their maturity criteria and measures are discussed in more detail in order to provide a foundation for the understanding of ICT and business alignment, thus providing the scope and context for the survey.

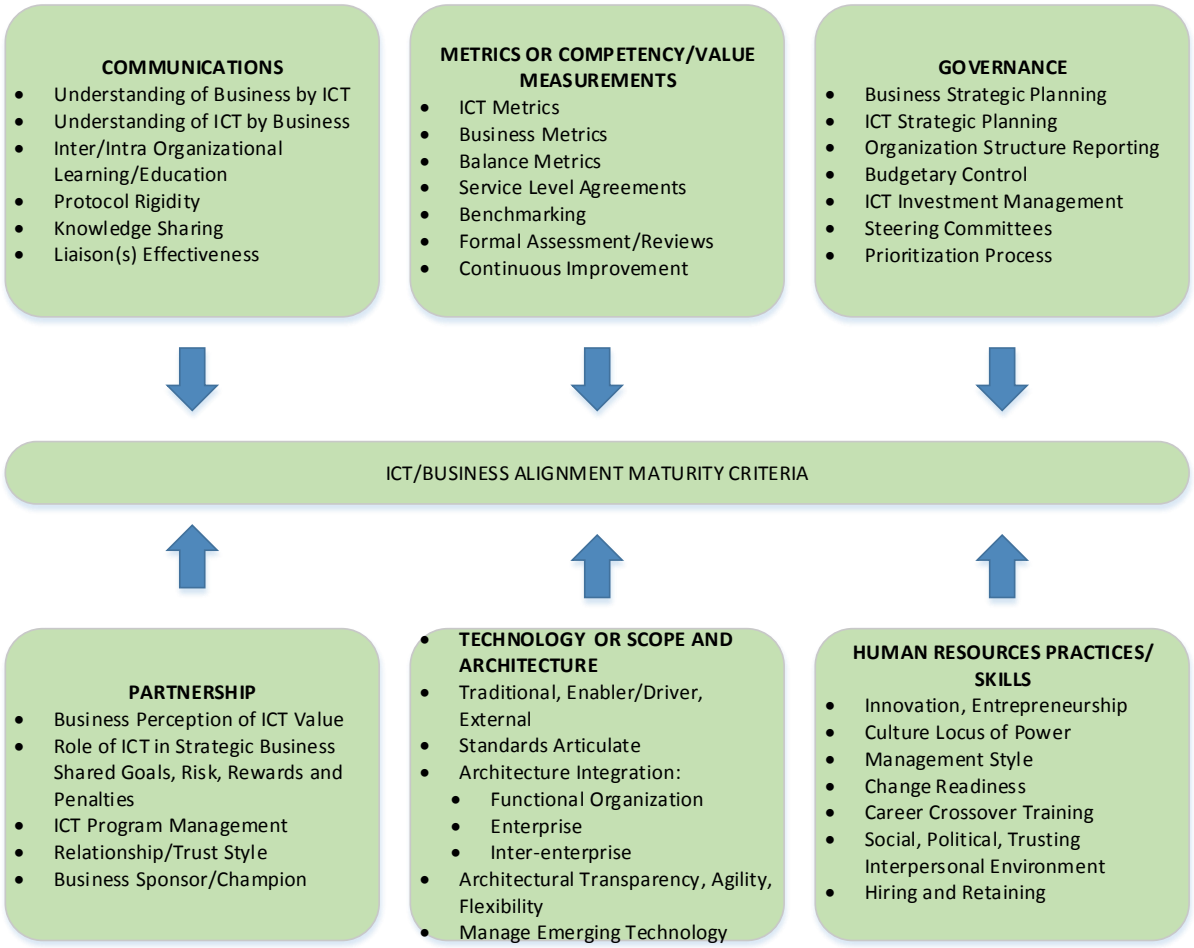


Figure 7-1: ICT and Business Alignment Maturity Model (adapted from Luftman, 2003)

The six alignment maturity *components* are covered briefly below to provide some background and context for the ICT and Business alignment survey. Questionnaires were distributed to the most senior ICT leader at public higher education institutions in South Africa, as well as the Registrar's office at each institution in order to obtain the view of the academic support division on the same questionnaire. Responses were received from 53% of the universities, 75% of the universities of technology and 25% of the comprehensive

institutions. In terms of size, 47% of the large institutions and 75% of the small institutions responded to the survey on the alignment between business and ICT, whilst in terms of historical status 56% historically disadvantaged institutions and 50 of the historically advantaged institutions responded. Refer to paragraph 5.2.1 for the discussion on the survey methodology which applies to the three information seeking surveys. The first two questions of the survey were used to ascertain the details of the participating institution and the rank of the most senior ICT official. This was followed by questions to ascertain the ICT and business alignment maturity levels of the 36 alignment criteria based on the Luftman survey. The content of the survey was adapted slightly to better suit the public higher education environment in South Africa. The survey was administered online using the commercial Survey Monkey toolset. Although the response rate from the Registrar division was lower than that of the most senior ICT officials, the results of both groups are seemingly similar, indicating that the view of alignment by both groups is similar. The six alignment criteria are covered in more detail in the following subsections.

7.3.1 Communication

The effective exchange of ideas and a clear understanding of what it takes to ensure successful strategies are high on the list of enablers and inhibitors of alignment (Luftmann & Brier, 1999). The facilitation of this exchange of ideas between business and ICT can be a major problem, because business is often of the view that ICT is an unnecessary and burdensome cost, while ICT is often of the view that that business may not be aware of ICT innovations. The role of the CIO in this process of dialogue facilitation cannot be underestimated and the CIO should engage with different groups within the organisation; reaching out to important groups with a well-articulated value proposition rather than those that may have been worked with before or are keen to be worked with currently (Fadia & Bhattacharjee, 2008).

7.3.2 Metrics or Competency/Value Measurements

Service level agreements (SLAs) are used both in business and higher education institutions to regulate the relationship between service providers and the users of those services. Service levels have to be expressed in terms that business understands and accepts and these service levels should be tied to criteria that are clearly defined and measureable and that the rewards and penalties for achieving or missing the objectives are clearly articulated (Luftman, 2003). Punitive measures are often taken when agreed service levels are not met and this has the net

effect of increasing prices for services rendered. In many public higher education institutions in South Africa SLAs regulate service provision between internal departments, but the inability to achieve agreed service levels is usually dealt with by understanding the root cause of incidents and problems, and to look for innovative ways for dealing with failure through the commitment of both parties to seek solutions and improvement. Nevertheless, the lack of a formal agreement often leads to the failure of services and this remains a risk in this environment.

7.3.3 Governance

Luftman (2003) is of the view that ICT governance is an element of ICT and business alignment. The Information Systems Audit and Control Association (ISACA) was incorporated in 1969 and formed the IT Governance Institute (ITGI) in 1998 to focus on original research on ICT governance and related topics (2011). The ITGI is the author of the COBIT 4.1 framework and lists ICT governance as one of the 34 primary processes of the framework. Despite the COBIT 4.1 model and the Luftman (2003) model referencing each other, it is clear that ICT and business alignment and ICT governance are working towards the mutual goal of achieving better value from ICT investment. Ensuring that the appropriate business and ICT participants formally discuss and review the priorities and allocation of ICT resources is among the most important enablers or inhibitors of alignment (Luftman, 2003).

7.3.4 Partnership

The partnership referred to in the Luftman (2003) model relates to giving the ICT function the opportunity to play an equal role in defining business strategies, thus allowing trust to develop among participants, resulting in the sharing of risk and reward and, therefore, contributing to improved alignment maturity. Luftman subsequently points out that this trust relationship should evolve to a point where ICT both *enables* and *drives* changes to both business processes and strategies, and that this is dependent on good business design in which the CIO and CEO share a clearly defined vision. The partnership envisaged is, however, still at the embryonic stage in many cases in business. Moreover, in the public higher education sector in South Africa the survey results of this study indicate that current reporting relationships in South African public higher education are also not in line with this vision, as not a single CIO reports to a vice chancellor. Most CIOs in the public higher education sector in South Africa report to second or third-tier executive managers, thus this partnership is only indirectly enabled through an intermediary. Whilst there is heightened awareness that ICT

can be a critical enabler for success, there is minimal acceptance of ICT as a partner (Luftman, 2003).

7.3.5 Technology/Scope and Architecture

Scope and architecture is the only technical criterion included in the alignment maturity assessment (Luftman, 2003), which relates to a set of criteria that tends to assess ICT *technology maturity* and, thus, defines the extent to which ICT is able to:

- go beyond the back office and the front office of the organisation
- assume a role supporting a flexible infrastructure that is transparent to all business partners and customers
- evaluate and apply emerging technologies effectively
- enable or drive business process and strategies as true standards
- provide solutions customisable to customer needs.

This is often an area where there is no formal integration, only functional integration (Luftman, 2003). This is also the case in public higher education institutions in South Africa where at least fifteen of the twenty-three institutions make use of an outsourced ERP system which results in little or no internal institutional input to process design and technology choice, at least in the functioning of the ERP system.

7.3.6 Human Resources Practices/Skills

Luftman (2003) contends that going beyond the traditional considerations of training, compensation, performance feedback and career opportunities are factors that include the organisation's cultural and social environment. This begs some of the following questions:

- Is the organisation ready for change in this dynamic environment? In the public higher education environment online learning, learning management systems (LMS) and desktop group video conferencing, amongst other technologies, have revolutionised education and have considerably improved access to quality education.
- Do individuals feel personally responsible for business innovation?
- Can individuals and organisations learn quickly from their experiences? (agility)
- Does the organisation leverage innovative ideas and a spirit of entrepreneurship?

As these are important conditions for a mature organisation, the components of alignment introduced above provide an understanding of the scope and relevance of issues affecting business and ICT alignment maturity. These components need to be quantified in some

manner and Luftman (2003) provides the relevant measurement levels which are discussed in the next section.

7.4 Business and ICT Alignment Maturity Levels

Figure 7-2 provides the business and ICT process maturity levels as defined by Luftman (2003). The alignment process maturity levels range between zero where there is no evidence of process at all and five where the business and ICT process alignment maturity would be perceived as being optimal.

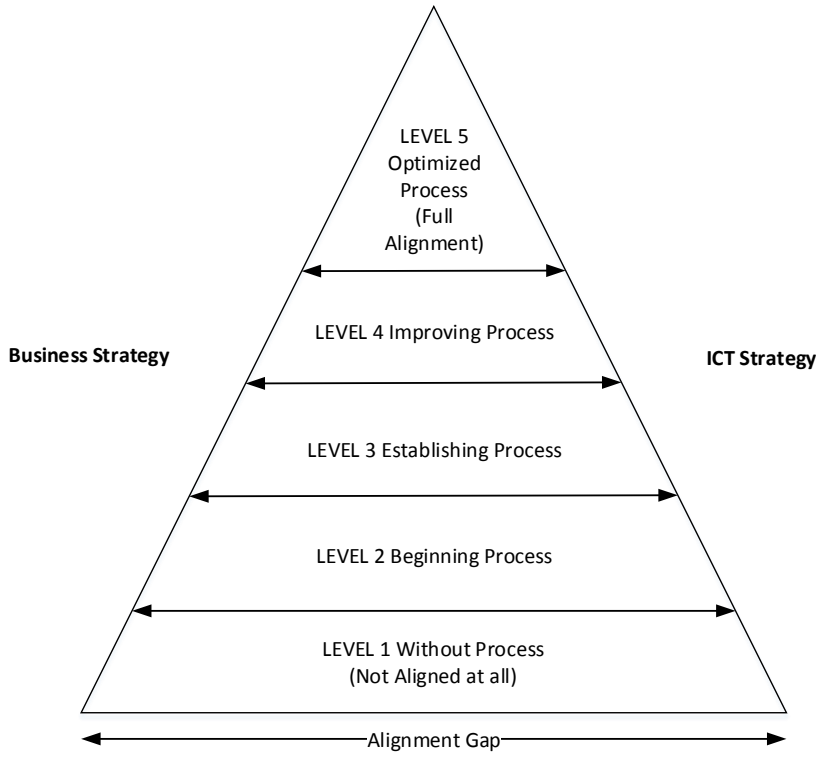


Figure 7-2: Strategic Alignment Maturity Assessment Levels (Luftman, 2003)

These measures were used in the survey sent to all of the highest level senior ICT officials at the twenty-three public higher education institutions in South Africa, as well as to the academic support divisions to obtain the views on alignment from both the supplier and the receiver of ICT services. Eleven institutions provided responses to construct the ICT view of alignment, whilst only seven institutions provided academic support responses to construct the business perspective. The survey findings are discussed in detail in the next section and responses are formulated to provide different views of the data in an attempt to provide some idea of correlation in terms of institutional age and alignment, as well as institutional historical status and alignment.

7.5 ICT and Business Alignment Survey findings

The business and ICT alignment survey was based on the Luftman (2003) model of alignment. The commercially available survey toolset *Survey Monkey* was used to collect the survey data. Responses were received from 53% of the universities, 75% of the universities of technology and 25% of the comprehensive universities. In terms of institutional size, responses were received from 75% of the small and 47% of the large institutions. Criteria are categorised into *components* of alignment in the Luftman model. The average responses per *component* of ICT and business alignment maturity are shown in Figure 7-3.

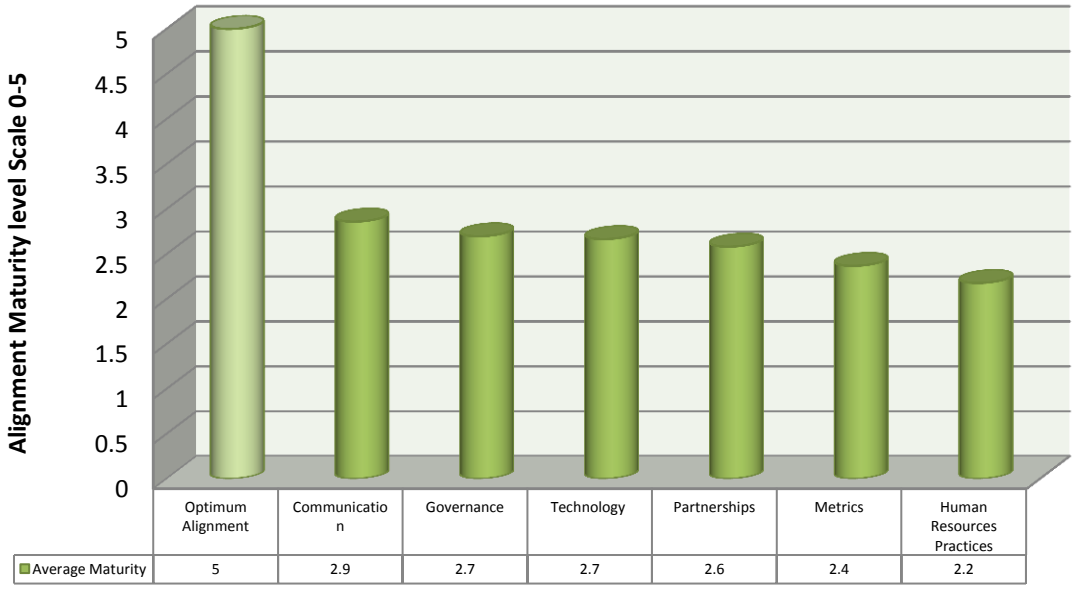


Figure 7-3: Components of Alignment Maturity, Average Responses by Public Higher Education Institutions in South Africa (Luftman, 2003)

The responses involving the *Human resource practices component* as indicated in Figure 7-3 have the lowest maturity values of the six *components* measured. This is supported by the findings of the process maturity levels in the section dealing with the COBIT 4.1 responses in Figure 6-20, where only 40% of institutions reported the maturity of the ICT HR process as being between *defined and optimised (level three is 'defined' and level five is 'optimised' in the COBIT 4.1 framework).* The average levels of all 36 ICT and business maturity criteria are shown in tabular format in Table 7-2, as well as in graphical format Figure 7-4. The first column shows the average value of the *ICT and business responses* of each alignment criterion. The second column shows the average value of the *ICT responses* of each criterion, while the third column shows the average value of the *business responses* of each criterion. The data is indexed on the value of the first column, namely, the average value of the ICT

and business responses of each alignment criterion and this is also represented graphically in Figure 7-4.

	ICT/Business Alignment Criterion	Average Maturity per Criterion	ICT Average Maturity per Criterion	Business Average Maturity per Criterion
	Fully Mature Measure	5,0	5,0	5,0
COMMUNICATION	Criterion 4: Style and ease of access	3,6	3,6	3,7
	Criterion 1: Understanding of the business (of tertiary education) by ICT	3,4	3,5	3,3
	Criterion 2: Formal ICT strategy planning	3,4	3,8	3,0
	Criterion 6: Rationale for ICT spending	3,2	3,2	3,3
	Criterion 1: Formal business strategy planning	3,2	3,2	3,1
	Criterion 8: How projects are prioritised	3,1	2,6	3,6
METRICS	Criterion 7: Continuous improvement practices	3,1	3,0	3,1
	Criterion 2: Standards	3,1	2,8	3,3
	Criterion 5: Benchmarking	3,0	2,9	3,1
	Criterion 7: Senior level ICT steering committee	3,0	2,7	3,3
	Criterion 1: Business perception of ICT	2,9	2,5	3,3
	Criterion 3: Organisational learning	2,9	2,9	2,9
	Criterion 3: Architectural integration	2,9	2,6	3,1
GOVERNANCE	Criterion 4: Managing the ICT-Business relationship	2,9	3,0	2,7
	Criterion 4: How ICT infrastructure is perceived	2,8	2,7	3,0
	Criterion 1: Primary systems	2,8	2,6	3,0
	Criterion 6: ICT-business liaison staff	2,8	3,0	2,6
	Criterion 2: Key ICT HR decisions made by whom	2,8	2,5	3,0
	Criterion 1: Innovative and entrepreneurial environment	2,7	2,8	2,6
	Criterion 1: ICT metrics	2,7	2,7	2,7
	Criterion 5: How ICT is budgeted	2,7	2,7	2,7
PARTNERSHIP	Criterion 2: Understanding of ICT by the business (of tertiary education)	2,7	2,5	2,9
	Criterion 6: Formally assess ICT investment	2,7	2,8	2,6
	Criterion 6: Business sponsors/champions	2,6	2,5	2,7
	Criterion 3: Shared risks and rewards	2,5	2,3	2,7
	Criterion 6: Social interaction	2,5	2,3	2,7
	Criterion 5: Internal relationship/trust style	2,5	2,7	2,3
TECH-NOLOGY	Criterion 2: ICT's role in strategic business planning	2,5	2,5	2,4
	Criterion 3: Link between ICT and business metrics	2,2	2,1	2,3
	Criterion 3: Change readiness	2,2	2,1	2,3
	Criterion 4: Career cross-over opportunities	2,1	2,1	2,1
SKILLS	Criterion 2: Business metrics	2,0	1,5	2,6
	Criterion 4: Reporting relationships	2,0	2,2	1,9
	Criterion 7: Attract and retain top talent	2,0	1,9	2,0
	Criterion 4: Service level agreements	1,7	1,7	1,7
	Criterion 3: Organisational structure	1,6	1,4	1,9
	Criterion 5: Cross-functional training and job rotation	1,5	1,5	1,6
	Criterion 5: Leveraging intellectual assets	1,4	1,7	1,1

Table 7-2: ICT and Business Alignment Maturity Survey Data Sheet

The responses with the highest maturity values indicate the areas where ICT and business executives have been engaged and it can be concluded that partial alignment has been achieved between ICT and business, with the average responses measuring in the region of three or above. Criterion 2 under the governance measurement component, formal ICT strategy planning, is rated on average by ICT staff at 3,8 while the business staff rate it at 3,0. The process P01, *defining a strategic ICT plan*, rated highest in the COBIT 4.1 survey and also rates in the top aligned criteria in the Luftman model. This is an indication that ICT strategic planning is taking place without the necessary participation from the business. The case of criterion 8 under the governance measurement component, *how projects are prioritised*, is rated on average by ICT staff at 2,6 while the business staff rates it at 3,6. This indicates that the perception of management is that the prioritisation of projects is more mature that ICT believes.

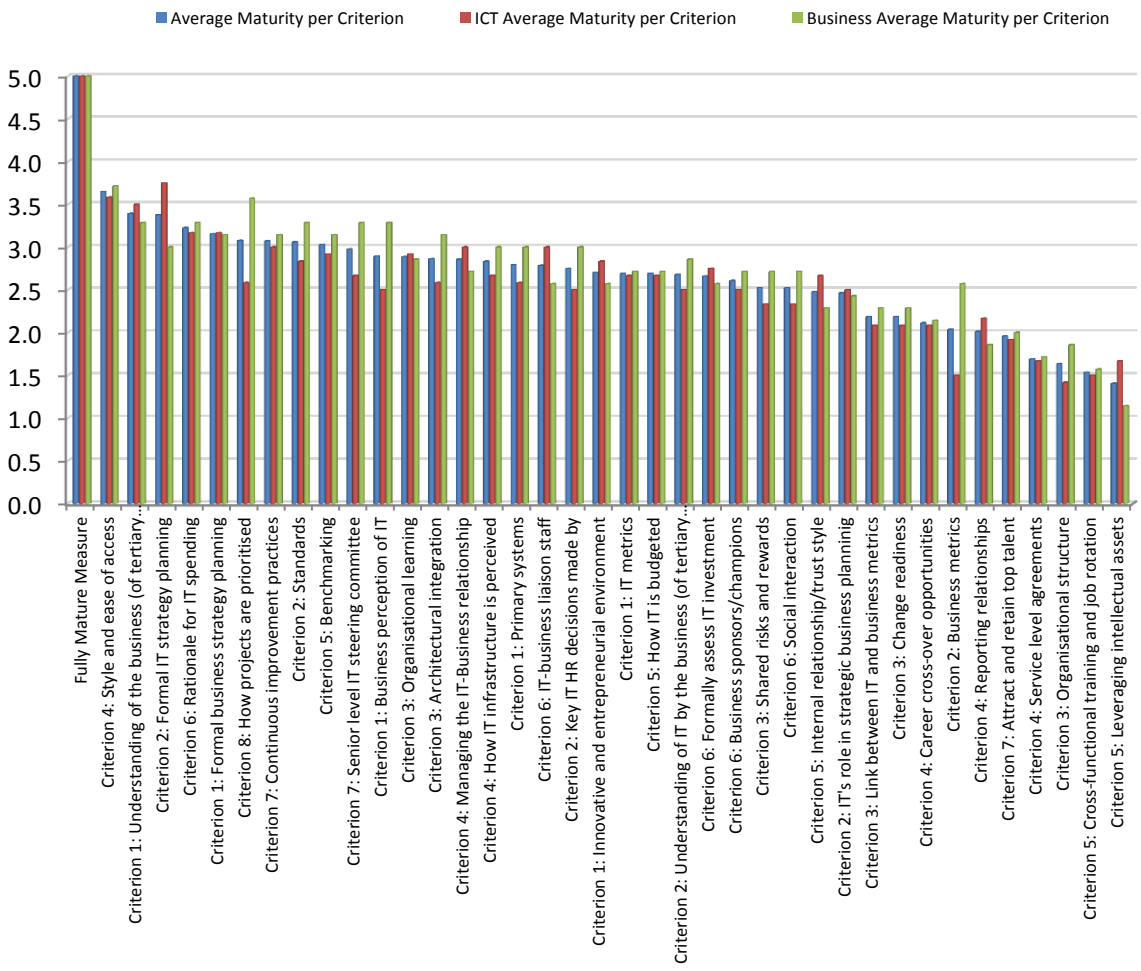
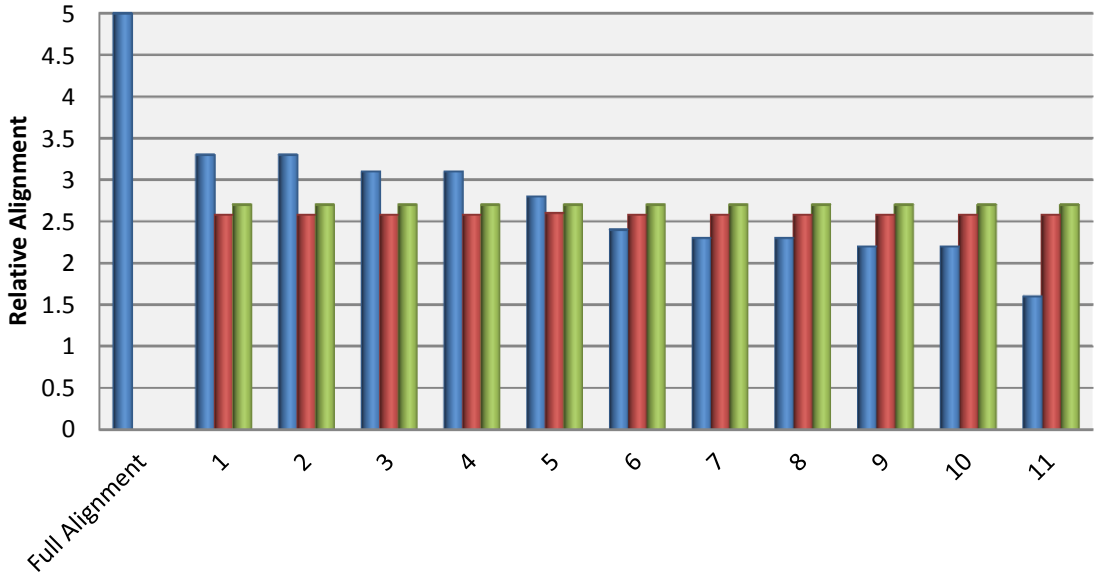


Figure 7-4: ICT and Business Alignment Maturity Survey Data in Graphical format

Both the ICT and business alignment maturity levels, as well as the differences between the levels, can serve to identify the areas where alignment is not optimal, and value can be added by addressing the areas with significant differences as well as those areas that have low alignment maturity.

The Luftman (2003) rating scale at level one is *without process or not aligned at all*, level two is *beginning process*, level three is *establishing process*, level four is *improving process* and level five is *optimised process* or complete alignment. The average responses across all the *components of alignment* only differ at most by 0,7. The responses place all of the average scores at the average maturity level of *establishing process*, which is at level three of five levels. The results provide indicators in two dimensions, the first being that of the actual view of respondents to the *level* at which alignment is in place at public higher education institutions and the second dimension being that of the views of ICT and business on the alignment level measured. These aspects are better reflected in Figure 7-5. which shows the individual institutional alignment averages against the business and ICT averages, respectively.



	Full Alignment	1	2	3	4	5	6	7	8	9	10	11
Business - IT Alignment Index	5	3.3	3.3	3.1	3.1	2.8	2.4	2.3	2.3	2.2	2.2	1.6
Average Business - IT Alignment Index (by CIO's)		2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
Average Business - IT Alignment Index (by non IT managers)		2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7

Figure 7-5: RSA Universities Business and ICT Alignment Index based on the Luftman Framework (2003)

The average responses from eleven of the twenty-three public higher education institutions in South Africa, showing the individual institutional average alignment maturity as well as the average alignment maturity of the ICT and business responses, are shown in Figure 7-5 as being 2,6. Significantly, the difference between ICT and non-ICT, or business responses, is only 0,1 on a scale of 0 to 5. Responses from non-ICT senior management are higher than the responses from the most senior ICT officials on campus. The lowest institutional average alignment maturity index is 1,6 and the highest institutional average alignment index is 3,3. No similar study was found against which this could be compared. Each element of the framework is rated according to the reference measures applicable and defined by Luftman (2003), although minor changes were made to adapt the framework to the public higher education environment. The average ICT alignment across institutions and components is 2,6. The measures of the Luftman (2003) framework are not identical to the measures of the COBIT 4.1 framework and in the absence of a cross-reference table these two measures are not compared. Suffice it to say that the processes that form part of ICT and business alignment have not yet matured to the *establishing process* level of maturity as defined by Luftman (2003).

A second possible correlation between ICT and business alignment maturity and the age of institutions was sought and the results are shown in Figure 7-6. The oldest institution has the third highest ICT and business alignment index, whilst the two youngest institutions have the highest ICT and business alignment index. The trend in other institutions is in line with the decreasing ICT and business alignment maturity index.

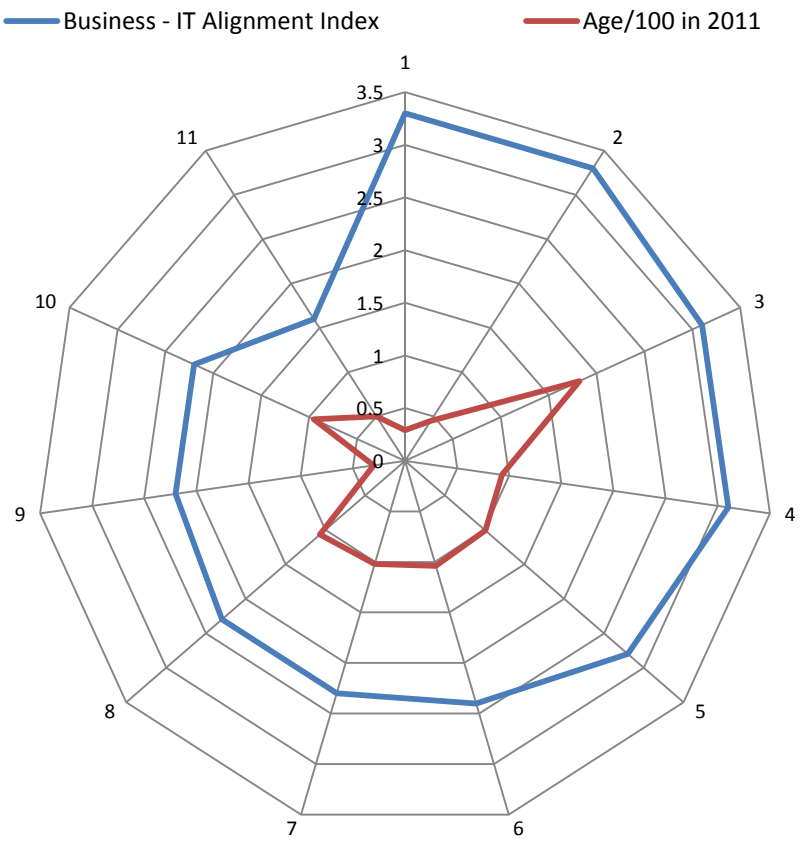


Figure 7-6: ICT and Business Alignment Index Compared to Institutional Age (/100 years)

It is therefore concluded that there is currently no correlation between the age of the institution and ICT and business alignment. Whilst the objective of the survey was only to ascertain the ICT and business alignment levels of responding institutions, there may be merit in further research in this area in terms of ICT and business alignment and other metrics, such as student pass rates or international institutional ranking, among other possible options.

7.6 Conclusion

The overall average levels of ICT and business alignment reported in the survey findings suggest that ICT and business alignment may be receiving attention in a few public higher education institutions in South Africa, possibly as a result of audit findings or through a need to improve the alignment of ICT with the business. Luftman and Brier (1999) and Luftman (2003) focus their attention on ICT and business alignment, whilst the IT Governance Institute (2011) covers five focus areas of ICT governance, as indicated in Figure 4-2 in chapter four. One of the focus areas in the COBIT 4.1 best practice framework is the *strategic alignment of ICT to the business*. It is clearly necessary to address all of the focus areas of the

framework, including strategic ICT and business alignment. Van Grembergen and De Haes (2010) postulate that *the key element in ICT governance is the alignment of business and ICT to lead to the achievement of business value.* These authors continue by suggesting that this high-level goal can be achieved by acknowledging ICT governance as a part of enterprise governance and by setting up an ICT best practice framework.

The results of the ICT and business alignment survey suggest that optimal enterprise or business value is not being achieved overall as a result of low ICT and business alignment maturity, which is measured on average at 2,65 on a scale of 0 to 5 in the public higher education sector environment in South Africa. The minimal differences in the measures of alignment between ICT and the business provide support for the conclusion that the view of alignment maturity by business and ICT is consistent, and that the alignment criteria vary in maturity level between 1,6 and 3,3. According to the results of the survey on ICT pervasiveness, ICT is highly pervasive in public higher education institutions and, thus, business or enterprise value is improved if ICT and business alignment maturity is improved. This improvement in turn contributes to the improvement of the DHET objectives of improved efficiency, throughput and cost per graduate.

The objective of the next chapter is to consolidate the concepts of governance within a multi-level system of governance and to focus on the layers of governance identified in this study in order to build the ICT governance value framework which will be able to inform the stakeholders, namely, the institutions, the DHET and government, on the way in which governance, particularly ICT governance, can contribute to these objectives.

Chapter Eight

Towards a Value Framework for Information and Communication Technology Governance in the Higher Education Sector in South Africa

8 Towards a Value Framework for Information and Communication Technology in the Higher Education Sector in South Africa

8.1 Introduction

The primary research objective of this study is *to produce a value framework that can be used to identify value created in tertiary institutions in South Africa by implementing good governance practices from the highest governing authority to the ICT functional environment.*

This chapter is structured to firstly build on the foundational elements of chapter's five to seven which are summarised below. This is followed by the systems view of the public higher education sector within the systems present in the country and within the higher education context. The value framework is then presented within the governance context to provide for a framework demonstrating praxis.

Three secondary research objectives were identified in this study, the first of which was to find a mechanism to measure ICT pervasiveness in public higher education institutions in South Africa and to associate the concept of pervasiveness with the increased need to govern ICT in order to ensure its value contribution in the sector. This first secondary research objective, dealt with in chapter five, was associated with an initial survey on the level of relative ICT pervasiveness in public higher education institutions in South Africa. A second survey was commissioned to verify that the ICT pervasiveness factors identified in the study were relevant. Responses to the survey indicated that the public higher education environment in South Africa is indeed highly ICT pervasive.

Chapter six provided the details on the second of three secondary research objectives which is *the identification of the ICT governance practices in public higher education institutions in South Africa.* A third survey was designed using the COBIT 4.1 best practice framework to acquire the necessary information. The maturity level and importance of each of the 34 high-level or primary processes were identified by respondents. Responses from the highest ranking ICT official at public higher education institutions indicated that ICT processes measured in terms of the COBIT 4.1 best practice framework were low in maturity. Low ICT process maturity, in a highly ICT pervasive environment such as the public higher education sector in South Africa, should have negative consequences in terms of ICT and business alignment and for the resulting efficiencies and effectiveness of ICT services.

Chapter seven provided the details on the third of three secondary research objectives, that is, *the ascertainment of the level of alignment of ICT to the academic and administrative processes in tertiary education.* A fourth survey was commissioned to measure the alignment between business and academic processes, and ICT processes. The academic and administrative processes are referred to as the *business* processes in this study. The results of the fourth survey indicate that the ICT and business alignment maturity index for the responding institutions is 2,6. This means that ICT and business alignment processes are low in maturity, being at the stage of the *beginning process* as shown in Figure 7-2. This supports the view of Weill and Ross who state that "effective ICT governance is the single most important predictor of the value an organisation generates from ICT" (2004, p. 3).

It has therefore been argued and in these previous chapters that ICT is highly pervasive in higher education institutions. It was also concluded that the maturity level of ICT governance is very low and that academic and administrative alignment with ICT is not particularly sound. Because of these aspects, ICT governance at HEIs is not properly instituted or formalised. Additionally, a number of different reporting relationships have been addressed where proper ICT governance structures should be introduced. Based on these issues, or the apparent lack thereof, it can be argued that it is essential to define an extensive value framework that will define a matrix of related parties, relationships, aspects and other things that affect governance, which, once utilised or implemented, will add value to the higher education sector. For this reason, the formalisation of such a value framework is the objective of this chapter.

8.2 Public Higher Education in South Africa and its Subsystems

In this study, the public higher education system is treated as a subsystem of government and each institution is, in turn, viewed as a subsystem of the public higher education system. As shown in Figure 8-1, at each of these system levels the governance cycle of direct–execute–control originating from the Australian standard on corporate governance AS 8000:2005, and ISO/IEC 38500 described more recently by Von Solms and Von Solms (2006) with reference to information security governance but applicable across the full spectrum of governance, is practised within the system and within each subsystem of government but particularly, in this case, by the DHET.

The European higher education system functions within a complex environment that spans

the European Union and involves each individual institution as a subsystem. Kohler (2006, p. 18) states that higher education governance is an issue permeating almost all matters of higher education dealt with by both higher education and research institutions, but no less by state authorities involved in higher education and research. He goes on to say that issues such as optimising institutional structures, internal and external participation and communication, democratic, legal and monetary steering mechanisms, public responsibility and autonomy, ensuring quality whilst minimising cost, to name just a few of the hotly debated topics concerning higher education governance, determine much of the current debate in higher education and research. Further, he indicates that higher education governance is indeed seen as being crucially important at both institutional and systems levels.

In published research on higher education governance in the European Union, Vukasovic (2006) defines three levels of governance, namely, institutional, system and international levels. The current study proposes that there are three levels of governance relevant to South Africa, the institutional level, the DHET level, and the government level, and that the governance cycle operates independently within each system, as well as influencing, interacting and inter-working between the autonomous systems. The subsystem autonomy is usually framed in the context of the public good and the public accountability of the higher education system in terms of the country or the public as a whole (South Africa, Department of Education, 1997). The highest level system thus places accountability on the autonomy granted to the subsystem. This accountability is passed through the levels to the core subsystem level of higher education, which is defined in this chapter as an individual autonomous institution. In the case of the DHET as the higher level system, the control element of the governance cycle is directed across the system boundary in the direction of the subsystem, which in this case is an individual public higher education institution.

Once the governance cycle elements of ‘direction’ has been successfully transferred, or in the context of autonomy placed as a mandate to be received by the next level subsystem. Then the process of acceptance of the mandate or ‘execution’ can take place. This entails another complete direct–execute–control cycle that functions within the subsystem of individual institutional governance until the end of the process cycle, after which the ‘control’ element of the governance cycle returns the system’s response back to the higher level system of the DHET. The subsystems therefore process the governance intent or mandate within each subsystem and then pass on the results of the intent or mandate, and thus the execution of this

mandate between systems through governance mechanisms and back to the governance source. It can therefore be concluded that there are multiple levels of governance within a system or subsystem, with these levels being identified by system boundaries.

Scholarship on multi-level governance has developed into one of the most innovative themes of research in political science and public policy. From 2000 to 2009, multi-level governance was a central topic in over 150 articles in academic journals with a steady increase in article publication every year (Enderlein, Wälti, & Zürn, 2010, p. 1). Public higher education governance is multidimensional (Council of Europe Higher Education, 2006) or multi-level and, as such, in most higher education systems higher education governance spans more than one system, subsystem or level of governance. These levels of governance form a hierarchical structure which is usually informed by law, policy or regulation. Public higher education in South Africa is governed by the Higher Education Act (1997) in which the governance framework is clearly defined. In some cases in the higher education system in South Africa, however, it is collective agreement towards shared goals or objectives that drives higher education governance.

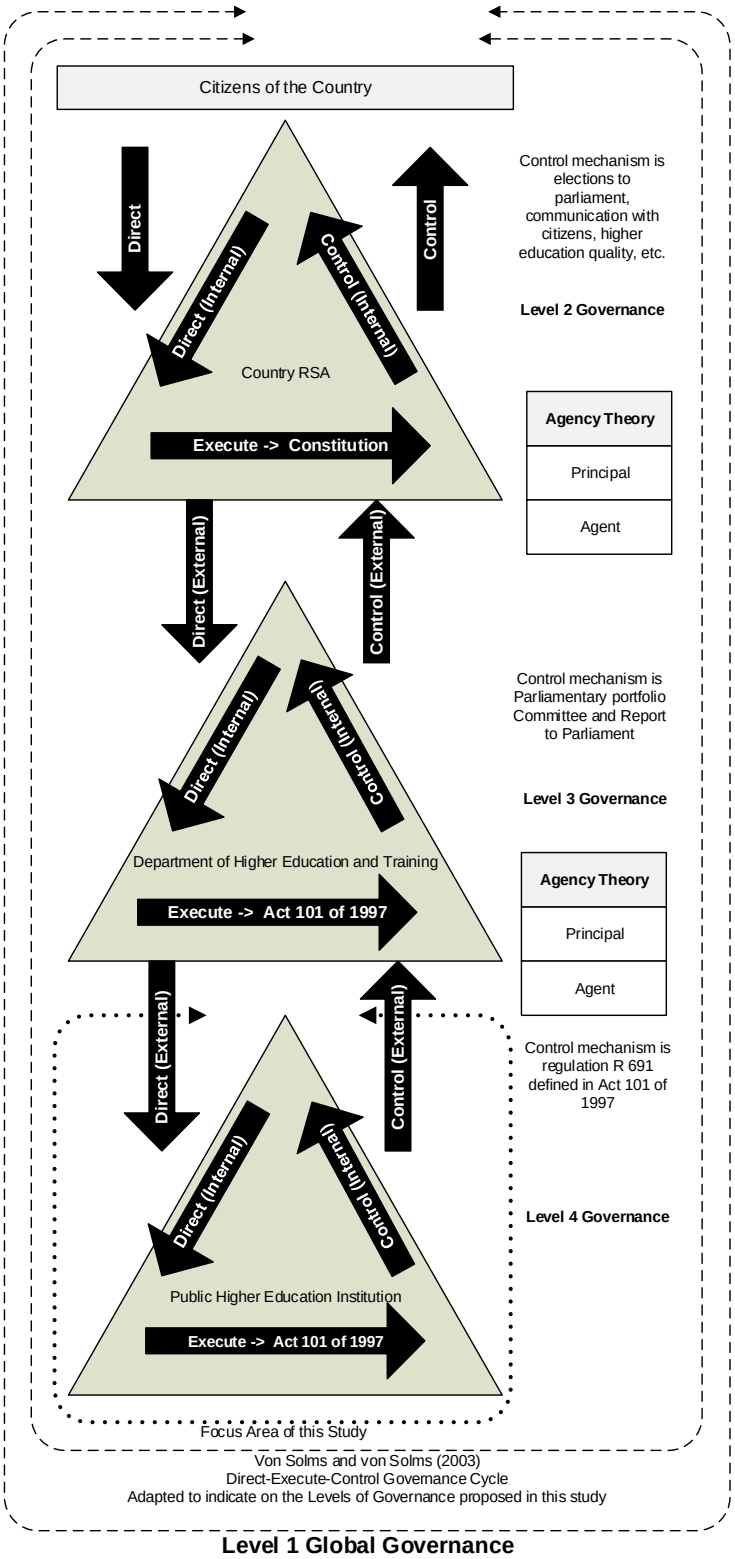


Figure 8-1: Direct–Execute–Control Governance Cycle (adapted from Von Solms & Von Solms, 2006)

This type of cooperative governance is usually not informed by law and is associative in nature, striving for collective benefit. It is maintained by the will of individual role players

which in this case are public higher education institutions. This type of governance is usually focused on specific objectives that may span one or more of the levels of governance across the higher education domain, and may possibly even have commercial participants. Higher education governance is a key aspect of maintaining and developing a democratic culture without which democratic institutions and democratic legislation cannot function, while at the same time higher education is crucial for developing the knowledge, skills, values and attitudes that modern societies need (Council of Europe Higher Education, 2006). In South Africa, the Higher Education Act defines the organs of governance required within each higher education institution. One of the five-year governance-related goals of the South African higher education system is to improve institutional efficiency through improved capability and the strengthened alignment of information, finance, governance and management in the post-school learning system (South Africa, Department of Higher Education and Training, 2010).

Figure 6-1 in chapter six shows the public higher education and institutional components of the system and subsystems referred to in this study. The diagram in Figure 8-1 indicates the separation between the system of Higher Education and Training (DHET) and one of its subsystems, a public higher education institution. The interface between the DHET system and the higher education institution subsystem is regulated by the Higher Education Act (South Africa, Department of Education, 1997). This Act defines a higher education institution as it functions within a complex framework of requirements in terms of financial controls, areas of study and other guidelines that must be followed in order to qualify for funding. Therefore, the Act maintains its very existence. The comprehensive annual results of higher education institutions are communicated to the DHET as defined in reporting Regulation R691 (South Africa, Department of Higher Education and Training, 2007) required in terms of the Higher Education Act. The next section covers the 'direct' requirements that the DHET places on higher education institutions in terms of steering institutions towards meeting the DHET objectives.

8.3 The 'Direct' Element of the Governance Cycle between DHET and Public Higher Education Institutions

As can be seen from Figure 8-2, the DHET has implemented a complex and comprehensive framework to steer the public higher education sector as defined in the Higher Education Act (1997). This section covers these requirements in more detail.

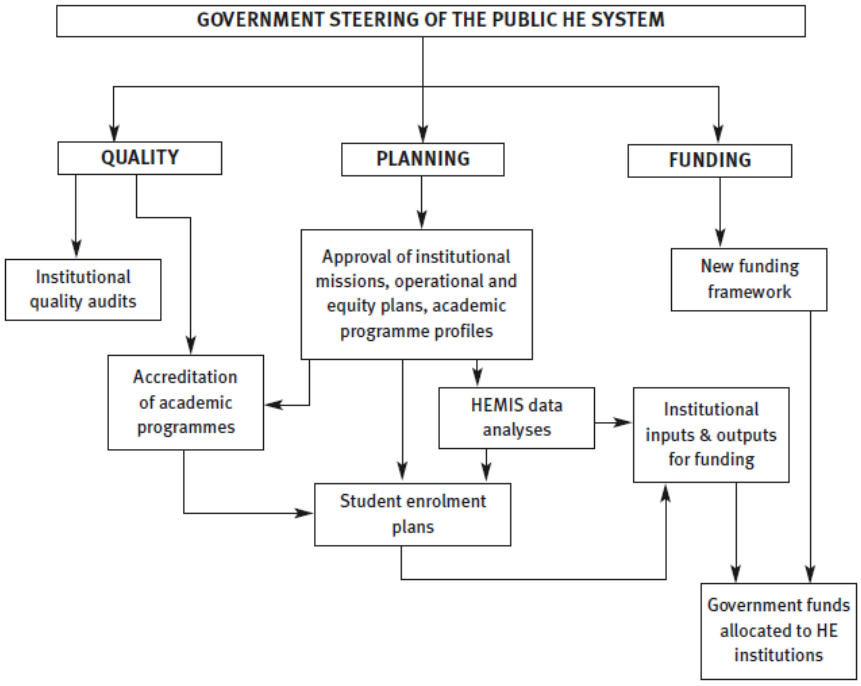


Figure 8-2: South African Government Steering Mechanisms of the Public Higher Education System (DHET, 1997)

Three areas of control by the DHET are evident in the steering mechanisms shown in Figure 8-2 for the public higher education system in South Africa. These are quality, planning and funding, which are directed, executed and controlled through governance mechanisms and not management mechanisms. *Governance*, by definition, means control by steering an ***autonomous*** system, whilst *management* means a system of controls between the management of DHET and staff at institutions. It is definitely not the intention of this study to promote the idea that the DHET should ***manage*** institutions, but rather that it should strengthen the best practice framework or ability to govern by autonomous institutions through the inclusion of an ICT best practice framework within the existing institutional best practice framework.

8.4 The 'Execute' Element of the Governance Cycle within Public Higher Education Institutions

The 'execute' element of the direct–execute–control governance cycle, as adapted from Von Solms and Von Solms (2006), maps directly onto the individual public higher education institutions' function of teaching, research and community engagement. The 'execute' element of the governance cycle takes input from the 'direct' element of the governance cycle and maintains its cyclical function indefinitely, ultimately providing output for the 'control'

element of the governance cycle required in terms of regulation R691. This is, however, moderated by changes to the public higher education system that may be required by legislative or regulatory change. It is during this element of the governance cycle that the education process takes place with annual intakes of students and their graduation on completion of the programmes. This is the element of the governance cycle that identifies with corporate governance as described in the King III Code (2009) and which is applicable to public higher education institutions.

8.5 The 'Control' Element of the Governance Cycle between DHET and Public Higher Education Institutions

Public higher education governance requirements are formalised in terms of the Higher Education Act (South Africa, Department of Education, 1997) with reference to Regulation R691, which requires specific data in a specified format. This regulation requires comprehensive reporting data that covers all of the functional areas within a public higher education institution with the exception of ICT, where only the ICT personnel costs are required to be identified. The DHET strategic plan (South Africa, Department of Higher Education and Training, 2010) does not, however, provide any policy directives on ICT governance.

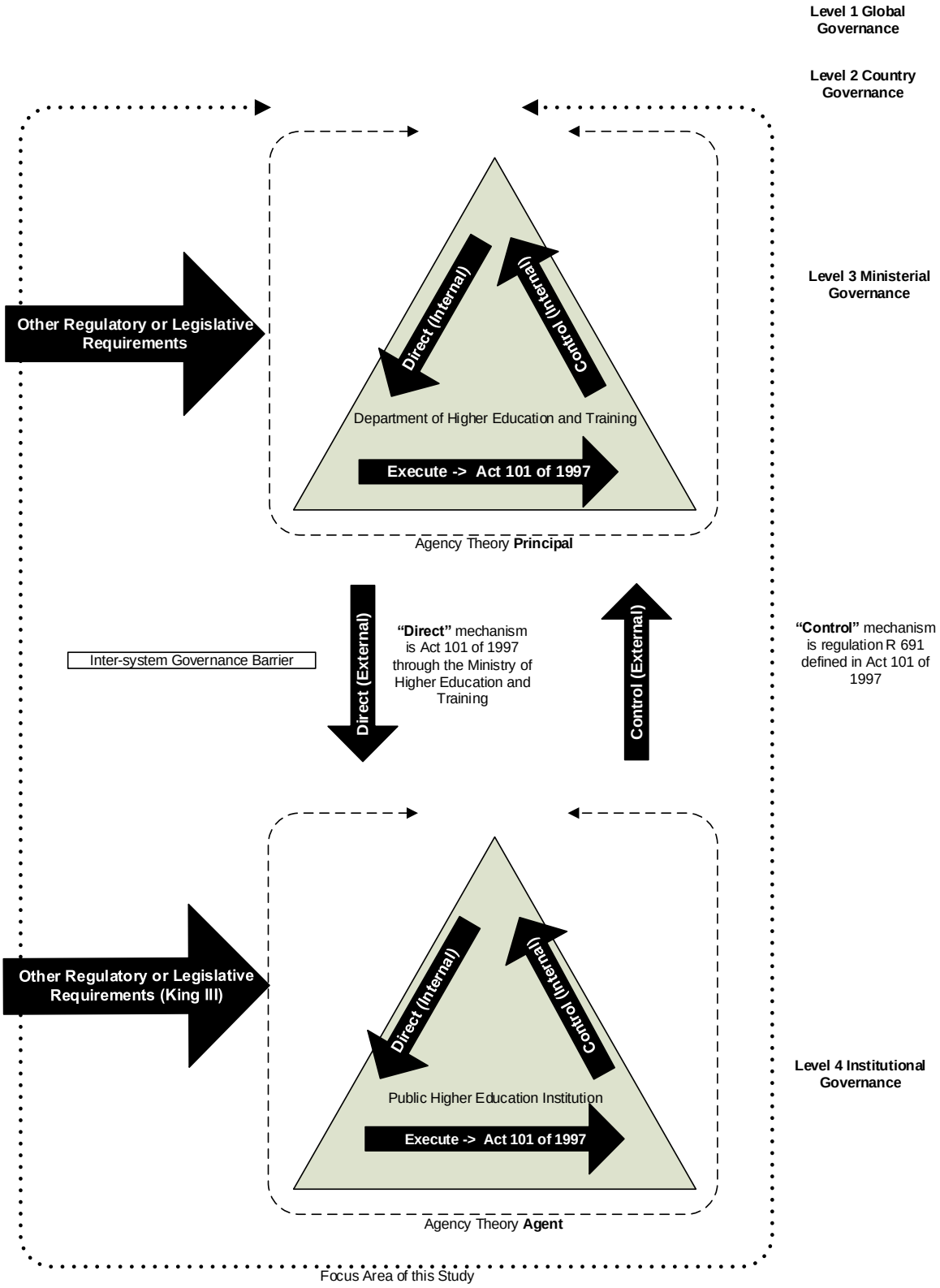


Figure 8-3: Governance Cycle indicating inter-system Governance Barrier (adapted from Von Solms & Von Solms, 2006)

Figure 8-3 indicates the institutional subsystem level at which there is an obligation to comply with the King III Code of best practices. There is, however, no formal obligation to

comply with the King III Code at the ministerial level of governance. There is also no regulatory requirement to channel any King III code-related governance intent or mandate between these levels of governance. The 'control' element of the direct–execute–control governance cycle (Von Solms & Von Solms, 2006) is identified in this study as the *feedback* or *reporting* requirements of the Higher Education Act. The primary purpose of reporting is the regulation of the format and content of a public higher education institution's annual report to the Minister, as prescribed in the regulations for annual reporting (South Africa, Department of Higher Education and Training, 2007) by higher education institutions in terms of section 41 of the Higher Education Act 101 of 1997. Despite this being the only legislated requirement in terms of annual reporting, there is formal interaction between the DHET and institutions during governance compliance reporting periods, the nature of which is mostly operational.

Governance structures between the DHET and public higher education institutions in South Africa are limited to the formal structures required in terms of the Higher Education Act. Accordingly, the CHE (South Africa, Department of Education, 1997) was established to advise the minister on aspects of higher education, one of which is the governance of higher education institutions. Conformance and performance, two of the primary objectives of governance, are not reinforced by participative governance structures within the public higher education sector in South Africa. The King III Code of good governance practices applies to public higher education institutions in South Africa, but is not required at the level of the ministry of Higher Education and Training. These inconsistencies in the requirements for governance at the different levels in the higher education system make it extremely difficult to set up a governance structure that is consistent and effective across the levels applicable to the public higher education system in South Africa. The next section seeks to investigate some of the factors influencing the interaction between these systems or subsystems.

8.6 Factors Influencing the Inter-system 'Direct', 'Execute' and 'Control' Governance Cycle Elements

The structure of the higher education system in South Africa is depicted in Figure 8-3 with more detail on ICT governance at institutional level. Two concepts are considered in the next section, namely, *institutional autonomy* and managerialism.

8.6.1 Institutional Autonomy

Factors influencing the effectiveness of the transfer of governance intent or the acceptance of the governance mandate from the DHET, and the return to the DHET of the control results as identified in this study, are supported by both the Von Solms and Von Solms's (2006) adaptation of the governance control cycle and Agency Theory. Agency Theory (Eisenhardt M. K., 1989), which is discussed in more detail in section 4.9 in chapter four of this study, is used here to describe the relationship between the DHET (the principal), which delegates work or 'directs' public higher education institutions (the agents) in terms of the direct–execute–control governance cycle (Von Solms & Von Solms, 2006) to perform that work. In summary, this theory is concerned with resolving two problems that can occur in agency relationships. The first is the agency problem that arises when (a) the desires or governance intent or goals of the DHET and institutions conflict, and (b) it is difficult or expensive for the DHET to verify what the institutions are actually doing. Willekens and Sercu (2005) state that in a world without agency costs there would be no need for an audit committee or a committee responsible for governance oversight. Institutions only need to report to the DHET within six months after the year-end cycle. This means that 18 months can pass between the governance intent of the DHET being declared or institutions being advised of governance requirements and the response to activities in terms of the annual report.

The King III Code (2009) indicates that the board, or in the case of public higher education institutions, the Council, should assign oversight of the institution's risk management function to an appropriate board committee, such as a risk or audit committee, and that this committee should consider risk as an integral part of the effective oversight of risk management. In terms of the current governance structure relevant in the public higher education sector and as indicated in Figure 8-4, the governance requirements defined in the King III Code relate only to the internal dynamics of an institution and do not cover the governance requirements between institutions and the DHET, or the DHET and the government at the next system level of governance.

The second agency problem is the problem of risk sharing that arises when the DHET and the higher education institutions have different attitudes towards risk. As response to risk mitigation is only reported to the DHET six months after completion of an annual cycle, this can strongly influence the ability of the DHET to direct any changes that may be required for institutional success in terms of risk mitigation. This relationship is defined in the preamble

to the Higher Education Act (1997) where it is stated that it is desirable for higher education institutions to enjoy freedom and autonomy in their relationship with the State within the context of public accountability and the national need for advanced skills and scientific knowledge (South Africa, Department of Education, 1997). The Act differentiates strategic risk from operational risk, the latter of which should be borne and managed by institutions on an on-going basis. The Council report on the risk portfolio is required in terms of paragraph 2.1.1 of reporting Regulation R691 and is thus part of the governance framework of the Higher Education Act.

The granting of autonomy to higher education institutions in a sense creates a barrier between them and the DHET in that autonomy granted within a specific context and under certain conditions could be freely and broadly interpreted; consequently, institutions are able to run without oversight and therefore at possible increased risk levels for up to 18 months without influence or intervention from the agency principal, the DHET. The governing public higher education institutional council has the mandate to "govern the public HEI, subject to this Act, any other law and the institutional statute" (South Africa, Department of Education, 1997, p. 24). This governing council comprises stakeholders which include persons appointed by the minister of Higher Education and Training. Thus, the transfer of the governance intent or mandate to institutions from the DHET places institutions under pressure to comply with the legislation or face the consequences of noncompliance. The formation of two *not for profit* (NPC) companies, HESA and ASAUDIT, which are not compelled by law to exist but exist out of the collective choice of institutional heads and is encouraged by the Higher Education Act (South Africa, Department of Education, 1997), in no way affects institutional autonomy. The actions and function of the two not for profit companies are directed towards the collective goals and objectives of all twenty-three institutions. The annual reporting requirement in terms of regulation R691 as a governance mechanism is defined in terms of the Higher Education Act and is thus mandatory. It is the mandatory nature of this requirement that has resulted in the good overall governance of the higher education sector. This is validated by the existence of governance monitoring data, such as that presented in Figure 6-33, on the cost of graduates per annum over a ten-year period. The level at which governance commences within the organisation thus has an effect on the effectiveness of governance.

The second idea that is discussed is the notion of managerialism and how it may have influenced higher education governance over the past two decades.

8.6.2 The Notion of Managerialism

The notion of managerialism is defined by Deem, Hillyard and Reed (2007) as a general ideology or belief system that regards managing and management as functionally and technically indispensable to the achievement of economic progress, technological development and social order in any modern political economy. Moreover, management is regarded as that generic activity, group and institution that is necessarily, technically and socially superior to any other conceivable form of social practice and organisation, such as a craft, profession, or community.

Public higher education in South Africa is primarily funded by government grants, student fees and income generated from the publication of research articles. In South Africa, the average proportion of institutional income derived from tax payers has decreased from 54,1% in 2004 to 51% in 2010 (DHET). In 2004 the currency value of this state spending amounted to approximately R12 billion and this escalated above the consumer inflation index to an amount of approximately R29 billion in 2010. The Higher Education Act is not the only act that governs the public higher education sector in South Africa (South Africa, Department of Education, 1997); other acts regulate issues associated with functional disciplines within higher education, such as finance, human resources and ICT. Associated with the funding of the public higher education system is the need to ensure that public money spent on education is efficiently and effectively managed.

It is clear from the DHET strategic plan (South Africa, Department of Higher Education and Training, 2010) that the public higher education system in South Africa is governed primarily to improve access, throughput and quality and this can be interpreted as being supportive of managerialist intent and practice. The governance goal of institutional efficiency aims at the improved capability and alignment of information, finance, governance and management in the post-secondary school environment. In its strategic plan, the DHET states that it also needs to significantly strengthen its internal systems so that the Department can increase its efficiency and effectiveness, as measured in terms of learner and employer satisfaction. The Department also states that it needs to dramatically increase the number of learners the system is able to accommodate over time and, in order to meet this need, new institutions

may very well be required. Central to the efficient and effective functioning of the envisaged system will be a broad-based, well-resourced information system. This will help individuals plan their careers better, while enabling learning institutions to align their programme offerings to the occupations for which there is the greatest demand. Consequently, establishing such an information system is a key national priority (South Africa, Department of Higher Education and Training, 2010).

8.7 Governance Oversight

Governance oversight is required in all functional areas of governance, including ICT governance, and is present nationally in some limited ways in the communities of practice (CoPs) set up by the HESA. These CoPs function at inter-institutional level and do not necessarily participate in governance structures together with the DHET, other higher education entities or entities making strategic use of ICT. The primary governance objectives of conformance and performance are difficult to achieve when the subsystems or institutions within a system operate without the appropriate inter-system interfaces. Accordingly, the ASAUDIT was formed to ensure collaborative synergy is achieved within the ICT domain of public higher education. It plays a broad role which includes operational, strategic and governance initiatives. Further, it is important to note that the changes envisaged in the transformation of the higher education system in South Africa after the change of government in 1994 are largely enabled by a revolution in the development and application of ICTs (South Africa, Department of Education, 1997). Moreover, the National Plan for Higher Education (South Africa, Department of Higher Education and Training, 2001) notes the critical and central role that higher education will have to play in contributing to the development of an information society in South Africa in terms of both skills development and research. At government level, the ministry of Education has not yet focused on these issues and, in this sense there has been no central steering of the development and application of ICTs in higher education in South Africa (Council for Higher Education, 2006).

In summary, the DHET does not have a technology roadmap for teaching and learning in place and it allows institutions the freedom to govern their own ICT systems in both the administrative and the academic realms. Although the dependence on ICT systems is extremely high, the DHET has not yet introduced the requirement to implement any ICT governance best practices into the existing higher education governance framework through legislation. The absence of ICT governance in the relationship between the DHET and higher

education institutions *denies* the DHET any governance-related knowledge of how ICT is used to support its objectives. Improving ICT governance for the benefit of the higher education sector could be achieved by acknowledging ICT governance as a part of corporate governance or, in the context of this chapter, higher education institutional governance, and by setting up an ICT governance framework with best practices (De Haes, 2007) that forms an integral part of the annual reporting process to the DHET as defined in Regulation R691 (South Africa, Department of Higher Education and Training, 2007). This implies that the higher education institutional governing council would remain the guardian of the institution's autonomy whilst improving its ability to make better use of ICT through improved ICT processes. The significant cost of ICT to institutions and the high risk resulting from the use of ICT should be properly addressed as, if overlooked, could cause significant failure in public higher education institutions in South Africa.

The next section of this chapter further consolidates the concepts of multi-layer governance within the public higher education system and describes the value framework produced from this study, particularly at institutional level.

8.8 Multi-layered Governance Focusing on Institutional Level Governance

The institutional level of the higher education system has students participating in teaching and learning, and research and community engagement activities as its input, and graduates, research output and community engagement as its outputs. Six layers of governance have been identified in these activities and these layers are discussed in terms of the barriers that exist in the effective transfer of governance objectives or governance 'intent', from the highest layer through to the lowest layer. The organs of governance as defined in the Higher Education Act 101 of 1997 are mapped to the layers of governance and this is contrasted to typical governance organs of the COBIT 4.1 framework and the IT Governance Standard ISO/IEC 38500:2008 E. Finally, the governance mechanisms defined in the Higher Education Act as well as other mechanisms created to improve governance in the sector are also mapped onto the structure. This structure, indicating the layers of governance and the inhibitors of effective governance intent transfer between the layers, clearly reveals the absence of an ICT best practice framework at the highest level in the higher education sector and arguments are presented in favour of the formalisation of ICT governance at this level. A framework is required to guide this important principle and to clearly indicate that ICT governance intent.

It is suggested that the formalisation of a framework will improve the optimisation of ICT-related resources both within and between institutions.

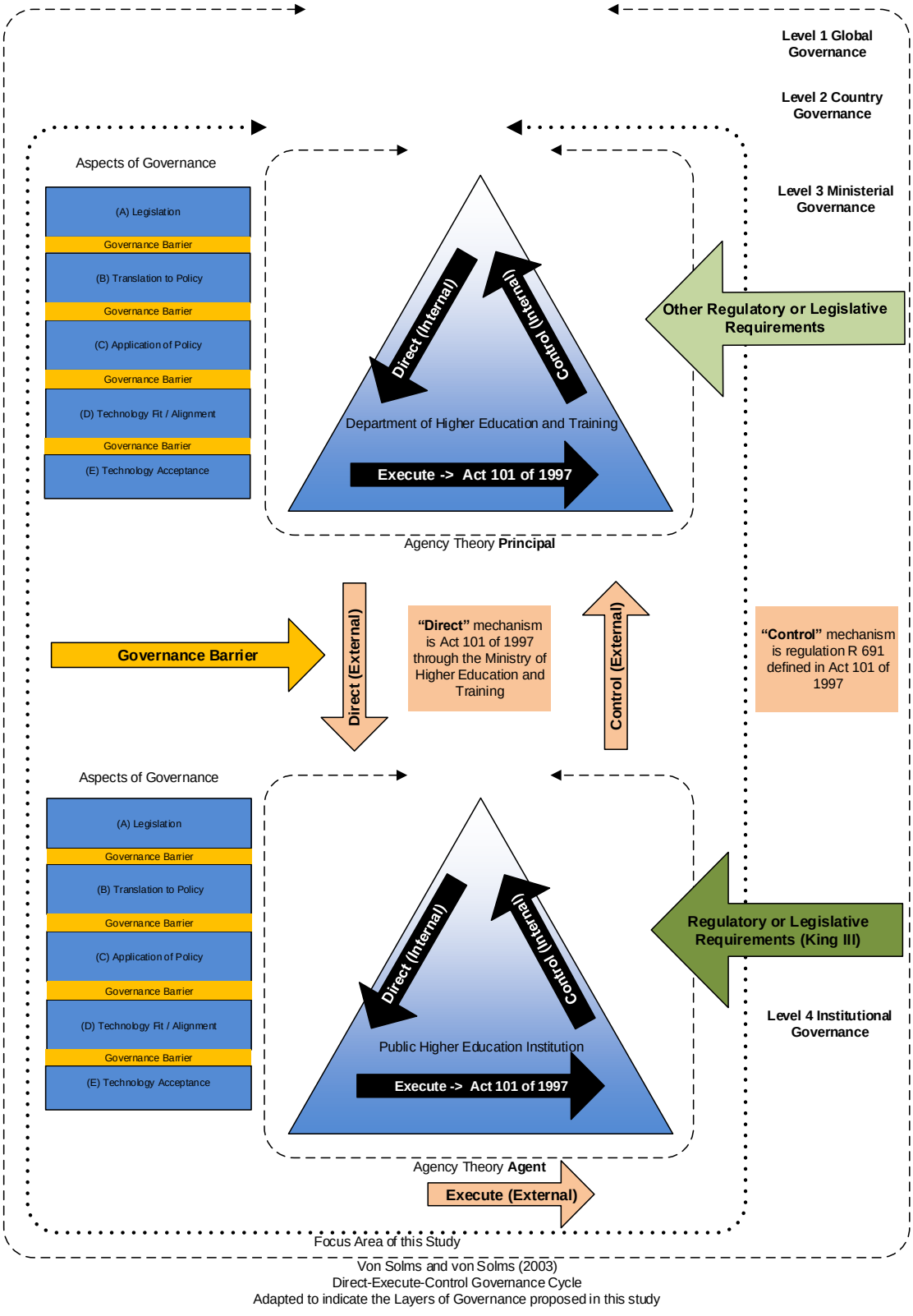


Figure 8-4: Layers of Governance at Institutional Level

The Higher Education Act (1997) defines the organs of governance required in each higher education institution. A Standard Institutional Statute (2002) published in terms of the Higher Education Act 101of 1997 (South Africa, Department of Education, 1997) can be amended or enhanced to provide for institutional requirements. None of the South African public higher education institutional statutes replacing the Standard Institutional Statute provide specifically for an ICT best practice framework, despite the significant investment in technology required to provide for ICT systems in the institutions.

One of the five-year governance related goals of the South African higher education system is to improve institutional efficiency through improved capability and the strengthened alignment of information, finance, governance and management in the post-school learning system (South Africa, Department of Higher Education and Training, 2010). It is suggested that this will improve the optimisation of ICT-related resources both within and between institutions. The DHET strategic plan does not, however, provide any policy directives on ICT governance either at country, government department or institutional levels of governance.

8.9 Layers of Governance in Higher Education Institutions

The CHE is the body contemplated in the Higher Education Act to assist in the governance of the higher education sector by advising the minister of Higher Education (South Africa, Department of Education, 1997). The South African Qualifications Authority (SAQA) is also constituted as a body to "provide for the development and implementation of a National Qualifications Framework and for this purpose to establish the South African Qualifications Authority; and to provide for matters connected therewith" (South Africa, Department of Higher Education, 1995, p. 1). The framework within which the public higher education sector is governed is shown in Figure 8-5. Central to the framework is the column showing the six layers of governance. This column is flanked on the right by the column showing the barriers to governance transfer effectiveness between the layers of governance. The governance layers column is flanked on the left by the aspects of governance at each layer or level of governance. This is followed by the column describing the governance organs as defined or implied by legislation. The left-most column shows the governance mechanisms that are in place both to conform to legislative requirements and to address the need for collective benefit.

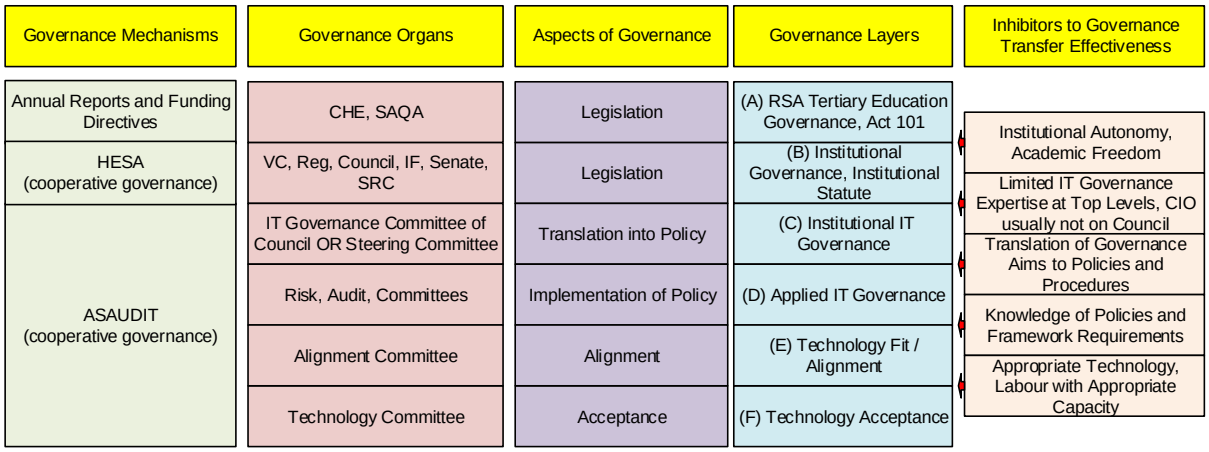


Figure 8-5: SA Public Higher Education Governance Architecture at Institutional Level

The layers of governance shown in Figure 8-5 indicate a structure in which governance intent or objectives are moved from one party, starting at the top layer A, to another layer and down to layer E under defined conditions. Agency Theory is used to explain the ownership, transition and acceptance of the role to be played between layers and at the next layer in the framework and, although discussed in chapter four, the main principles are summarised below.

8.9.1 Agency Theory in the Context of Layers of Governance

Agency Theory is directed at the ubiquitous agency relationship, in which one party (the principal) delegates work to another (the agent), who performs that work. Agency Theory is concerned with resolving two problems that can occur in agency relationships. The first is the agency problem that arises when (a) the desires or goals of the principal and agent conflict and (b) it is difficult or expensive for the principal to verify what the agent is actually doing. The problem here is that the principal cannot verify that the agent has behaved appropriately. The second is the problem of risk sharing that arises when the principal and agent have different attitudes towards risk. The problem here is that the principal and the agent may prefer different actions because of the different risk preferences (Eisenhardt M. K., 1989). Agency Theory is applied to the layers of governance in the public higher education sector where, in the first instance at layer (A) of the framework in Figure 8-5, the principal is the sector authority (DHET) and the agent, the institution, is layer (B). The DHET or principal only requires a report six months after the completion of an academic year. ‘What’ needs to be ‘corporately’ governed is clearly articulated in the applicable legislation, but the ‘how’ is left to the institutions in the context of institutional autonomy.

Figure 8-5 describes the layers of governance as they are traversed from the South African Higher Education Act, Governance layer (A) towards the functional technology acceptance layer (F) at the bottom of the structure. The CIO plays a key role in this transfer of governance effectiveness through the layers. The role of the CIO is defined by Gottschalk and Solli-Sæther (2009, p. 190) as "the highest-ranking ICT executive who typically exhibits managerial roles requiring effective communication with top management, a broad corporate perspective in managing information resources, influence on organizational strategy, and responsibility for the planning of ICT".

The CIO role in most of the public higher education institutions in South Africa is still held in lower regard than those of senior managers of the more traditional business units such as finance and HR. The role of the CIO has also been categorised as a 'support' role not necessarily creating the need to engineer and provide technological solutions that enable modern teaching and learning, but diminishing the creative requirement to a mere reactive response to an academic or administrative need for new technology.

In 2009, 837 779 students were enrolled at twenty-three institutions in the public higher education system. The size of this system therefore requires that appropriate governance structures are put in place to ensure that the government's objectives for the sector are met. The governance organs and mechanisms at each layer need to ensure that the objectives at 'layer level' in Figure 8-5 are addressed. However, there are inhibitors between layers that need to be overcome to ensure the maximisation of governance effect at the functional layer. The first inhibitor to the transfer of governance effectiveness between layers A and B is the academic freedom (South Africa, Department of Justice and Constitutional Development, 1996) that institutions enjoy in terms of legislation. Academic freedom is defined by Van Zyl Slabbert (2003) as a generic term for a cluster of values. The first of the three values is the conventional one, which is usually implied when the term is used, that is, the freedom that a university enjoys to appoint teachers and students to its own community and teach what it feels should be taught. The second value is the principle of university autonomy, that is, the degree of discretionary freedom that a university as an institution enjoys in relation to other institutions such as the State, government, commerce and industry. The third and final value is institutional neutrality which refers to the situation where a university, as a corporate entity, does not allow its members to be coerced into taking a collective stand on controversial societal issues – usually ideological or political in nature.

This autonomy allows institutions to function for 18 months before statutory reporting is done against regulation R691, paragraph 2.5 (South Africa, Department of Higher Education and Training, 2007) published in terms of the Higher Education Act 101 of 1997. The CHE is the only statutory body that performs a governance function in terms of this Act (South Africa, Department of Education, 1997) by providing advice to the Minister of Education. Between the next layers of governance, Institutional Governance, level B and institutional ICT governance level C, the Act allows for institutions to be creative and add to the minimum governance requirements by creating their own unique institutional statute from the Standard Institutional Statute. It is at this level that the inclusion of an ICT best practice framework requirement is essential.

Every layer of governance has governance compliance requirements that point in the direction of governance, that is, towards the base of the framework, and from this base compliance reporting forms a response that is directed upwards towards the governance objectives. Between the third and fourth layers of governance, layers C and D, is the level where the translation of objectives to policies and procedures takes place and where much of the governance intent can be lost. Robson (1997) states that policies are a form of delegation that has the intention of allowing autonomy and yet still maintaining a consistency of direction. In the context of the public higher education sector in South Africa and in the spirit of cooperative governance, it is critical that the governance objectives are clearly understood and that policy and procedures are drafted in a manner that includes stakeholder participation. The fourth layer of governance (D) is the layer at which the CIO must translate the policies into practices. These practices are formulated so that the strategies are achieved, one of which is alignment of ICT to the business. The fifth layer of governance (E) is the layer at which the CIO must lead the identification and selection process in terms of which technology is selected that is deemed to be appropriate and fit for purpose. The final layer (F) is the layer at which the combined governance effort is put to the practical test of acceptability. Whatever the layer on which people function, they function in an environment governed by the interpretation of the governance intent at that layer.

ICT governance in public higher education in South Africa is still being guided by the individual institutions themselves and their particular circumstances and internal governance requirements. The Higher Education Act 101 of 1997 (South Africa, Department of Education, 1997) requires strict financial reporting in terms of financial best practices, as well

as adherence to the laws governing the accounting and auditing professions in South Africa but it requires no formalised ICT governance.

The public higher education reporting requirements are explicitly defined in reporting regulation R671 (2007) which is gazetted in terms of the Higher Education Act and comprises 'corporate' governance mechanisms in the higher education sector. The Engineering Council of South Africa (ECSA) also has many laws that cover the civil and electrical engineering professions. The ICT profession however, has no specific laws that regulate or govern it.

In this research study, five surveys were compiled and made available to the highest ranking ICT officials at each of the twenty-three public higher education institutions in South Africa. The responses from these surveys provided a wealth of information in terms of the level of pervasiveness of ICT at public higher education institutions, the maturity of ICT processes and business and ICT alignment maturity. The high level of ICT pervasiveness in public higher education institutions in South Africa requires that considerable effort be made to govern ICT and in so doing improve governance maturity and business ICT alignment.

8.10 ICT Value Framework

The ICT governance value framework developed in this study provides a view of governance that includes the *layers of governance* within the public higher education sector in South Africa, as well as the *aspects* and *organs* of governance, the *mechanisms* for governance control and inhibitors to the effective transfer of governance *intent* between the layers of governance in the structure. This provides for a primarily qualitative measurement of governance to give an indication on the ICT governance maturity of the system. This knowledge should help to mitigate risk by becoming aware of the actions required to counter inhibitors of the transfer of the governance *mandate or intent* between layers in the structure, thereby optimising the transfer of the governance *mandate or intent* to the functional layer of the organisation and, thus, ***mitigating risk and providing increased value to the organisation.***

This study has focused on the public higher education system which is defined in the research scope as including only the twenty-three public higher education institutions in South Africa. General Systems Theory (Von Bertalanffy, 1969) and subsequent contributors to systems thinking such as Skyttner (2005) have provided the systems value in terms of the participants

in the public higher education *system*, their effects on each other and the system as a whole and their interdependence on each other. This indicates that the *root* of governance is at the DHET level and that *corporate or institutional governance* is implemented from this level. Despite the applicability of chapter five of the King III Code (2009) to the public higher education sector in South Africa, which deals amongst other things with the requirements for the implementation of an ICT governance best practice framework, the selective adoption of ICT governance best practices is left entirely up to institutions without there being requirements similar to the financial and human resources requirements.

The overall value framework is made up of four processes, the first of which is to identify the level of ICT pervasiveness in higher education institutions in South Africa. The purpose of this is to be made aware of the level and scope of ICT use and, indirectly, the level of dependence of institutions on ICT. Secondly the level of ICT governance maturity is measured using the COBIT 4.1 framework and its 34 primary processes and the measures of process maturity. This sets the baseline from which improvement can be measured and monitored. The third stage is the definition of the governance structure, including the *layers* of governance, the inhibitors to the effective transfer of the governance *mandate or intent* between layers, the *organs* of governance and the governance *mechanisms*. It is important to recognise the ***root*** of governance as this identifies where the *reason to govern has its source*. In the case of this study the *root* of governance is found in the Higher Education Act 101 of 1997 and the owner of the *root* is the Minister of Education. Currently, however, the ICT governance *root* is found at the level of institutions' ICT departments and is implemented inconsistently across all of the twenty-three institutions in the higher education sector. ICT governance is about control (IT Governance Institute, 2003); control requires information feedback to the *controller* and without feedback the system is not aware of the state of processes. Currently, the state of control of ICT is not fed back to the DHET because the governance *root* is at ICT department level, and this results in the DHET not being aware of the state of ICT within the *system*. Figure 8-6 shows the flow of the processes required to identify and improve *ICT governance value* in the public higher education system.

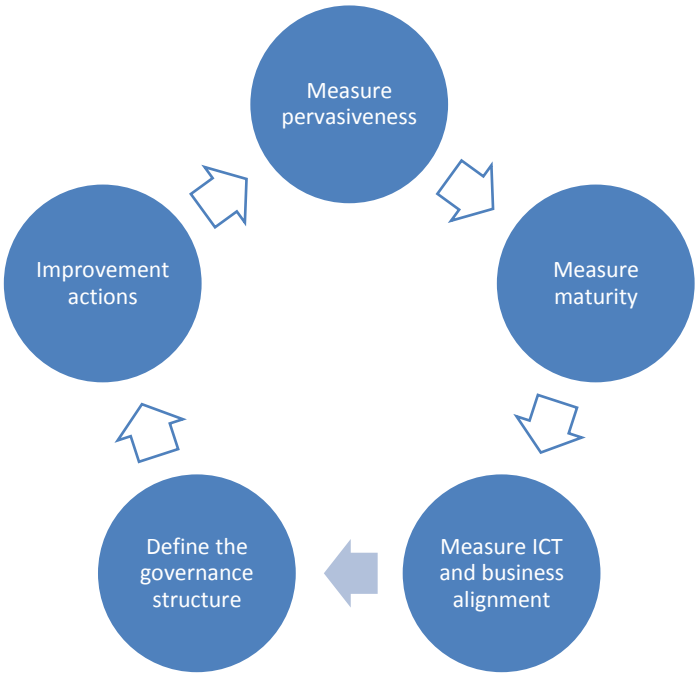


Figure 8-6: ICT Value Framework Diagram Process Flow

Step one in the process shown in Figure 8-6 is to measure ICT pervasiveness using a set of relevant *indicators of pervasiveness* that were identified in chapter five of this study. Because *indicators of pervasiveness* were not found in other studies, those identified in this study had to be validated by means of a survey. In this survey, the respondents were the top ICT officials at the public higher education institutions in South Africa. The indicators were subsequently mapped to the categories of pervasiveness identified by Karaiskos (2009) as indicated in Figure 5-6.

Step two in the process is to identify and measure the level of ICT governance maturity of the 34 primary processes in the COBIT 4.1 framework and to set the baseline for improvement.

Step three in the process is to measure ICT and business alignment as a reference for governance success.

Step four in the process is core to this study and this is where the six ***layers of governance*** identified in the study and shown in Figure 8-5 are mapped to the *inter-layer governance transfer intent barriers* and to the governance *aspects*, *organs* and *mechanisms*. It is critical that these are correctly identified and mapped to ensure that the effort that goes into governance is directed to the correct *layer of governance organs* and that *governance*

mechanisms are put in place to ensure that governance alignment effort is optimised through the selection of appropriate *organs* and *mechanisms*. The improvement action in step five completes the cycle. This step in the process requires the governing body of the organisation to measure the governance maturity levels and the other metrics defined in the governance structure against the governance objectives and, subsequently, to formulate actions for improvement.

8.11 ICT Governance initial Mandate Level compared to the Financial and HR Functions

The diagram in Figure 8-7 indicates the level at which the initial governance mandate or intent of the ICT function compared to the finance and HR functions begin within the current legislative framework and regulations. The *direct* element of the Von Solms and Von Solms direct–execute–control governance cycle takes effect at the departmental level in an institution rather than at the Council level, as is the case with the finance and HR functions.

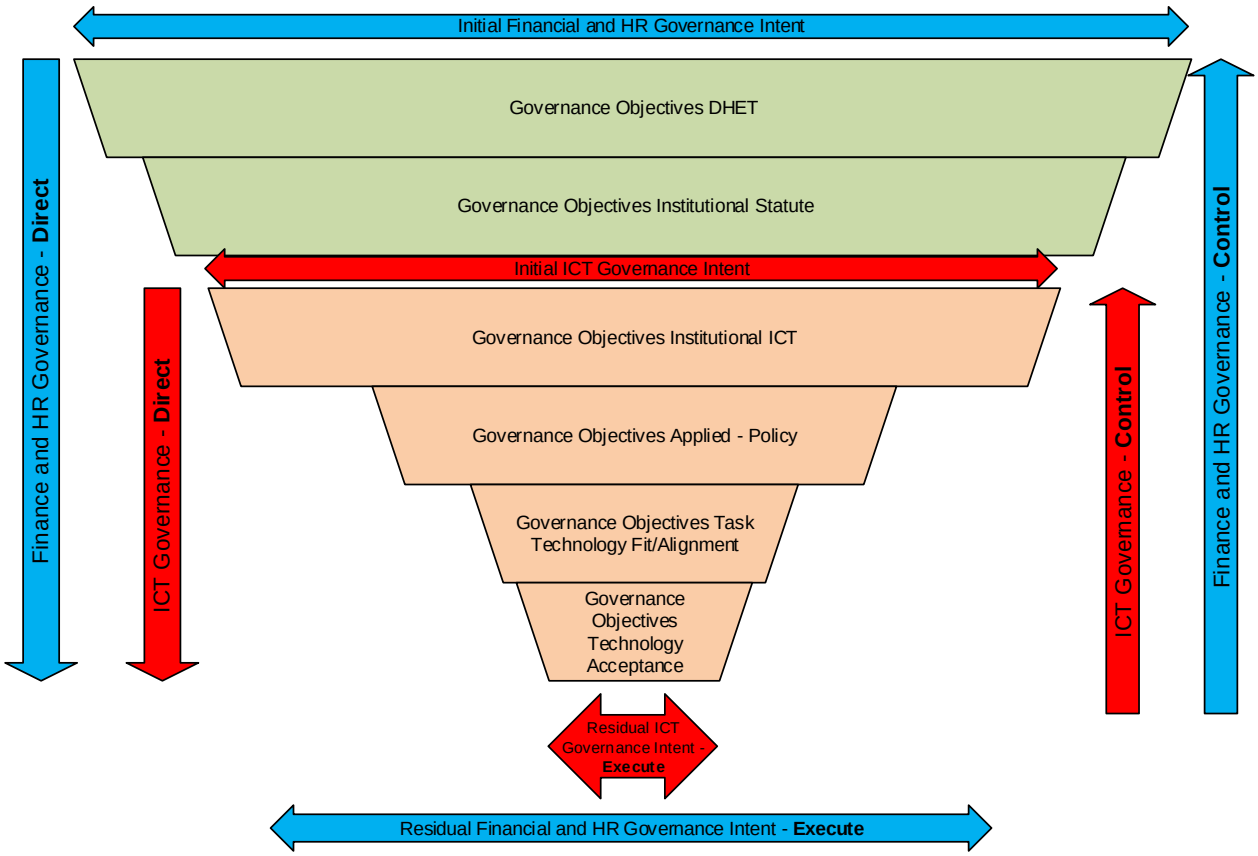


Figure 8-7: South African Higher Education Sector Governance Objectives Transfer Effectiveness, Current

In most public higher education institutions ICT governance currently commences at the ICT divisional level and is not specifically required by law (South Africa, Department of Education, 1997) or regulation (South Africa, Department of Higher Education and Training, 2007). The effect of this is that higher education institutions do ***not*** send ICT governance information to the DHET. Figure 8-8 shows the framework in which ICT governance is depicted ***as a requirement*** by the Ministry of Education and how this could lift the level on which governance could be applied. This would ultimately result in supplying the DHET with ICT governance maturity data. It also has the capacity to broaden the expectation of better inter-layer governance mandate or intent transmission to the functional governance layer. The current DHET data requirements include financial information on the personnel expenses of ICT staff, but do not include ICT operational or capital costs. If these were to be captured and provided by institutions, the DHET could have the capacity to measure institutional ICT costs against the maturity of ICT processes.

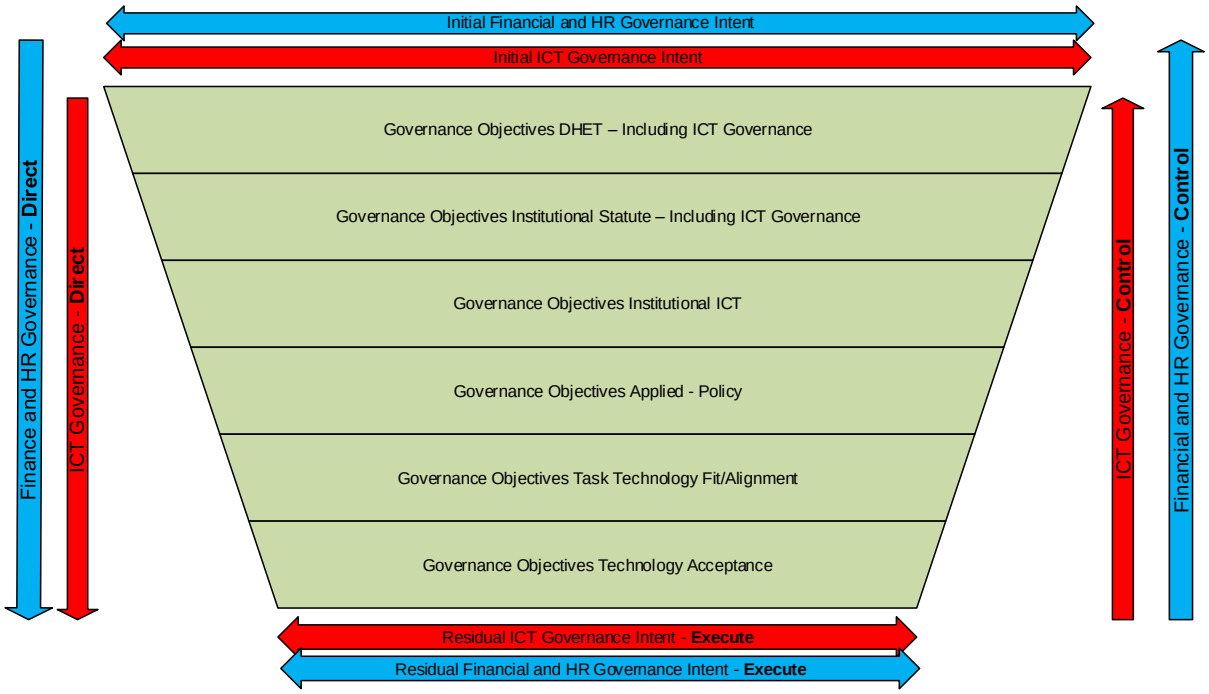


Figure 8-8: South African Higher Education Sector Governance Objectives Transfer Effectiveness, Proposed

8.12 Discussion

The changes envisaged in the transformation of the higher education system in South Africa after the change of government in 1994 were largely enabled by a revolution in the development and application of ICTs (South Africa, Department of Education, 1997).

Moreover, the National Plan (South Africa, Department of Higher Education and Training, 2010) noted the critical and central role that higher education would have to play in contributing to the development of an information society in South Africa in terms of both skills development and research. Despite the realisation of the importance of these issues, higher education as a sector has not really engaged with the implications of introducing ICTs into teaching, learning and research or with the conceptual and political frameworks that inform this (South Africa, Department of Education, 1997).

The governance cycle as adapted by Von Solms and Von Solms (2006) and its application in public higher education institutions in South Africa has been presented in this chapter to consolidate the concepts of multi-layer governance within the broader system of public higher education in South Africa, as well as ICT governance as a subsystem of governance both at the system and subsystem levels. The relevance and applicability of this adapted cycle to the governance cycle that takes place between public HEIs and the DHET have also been discussed. The final value framework is depicted in Figure 8-9.

Figure 8-9 shows the overall ICT governance value framework. The root or starting point of the framework is indicated by callout 35, which is the *direct* element of the governance cycle passing the governance mandate to the DHET. The mandate is passed to the internal DHET governance cycle indicated by callouts one, two and three. The internal governance cycle is moderated by the aspects of governance and the inter-layer governance barriers shown by callouts four to 12. The internal DHET governance cycle goes through the phases of governance within its cycle terms, this also being indicated by callout 33 and, once completed, returns the governance *control* element of the governance cycle to the government. The Higher Education Act does not specify the control mechanism that needs to be in place between the DHET and the government.

The DHET passes the governance mandate indicated by callout 14 and regulated by the Higher Education Act to each of the twenty-three public higher education institutions. Once the mandate has been passed to the institutions, the internal direct–execute–control governance cycle commences. Typically, quarterly council meetings are held for governance reporting and control. Callout 31 shows the *execute* element of the DHET governance cycle which equates to the internal complete direct–execute–control governance cycle of an individual institution. At the end of the institutional governance cycle, the reports required by

Regulation R691 are submitted to the DHET and this process completes the *control* element of the governance cycle.

This study focuses on the relationship between the higher education system and its subsystems, the public higher education institutions, using Agency Theory, which relates to the *principal (DHET)* acting to provide *agents (institutions)* with the *rules* of engagement around the *autonomy* of the system. The rules of engagement, along with the consequences of compliance and non-compliance of the rules, facilitate the agency relationship.

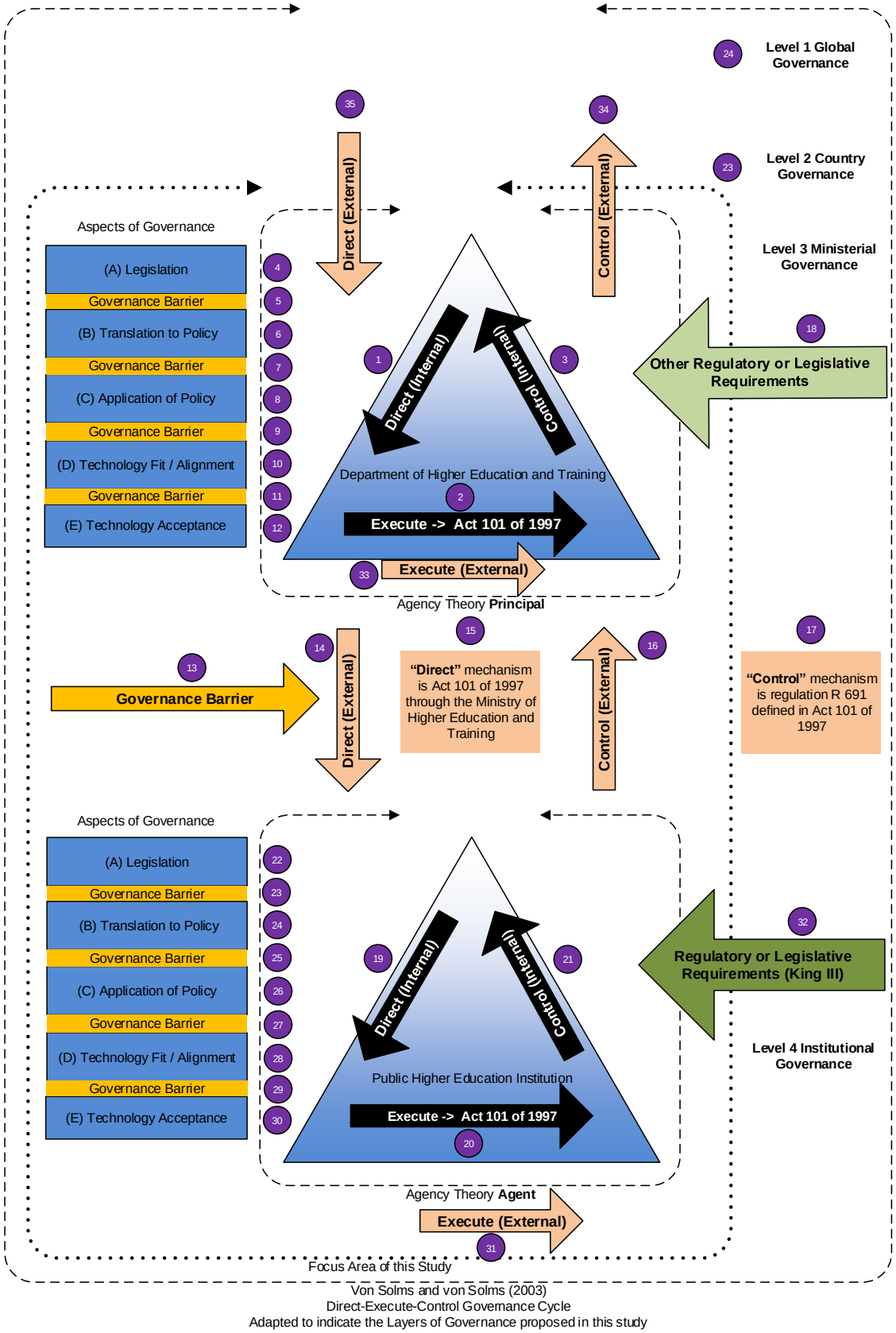


Figure 8-9: ICT Value Framework for Public Higher Education in South Africa

The rules for this autonomous relationship are provided by legislation and the regulations applicable to public higher education institutions, as well as other legislation applicable generally with South Africa. The effectiveness of the agency relationship and, thus, the ability to execute the governance mandate or intent is moderated by the efficiency of the transfer of the governance mandate or intent within the system of higher education and its subsystems, as well as within each subsystem, which in this study is a public higher education institution.

Weill and Ross (2004) and Van Grembergen and De Haes (2004) state that improved ICT governance will improve the value delivered by ICT to the organisation. The Von Solms and Von Solms (2006) direct–execute–control governance cycle, which was adapted for use in this study, provides the framework for identifying the six layers of governance that can be applied to create the value framework in Figure 8-9, which accordingly promotes the identification of governance organs and mechanisms *at each layer* of governance. This in turn provides for better governance granularity to ensure that effective governance mechanisms can be set up to deal with specific governance organs. Barriers to the transfer of the governance mandate or intent, indicated by callouts 23, 25, 27 and 29, can also be dealt with at a more granular level than simply at the level of *governance*.

This discussion highlights the need to improve the inter-system governance oversight function in public higher education in South Africa. Regulation R691 is currently under review and a new regulation, R1002, has been gazetted for public comment but has not yet promulgated into law. This proposed new regulation strengthens the finding of this study in that an ICT best practice framework will be required in terms of the amended regulation R1002 once promulgated, but it does not require any specific framework, which may result in the adoption of different frameworks. The result of this may be difficulties in terms of the execution of the governance cycle in that data returned during the *control cycle* will not necessarily be comparable between public higher education institutions in South Africa.

8.13 Conclusion

The survey results presented in this study indicate that ICT governance in public higher education institutions has been neglected, as the first movement towards the governance oversight of the ICT function only appeared when the King III Code became applicable to public higher education institutions. The second possibility of ICT governance becoming

mandatory in public higher education institutions is brought on by the requirement expressed in the new but as yet not promulgated reporting requirement R1002, in which the creation of an ICT governance oversight committee of Council and the mandatory use of an ICT governance best practise framework are stipulated.

A consultative process between the role players in the DHET, public higher education institutions and other governance structures such as HESA and ASAUDIT to determine the most appropriate framework to use, could result in the early adoption and use of an ICT best practice framework that would contribute to the overall DHET goal of improved efficiency through improved capability and strengthened alignment of information, finance, governance and management in the post-school learning system (South Africa, Department of Higher Education and Training, 2010).

At government level, the Ministry of Education has not yet focused on these issues and in this sense there has been no central steering of the development and application of ICTs in higher education in South Africa (Council for Higher Education, 2006). In summary, the DHET does not have a technology roadmap for teaching and learning in place and it allows institutions the freedom to implement their own ICT systems in both the administrative and academic realms without having any knowledge of what is implemented.

The low ICT governance maturity levels of institutions averaging 1,8 on a scale of 1 to 5 in South Africa also indicates the requirement for the formalisation of ICT governance best practices. The residual ICT governance proposed in Figure 8-8 in the technology acceptance layer can be maximised by the introduction of an ICT governance best practice framework at all layers of governance, specifically introducing ICT governance best practices at the top layer of the framework. The framework will address inhibitors to the inter-layer governance transmission of the highest level of governance intent by the DHET, through to the technology acceptance layer. This high level goal of improving ICT governance for the benefit of the higher education sector can be achieved by acknowledging ICT governance as a part of corporate governance and by setting up an ICT framework that includes best practices (De Haes, 2007).

The significant cost of ICT to institutions and the high risk resulting from the use of ICTs need to be properly addressed and, if overlooked, may result in significant failure in the ICT and other systems in public higher education institutions in South Africa.

Guideline three of the Design Science Research (DSR) paradigm followed in this study requires that an artefact be produced and evaluated to demonstrate its worth, using evidence that addresses criteria such as validity, quality and efficacy (Gregor & Hevner, 2013). A fifth and final survey was designed to test the final value framework for ICT governance in public higher education institutions in South Africa.

The following chapter reviews the survey results of the fifth and final value framework validation survey which were completed by a voluntary, smaller group comprising the highest ranking specialist ICT officers at public higher education institutions.

Chapter Nine

Validation of the ICT Value Framework for ICT Governance in South African Higher Education Institutions

9 Validation of the ICT Value Framework for ICT Governance in South African Higher Education Institutions

9.1 Introduction

The problem identified in this study is that the South African DHET does not specifically require public higher education institutions that fall within its ambit of control to implement ICT governance practices; although it does require finance and HR governance practices to be implemented. In addition, although the King III Code is applicable to all public higher education institutions, it may be implemented on *an apply or explain* basis (King III Code, 2009)

The ICT governance value framework developed in chapter eight, as a response to the problem identified in this study, provides a systematic manner in which to identify aspects of governance, inhibitors to the effective transfer of the governance mandate between layers of governance and systems, and how these relate to governance organs and mechanisms. Despite the conclusiveness of the survey findings, the value framework constructed in chapter eight still needed to be validated to ascertain its applicability in the view of experts, particularly those in the public higher education system in South Africa.

Winter, Zhao, and Aier (2010) indicate in their discourse on DSR that evaluation is concerned with the utility of an artefact, whereas validity is about truthfulness of claims and their reliability and robustness. Guideline three of the DSR paradigm followed in this study requires that an artefact be produced and evaluated to demonstrate its worth together with evidence addressing criteria such as validity, quality and efficacy (Gregor & Hevner, 2013). This validation should provide evidence of whether the artefact represents the theory sufficiently to give way to theoretical insights (Winter, Zhao, & Aier, 2010). An expert review was designed to determine whether data exists or can be found to support the components and interactions of the proposed framework and thus satisfy the DSR requirements in order to subsequently validate the ICT governance value framework.

9.2 Expert Review Technique to Validate the Value Framework

According to Klein and Richey (2007), an expert review seeks to determine whether data exists in support of the components of the proposed model or, in this case, the value framework. Ostrowski and Helfert (2011) contend that activities such as focus groups, semi-structured interviews and workshops will be involved as the main facilitators in the act of

artefact design. Seasoned ICT practitioners, who in all cases are the most senior ICT executives at the high education institutions in this study, were asked to complete surveys which were designed to create the knowledge base required to build the value framework. It is essential that experts used in the validation exercise have intimate knowledge of the public higher education environment in South Africa as well as good knowledge of the COBIT framework. The typical qualification required of an IT director in the public higher education sector is a matric plus 5 year degree (M+5) and at least 10 years' experience in the environment. The typical qualification required of a CIO in this environment is a technological M+5 degree as well as an advanced business degree, typically an MBA. In this respect, comments were sought from these experts on the value framework that was developed. Five convenience sample (Johnson & Christensen, 2012) responses were targeted but seven were received. The fifth and final survey questionnaire contained 24 questions. These were structured in the form of a Likert Scale with responses *strongly disagree, disagree, neutral, agree* and *strongly agree,* representing the values between -2, -1, 0, +1 and +2 for the levels of disagreement or agreement respectively to be able to aggregate the scores for each response. This survey is attached as Annexure E. Respondents were also invited to comment on each response to ensure that any information qualifying a response or additional information could be captured as well. The survey data was collected *anonymously* using the Internet-based commercial survey system, Survey Monkey; thus improving the likelihood and accuracy of responses (Babbie, 2013). The survey consisted of questions grouped into four logical groups. An overview of the survey is presented first to provide a broad view of the responses. This is followed by grouping the responses into four logical groups and, finally, each question is dealt with separately.

9.2.1 The Expert Review Process

Once the Value Framework was completed a brief but detailed overview and explanation of the Framework was developed into an automated PowerPoint presentation with audio. A compact disk (CD) with the automated presentation on it is attached to the back cover of the thesis document. This was emailed together with the Uniform Resource Locator (URL) of the survey website, as well as the website on which the automated presentation and supporting documentation was loaded. The most senior ICT executives of the twenty-three public higher education institutions in South Africa were invited to listen to the automated PowerPoint presentation and subsequently complete the survey. All seven responses received have been

used in the report that follows. This creates a limitation on the data collection for this survey which must be acknowledged in that no particular size, geographical position or status in terms of university type was targeted for response. Responses are therefore anonymous, random and voluntary. Accordingly, a different random set of responses might have provided a different outcome. The four sections of the survey are dealt with in the following four subsections, providing an interpretive analysis of the responses.

9.3 Overview of the Survey Responses

A summary of the responses to the final validation survey is shown in Table 9-1. The percentage of positive responses resulting from the sum of *agree* and *strongly agree* responses is also shown in the adjoining pie graphs. Integer values shown in Table 9-1 indicate the vote count in each of the four sections, as well as the overall totals, whilst percentage values are also clearly indicated.

Questions	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Response Count	Aggregated Value	Percentage Positive Response (Sum of *Agree* and *Strongly agree* responses)
Overall ICT Governance Value Framework Score	0	10	21	85	49	Negative	Neutral	Positive
	0.0%	6.1%	12.7%	51.5%	29.7%	6.1%	12.7%	81.2%
Open System, Agency Theory & Direct-Execute-Control	0	1	8	23	15			
	0.0%	2.1%	17.0%	48.9%	31.9%	2.1%	17.0%	80.9%
Aspects of Governance	0	4	1	21	8			
	0.0%	11.8%	2.9%	61.8%	23.5%	11.8%	2.9%	85.3%
Barriers to Effective transfer of the Governance Mandate between layers of Governance	0	3	4	20	8			
	0.0%	8.6%	11.4%	57.1%	22.9%	8.6%	11.4%	80.0%
Overall System ICT Governance and the Value of the Framework	0	2	8	21	18			
	0.0%	4.1%	16.3%	42.9%	36.7%	4.1%	16.3%	79.6%

Table 9-1: Survey Response Count and Percentage per Section, ICT Value Framework

Overall, the support for the ICT governance value framework originating from this study is 81,2% positive, 12,7% neutral and 6,1% negative. The first of the four sections of the survey sought to measure the view of existing theory on open systems, Agency Theory and the governance cycle, which were adapted for use in this study, and this enjoyed strong positive support from respondents at 80,9%. The second of the four sections of the survey tested the new concept of *aspects of governance* which was first introduced in this study. This elicited the highest support of the four sections at 85,3%. Being a new concept, it also had the highest

percentage of negative responses at 11,8%. The third section of the survey dealt with the second new concept of *barriers to the effective transfer of governance mandate between layers of governance*, which also enjoyed positive support of 80%. The final group of measures reports on overall ICT system governance and the value of the framework. This also enjoys 79,6% positive support. A more detailed review of the responses follows in the next four subsections in which respondents are referred to by their response number. The first respondent to submit the completed survey is referred to as respondent one, while the nth respondent to complete the survey is referred to as respondent n. This allows the responses to be associated with the specific responder. Responses are tabulated and attached as Annexure K.

9.3.1 The Open System Nature of Public Higher Education in South Africa, the Applicability of Agency Theory, and the Direct-Execute-Control Governance Cycle

Responses to the first section covering open systems, Agency Theory and the direct–execute–control survey questions are shown in Figure 9-1.

Responses to the first question on the applicability of systems theory to the higher education system in South Africa were not as expected. Systems theory in terms of system autonomy is well articulated by Kohler (2006), who states that higher education governance is indeed seen as being crucially important at both the institutional and the system levels. The DHET also states that subsystem autonomy is usually framed in the context of the public good and the public accountability of the higher education system in terms of the country or the public as a whole, clearly indicating that the higher education system in South Africa is part of a system (South Africa, Department of Education, 1997). It is suggested that ICT directors or CIOs who responded to the surveys are viewing institutions more as *independent* and not *autonomous*, as there has been much debate on the new reporting regulation R1002 (South Africa, Department of Higher Education and Training, 2012) in this regard.

Questions 2 to 6 deal with the adaptation of the Von Solms and Von Solms (2006) ICT security governance cycle from the ISO/IEC 38500:2008 ICT governance cycle, and the applicability of this to the ICT governance value framework originating from this study. The 100% positive response to question 2 confirms that the ICT governance cycle applies to higher education institutions as individual autonomous systems, whilst the slightly lower

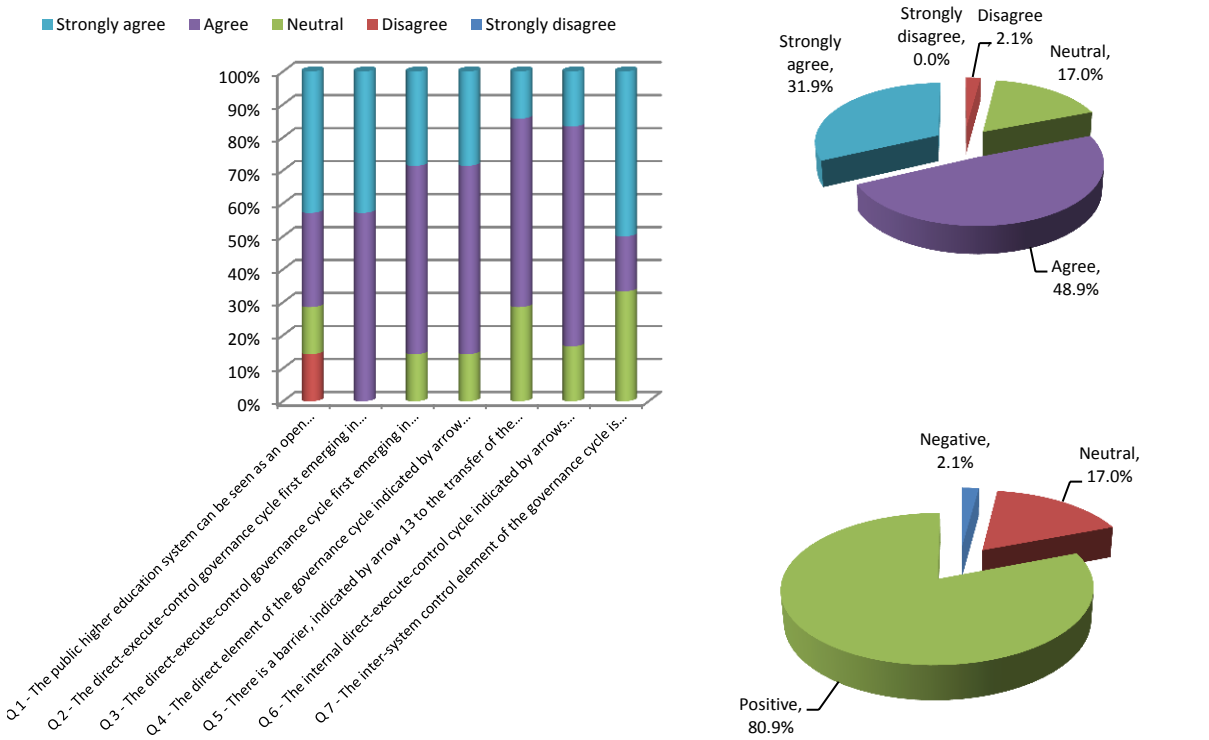
positive response to question 3 at 85,7% confirms that the ICT governance cycle also applies between the DHET and individual institutions in the South African higher education system.

Questions	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Response Count	Aggregated Value	Percentage Positive Response (Sum of *Agree* and *Strongly agree* responses)
Q 1 - The public higher education system can be seen as an open system that has 23 institutions as sub-systems	0	1	1	2	3	7	7	71.4%
Q 2 - The direct-execute-control governance cycle first emerging in the ISO 38500 governance standard , and later adapted by Von Solms and Von Solms, is applicable internally to the 23 public higher education institutions as indicated by arrows 19, 20 and 21 in slide 5 of the attached Power Point presentation.	0	0	0	4	3	7	10	100.0%
Q 3 - The direct-execute-control governance cycle first emerging in the ISO 38500 governance standard , and later adapted by Von Solms and Von Solms, is applicable externally between the DHET and institutions as indicated by arrows 14, 31 and 16	0	0	1	4	2	7	8	85.7%
Q 4 - The direct element of the governance cycle indicated by arrow 14 from the DHET as the principal to institutions as the agents uses the Higher Education Act 101 of 1997 as the governance mechanism to pass the governance mandate from DHET to institutions	0	0	1	4	2	7	8	85.7%
Q 5 - There is a barrier, indicated by arrow 13 to the transfer of the governance mandate indicated by the direct element of the governance cycle and shown by arrow 14 between the DHET and institutions (inter-system) and this barrier can be the interpretation of Act 101 of 1997 by institutions	0	0	2	4	1	7	6	71.4%
Q 6 - The internal direct-execute-control cycle indicated by arrows 19, 20 and 21 is also the external execute element of the inter-system governance cycle shown by arrow 31	0	0	1	4	1	6	6	83.3%
Q 7 - The inter-system control element of the governance cycle is regulation R 691 as defined in the higher education Act 101 of 1997	0	0	2	1	3	6	7	66.7%

Table 9-2: Extract of Responses to Questions covering Open Systems, Agency Theory and the Direct-Execute-Control Governance Cycle

There is also high positive agreement at 85,7% relating to question 4 that the Higher Education Act 101 of 1997 is the mechanism by which the governance mandate from the DHET is transferred to public higher education institutions in South Africa. Barriers to the effective transfer of the governance mandate to the next layer, level or subsystem is a new concept presented for the first time in this study, and the 71,4% positive response to question 5 gives firm support for both the concept of barriers to effective transfer of the governance mandate and the Higher Education Act as being the mechanism that transfers the governance mandate between the DHET and the higher education institutions. Whilst the response to question 7 is less positive than those to questions 2 to 6, it is nevertheless a positive response of 66,7%, which confirms the recognition of regulation R691 as the *control* element in the direct–execute–control governance cycle. The lower positive value can be interpreted in the

same manner as the response to question 1, in that there is a perception in higher education in South Africa that institutions should be independent rather than autonomous, but still funded by government. The individual as well as percentage responses are shown in Figure 9-1.



Percentage responses covering questions one to seven

Figure 9-1: Final Validation Survey, Responses to Questions covering Open Systems, Agency Theory and the Direct–Execute–Control Governance Cycle

In response to question 4, respondent 3 agreed that the Higher Education Act bestows the governance mandate on the DHET.

9.3.2 Aspects of Governance

The second section of the survey comprised five questions covering each of the five *aspects* of governance introduced in this study. These five questions were intended to test the respondents' views on this new concept in governance, which is intended to make governance more granular and thus be able to set up governance organs and mechanisms more efficiently and effectively that will be more appropriate for the different layers of governance identified in the value framework. A valuable observation made by one of the respondents indicated that current theory, including the newly released COBIT 5, clearly differentiates between management and governance processes. This view is also held by Van

Grembergen (2004) and by Weill and Ross (2004). Oversight of governance processes will, however, be applicable at the level on which implementation takes place to ensure performance and conformance, which are two objectives of governance (IT Governance Institute, 2003).

Questions	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Response Count	Aggregated Value	Percentage Positive Response (Sum of *Agree* and *Strongly agree* responses)
Q8 - There are intra-system aspects of governance that can be used to increase the level of granularity of governance internally within an organization. The first of these is Legislation and is shown by callout 22. Legislation is the starting point of governance in a system such as the public higher education system	0	1	0	4	2	7	7	85.7%
Q9 - The second aspect of governance is Translation to Policy and is shown by callout 24.	0	1	0	4	2	7	7	85.7%
Q10 - The third aspect of governance is Application of Policy and is shown by callout 26.	0	1	0	4	2	7	7	85.7%
Q11 - The fourth aspect of governance is Alignment/Fit and is shown by callout 28.	0	0	0	5	1	6	7	100.0%
Q12 - The fifth aspect of governance is Acceptance of Technology and is shown by callout 30.	0	1	1	4	1	7	5	71.4%

Table 9-3: Final Validation Survey, Extract of Responses to Questions covering Aspects of Governance

Principle 5.1 of the King III code on corporate governance (2009, p. 82) states that:

"ICT is essential to manage the transactions, information and knowledge necessary to initiate and sustain a company. In most companies, ICT has become pervasive because it is an integral part of the business and is fundamental to support, sustain and grow the business. Companies should understand and manage the risks, benefits and constraints of ICT. As a consequence, the board should understand the strategic importance of ICT, assume responsibility for the governance of ICT and place ICT governance on the board agenda."

ICT is also essential in the functioning of higher education institutions as is reflected in paragraph 6.6 on page 182 of this study. The support from respondents for this new concept in the *granularisation* of governance was either extremely positive or marginally negative. The first, second and third aspects of governance enjoyed the highest level of support with six of the seven votes for each aspect of governance being positive and only a single one being negative. The fourth aspect of governance, which relates to business and ICT alignment, moved one respondent to recommend that the fact that *governance oversight* is an integral

part of the *governance* function should be highlighted. The fifth aspect of governance is the acceptance of technology. This aspect of governance had the lowest support and in terms of the comments associated with the previous aspect of governance, this aspect may appear to be more of a management function than the fourth aspect of governance identified in this study. The analogy of the game of soccer referred to in section 4.9.2.8 of this study and the way governance and management are clearly separable and distinct can again be used to indicate that despite their clear separation there is oversight and acceptance of technology required by those who are charged with governance. In the context of the soccer analogy, goal line technology could only be introduced once FIFA, the soccer world governing body, was convinced of its ability to function as well as or better than the existing technology or systems used to decide goal validity. In the same manner, business and ICT alignment, as well as technology acceptance, are as much a part of the governance function in their acceptance and monitoring of fitness and alignment as are the other readily recognisable aspects of governance.

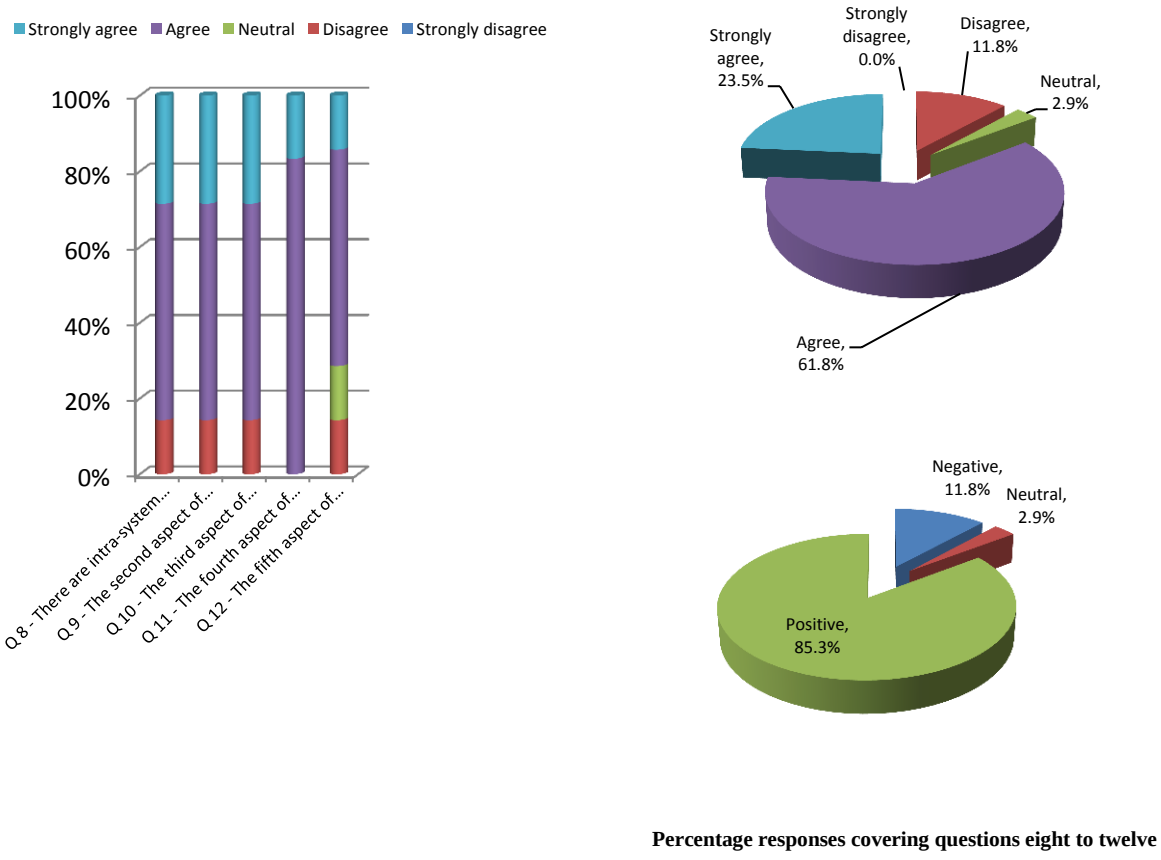


Figure 9-2: Final Validation Survey, Responses to Questions covering Aspects of Governance

The individual and percentage responses for the second section are shown in Figure 9-2.

9.3.3 Barriers to the Effective Transfer of the Governance Mandate between Layers of Governance

The third section of the survey comprised five questions covering each of the five barriers to the effective transfer of the governance mandate between the layers of governance introduced in this study. These are shown Table 9-4.

Questions	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Response Count	Aggregated Value	Percentage Positive Response (Sum of *Agree* and *Strongly agree* responses)
Q13 - The first barrier to internal institutional governance is institutional autonomy and academic freedom and is shown by callout 23 (Legislation). (Please see the mapping of aspects of governance to layers of governance on slide 4: The first two layers of governance map to legislative aspects of governance, hence both question 13 and 14 refer to callout 23 on the diagram on slide 5)	0	0	1	6	0	7	6	85.7%
Q14 - The second barrier to internal institutional governance is Limited ICT Governance Expertise at Executive levels and CIO not usually on Council and is shown by callout 23 (Legislation).	0	1	0	3	3	7	8	85.7%
Q15 - The third barrier to internal institutional governance is translation of governance aims to policy and procedure and is shown by callout 25.	0	1	1	4	1	7	5	71.4%
Q16 - The fourth barrier to internal institutional governance is Knowledge of Policies and Framework Requirements and is shown by callout 27.	0	0	1	4	2	7	8	85.7%
Q17 - The fifth barrier to internal institutional governance is Appropriate Technology and Labour with Appropriate Capacity and is shown by callout 29.	0	1	1	3	2	7	6	71.4%

Table 9-4: Final Validation Survey, Extract of Responses to Questions covering Barriers to the Effective Transfer of Governance Intent between Layers of Governance

The barriers to the effective transfer of the governance mandate between layers of governance and the aspects of governance are interdependent and are thus inextricably linked. This linkage does not however mean that responses to the second section should track those in this section. Responses at 85,7 percent positive, made up from six votes at the *agreed* level of support for the statement and one *neutral* vote, offer high level support for the view that institutional autonomy within the current understanding of institutional governance, and academic freedom, both create barriers to the effective transfer of the governance mandate to the next layer of governance. Embracing the conditions for autonomy and exercising academic freedom fearlessly can help to focus institutional intent and resources, consequently

minimising this effect and producing the outputs required by the DHET in terms of its governance mandate.

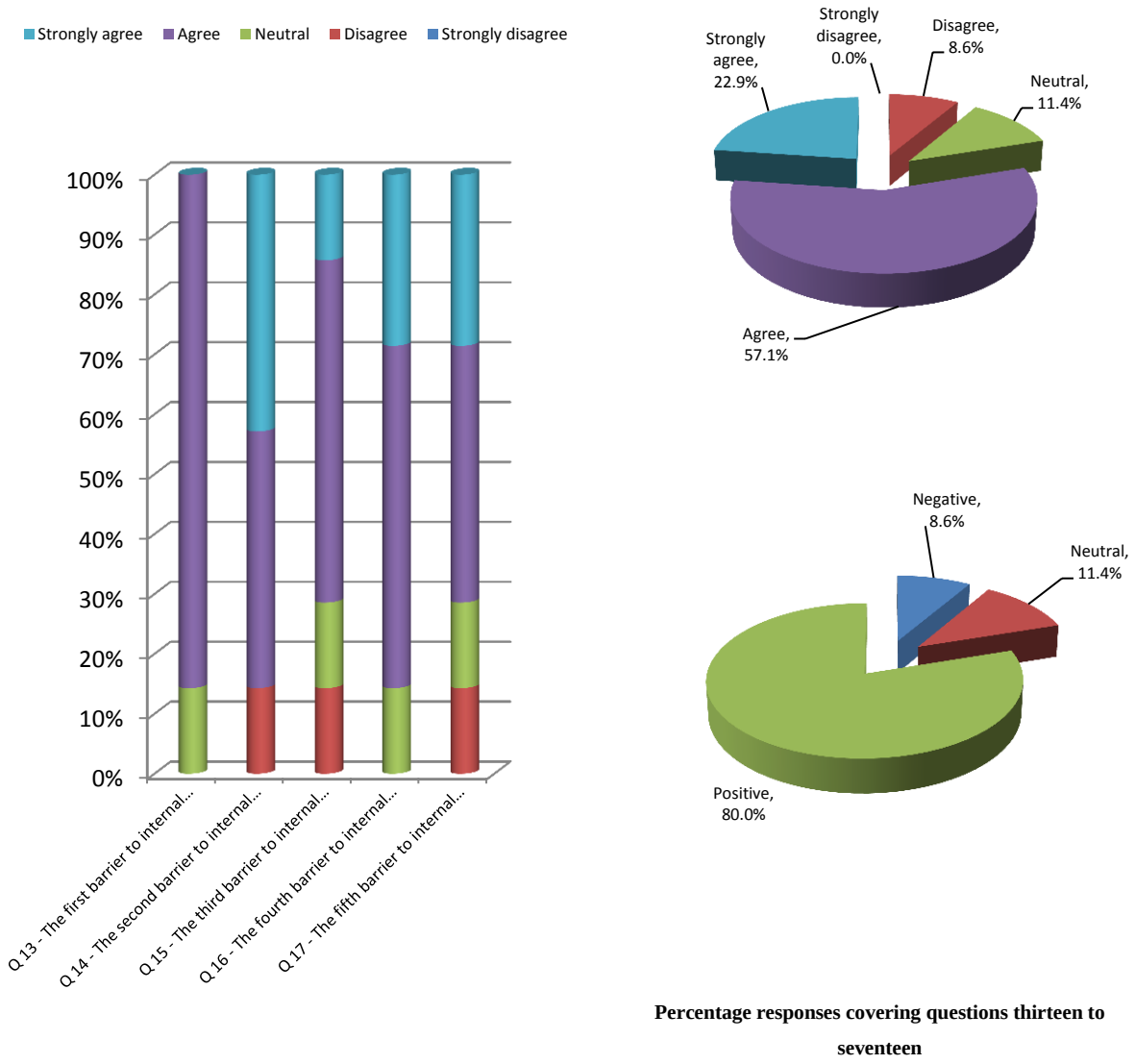


Figure 9-3: Final Validation Survey, Responses to Questions covering Barriers to the Effective Transfer of Governance Intent between Layers of Governance

Despite there being significant support of 85,7% for the first barrier to internal governance mandate transfer, the next layer or level of governance, there are also no respondents who *strongly agreed* with the statement in this question. Perhaps the breadth of view of the concepts of autonomy and academic freedom, as articulated in section 8.6.1 on page 213, has contributed to this being the only question in the survey that has no *strongly agreed* responses.

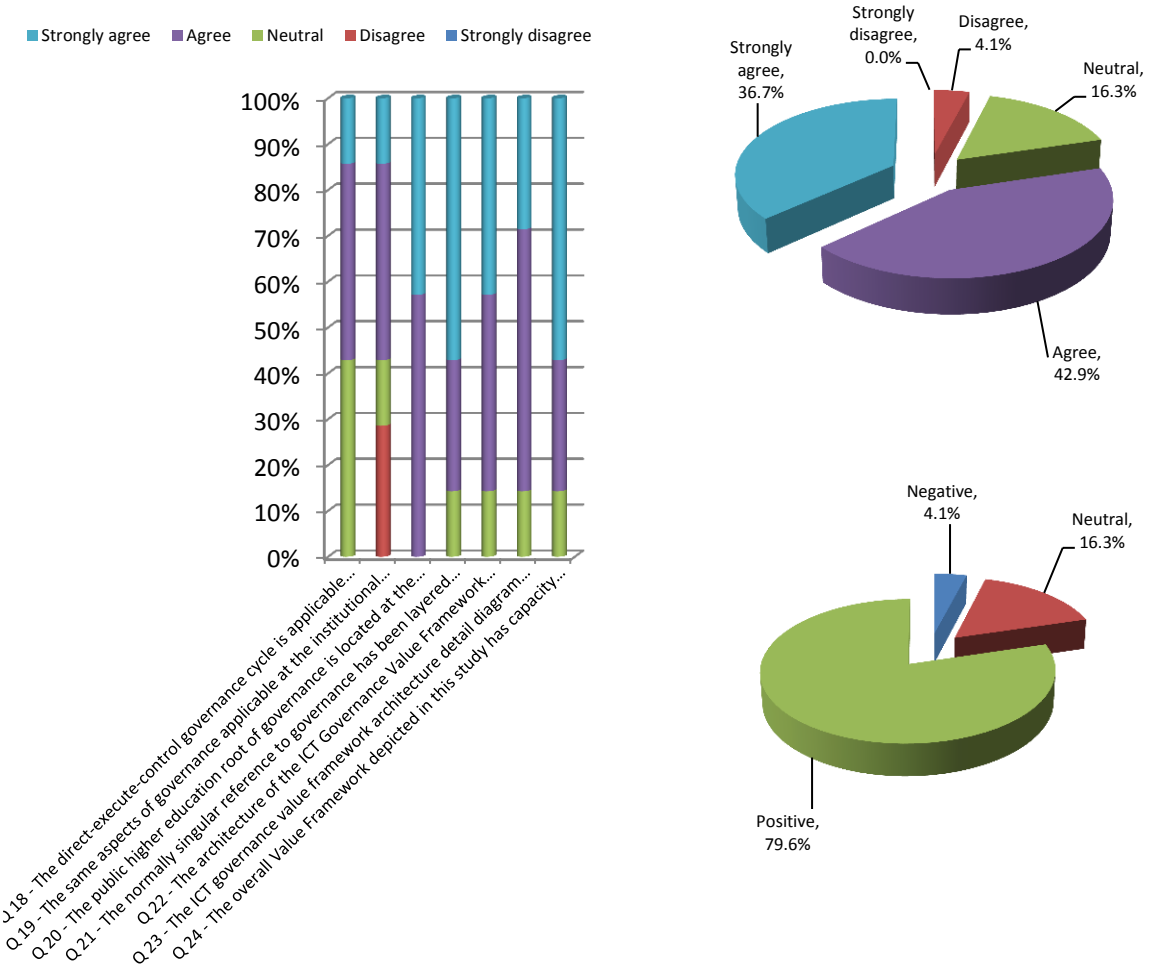
9.3.4 Overall System ICT Governance and the Value of the Framework

This section covers the last seven questions of the survey and the responses relating to the overall value of the framework. Questions 18 and 19 received the lowest percentage of positive responses to the survey questions. Callout eighteen on Figure 8-9 refers to the legislation applicable to the DHET. The King III Code is currently not applicable to the DHET as it applies to *entities incorporated in and resident in South Africa* (King III Code, 2009, p. 18) and this could give the perception that government departments are not subject to governance best practices. This is, however, an incorrect perception as other legislation such as the Public Finance Management Act (PFMA) applies to all government departments, including the DHET. The DHET also has ICT systems in place to enable it to function and as such will have the same requirements to govern all aspects of the enterprise, including ICT. The same aspects of governance will therefore apply to all subsystems within the higher education system, including the highest level, which is the government of South Africa.

Questions	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Response Count	Aggregated Value	Percentage Positive Response (Sum of *Agree* and *Strongly agree* responses)
Q18 - The direct-execute-control governance cycle is applicable internally to the ministerial level of governance as indicated by arrows 1, 2 and 3	0	0	3	3	1	7	5	57.1%
Q19 - The same aspects of governance applicable at the institutional level are applicable at the DHET level and higher.	0	2	1	3	1	7	3	57.1%
Q20 - The public higher education root of governance is located at the DHET, where the Higher Education Act 101 of 1997, as amended, has its foundation	0	0	0	4	3	7	10	100.0%
Q21 - The normally singular reference to governance has been layered into six layers of governance. The increased granularity of governance allows for better identification of appropriate governance organs and mechanisms for more appropriate control	0	0	1	2	4	7	10	85.7%
Q22 - The architecture of the ICT Governance Value Framework depicted on slide 5 helps to understand ICT governance in the context of public higher education in South Africa	0	0	1	3	3	7	9	85.7%
Q23 - The ICT governance value framework architecture detail diagram on slide 5, (with some detail on slide 4) fairly represents the layers of governance and their inhibitors, aspects, organs and mechanisms of governance that are applicable in the public higher education sector in South Africa	0	0	1	4	2	7	8	85.7%
Q24 - The overall Value Framework depicted in this study has capacity to improve governance, specifically ICT governance in public higher education institutions.	0	0	1	2	4	7	10	85.7%

Table 9-5: Final Validation Survey, Extract of Responses to Questions on Overall ICT Governance and the Value of the Framework

The concept of the *root* of governance enjoys particularly strong support in that all responses to this question are positive at 100% and the aggregate value of the responses is ten. This is one of only four survey questions that enjoy this level of aggregate support. It can thus be concluded that the *root* of governance is found at the highest level in the education system. DHET governance currently excludes any requirement for ICT governance reporting. ICT governance currently has its *roots* in the individual institutional level as there is clearly no ICT governance mandate passed to institutions by the Higher Education Act or any other current legislation, apart from the King III Code of best practice. Even the King III Code of best practice need only be 'applied or explained' and, as such, does not require compliance by the public higher education sector in South Africa.



Percentage responses covering questions eighteen to twenty four

Figure 9-4: Final Validation Survey, Responses to Questions covering Overall ICT Governance and the Value of the Framework

In this study the normally singular reference to governance is split into aspects of governance that can be classified into layers of governance and thus become associated with organs of governance that will in turn be controlled by mechanisms of governance. The responses to survey question 21 provide strong support of 85,7% for this structure. Along with an aggregate response value of 10, this is confirmed as one of the top four highest value responses.

In survey question 23 respondents were asked to assess the fair representation of the detailed architectural structure of the layers of governance, inhibitors to the effective transfer of the governance mandate or intent to the next layer of governance, organs and mechanisms of governance that are applicable in the public higher education sector in South Africa. The detailed architectural diagram at the institutional level is depicted in Figure 8-5. Respondents' positive support for the institutional ICT governance architecture at 85,7% is a strong indication that the architecture is well founded on the principles of multi-level governance as espoused by Enderlein et al. (2010) and on the direct–execute–control governance cycle adapted from Von Solms and Von Solms (2006) for this study and on whose principles the framework has been built.

There is extremely strong support for the final four statements in the survey which cover the final ICT governance value framework. The value of the ICT governance value framework and its contribution to the improvement of ICT governance in the public higher education sector in South Africa are therefore strongly endorsed by respondents to the survey.

9.4 Conclusion

The objective of this chapter was to validate the support for the artefact created in this study and based on the DSR paradigm. Guideline three of the DSR paradigm followed in this study required that an artefact be produced and evaluated to demonstrate its worth together with evidence addressing criteria such as validity, quality and efficacy (Gregor & Hevner, 2013). Despite the availability of a textual response area per survey question, most respondents exercised choice selections only. However, one of the most significant challenges to the concepts devised in the value framework was put forward by respondent 6, who consistently disagreed with the statements relating to the three lower aspects of governance, namely, interpretation of policy, business and ICT alignment and technology acceptance. Whilst there is agreement that activities related to these aspects of governance are management-directed

activities performed by employees, nevertheless governance oversight is required and this is best described by the soccer analogy used in paragraph 9.3.2. The overall responses to the survey questions, which averaged a positive 81,2% aggregate, are therefore a clear indication of support for the value framework that has been designed and presented.

The summary of the contribution of this study to the body of knowledge in the area of governance, particularly the value created by the application of ICT governance best practices, are discussed and finalised in the next and final chapter.

Chapter Ten

Conclusion

10 Conclusion

10.1 Introduction

This study commenced with an introduction to the public higher education system in South Africa. Included in the introductory chapters is a short history of each of the twenty-three institutions in the public higher education system which provides the context for the study.

The research problem is stated in paragraph 1.6 as: *The Department of Higher Education and Training (DHET) of South Africa does not specifically require public higher education institutions to implement ICT governance practices at institutions that fall within its ambit of control.* This elicited the research question: *How can recognised ICT governance practices be utilised to create a value framework for ICT governance in the public higher education sector in South Africa and how can this value framework contribute to better ICT governance and how can better collaborative ICT governance be implemented to ensure optimal value of the ICT investment across the sector?*

This in turn led to the formulation of the primary objective of the study being set. The primary objective was supported by three secondary objectives; the details of the objectives as well as a summary of the findings are covered in more detail in the following sections. The overall aim of this thesis is to advance the understanding of the state of ICT governance in public higher education institutions in South Africa by investigating the level of pervasiveness, the level of ICT process maturity and the alignment of ICT to the institutional processes within the public higher education institutions by producing a contextually appropriate value framework that will contribute towards the understanding of the need for improving ICT governance.

10.2 Objectives of the Study and Summary of Findings

The primary objective of this research project is *to produce a value framework that can be used to identify value created in public higher education institutions in South Africa by implementing good ICT governance practices from the highest governing authority to the ICT functional environment.* This was done by developing three secondary research objectives to guide the approach to the creation of a value framework. The concept of layered governance that is used for the foundation of the multi-layered governance value framework is based on concepts presented in contributions by Enderlein et al. (2010, p. 2) in their book titled *Handbook on multi-layered governance*, which contains questions such as: "“Under what

conditions do multi-layered institutional arrangements yield effective regulations and compliance?"; "Which type of hierarchical order and instruments fosters compliance?" and "Is enforcement across governance levels possible?" This book is founded in the governance structures of governments in the European Union and is guided by their generic definition of governance: "to denote the sum of regulations brought about by actors, processes as well as structures and justified with reference to a public problem" (Enderlein, Wälti, & Zürn, 2010, p. 2).

The concept of levels or layers of governance is used in this thesis to differentiate between 'autonomous' subsystems, which are the institutions themselves, and 'semi-autonomous' layers within the governance structure of public higher education institutions. Accordingly, this enables the ICT governance value framework to deal with layers of governance, as well as the organs and mechanisms of governance at each layer. This in turn allows institutions to recognise the need for organs and mechanisms of governance to address particular requirements. To get to this point, however, a mechanism had to be constructed that was able to identify the current status of ICT governance at public higher education institutions in South Africa. Three secondary research objectives dictated the processes that would be followed in this regard. The first of the secondary research objectives was to identify the ICT governance practices currently in place at public higher education institutions in South Africa, the second was to ascertain the level of ICT pervasiveness in these institutions and the third was to ascertain the level of alignment of ICT to the academic and administrative processes in public higher education. A brief discussion on the way in which these objectives were achieved and the subsequent findings are included in the following subsections.

10.2.1 Summary of Findings on ICT Governance Practices

A survey on ICT governance practices was used to obtain details on the level of ICT process maturity of the 34 COBIT 4.1 primary processes. This data was used to indicate areas of low ICT process maturity. This, in turn, is an indicator of areas that require improved governance. The appropriate governance organ and mechanism can then be identified and, with the inhibitors to the transfer of governance intent to the next layer of governance being known, the responses to the requirement can be suitably engineered.

The COBIT framework was selected as the framework against which to measure the current ICT governance maturity because it is familiar to all South African public higher education institutions, at least in varying degrees. Using COBIT 4.1, the average ICT governance

maturity of South African higher education institutions was measured at 1,8 on a scale of 0 to 5, where zero indicates that the 34 primary ICT processes are 'non-existent', 1 is 'initial/ad-hoc', 2 is 'intuitive', 3 is 'defined', 4 is 'measured and managed', and 5 is 'optimised. The measure of 1,8 means that on average South African public higher education institutions ICT processes are 'initial' or 'ad/hoc'. This was contrasted with the international perspective provided by Australian institutions, which were measured at 2,3. This equates to ICT processes that are 'intuitive'. The findings also indicate that historically disadvantaged institutions have lower ICT process maturity measured on average at 1,2 while the formerly advantaged institutions were measured higher at an average of 2,7. The historically disadvantaged institutions are also generally the youngest institutions. The age of the institutions correlated somewhat loosely with the level of ICT governance maturity, with the older institutions generally having higher levels of ICT governance maturity.

It was also concluded from the survey that the level of importance of the individual processes on a scale of 1 to 3, which the public higher education sector level of importance associated with all except nine of the 34 primary processes, was higher than the COBIT 4.1 best practice framework provides for.

The survey responses also indicate that, in terms of the ICT governance best practice processes associated either with legal or with reporting requirements, institutions mainly have processes that fall into the 'measured and managed' maturity level. *This is a clear indication that the formalisation of the requirement to implement an ICT best practice framework will provide some level of process maturity improvement.* The ICT governance mechanisms in the public higher education sector in South Africa were extracted from the Higher Education Act 101 of 1997 (South Africa, Department of Education, 1997), institutional statute (2002), the DHET strategic plan 2010 to 2015 (South Africa, Department of Higher Education and Training, 2010), the ministerial statement on funding (South Africa, Department of Higher Education and Training, 2010) and the regulations for reporting as required in terms of the Higher Education Act (South Africa, Department of Education, 2007). Both the mandatory governance 'mechanisms' and those chosen to be implemented by the vice chancellors and the CIOs of the public higher education institutions in South Africa were integrated into the value framework.

Six layers of governance were identified and these were classified into aspects of governance, which were then in turn aligned with governance organs and mechanisms. These layers of

governance, supported by Agency Theory, provided an understanding of the way in which inhibitors to the transfer of governance intent between layers could be minimised. The findings of the survey indicate that HR and finance governance start at the root of governance, whilst ICT governance starts at the institutional level only. Moreover, ICT governance is optional, whilst finance and HR governance are mandatory.

10.2.2 Summary of Findings on ICT Pervasiveness

The survey on ICT pervasiveness was conducted to assess the level of ICT pervasiveness found in the South African public higher education system. Responses resulted in levels of ICT pervasiveness in South African higher education institutions being found to be between 46 and 74%. Those at the higher end of the ICT pervasiveness rankings are once again the previously advantaged institutions, whilst those at the lower end are generally the younger and previously disadvantaged institutions. Factors influencing ICT pervasiveness could not be found in research work done previously, so a survey was set up with factors that were informed by the researcher's experience in the higher education sector as well as the categories of ICT pervasiveness researched by Karaiskos (2009).

As there was no available means against which to validate the factors generated in the survey, the highest ranking ICT officer within the public higher education institutions was requested, by means of an 'ICT pervasiveness factor validation' survey, to validate the survey questions. A 70% response rate was received for this survey. Responses could fall within the range of −32 and +32. However, the aggregated responses were found to be all positive, ranging between +5 and +24. This validation survey provided the necessary assurance that the factors had value in terms of the measurement of pervasiveness. Furthermore, the results of this survey provide reasonable assurance that the public higher education institutions in South Africa are using ICT pervasively and therefore depend on ICT for a significant proportion of their function.

10.2.3 Summary of Findings on Business and ICT Alignment

One of the focus areas of the COBIT 4.1 best practice framework is 'Business and ICT alignment'. The purpose of this survey, which was based on the Luftman and Brier (1999) business/ICT alignment model, was twofold: to assess the alignment between ICT and business on a scale of 0 to 5 and to be aware of the differences in perception between the 'business' and 'ICT' groups in the institutions in terms of the ICT function. The average business/ICT alignment index is 2,6, with the minimum being 1,6 and maximum being 3,3.

The levels of measurement range from: (a) up to level 1, that is, being without process or not aligned at all; (b) up to level 2, that is, a beginning process; (c) up to level 3, that is, establishing process; (d) up to level 4, that is, improving process; and (e) up to level 5, that is, optimised processes or complete alignment. The results indicate that institutions in South Africa lie somewhere between being 'without process' and 'beginning process' on the measures provided for in the alignment model of Luftman and Brier (1999). This measure relates well to the overall COBIT 4.1 measure of the average ICT governance maturity level of institutions being 1,8 on the scale of 0 to 5 and meaning that processes overall are somewhere between 'initial/ad-hoc' and 'repeatable and intuitive'.

The low level of ICT and business alignment means that technology is not planned and implemented at high enough levels of debate and discussion with the users. This could be likened once again to the soccer analogy with the soccer governing body deciding to implement goal-line technology without ever discussing it with the clubs and players. It is imperative that governance has oversight and that, users, managers and governors meet in the appropriate technology forums to become aware of each other's views and aim for the alignment of objectives. The ICT and business group views of the survey results differ by just 0,1 and the low average result of the survey responses of 2,8, both on a scale of 0 to 5, indicate that both business and ICT are of the same view, that is, that alignment is poor.

10.3 Findings on ICT Process Maturity

Based on the results of the survey on ICT process maturity, institutions that have processes at the 'measured and managed' maturity level are required directly or indirectly by law or regulation to govern these processes. In addition, processes that are not required by law or regulation to be governed are at lower levels of maturity. It can therefore be concluded that the *formalisation of an ICT best practice framework will improve the level of ICT process maturity of the public higher education institutions in South Africa.*

In addition to this, the average ICT process importance in the public higher education sector is 2,6, which is higher than the average process importance of the COBIT 4.1 framework at 1,9. *This higher importance level is an indicator of the importance of ICT to the public higher education sector in South Africa and thus the need to govern it which in turn will provide improved value* (Van Grembergen, 2004). This value is difficult to measure in terms of the traditional financial measures but can be measured in terms of the value of investment model

(Ataya, 2003). The measure is best expressed in terms of ICT governance maturity (IT Governance Institute, 2003).

ICT is pervasive: It has become embedded in all sectors, including public higher education institutions, to the point that not only do the administrative functions depend on ICT systems, but the academic function is also growing to depend more and more on the advantages provided by technology-based education systems (Misthry, Mkhize, & Harypursat, 2002). *Survey responses indicate that relative ICT pervasiveness ranges between 46 and 74% at institutions that responded to the survey, which clearly gives support for the above statement.* The result represents the first known attempt at measuring the level of ICT pervasiveness in higher education and provides a clear indication that ICT is pervasive in higher education in South Africa.

The institutional processes, which are referred to in this study as the *business processes* and the *ICT processes*, are also not optimally aligned. Survey results indicate that the average alignment is at 2,8 on a scale of 1 to 5; representing alignment that is at the level of *establishing process*. The view of alignment was taken from both the ICT and business perspective and found to differ between these views by only 0,1 on the scale of 0 to 5. This also indicates that the views of management and ICT are similar.

The final survey evaluated the value framework produced as the artefact in this study. Accordingly, it was found to be positively supported to a degree of more than 80% by the respondents. This therefore provides support for the defined *aspects of governance* and the *barriers to effective* governance mandate transfer between layers of governance, as well as, between systems and subsystems within the higher education sector. The concept of layers of governance and the organs and mechanisms of governance associated in these layers of governance also finds traction from the survey responses. One of the core principles that sought support in this study was the principle that ICT governance also needs to commence at the *root of governance*, a new concept that found strong support in this study, and is already the case with finance and HR governance in the sector. There is therefore strong agreement from the respondents to the survey that *the overall ICT value framework depicted in this study has the capacity to improve governance, specifically ICT governance, in public higher education institutions.*

10.4 Summary of Contributions

The purpose of research is to produce new knowledge. The nature, relevance and significance

of the contribution to the related body of knowledge are a major concern for many researchers and this is also a significant aspect of this research. Locke and Golden-Biddle (1997) refer to the notion of constructing a contribution by establishing a problematising context for the contribution, which is really about identifying a 'gap' in the body of knowledge of the discipline. The primary research question developed from this problem statement is to ascertain how recognised ICT governance practices can be utilised to create a value framework for ICT governance in the public higher education sector in South Africa. How can this value framework contribute to the improvement of ICT governance and how can better collaborative and multi-layer ICT governance be implemented to ensure optimal value of the ICT investment across the sector?

This section presents the merits of this contribution to the body of knowledge relating to ICT governance.

Firstly, two papers covering contributions from this study have been accepted for publication by the *South African Journal for Higher Education* (*SAJHE*). The first paper, 'Information technology governance process maturity in higher education institutions in South Africa' (Johl, Von Solms, & Flowerday, 2013) is published in volume 27(3) of the *SAJHE* and the second paper 'Information technology governance in the context of higher education governance in South Africa' (Johl, Von Solms, & Flowerday, 2014) will be published in volume 28(1) of the *SAJHE*.

The primary research objective of this study was to construct a 'Value framework for information technology governance in South African Public higher education institutions'. Three secondary research objectives were addressed to ensure that the value framework was based on a relevant and appropriate foundation. The result of the first secondary research objective is the discovery of the ICT process maturity level and the levels of importance of each of the 34 primary COBIT 4.1 process in the public higher education sector. This can serve as a baseline for future studies. Whilst the mechanism to acquire these measures is not unique and depends entirely on the COBIT 4.1 best practice framework, the measurement of the ICT process levels themselves is unique in the public higher education sector in South Africa. This contributes significantly to the body of knowledge as it defines the status of ICT processes in this sector and, with this knowledge, the process of addressing low levels of ICT process maturity can begin. The importance of using an internationally defined and recognised mechanism to measure the levels of ICT process maturity cannot be

overemphasised, as this allows for comparison with previous similar studies that have been concluded elsewhere in the world. Such a study has been undertaken by EDUCAUSE (2008) where the worldwide average ICT process maturity level was measured at 2,3 on a scale of 0 to 5. A similarly structured survey placed the average ICT governance maturity level of South African public higher education institutions at a level of 1,8. This provides an indication of the low level of ICT process maturity in the public higher education sector in South Africa and provides the mechanism for further measurements.

The second secondary research objective result is the ICT pervasiveness survey set up to assess the impact of ICT in the public higher education sector in South Africa, which can also serve as a baseline for future studies. Both the mechanism for this measure and the resulting measure itself are unique and make a significant contribution to the body of knowledge in this domain. The set of questions in the survey was developed through a consultative process between the researcher and the universities at the Association of South African University Directors of Information Technology (ASAUDIT) bi-annual conferences or collaborative meetings held between 2009 and 2011. The work by Karaiskos (2009), in which he develops a model for the identification of pervasive systems in which "statements of ubiquity" are made and statistically affirmed, was used as the basis for the ICT pervasiveness survey. These factors of ubiquity or pervasiveness were mapped to the pervasiveness factors of the survey consultatively within the ASAUDIT group between 2010 and 2011. The grouped factors resulting from the mapping are presented to indicate that ICT pervasiveness is associated with the primary objectives of the South African Department of Higher Education and Training. The Green Paper on post-school education in South Africa released in 2012 indicates the need for the increased use of ICTs to be able to accommodate the target number of 1,5 million students in the higher education system by 2030 (South Africa, Department of Higher Education and Training, 2012). Pervasiveness and the measure of pervasiveness clearly play a significant role in the ability to identify institutions that require an increase in ICT pervasiveness to be able to achieve the targets set by the DHET.

The second part of the second secondary research objective resulted is the pervasiveness validation mechanism. As this was, to the researcher's knowledge, the first attempt at measuring ICT pervasiveness the researcher reviewed the questions set with a specialist group of the highest ranking ICT offers at public higher education institutions to ensure the validity of the questions by means of a survey. The aggregated responses ranged between +5 and +24 where the limits were between −32 and +32. Significantly, none of them were

negative. This provided assurance on the validity of the questions.

The third secondary research objective result is the business/ICT alignment measures which are used by Luftman and Briers (1999). The measures were adapted to address terminology used in the higher education sector. Once the supporting work was complete the rationale for the study became evident and the construction of the value framework began.

The artefact referred to in the DSR paradigm used in this study is the framework itself which can be used to identify the layers of governance, the organs of governance and the mechanisms of governance. The barriers to effective transfer of governance intent between the layers of governance can then be identified and this allows for better alignment of the organs and mechanisms of governance. The concept of layers of governance is not new and the work done by Enderlein et al., (2010) laid the foundation for the levels of governance approach which was adapted for use in this study. This is supported by Agency Theory, which emerged from the seminal papers of Alchian and Demsetz (1972) and Jensen and Meckling (1976), explaining the firm as a nexus of contracts among individual factors of production. Agency Theory explains how to best organise relationships in which one party, the principal, determines the work that another party, the agent, undertakes (Eisenhardt K. , 1985). This concept is used to underpin the layers of governance approach, where the highest layer of governance transfers the governance mandate or intent to the next layer. This continues on down to the layer where the functional work takes place and the completed responses are returned to the top layer in the structure in the format required.

This is also supported by the concept of the direct−control cycle introduced by Von Solms and Von Solms (2006). The concept of layers of governance was also developed consultatively with the members of ASAUDIT over the period 2009 to 2011 at the bi-annual meetings of the group. Accordingly, the organs of governance and their mechanisms of governance, as well as the inhibitors to effective governance transfer, have been debated and the value framework presented is an outcome of this effort. This value framework allows for the identification of the appropriate governance organs and mechanisms at the various levels of governance. The artefact is presented in Annexure I and there is a detailed section on the artefact in Annexure J.

In summary it can be argued that three secondary research objectives were addressed to provide a relevant and appropriate foundation on which to base the value framework, and that since these three secondary objectives have been successfully achieved during the course of

this research, the primary objective has also been achieved by building the value framework on the appropriate foundation.

10.5 Limitations of the Study

Three information seeking surveys were made use of to acquire information from the top ICT official at each of the 23 public higher education institutions in South Africa. The survey on ICT pervasiveness yielded 9 responses whilst the COBIT process maturity survey yielded 10 responses and the business and ICT alignment survey yielded 12 responses. At best these responses constitute a little more than a 50% response rate. There is no manner in which the response rate could have been improved without undue influence on the respondents. The surveys were open for completion for a period of approximately two months and reminders were sent to all participants indicating that more responses were required. It was thus decided to use the sample as a convenience sample. Researchers use convenience sampling when they include in their sample people who are available or volunteer or can be easily recruited or are willing to participate in the research study (Johnson & Christensen, 2012). Whilst this method is usually not used for large population sampling it can be used for small population sampling. The response rate does however create a limitation on the ability to confidently make generalisations in the study.

The use of the 34 COBIT 4.1 primary processes' maturity as a measure of governance is only used a 'proxy' for governance making this a possible limitation of the study. The COBIT 5 framework has evolved to include specific governance processes. COBIT 5 was however not available at the time of data collection for this study.

10.6 Suggestions for Further Research

The level of study of ICT pervasiveness worldwide appears to be extremely shallow. Whilst many researchers and authors refer to ICT pervasiveness or ICT ubiquity there is very little evidence of any attempts to measure the level of ICT pervasiveness. The higher education sector in South Africa has a very low level of ICT process maturity and therefore there is little hope of being able to produce evidence of the impact of ICT on the sector without further research. The usefulness of the concept of layers of governance could be further explored. The survey could be redone with current participants to monitor improvement that may have taken place. The surveys could be redone under the auspices of the DHET who could make participation mandatory and thus provide a full and comprehensive report on the status of ICT governance in the sector. The surveys could also be restructured using the

COBIT 5 framework. Van Grembergen and De Haes (2010) explicate their experiences in the domain of enterprise governance of IT, business/IT alignment and value creation, topics that are closely related to the core themes of this study. It may be very interesting to relate this study to the above study to find if there are synergies. Lastly, while financial governance has been active since the early seventeenth century, ICT governance has only been active for the past three decades. Nevertheless, the impact of poor ICT governance in an era when pervasiveness of ICT is increasing extremely fast, needs to be investigated to ensure that ICT supports and enables the strategic objectives of the public higher education sector in South Africa.

10.7 Epilogue

The research question addressed in this study deals with *the Department of Higher Education and Training (DHET) of South Africa which does not specifically require public higher education institutions to implement ICT governance practices at institutions that fall within its ambit of control.* The DHET does, however, require HR and finance governance and these reporting requirements are articulated through regulation R691 (South Africa, Department of Education, 2007).

Five powerful and informative surveys including the average importance and maturity of ICT processes, the level of pervasiveness of ICT in public higher education institutions and the alignment of business and ICT, all based on recognised frameworks or practices, provided the foundation on which to develop and successfully validate the value framework. For this reason it can be stated that the study has been successfully concluded and that this study demonstrates praxis for ICT governance implementation across all layers of governance by identifying how and where value can be created for ICT governance improvement in the public higher education sector in South Africa.

References

Alchian, A., & Demsetz, H. (1972). Production, Information costs, and economic organization. *American Economic Review, Vol 62*, 777-95.

Ataya, G. (2003). Risk-aware decision making for new IT investments. *Information Systems Control Association Journal, Vol 2*, 12-14.

Aversano, L., Grasso, C., & Tortorella, M. (2012). A litereratrure review of business/IT alignment strategies. *Procedia Technology, Vol 5*, (pp. 462 - 474).

Babbie, E. R. (2013). *The practice of social research, 13th Ed.* Belmont, CA: Wadsworth.

Boulding, K. E. (1956). *The image, knowledge in life and society.* Rexdale: John Wiley and Sons.

Cape Peninsula University of Technology website. (2011, June 10). *www.cput.ac.za/home*. Retrieved June 10, 2011, from www.cput.ac.za: http://www.cput.ac.za/home

Central University of Technology website. (2011, June 10). *www.cut.ac.za/home*. Retrieved June 10, 2011, from www.cut.ac.za: http://www.cut.ac.za/home

Chen, L. (2010). Business IT- alignment maturity of companies in China. *Information & Management, Vol 47*, 9-16.

Chun, M., & Mooney, J. (2009). CIO roles and responsibilities: Twenty-five years of evolution and change. *Information and Management, Vol 46*, 323-344.

Churchman, C. W. (1971). *The design of inquiring systems: Basic concepts of systems and organization.* London: Basic Books.

Clarke, T. (2008). *Theories of corporate governance.* Glasgow: Bell & Bain.

Cloete, N., & Kulati, T. (2003). *Managerialism within a Framework of Cooperative Governance.* Pretoria: Centre for Higher Education transformation.

Collins, J., Vile, D., Macehiter, N., & Ward-Dutton, N. (2007). *The technology garden: Cultivating sustainable IT-business alignment.* Chichester: John Wiley.

Collis, J., & Hussey, R. (2009). *Business research: A practical guide for undergraduate & postgraduate students.* Basingstoke: Palgrave Macmillan.

Council for Higher Education. (2006, July). *http://www.che.ac.za/documents/d000127/ICTs_HE_Landscape_Jul2006.pdf.* Retrieved June 11, 2011, from http://www.che.ac.za: http://www.che.ac.za/documents/d000127/ICTs_HE_Landscape_Jul2006.pdf

Council of Europe Higher Education. (2006). *Higher education governance between democratic culture, academic aspirations and market forces* (Series No. 5 ed.). (S. Bergan, Ed.) Strasbourg: Council of Europe Publishing.

De Haes, S. (2007). *Implementing information technology governance: Models, practices, and cases.* Hershey, PA: IGI.

Deem, R., Hillyard, S., & Reed, M. (2007). *Knowledge, higher education and the new managerialism.* New York: Oxford University Press.

Drucker, P. F. (2003). *A functioning society.* Piscataway, NJ: Rutgers.

Durban University of Technology website. (2011, June 10). *www.dut.ac.za/home*. Retrieved June 10, 2011, from www.dut.ac.za: http://www.dut.ac.za/home

EDUCAUSE. (2003, December). *Funding information technology.* Retrieved August 4, 2010, from net.educause.edu: http://www.educause.edu/ir/library/pdf/pub4002.pdf

EDUCAUSE. (2006). *Improving IT governance in higher education.* Berkeley: EDUCAUSE, Centre for Applied Research.

EDUCAUSE. (2006). Improving IT governance in higher education. *EDUCAUSE Quarterly, Issue 18*, 2-12.

EDUCAUSE. (2010, February). Students and information technology in higher education. *EDUCAUSE, Center for Applied Research*. EDUCAUSE.

EDUCAUSE. (2011). *Technology leadership: Today's higher education CIO.* Berkley: EDUCAUSE, Center for Applied Research.

EDUCAUSE Center for Applied Research. (2008). *Process and politics: IT governance in higher education institutions.* Boulder, CO: Educause.

Eisenhardt, K. (1985). Control: Organizational and economic approaches. *Management Science*, 31(2), 134-149.

Eisenhardt, M. K. (1989). Agency Theory: An assessment and review. *Academy of Management Review*, 14(1), 57.

Enderlein, H., Wälti, S., & Zürn, M. (2010). *Handbook on multi-level governance.* Cheltenham, UK: Edward Elgar.

Fadia, A., & Bhattacharjee, J. (2008). Encryption: Protecting your data. *International Journal of Information Management, Vol 28(3),* 229.

Flowerday, S., & Von Solms, R. (2005). Real-time information integrity=system integrity+data integrity+continuous assurances. *Computers and Security, 24(8),* 604-613.

Frentrop, P. (2003). *A history of corporate governance 1602 - 2002.* Brussels: Deminor.

Goodhue, D. L., & Thompson, R. (1995). Task-technology fit and individual performance. *MIS Quarterly, Vol 19(2),* 213-236.

Gottschalk , P., & Solli-Sæther , H. (2009). *E-government interoperability and information resource integration: Frameworks for aligned development.* Hershey, PA: IGI Global.

Government Gazette. (1999, May 4). Statute of the University of the Western Cape. *Notice no. 4272005, Gazette no. 27556*. Pretoria, Gauteng, South Africa: Government Printers.

Government Gazette. (2002, December 19). Higher Education Amendment Act. *Act 63 of 2002*. Cape Town, Western Cape, South Africa: Government Printers.

Government Gazette. (2002, February 15). Statute of the University of Witwatersrand, Johannesburg. *Notice no. 23132*. Pretoria, Gauteng, South Africa: Government Printers.

Government Gazette. (2005, May 4). Statute of the University of Venda. *Notice no. 428 of Gazette no. 27558*. Pretoria, Gauteng, South Africa: Government printers.

Government Gazette. (2006, August 8). Statute of the North West University. *Notice no. 27872*. Pretoria, Gauteng, South Africa: Government Printers.

Government Gazette. (2006, February 3). The Statute of the University of South Africa. *Notice no. 108 of Gazette no. 28464*. Pretoria, Gauteng, South Africa: Government Printers.

Government Gazette. (2008, September 11). Statute of the Central University of Technology, Free State. *Notice no. 976 of 31413*. Gauteng, Gauteng, South Africa: Government Printers.

Government Gazette. (2008, August 26). Statute of Walter Sisulu University. *Notice no. 900 of gazette no. 31358*. Pretoria, Gauteng, South Africa: Government Printers.

Government Gazette. (2010, May 17). Institutional Statute: Cape Peninsula University of Technology. *Notice no. 406 of 33202*. Pretoria, Gauteng, South Africa: Government Printers.

Government Gazette. (2010, August 27). Institutional Statute: University of Johannesburg. *Notice no. 749 of 2010*. Pretoria, Gauteng, South Africa: Government Printers.

Government Gazette. (2010, August 27). Institutional Statute: University of Limpopo. *Notice no. 746 of Gazette no. 33489*. Pretoria, Gauteng, South Africa: Government Printers.

Government Gazette. (2010, August 27). Institutional Statute: University of the Free State. *Notice no. 33490*. Pretoria, Gauteng, South Africa: Government Printers.

Government Gazette. (2011, December 9). Nelson Mandela Metropolitan University Statute. *Notice number 929, Gazette no. 34834*. Pretoria, Gauteng, South Africa: Government Printers.

Gregor, S., & Hevner, A. R. (2013). Positioning and presenting design science research for maximum impact. *MIS Quarterly, 37(2),* 337-355.

Hevner, A. R., March, S. T., Park, J., & Ram, S. (2004). Design science in information systems research. *MIS Quarterly, 28(1),* 75-105.

Hevner, A., & Chatterjee, S. (2010). *Design research in information systems.* New York: Springer.

Hofstee, E. (2006). *Constructing a good dissertation.* Johannesburg: EPE.

Infonomics Pty Ltd. (2008). *Corporate Governance of ITIL ISO 38500 Case Study.* Canberra: Infonomics Pty Ltd.

International Standards Organization. (2008). *ISO 38500:2008 (E) IT Governance Framework.* Geneva: International Standards Organization.

IT Governance Institute. (2003). *Board Briefing on IT Governance 2nd Edition.* Retrieved January 11, 2010, from http://www.itgi.org: http://www.itgi.org

IT Governance Institute. (2003). *Board Briefing on IT Governance 2nd Edition.* Retrieved January 11, 2010, from http://www.itgi.org

IT Governance Institute. (2007). *http://www.isaca.org/Knowledge-Center/cobit/Documents/.* Retrieved May 23, 2012, from http://www.isaca.org/: http://www.isaca.org/Knowledge-Center/cobit/Documents/CobiT_4.1.pdf

IT Governance Institute. (2008). *http://www.isaca.org/Knowledge-Center/Research/ResearchDeliverables/Pages.* Retrieved June 11, 2012, from http://www.isaca.org/Knowledge-Center: http://www.isaca.org/Knowledge-Center/Research/ResearchDeliverables/Pages/Val-IT-Framework-2.0.aspx

IT Governance Institute. (2011, 10 29). *http://www.isaca.org/Knowledge-Center/cobit/Documents/.* Retrieved 10 29, 2011, from IT Governance Institute: http://www.isaca.org/Knowledge-Center/cobit/Documents/CobiT_4.1.pdf

Jensen, M. C., & Meckling, W. H. (1976). Theory of the Firm, Managerial Behavior, Agency Costs and Ownership Structure. *Journal of Financial Economics, Vol 3(4)*, 305-360.

Johl, C. P., Von Solms, R., & Flowerday, S. (2013). Information technology governance process maturity in higher education institutions in South Africa. *South African Journal for Higher Education, 27(3)*, 627-644.

Johl, C. P., Von Solms, R., & Flowerday, S. (2014). Information technology governance in the context of higher education governance in South Africa. *South African Journal for Higher Education, 28(1) to be published*.

Johnson, B., & Christensen, L. (2012). *Educational Research: Quantitative, Qualitative and Mixed Approaches.* London: Sage.

Kaplan, R. S., & Norton, D. P. (2006). *Alignment.* Boston, MA: Harvard Business School.

Karaiskos, D. (2009). *A predictive model for the acceptance of pervasive information systems by individuals.* Athens: Athens University of Economics and Business.

King III Code. (2009). *Report on governance for South Africa.* Johannesburg: Institute of Directors in Southern Africa.

Klein, J. D., & Richey, R. (2007). *Design and development research.* New Jersey: Lawrence Erlbaum Associates.

Kohler, J. (2006). Higher education governance: Background, significance and purpose. In C. o. Europe, *Higher education governance, Between democratic culture and market forces* (pp. 17-32). Strasbourg: Council of Europe.

Laszlo, A., & Krippner, S. (1998). Systems theories: Their origins, foundations and development. In J. Jordan, *Systems Theories and A Priori Aspects of Perception* (pp. 47-74).

Locke, L., & Golden-Biddle, K. (1997). Constructing opportunities for contribution: Structuring intertextual coherence and 'problematizing' in organizational studies. *Academy of Management Journal, 40(5),* 1023-1062.

Locke, W., Cummings, W. K., & Fisher, D. (2011). *Changing governance and management in higher education: The perspectives of the academy.* New York: Springer.

Luftman, J. N. (2003). *Competing in the informatiion age: Align in the sand.* New York: Oxford University Press.

Luftmann, J., & Brier, T. (1999). Achieving and sustaining business-IT alignment. *California Management Review, Vol 42*, 109-122.

Mangosuthu University of Technology website. (2011, June 10). *www.mut.ac.za/home*. Retrieved June 10, 2011, from www.mut.ac.za: http://www.mut.ac.za/home

Marginson, S., & Considine, M. (2000). *The Enterprise University. Power, Governance and Reinvention in Australia.* Cambridge, UK: Cambridge University Press.

Martin, D. D. (2009, September 18). (C. Johl, Interviewer)

McColgan, P. (2001). *Agency Theory and Corporate Governance: A Review of the Literature from a UK Perspective.* Glasgow: University of Strathclyde.

McLure, P. A. (2003). *Educause leadership strategies: Organising and managing information resources on your campus.* San Fransisco, CA: John Wiley.

Microsoft. (2009, June). *MOF-COBIT-VALIT_Cross-Impl_Guide_Final.pdf.* Retrieved October 15, 2009, from www.mocrosoft.com: http://www.microsoft.com/datagovernance

Mintzberg, H. (1994). The Fall and Rise of Strategic Planning. *Harvard Business Review, Jan-Feb*, 107-115.

Misthry, N., Mkhize, P., & Harypursat, R. (2002). The role of information technology and its impact on tertairy education. *Conference for Information Technology in Tertiary Education (CITTE)* (p. 8). Durban: Association of South African University Directors of Information Technology.

Nelson Mandela Metropolitan University. (2013, April). *qa.nmmu.ac.za/qa/media/Store/documents/QA.* Retrieved April 13, 2013, from http://www.nmmu.ac.za: http://qa.nmmu.ac.za/qa/media/Store/documents/QA%2520Framework/Good%2520Practice/H/Code-of-Ethics-for-Research_H2.doc&sa=U&ei=h4VpUcCbFoePtQa5loCIBg&ved=0CAkQFjAB&client=internal-uds-cse&usg=AFQjCNGh1uWSTYZFrHcyoz1tyYmR88Eu8A

Nelson Mandela Metropolitan University website. (2011, June 10). *www.nmmu.ac.za/home*. Retrieved June 10, 2011, from www.nmmu.ac.za: http://www.nmmu.ac.za/home

North West University website. (2011, June 10). *www.nwu.ac.za/home*. Retrieved June 10, 2011, from www.nwu.ac.za: http://www.nmu.ac.za/home

O'Brien, J. A. (2000). *Introduction to information systems: Essentials for the internetworked enterprise (9th Ed.).* USA: McGraw-Hill.

OECD. (2000). *Knowledge Management in the Learning Society.* Paris: OECD Publications Service.

OECD. (2004). *OECD principles of corporate governance.* Paris: OECD.

O'Reilly. (2011). *http://radar.oreilly.com/2011*. Retrieved 12 20, 2011, from http://radar.oreilly.com/: http://radar.oreilly.com/2011/01/why-is-it-governance-so-diffic.html

Ostrowski, L., & Helfert, M. (2011). Commonality in various design science methodologies. *Conference on Computer Science and Information Systems* (pp. 317 - 320). Dublin: IEEE.

Patel, N. V. (2003). An emerging strategy for e-business IT governance. In W. Van Grembergen, *Strategies for Information Technology Governance* (pp. 81-97). Hershey, PA: Idea Group.

Pityana, N. B. (2004). Governance and democracy in higher education. *Higher Eduaction Conference 2004* (p. 8). Port Elizabeth: Price Waterhouse Coopers.

Posthumus, S. M. (2009). *A model for aligning information technology strategic and tactical management.* Port Elizabeth: Nelson Mandela Metropolitan University.

Posthumus, S., & Von Solms, R. (2005). IT oversight: An important function of corporate governance. *Computer Fraud & Security, 2005(6)*, 11-17.

Pretorius, D. J. (2005, June 11). Information Technology Governance. Pretoria, Gauteng, South Africa.

Ramage, M., & Shipp, K. (2009). *Systems thinkers.* London: Springer.

Rhodes University. (2005, March 15). *www.ru.ac.za/documents.* Retrieved May 28, 2011, from www.ru.ac.za: https://www.ru.ac.za/documents/Institutional%20Planning/RU%20Statute%2015%20March%202005.pdf

Rhodes University website. (2011, June 10). *www.ru.ac.za/home*. Retrieved June 10, 2011, from www.ru.ac.za: http://www.ru.ac.za/home

Robson, W. (1997). *Strategic management and information systems (2nd ed.).* Essex: Pearson Education.

Roe, M. J. (1994). *Strong managers, weak owners.* Princeton: Princeton University Press.

Russel, C. (1993). *Academic freedom.* London: Routledge.

Sage, T. A. (2006). A model of factors affecting business and information technology alignment enabled by enterprise architecture: A structural equation modelling analysis. *PhD Thesis*. Michigan: Capella University.

Saunders, M., Lewis, P., & Thornhill , A. (2009). *Research methods for business students (5th ed.).* Essex: Pearson Education.

Saunders, M., Lewis, P., & Thornhill, A. (2003). *Research methods for business students (3rd ed.).* London: Prentice Hall.

Skyttner, L. (2005). *General systems theory: Problems, perspectives, practice (2nd ed.).* London: World Scientific.

South Africa, Centre for higher education transformation. (2012). *http://chet.org.za*. Retrieved 4 24, 2012, from http://chet.org.za: http://chet.org.za

South Africa, Department of Communications. (2008). *Regulation of Interception of Communications and Provision of Communication Related Information Act No. 48 of 2008.* Cape Town: Government Printers.

South Africa, Department of Education. (1997, December 19). Higher Education Act 101 of 1997. *Government Gazette 18515*. Pretoria, Gauteng, South Africa: Government Printers.

South Africa, Department of Education. (1997, July 24). *http://www.info.gov.za/whitepapers/1997/education3.htm.* Retrieved February 12, 2011, from http://www.info.gov.za/: http://www.info.gov.za/whitepapers/1997/education3.htm

South Africa, Department of Education. (2002, March 27). *Standard Institutional Statute, Government Gazette 23061*. Pretoria: Government Printers.

South Africa, Department of Education. (2007, August 1). Regulations for Annual Reporting by Public Higher Education Institutions. *Government Gazette 30132, Regulation R691*. Pretoria: Government Printers.

South Africa, Department of Finance. (2005). *Auditing Professions Act 26 of 2005.* Cape Town: Government Printers.

South Africa, Department of Finance. (2008). *Act no. 71 of 2008: Companies Act.*

South Africa, Department of Higher Education. (1995, October 4). *South African Qualifications Authority, Act 58 of 1995.* Cape Town: Government Printers.

South Africa, Department of Higher Education and Training. (1995, October 4). South African Qualifications Authority Act. *Act 58 of 1995 - Government Gazette 1521*. Cape Town, Western Cape, South Africa: Government Printers.

South Africa, Department of Higher Education and Training. (2001, 3 9). National Plan for Higher Education. *Notice no. 230 - Government Gazette no. 22138*. Pretoria, Gauteng, South Africa: Government Printers.

South Africa, Department of Higher Education and Training. (2002, September 20). Statute of the University of Cape Town. *Notice Number 1199 - Government Gazette 23837*. Pretoria, Gauteng, South Africa: Government Printers.

South Africa, Department of Higher Education and Training. (2003). Higher Education Funding Framework. *Ministerial Statement on the Higher Education Funding Framework - Government Gazette 25824*. Cape Town, Western Cape, South Africa: Government Printers.

South Africa, Department of Higher Education and Training. (2007, August 1). *Regulations for Annual Reporting by Public Higher Education Institutions.* Pretoria: Government Printers.

South Africa, Department of Higher Education and Training. (2009, May 15). Repeal of the Statute of the Mangosuthu University of Technology. *Notice Number 563 - Government Gazette 32238*. Pretoria, Gauteng, South Africa: Government Printers.

South Africa, Department of Higher Education and Training. (2010). *100310HETStratPlan_0[1].pdf.* Cape Town: Department of Higher Education and Training.

South Africa, Department of Higher Education and Training. (2010). *Ministerial Statement on University Funding: 2011/12, 8 December 2012.* Pretoria: Department of Higher Education and Training.

South Africa, Department of Higher Education and Training. (2010, November 29). Statute of the University of Fort Hare. *Notice Number 1088 - Government Gazette 33808*. Pretoria, Gauteng, South Africa: Government Printers.

South Africa, Department of Higher Education and Training. (2011, August 2011). Statute of Stellenbosch University. *Notice Number 605 - Government Gazette 34576*. Pretoria, Gauteng, South Africa: Government Printers.

South Africa, Department of Higher Education and Training. (2012, November 29). Call for Comments on the Draft Regulations for Reporting by Public Higher Education Institutions and Notice to repeal the Regulations for Reporting by Public Higher Education Institutions Published in Government Gazette No 301232 of 1 August 2007. *Notice No. 1002 - Government Gazette 35923*. Pretoria, Gauteng, South Africa: Government Printers.

South Africa, Department of Higher Education and Training. (2012, January 13). Green Paper for Post School Education and Training. *Government Gazette, No. 34935*. Pretoria, Gauteng, South Africa: Government Printers.

South Africa, Department of Higher Education and Training. (2012, June 22). Higher Education and Training Information Policy: For Public Comment. *Notice Number 520 - Government Gazette 35454*. Pretoria, Gauteng, South Africa: Government Printers.

South Africa, Department of Higher Education and Training. (2012, January 20). Statute of the Durban University of Technology. *Notice number 43 - Government Gazette 34953*. Pretoria, Gauteng, South Africa: Government Printers.

South Africa, Department of Higher Education and Training. (2012, June 14). Statute of The Tshwane University of Technology. *Notice number 460 - Government Gazette 35441*. Pretoria, Gauteng, South Africa: Government Printers.

South Africa, Department of Higher Education and Training. (2012, October 12). Statute of The University of Zululand. *Notice Number 843 - Government Gazette 35784*. Pretoria, Gauteng, South Africa: Government Printers.

South Africa, Department of Higher Education and Training. (2013, April 3). Statute of the Vaal University of Technology. *Notice Number 245 - Government Gazette 36325*. Pretoria, Gauteng, South Africa: Government Printers.

South Africa, Department of Justice. (2000). *Access to Information Act No. 2 of 2000.* Cape Town: Government Printers.

South Africa, Department of Justice and Constitutional Development. (1996, December 18). *Constitution of the Republic of South Africa, Act 108 of 1996.* Cape Town: Government Printers.

South Africa, Department of Manpower. (1997, November 27). Basic Conditions of Employment Act 75 of 1997. *Government Gazette No. 18491*. Cape Town, Western Cape, South Africa: Government Printers.

South Africa, Department of Trade and Industry. (2003). *No. 53 of 2003: Broad-Based Black Economic Empowerment Act.* Pretoria: Government Printers.

South Africa, Qualifications Authority. (2011, August 14). *www.saqa.org.za*. Retrieved August 14, 2011, from www.saqa.org.za: http://www.saqa.org.za

South African Government. (2010, November 23). *www.info.gov.za/aboutgovt/programmes/new-growth-path/index.html.* Retrieved June 16, 2012, from http://www.info.gov.za/: http://www.info.gov.za/aboutgovt/programmes/new-growth-path/index.html

Standards Australia. (2005). *Governance of Information and Communication Technology.* Retrieved 07 12, 2010, from http://www.ramin.com.au/itgovernance/as8015.html: http://www.ramin.com.au/itgovernance/as8015.html

Stellenbosch University website. (2011, June 10). *www.sun.ac.za/home*. Retrieved June 10, 2011, from www.sun.ac.za: http://www.sun.ac.za/home

Strassmann, P. A. (1997). *The Squandered Computer: Evaluating the Business Alignment of Information Technologies.* Connecticut: The Information Economic Press.

Symons, C. (2005). *IT governance framework.* Cambridge, MA: Forrester.

The University of KwaZulu-Natal. (2006, July 14). *www.ukzn.ac.za/aboutus.* Retrieved May 28, 2011, from www.ukzn.ac.za: http://www.ukzn.ac.za/aboutus/StatuteEnglishVersion.pdf

Thomas, G., & Fourie, I. (2006). Academic Library Consortia in South Africa: Where we come from and where we are heading. *The Journal of Academic Librarianship, 32 (4),* 432-438.

Tshwane University of Technology website. (2011, June 10). *www.tut.ac.za/home*. Retrieved June 10, 2011, from www.tut.ac.za: http://www.tut.ac.za/home

University of Cape Town website. (2011, June 10). *www.uct.ac.za/home*. Retrieved June 10, 2011, from www.uct.ac.za: http://www.uct.ac.za

University of Fort Hare website. (2011, June 10). *www.ufh.ac.za/home*. Retrieved June 10, 2011, from www.ufh.ac.za: http://www.ufh.ac.za/home

University of Free State website. (2011, June 10). *www.ufs.ac.za/home*. Retrieved June 10, 2011, from www.ufs.ac.za: http://www.ufs.ac.za

University of Johannesburg website. (2011, June 10). *www.uj.ac.za/home*. Retrieved June 10, 2011, from www.uj.ac.za: http://www.uj.ac.za/home

University of KwaZulu-Natal website. (2011, June 10). *www.ukzn.az.a/home*. Retrieved June 10, 2011, from www.ukzn.ac.za: http://www.ukzn.ac.za/home

University of Limpopo website. (2011, June 10). *www.ul.ac.za/home*. Retrieved June 10, 2011, from www.ul.ac.za: http://www.ul.ac.za/home

University of Pretoria. (2003, December 24). *www.up.ac.za/sitefiles.* Retrieved May 28, 2011, from www.up.ac.za: http://web.up.ac.za/sitefiles/1530/File/Statute_of_UP_2003.pdf

University of Pretoria website. (2011, June 10). *www.up.ac.za/home*. Retrieved June 10, 2011, from www.up.ac.za: http://www.up.ac.za/home

University of South Africa website. (2011, June 10). *www.unisa.ac.za/home*. Retrieved June 10, 2011, from www.unisa.ac.za: http://www.unisa.ac.za/home

University of the Western Cape website. (2011, June 10). *www.uwc.ac.za/home*. Retrieved June 10, 2011, from www.uwc.ac.za: http://www.uwc.ac.za/home

University of the Witwatersrand website. (2011, June 10). *www.wits.ac.za/home*. Retrieved June 10, 2011, from www.wits.ac.za: http://www.wits.ac.za/home

University of Venda website. (2011, June 10). *www.univen.ac.za/home*. Retrieved June 10, 2011, from www.univen.ac.za: http://www.univen.ac.za/home

University of Zululand website. (2011, June 10). *www.unizul.ac.za/home*. Retrieved June 10, 2011, from www.unizul.ac.za: http://www.unizul.ac.za/home

Van Grembergen, W. (2004). *Strategies for information technology governance.* London: Idea Group.

Van Grembergen, W., & De Haes, S. (2005). Measuring and Improving IT Governance Through the Balanced Scorecard. *Information Systems Control Journal, Vol 2*.

Van Grembergen, W., & De Haes, S. (2010). A Research Journey into Enterprise Governance of IT, Business/IT Alignment and Value Creation. *International Journal on IT/Business Alignment and Governance Vol. 1(1)*, 1-13.

Van Zyl Slabbert, D. (2003, October). *http://www.uct.ac.za/downloads/news.uct.ac.za/lectures/tbdavie.* Retrieved January 21, 2012, from http://www.uct.ac.za: http://www.uct.ac.za/downloads/news.uct.ac.za/lectures/tbdavie/acfree_newsa.pdf

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, Vol 27(3)*, 425-478.

Von Bertalanffy, L. (1969). *General systems theory.* New York: George Braziller.

Von Solms, R., & Von Solms, S. (2006). Information security governance: A model based on the direct-control cycle. *Computers & Security, 25(6)*, 408-412.

Vukasovic, M. (2006). Higher education governance: General report. In C. o. Europe, *Higher education governance, between democratic culture and market forces* (pp. 203-212). Strasbourg: Council of Europe.

Walter Sisulu University website. (2011, June 10). *www.wsu.ac.za/home*. Retrieved June 10, 2011, from www.wsu.ac.za: http://www.wsu.ac.za/home

Weill, P., & Ross, J. W. (2004). *IT governance: How top performers manage IT decision rights for superior results.* Boston, MA: Harvard Business School .

Weiser, M. (1991, September). The computer for the twenty-first century. *Scientific American, 94-1-10*. Scientific American.

Wiener, N. (1965). *Cybernetics: Or control and comminication in the animal and the machine.* Massachusetts: MIT Press.

Willekens, M., & Sercu, P. (2005). *Corporate governance at the crossroads.* Oxford, UK: Hart.

Winter, R., Zhao, J. L., & Aier, S. (2010). Quo vadis, design science? - A survey of literature. *Global Perspectives on Design Science Research: 5th International Conference, DESRIST* (pp. 93-108). St. Gallen, Switzerland: Springer.

Zachman, J. A. (2013). *The Zachman framework for enterprise architecture: A primer for enterprise engineering and manufacturing*. Retrieved 08 31, 2013, from http://zachmaninternational.com: http://zachmaninternational.com/index.php/home-article/13

Zhou , T., Lu, Y., & Wang, B. (2010). Integrating TTF and UTAUT to explain mobile banking user adoption. *Computers in Human Behaviour, 26*, 760-767.

List of Abbreviations and Definitions

ASAUDIT	Association of South African University Directors of Information Technology
COBIT	Control Objectives for Information and Related Technology
CEO	Chief executive officer
CFO	Chief financial officer
CHE	Council on Higher Education
CIO	Chief information officer
CSIR	Council for Scientific and Industrial Research
DHET	Department of Higher Education and Training
DSR	Design science research paradigm
DST	Department of Science and Technology
ERP	Enterprise resource planning
GST	General Systems Theory
ICT	Information and communication technology
IS	Information system(s)
IT	Information technology
ITIL	Information Technology Infrastructure Library
ITS	Integrated tertiary software
MOF	Microsoft Operation Framework
ROI	Return on investment
RRT	Internal rate of return
TENET	Tertiary Education Network
TTF	Task–technology fit
UTAUT	Unified theory of acceptance and use of technology
VAL-IT	Governance of ICT Investments Framework
VOI	Value of investment

Annexure A: ICT Pervasiveness/Ubiquity in Tertiary Education

This survey forms part of my ICT governance PHD studies at the Nelson Mandela Metropolitan University in Port Elizabeth.

My promoter is Professor Rossouw von Solms (NMMU) and co-promoter is Professor Stephen Flowerday (UFH). The responses to this survey will not be published in a manner that will identify individual institutions.

The responses will also be reported at the next ASAUDIT meeting. Only once all mandatory questions in the survey are completed will you be able to save the survey.

The save button is at the end of the form.

This survey should take no more than 20 minutes to complete ONCE YOU HAVE ACQUIRED THE FINANCIAL AND STUDENT/STAFF INFORMATION REQUIRED IN QUESTIONS 2 AND 7-13.

Thank you in anticipation of your response!

Chris Johl, CIO, University of Fort Hare, Cell No: 079 520 4414

1. **Which Tertiary Institution in South Africa are you the ICT Director/CIO of?**

- ◯ University of Stellenbosch
- ◯ University of Pretoria
- ◯ Tshwane University of Technology
- ◯ University of Cape Town
- ◯ Cape Peninsula University of Technology
- ◯ University of the Western Cape
- ◯ University of Fort Hare
- ◯ Walter Sisulu University
- ◯ Nelson Mandela Metropolitan University
- ◯ Rhodes University
- ◯ University of KwaZulu-Natal
- ◯ Mangosuthu University of Technology

- ◯ University of Zululand
- ◯ Durban University of Technology
- ◯ University of the North
- ◯ University of Johannesburg
- ◯ University of Limpopo
- ◯ Vaal University of Technology
- ◯ Central University of Technology
- ◯ University of the Free State
- ◯ University of South Africa
- ◯ University of Venda
- ◯ University of Witwatersrand
- ◯ Other (please specify)

2. **How many students were registered at your institution during 2010? The headcount is available in Hemis table 2.7. The headcount for 2010 may not be audited yet. Please provide the figure submitted to the Department of Higher Education and Training.**

Student Head Count

3. **Does the CIO/ICT Director in your university report to the Vice Chancellor?**

- ◯ Yes
- ◯ No

4. **Does your Institution have a Council ICT Governance or Steering Committee?**

- ◯ Yes
- ◯ No

5. **Does your Institutions CIO/ICT Director sit on the Council ICT Governance or ICT Steering Committee?**

- ◯ Yes
- ◯ No

6. **Is your Institutions CIO/ICT Director a member of the Council Audit Committee?**

- ◯ Yes
- ◯ No

7. **What was your ICT spend in 2010 for operational expenses?**

   Rands

8. **What was your ICT spend in 2010 for capital expenditure?**

   Rands

9. **What was your ICT spend in 2010 for Personnel expenditure?**

   Rands

10. **What was your ICT OPERATIONAL EXPENDITURE in 2010 as a percentage of total operational expenditure for the entire institution?**

    Rands

11. **What was your ICT CAPITAL EXPENDITURE in 2010 as a percentage of total Capital expenditure for the entire institution?**

    Rands

12. **What was your ICT PERSONNEL EXPENDITURE in 2010 as a percentage of total personnel expenditure for the entire institution?**

    Rands

13. **What was the total number of Employees at your institution at the end of 2010?**

    Employee Head Count

14. **Does your institution provide laboratory computers for students to access the Internet?**

    ◯ Yes
    ◯ No

15. **How many laboratory computers provided by your institution were available to students during 2010? Include all open access laboratory computers, i.e., computers that any student can use at any time that the lab is open.**

    Number of Computers

16. **How many FTE ICT staff members were employed by your institution during 2010? Please include all ICT staff that are both centralized and decentralized**

    ICT FTE Staff Count

17. **Does your institution provide students their own laptops as part of their study fee?**

    ◯ Yes most postgraduate students

- ◯ Yes some postgraduate students
- ◯ Yes undergraduate students
- ◯ No students at all

18. **Does your institution provide any type of wireless connectivity to those students who have their own computers?**

- ◯ Yes full campus coverage
- ◯ Yes partial campus coverage
- ◯ No coverage at all

19. **What is the BACKBONE bandwidth capacity that connects your institution to the Internet? (If yours is a multi-campus institution, the HIGHEST CONNECTION bandwidth of all access points) Please give the answer in Mega Bytes / sec**

Mega Bytes / sec ☐

20. **What is the INTERNATIONAL bandwidth capacity that connects your institution to the Internet? (If yours is a multi-campus institution, the SUM OF THE CONNECTION bandwidth of all access points) Please give the answer in Mega Bytes**

Mega Bytes / sec ☐

21. **Does your institution provide electronic mail for all staff?**

- ◯ Yes, internally
- ◯ Yes, externally hosted
- ◯ No

22. **Does your institution provide electronic mail for all students?**

- ◯ Yes, internally hosted
- ◯ Yes, internally hosted mail for life
- ◯ Yes, externally hosted
- ◯ Yes, externally hosted mail for life
- ◯ No

23. **Do all staff have Internet access on campus?**

- ◯ Yes, all hours
- ◯ Yes, specific times during working hours
- ◯ Yes, only after hours

- ◯ Yes only certain staff depending on need

24. **Does your institution provide students with Internet access on campus?**

- ◯ All hours
- ◯ Specific hours
- ◯ There is a limit on usage per student per period
- ◯ No

25. **Does your institution provide Internet access to students in the residences?**

- ◯ Yes, Internet access is provided in all/most residences
- ◯ Yes, Internet access is provided in some residences
- ◯ No Internet access in residences

26. **How many teaching venues have presentation equipment, i.e., Video Projectors and/or sound fitted or available for use?**

- ◯ Most teaching venues
- ◯ Many teaching venues
- ◯ Only a few venues
- ◯ No venues

27. **How many full Video Conferencing suites/venues does your institution have installed? Include all suites that have typical meeting type video conferencing equipment such as Polycom or Tandberg etc.**

Video conference suites ☐

28. **What is the average occupation of these suites per day? (If there is a waiting list of users that cannot be accommodated, then a figure exceeding 100% but less than 200% can be captured)**

Percentage Occupation ☐

29. **For what purposes are the video conferencing suites used?**

- ◯ Mainly for academic purposes, i.e., teaching across multi campuses
- ◯ Mainly for administrative meetings
- ◯ Standby as a last resort to meet if face to face meetings can't take place

30. **Does your institution make use of Smart Board technology?**

- ◯ Yes, in most venues
- ◯ Yes in many venues
- ◯ Yes in some venues

◯ Still investigating Smart Board Technology

31. **Please estimate the percentage of teaching venues that make use of Smart Board technology.**

Smart Board teaching venues

32. **Please estimate the percentage of meeting venues that make use of Smart Board technology.**

Smart Board meeting venues

33. **Does your institution make use of clickers or student response systems?**

◯ Yes for the past few years

◯ Yes, only recently

◯ No, not yet, still investigating

34. **Does your institution provide access to video sharing sites such as YouTube?**

◯ Yes, only to staff

◯ Yes, to staff and students

◯ No, not at all

35. **Does your institution make official use of social networking sites?**

◯ Yes, only to staff

◯ Yes, to staff and students

◯ No, not at all

36. **Estimate the percentage of your institutions telephones that are IP (network) telephones?**

Percentage IP Network Telephones

37. **Are your intercampus telephone calls routed over the internal IP network?**

◯ Yes, all of them

◯ Yes, where possible

◯ Very few of them

◯ Little or none of them

38. **How many servers do you have running in a virtual environment?**

Virtual servers

39. **How many servers do you have running on their own outside of a virtual environment?**

Stand-alone servers

40. **What is the total server storage capacity of your institutions SAN's in Terabytes? Storage Area Networks or any disks that are not an integral part of a computer.**

Terabytes of SAN storage

41. **Does your institution provide e-book access?**

- ◯ Yes, to staff and students
- ◯ Yes, only to staff
- ◯ No, not at all

42. **Does your institution provide online collaboration tools/suites such as Share Point?**

- ◯ Yes, for both staff and students
- ◯ Yes, only for staff
- ◯ No, not yet

43. **Are lecturers at your institution required to have competencies in Information Technology?**

- ◯ Yes, formal certification is required such as A+ or ICDL
- ◯ Yes, and competencies required are tested
- ◯ No competency required

44. **Does your institution provide on-line lecturer assistance to students through a collaboration portal?**

- ◯ Yes, comprehensively for all levels and qualifications
- ◯ Yes, for many levels and qualifications
- ◯ Yes, for some levels and qualifications
- ◯ No on-line assistance is available

45. **Does your institution provide technology to capture and store video clips of classes or tutorials for later download or review?**

- ◯ Yes, comprehensively for all levels and qualifications
- ◯ Yes, for many levels and qualifications
- ◯ Yes, for limited levels or qualifications
- ◯ No video recording and playback technology is available

46. **Does your institution make use of electronic learning management systems such as Blackboard, Moodle, Sakai, etc.?**

- ◯ Yes, for the past few years

- ◯ Yes, but only in the last year
- ◯ No systems in use yet

47. **Does your institution provide technology for students to submit assignments on-line?**

- ◯ Yes, comprehensively for all levels and qualifications
- ◯ Yes, for many levels and qualifications
- ◯ Yes, for limited levels or qualifications
- ◯ No, assignments all need to be submitted on paper

48. **Does your institutions library have electronic knowledge commons?**

- ◯ Yes with more than 500 stations
- ◯ Yes with more than 200 stations
- ◯ Yes with more than 50 stations
- ◯ Yes with less than 50 stations
- ◯ No, not at all

49. **Does your institution's library provide on-line access to research journals and other electronic media?**

- ◯ Yes, to both staff and students
- ◯ Yes, to staff only
- ◯ No, not at all

50. **Does your institution provide electronic banking facilities for students to pay fees?**

- ◯ Yes
- ◯ No

51. **Does your institution provide technology that allows students to register on-line?**

- ◯ Yes, comprehensively for all levels and qualifications
- ◯ Yes, for many levels and qualifications
- ◯ Yes, for limited levels and qualifications
- ◯ No, only on campus registration allowed

52. **Does your institution provide electronic meal management systems?**

- ◯ Yes
- ◯ No

53. **Does your institution provide electronic asset management systems?**

- ◯ Yes all ICT assets have RFID tags monitored by an electronic system
- ◯ Yes, many ICT assets are monitored
- ◯ Yes some ICT assets are monitored
- ◯ No RFID tags on campus yet

54. **Does your institution make use of Electronic Access Control for staff and students?**

- ◯ Yes, all campuses are comprehensively covered
- ◯ Yes, many campuses are covered
- ◯ Yes some campuses are covered
- ◯ No campuses are covered

55. **Are your institution's ICT assets monitored on the network?**

- ◯ Yes, a network services runs to monitor connection of equipment
- ◯ Yes, limited equipment such as servers are monitored
- ◯ No equipment is monitored

56. **Has your institution tested or implemented Near Field Communication (NFC) for short range wireless application?**

- ◯ Yes, implemented the technology comprehensively
- ◯ Yes, implemented the technology in some areas
- ◯ No, just testing or researching in the field
- ◯ No plans yet with NFC technology

Annexure B: Validation of ICT Pervasiveness Factors in Tertiary Education

This survey forms part of my ICT governance PHD studies at the Nelson Mandela Metropolitan University in Port Elizabeth. This survey is aimed at validating the factors associated with ICT pervasiveness in the higher education sector in South Africa.

My promoter is Professor Rossouw von Solms (NMMU) and co-promoter is Professor Stephen Flowerday (UFH). The responses to this survey will be published respecting the anonymity of the participating institutions.

The responses will also be reported at the next ASAUDIT meeting. Only once all mandatory questions in the survey are completed will you be able to save the survey.

The save button is at the end of the form.

This survey should take no more than 10 minutes to complete. Thank you in anticipation of your response! Chris Johl, CIO, University of Fort Hare, Cell No: 079 520 4414

Which Tertiary Institution in South Africa are you the ICT Director/CIO of?

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- ◯ University of Pretoria
- ◯ Tshwane University of Technology
- ◯ University of Cape Town
- ◯ Cape Peninsula University of Technology
- ◯ University of the Western Cape
- ◯ University of Fort Hare
- ◯ Walter Sisulu University
- ◯ Nelson Mandela Metropolitan University
- ◯ Rhodes University
- ◯ University of KwaZulu-Natal
- ◯ Mangosuthu University of Technology
- ◯ University of Zululand
- ◯ Durban University of Technology
- ◯ University of the North

- ◯ University of Johannesburg
- ◯ University of Limpopo
- ◯ Vaal University of Technology
- ◯ Central University of Technology
- ◯ University of the Free State
- ◯ University of South Africa
- ◯ University of Venda
- ◯ University of Witwatersrand
- ◯ Other (please specify)

Pervasiveness is defined in the Merriam Webster dictionary as "existing in every part of something: spreading to all parts of something" where ubiquity is defined as "presence everywhere or in many places, especially simultaneously". The terms are used interchangeably in this study.

Please indicate how strongly you agree or disagree with the statements reflecting the factors that impact on the pervasiveness of ICT in the tertiary sector in South Africa.

The LEVEL to which each factor affects pervasiveness is NOT being measured, only the fact that it does affect pervasiveness in SOME way is required in the response.

Example: If you strongly agree with question one it means that you will strongly agree that the size of an institution affects ICT pervasiveness. You will not be agreeing that the size affects pervasiveness in a smaller or larger way merely that it is affected.

The goal of the survey is to ascertain which factors affect pervasiveness and not to get a measure of the effect on pervasiveness.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.	The size of an institution affects ICT pervasiveness at the institution	◯	◯	◯	◯	◯
2.	The influence created by the reporting relationship between the CIO and Vice Chancellor (1st tier reporting) affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
3.	The existence and functioning of an ICT governance or steering committee of Council affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
4.	The participation of the CIO/ICT Director in an ICT Governance or Steering Committee of council affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
5.	The participation of the CIO/ICT Director in the Council Audit Committee affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
6.	The relative amount of ICT operational expenditure affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
7.	The relative amount of ICT capital expenditure affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
8.	The relative amount of ICT personnel expenditure affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
9.	The number of employees affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
10.	The number of laboratory computers to access the Internet that are available to students affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
11.	The size of the ICT staff structure relative to the total institutional structure affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
12.	Including network wireless access devices for students as part of their study fee affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
13.	The extent of wireless network coverage on campus affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
14.	National network bandwidth capacity affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
15.	International network bandwidth capacity affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
16.	Email provision for staff affects	◯	◯	◯	◯	◯

	ICT pervasiveness at an institution					
17.	Email provision for students affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
18.	On campus staff access to the Internet affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
19.	On campus student access to the Internet affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
20.	Access to the Internet for students in residences affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
21.	The provision of venue equipment such as audio lift and video projectors affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
22.	The provision of video conferencing equipment affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
23.	The use of video conferencing equipment for academic purposes affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
24.	The use of video conferencing equipment for administrative purposes affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
25.	The use of smart board equipment affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
26.	The use of student response systems (clickers) affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
27.	Access to video sharing sites such as YouTube affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
28.	Access to social networking sites such as Facebook affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
29.	The use of IP telephones affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
30.	Routing internal calls over the network affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
31.	Running servers in a virtual environment affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
32.	Making use of SANs in place of traditional discreet disk storage affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
33.	Providing electronic access to books and journals affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
34.	Providing on-line collaboration tools such as SharePoint affects	◯	◯	◯	◯	◯

	ICT pervasiveness at an institution					
35.	Requiring academic staff to have formal certification in Information Technology affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
36.	Providing on-line lecturer assistance to students through a collaboration portal affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
37.	Providing on-line lecture download or review affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
38.	Providing electronic learner management systems such as Blackboard or Moodle affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
39.	Providing technology for students to submit assignments on-line affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
40.	Library electronic knowledge commons affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
41.	Providing electronic banking facilities for students affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
42.	Providing technology that allows students to register on-line affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
43.	Electronic meal management systems affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
44.	Electronic asset management systems affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
45.	Electronic access control for staff and students affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
46.	Monitoring the institutions electronic assets on the network affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯
47.	Innovating with Near Field Communication (NFC) technology affects ICT pervasiveness at an institution	◯	◯	◯	◯	◯

Annexure C: COBIT 4.1 Survey Process Maturity and Importance

This survey forms part of my ICT Governance PHD studies at the Nelson Mandela Metropolitan University in Port Elizabeth.
My promoter is Professor Rossouw von Solms (NMMU) and co-promoter is Professor Stephen Flowerday (UFH).
The responses to this survey will not be published in a manner that will identify individual institutions.
The responses will also be reported at the next ASAUDIT meeting. Only once all mandatory questions in the survey are completed will you be able to save the survey.
The save button is at the end of the form.
This survey should take no more than 30 minutes to complete.
Thank you in anticipation of your response!
Chris Johl, CIO, University of Fort Hare, Cell No: 079 520 4414

1. **Which Tertiary Institution in South Africa are you the ICT Director/CIO of?**

- ◯ University of Stellenbosch
- ◯ University of Pretoria
- ◯ Tshwane University of Technology
- ◯ University of Cape Town
- ◯ Cape Peninsula University of Technology
- ◯ University of the Western Cape
- ◯ University of Fort Hare
- ◯ Walter Sisulu University
- ◯ Nelson Mandela Metropolitan University
- ◯ Rhodes University
- ◯ University of KwaZulu-Natal
- ◯ Mangosuthu University of Technology
- ◯ University of Zululand
- ◯ Durban University of Technology
- ◯ University of the North
- ◯ University of Johannesburg
- ◯ University of Limpopo
- ◯ Vaal University of Technology
- ◯ Central University of Technology
- ◯ University of the Free State

- ◯ University of South Africa
- ◯ University of Venda
- ◯ University of Witwatersrand
- ◯ Other (please specify)

2. **What is your position title?**

- ◯ Chief Information Officer
- ◯ ICT Director
- ◯ Other (please specify)

3. **Does your institution have a published IT Services catalogue?**

- ◯ Yes
- ◯ No

Introduction to the first part of the survey on the LEVEL OF IMPORTANCE of the 34 primary COBIT processes.

The following questions are related to the COBIT 4.1 Framework. The framework attaches a level of importance to each of the 34 high level processes and also identifies them as Primary or Secondary enablers and in some cases neither primary or secondary enablers.

The five focus areas in this framework are:

1) Strategic Alignment,

2) Value Delivery,

3) Resource Management,

4) Risk Management,

5) Performance Measurement.

4. **Please define the LEVEL OF IMPORTANCE that you associate with the ICT**

Governance processes in your institution.

	High	Medium	Low	Not Applicable
PO1 - Define a Strategic Plan	◯	◯	◯	◯
PO2 - Define the Information Architecture	◯	◯	◯	◯
PO3 - Determine the Technological Direction	◯	◯	◯	◯
PO4 - Define the IT Processes, Organization and relationships	◯	◯	◯	◯
PO5 - Manage the IT Investment	◯	◯	◯	◯
PO6 - Communicate Management Aims and Direction	◯	◯	◯	◯
PO7 - Manage IT Human Resources	◯	◯	◯	◯
PO8 - Manage Quality	◯	◯	◯	◯
PO9 - Assess and Manage IT Risks	◯	◯	◯	◯
PO10 - Manage Projects	◯	◯	◯	◯
AI1 - Identify Automated Solutions	◯	◯	◯	◯
AI2 - Acquire and Maintain Application Software	◯	◯	◯	◯
AI3 - Acquire and Maintain Technology Infrastructure	◯	◯	◯	◯
AI4 - Enable Operation and Use	◯	◯	◯	◯
AI5 Procure ICT Resources	◯	◯	◯	◯
AI6 Manage Changes	◯	◯	◯	◯
AI7 Install and Accredit Solutions and Changes	◯	◯	◯	◯
DS1 Define and Manage	◯	◯	◯	◯

Service Levels				
DS2 Manage Third Party Services	◯	◯	◯	◯
DS3 Manage Performance and Capacity	◯	◯	◯	◯
DS4 Ensure Continuous Service	◯	◯	◯	◯
DS5 Ensure Systems Security	◯	◯	◯	◯
DS6 Identify and Allocate Costs	◯	◯	◯	◯
DS7 Educate and Train Users	◯	◯	◯	◯
DS8 Manage Service Desk and Incidents	◯	◯	◯	◯
DS9 Manage the Configuration	◯	◯	◯	◯
DS10 Manage Problems	◯	◯	◯	◯
DS11 Manage Data	◯	◯	◯	◯
DS12 Manage the Physical Environment	◯	◯	◯	◯
DS13 Manage Operations	◯	◯	◯	◯
ME1 Monitor and Evaluate ICT Performance	◯	◯	◯	◯
ME2 Monitor and Evaluate Internal Control	◯	◯	◯	◯
ME3 Ensure Compliance with External Requirements	◯	◯	◯	◯
ME4 Provide ICT Governance	◯	◯	◯	◯

Introduction to the second part of the survey on the classification of the 34 primary COBIT processes into PRIMARY OR SECONDARY ENABLERS.

The COBIT Model only defines PRIMARY or SECONDARY enablers. The objective of the following 5 questions is to ascertain the certainty with which Senior ICT staff at tertiary institutions believe that the 34 primary COBIT processes are ***primary***, ***secondary*** or ***not applicable*** in the context of the question. Option is provided for an intermediate stage that is 'tending' or 'between' the norms defined, and non-applicability.

An example of how to approach the following 5 questions is:

In terms of *Strategic Alignment*, do I think that: *Defining a Strategic Plan* is, *Primary*, *Secondary*, *Not Applicable* or *Tending* to either of these?

5. **Please indicate your choice of PRIMARY or SECONDARY ENABLER of the ICT Governance processes for the *STRATEGIC ALIGNMENT* FOCUS AREA of COBIT.**

	Primary	Tending to Primary	Not Applicable in the STRATEGIC ALIGNMENT FOCUS AREA	Tending to secondary	Secondary
PO1 - Define a Strategic Plan	◯	◯	◯	◯	◯
PO2 - Define the Information Architecture	◯	◯	◯	◯	◯
PO3 - Determine the Technological Direction	◯	◯	◯	◯	◯
PO4 - Define the IT Processes, Organization and relationships	◯	◯	◯	◯	◯
PO5 - Manage the IT Investment	◯	◯	◯	◯	◯
PO6 - Communicate Management Aims and Direction	◯	◯	◯	◯	◯

PO7 - Manage IT Human Resources	◯	◯	◯	◯	◯
PO8 - Manage Quality	◯	◯	◯	◯	◯
PO9 - Assess and Manage IT Risks	◯	◯	◯	◯	◯
PO10 - Manage Projects	◯	◯	◯	◯	◯
AI1 - Identify Automated Solutions	◯	◯	◯	◯	◯
AI2 - Acquire and Maintain Application Software	◯	◯	◯	◯	◯
AI3 - Acquire and Maintain Technology Infrastructure	◯	◯	◯	◯	◯
AI4 - Enable Operation and Use	◯	◯	◯	◯	◯
AI5 Procure ICT Resources	◯	◯	◯	◯	◯
AI6 Manage Changes	◯	◯	◯	◯	◯
AI7 Install and Accredit Solutions and Changes	◯	◯	◯	◯	◯
DS1 Define and Manage Service Levels	◯	◯	◯	◯	◯
DS2 Manage Third Party Services	◯	◯	◯	◯	◯
DS3 Manage Performance and Capacity	◯	◯	◯	◯	◯
DS4 Ensure Continuous Service	◯	◯	◯	◯	◯
DS5 Ensure Systems Security	◯	◯	◯	◯	◯
DS6 Identify and	◯	◯	◯	◯	◯

Allocate Costs					
DS7 Educate and Train Users	◯	◯	◯	◯	◯
DS8 Manage Service Desk and Incidents	◯	◯	◯	◯	◯
DS9 Manage the Configuration	◯	◯	◯	◯	◯
DS10 Manage Problems	◯	◯	◯	◯	◯
DS11 Manage Data	◯	◯	◯	◯	◯
DS12 Manage the Physical Environment	◯	◯	◯	◯	◯
DS13 Manage Operations	◯	◯	◯	◯	◯
ME1 Monitor and Evaluate ICT Performance	◯	◯	◯	◯	◯
ME2 Monitor and Evaluate Internal Control	◯	◯	◯	◯	◯
ME3 Ensure Compliance with External Requirements	◯	◯	◯	◯	◯
ME4 Provide ICT Governance	◯	◯	◯	◯	◯

6. **Please indicate your choice of PRIMARY or SECONDARY ENABLER of the ICT Governance processes for the *VALUE DELIVERY* FOCUS AREA of COBIT**

	Primary	Tending to Primary	Not Applicable in the VALUE DELIVERY FOCUS AREA	Tending to secondary	Secondary
PO1 - Define a Strategic Plan	◯	◯	◯	◯	◯
PO2 - Define the Information Architecture	◯	◯	◯	◯	◯
PO3 - Determine the Technological Direction	◯	◯	◯	◯	◯
PO4 - Define the IT Processes, Organization and relationships	◯	◯	◯	◯	◯
PO5 - Manage the IT Investment	◯	◯	◯	◯	◯
PO6 - Communicate Management Aims and Direction	◯	◯	◯	◯	◯
PO7 - Manage IT Human Resources	◯	◯	◯	◯	◯
PO8 - Manage Quality	◯	◯	◯	◯	◯
PO9 - Assess and Manage IT Risks	◯	◯	◯	◯	◯
PO10 - Manage Projects	◯	◯	◯	◯	◯
AI1 - Identify Automated Solutions	◯	◯	◯	◯	◯

AI2 - Acquire and Maintain Application Software	◯	◯	◯	◯	◯
AI3 - Acquire and Maintain Technology Infrastructure	◯	◯	◯	◯	◯
AI4 - Enable Operation and Use	◯	◯	◯	◯	◯
AI5 Procure ICT Resources	◯	◯	◯	◯	◯
AI6 Manage Changes	◯	◯	◯	◯	◯
AI7 Install and Accredit Solutions and Changes	◯	◯	◯	◯	◯
DS1 Define and Manage Service Levels	◯	◯	◯	◯	◯
DS2 Manage Third Party Services	◯	◯	◯	◯	◯
DS3 Manage Performance and Capacity	◯	◯	◯	◯	◯
DS4 Ensure Continuous Service	◯	◯	◯	◯	◯
DS5 Ensure Systems Security	◯	◯	◯	◯	◯
DS6 Identify and Allocate Costs	◯	◯	◯	◯	◯
DS7 Educate and Train Users	◯	◯	◯	◯	◯
DS8 Manage Service Desk and Incidents	◯	◯	◯	◯	◯
DS9 Manage the Configuration	◯	◯	◯	◯	◯
DS10 Manage Problems	◯	◯	◯	◯	◯

DS11 Manage Data	◯	◯	◯	◯	◯
DS12 Manage the Physical Environment	◯	◯	◯	◯	◯
DS13 Manage Operations	◯	◯	◯	◯	◯
ME1 Monitor and Evaluate ICT Performance	◯	◯	◯	◯	◯
ME2 Monitor and Evaluate Internal Control	◯	◯	◯	◯	◯
ME3 Ensure Compliance with External Requirements	◯	◯	◯	◯	◯
ME4 Provide ICT Governance	◯	◯	◯	◯	◯

7. **Please indicate your choice of PRIMARY or SECONDARY ENABLER of the ICT Governance processes for the *RESOURCE MANAGEMENT* FOCUS AREA of COBIT**

	Primary	Tending to Primary	Not Applicable in the RESOURCE MANAGEMENT FOCUS AREA	Tending to secondary	Secondary
PO1 - Define a Strategic Plan	◯	◯	◯	◯	◯
PO2 - Define the Information Architecture	◯	◯	◯	◯	◯
PO3 - Determine the Technological Direction	◯	◯	◯	◯	◯
PO4 - Define the IT Processes, Organization and relationships	◯	◯	◯	◯	◯
PO5 - Manage the IT Investment	◯	◯	◯	◯	◯
PO6 - Communicate Management Aims and Direction	◯	◯	◯	◯	◯
PO7 - Manage IT Human Resources	◯	◯	◯	◯	◯
PO8 - Manage Quality	◯	◯	◯	◯	◯
PO9 - Assess and Manage IT Risks	◯	◯	◯	◯	◯
PO10 - Manage Projects	◯	◯	◯	◯	◯
AI1 - Identify Automated Solutions	◯	◯	◯	◯	◯
AI2 - Acquire and Maintain	◯	◯	◯	◯	◯

Application Software					
AI3 - Acquire and Maintain Technology Infrastructure	◯	◯	◯	◯	◯
AI4 - Enable Operation and Use	◯	◯	◯	◯	◯
AI5 Procure ICT Resources	◯	◯	◯	◯	◯
AI6 Manage Changes	◯	◯	◯	◯	◯
AI7 Install and Accredit Solutions and Changes	◯	◯	◯	◯	◯
DS1 Define and Manage Service Levels	◯	◯	◯	◯	◯
DS2 Manage Third Party Services	◯	◯	◯	◯	◯
DS3 Manage Performance and Capacity	◯	◯	◯	◯	◯
DS4 Ensure Continuous Service	◯	◯	◯	◯	◯
DS5 Ensure Systems Security	◯	◯	◯	◯	◯
DS6 Identify and Allocate Costs	◯	◯	◯	◯	◯
DS7 Educate and Train Users	◯	◯	◯	◯	◯
DS8 Manage Service Desk and Incidents	◯	◯	◯	◯	◯
DS9 Manage the Configuration	◯	◯	◯	◯	◯
DS10 Manage Problems	◯	◯	◯	◯	◯
DS11 Manage Data	◯	◯	◯	◯	◯
DS12 Manage the	◯	◯	◯	◯	◯

Physical Environment					
DS13 Manage Operations	◯	◯	◯	◯	◯
ME1 Monitor and Evaluate ICT Performance	◯	◯	◯	◯	◯
ME2 Monitor and Evaluate Internal Control	◯	◯	◯	◯	◯
ME3 Ensure Compliance with External Requirements	◯	◯	◯	◯	◯
ME4 Provide ICT Governance	◯	◯	◯	◯	◯

8. **Please indicate your choice of PRIMARY or SECONDARY ENABLER of the ICT Governance processes for the *RISK MANAGEMENT* FOCUS AREA of COBIT**

	Primary	Tending to Primary	Not Applicable in the RISK MANAGEMENT FOCUS AREA	Tending to secondary	Secondary
PO1 - Define a Strategic Plan	○	○	○	○	○
PO2 - Define the Information Architecture	○	○	○	○	○
PO3 - Determine the Technological Direction	○	○	○	○	○
PO4 - Define the IT Processes, Organization and relationships	○	○	○	○	○
PO5 - Manage the IT Investment	○	○	○	○	○
PO6 - Communicate Management Aims and Direction	○	○	○	○	○
PO7 - Manage IT Human Resources	○	○	○	○	○
PO8 - Manage Quality	○	○	○	○	○
PO9 - Assess and Manage IT Risks	○	○	○	○	○
PO10 - Manage Projects	○	○	○	○	○
AI1 - Identify Automated Solutions	○	○	○	○	○
AI2 - Acquire and Maintain Application Software	○	○	○	○	○

AI3 - Acquire and Maintain Technology Infrastructure	◯	◯	◯	◯	◯
AI4 - Enable Operation and Use	◯	◯	◯	◯	◯
AI5 Procure ICT Resources	◯	◯	◯	◯	◯
AI6 Manage Changes	◯	◯	◯	◯	◯
AI7 Install and Accredit Solutions and Changes	◯	◯	◯	◯	◯
DS1 Define and Manage Service Levels	◯	◯	◯	◯	◯
DS2 Manage Third Party Services	◯	◯	◯	◯	◯
DS3 Manage Performance and Capacity	◯	◯	◯	◯	◯
DS4 Ensure Continuous Service	◯	◯	◯	◯	◯
DS5 Ensure Systems Security	◯	◯	◯	◯	◯
DS6 Identify and Allocate Costs	◯	◯	◯	◯	◯
DS7 Educate and Train Users	◯	◯	◯	◯	◯
DS8 Manage Service Desk and Incidents	◯	◯	◯	◯	◯
DS9 Manage the Configuration	◯	◯	◯	◯	◯
DS10 Manage Problems	◯	◯	◯	◯	◯
DS11 Manage Data	◯	◯	◯	◯	◯
DS12 Manage the Physical Environment	◯	◯	◯	◯	◯

DS13 Manage Operations	◯	◯	◯	◯	◯
ME1 Monitor and Evaluate ICT Performance	◯	◯	◯	◯	◯
ME2 Monitor and Evaluate Internal Control	◯	◯	◯	◯	◯
ME3 Ensure Compliance with External Requirements	◯	◯	◯	◯	◯
ME4 Provide ICT Governance	◯	◯	◯	◯	◯

9. **Please indicate your choice of PRIMARY or SECONDARY ENABLER of the ICT Governance processes for the *PERFORMANCE MEASUREMENT* FOCUS AREA of COBIT**

	Primary	Tending to Primary	Not Applicable in the PERFORMANCE MEASUREMENT FOCUS AREA	Tending to secondary	Secondary
PO1 - Define a Strategic Plan	◯	◯	◯	◯	◯
PO2 - Define the Information Architecture	◯	◯	◯	◯	◯
PO3 - Determine the Technological Direction	◯	◯	◯	◯	◯
PO4 - Define the IT Processes, Organization and relationships	◯	◯	◯	◯	◯
PO5 - Manage the IT Investment	◯	◯	◯	◯	◯
PO6 - Communicate Management Aims and Direction	◯	◯	◯	◯	◯
PO7 - Manage IT Human Resources	◯	◯	◯	◯	◯
PO8 - Manage Quality	◯	◯	◯	◯	◯
PO9 - Assess and Manage IT Risks	◯	◯	◯	◯	◯
PO10 - Manage Projects	◯	◯	◯	◯	◯
AI1 - Identify Automated Solutions	◯	◯	◯	◯	◯
AI2 - Acquire and Maintain Application	◯	◯	◯	◯	◯

Software					
AI3 - Acquire and Maintain Technology Infrastructure	◯	◯	◯	◯	◯
AI4 - Enable Operation and Use	◯	◯	◯	◯	◯
AI5 Procure ICT Resources	◯	◯	◯	◯	◯
AI6 Manage Changes	◯	◯	◯	◯	◯
AI7 Install and Accredit Solutions and Changes	◯	◯	◯	◯	◯
DS1 Define and Manage Service Levels	◯	◯	◯	◯	◯
DS2 Manage Third Party Services	◯	◯	◯	◯	◯
DS3 Manage Performance and Capacity	◯	◯	◯	◯	◯
DS4 Ensure Continuous Service	◯	◯	◯	◯	◯
DS5 Ensure Systems Security	◯	◯	◯	◯	◯
DS6 Identify and Allocate Costs	◯	◯	◯	◯	◯
DS7 Educate and Train Users	◯	◯	◯	◯	◯
DS8 Manage Service Desk and Incidents	◯	◯	◯	◯	◯
DS9 Manage the Configuration	◯	◯	◯	◯	◯
DS10 Manage Problems	◯	◯	◯	◯	◯
DS11 Manage Data	◯	◯	◯	◯	◯
DS12 Manage the	◯	◯	◯	◯	◯

Physical Environment					
DS13 Manage Operations	◯	◯	◯	◯	◯
ME1 Monitor and Evaluate ICT Performance	◯	◯	◯	◯	◯
ME2 Monitor and Evaluate Internal Control	◯	◯	◯	◯	◯
ME3 Ensure Compliance with External Requirements	◯	◯	◯	◯	◯
ME4 Provide ICT Governance	◯	◯	◯	◯	◯

The next set of questions relates to the Maturity Level of the 34 IT COBIT 4.1 processes in your institution.

The possible maturity levels that your institution may identify with are as follows:

1. Non-existent—Complete lack of any recognizable processes. The enterprise has not even recognized that there is an issue to be addressed.
2. Initial/Ad Hoc—There is evidence that the enterprise has recognized that the issues exist and need to be addressed. There are, however, no standardized processes; instead there are ad hoc approaches that tend to be applied on an individual or case-by-case basis. The overall approach to management is disorganized.
3. Repeatable but Intuitive—Processes have developed to the stage where similar procedures are followed by different people undertaking the same task. There is no formal training or communication of standard procedures, and responsibility is left to the individual. There is a high degree of reliance on the knowledge of individuals and, therefore, errors are likely.
4. Defined Process—Procedures have been standardized and documented, and communicated through training. ICT is mandated that these processes should be followed; however it is unlikely that deviations will be detected. The procedures

themselves are not sophisticated but are the formalization of existing practices.

5. Managed and Measurable—Management monitors and measures compliance with procedures and takes action where processes appear not to be working effectively. Processes are under constant improvement and provide good practice. Automation and tools are used in a limited or fragmented way.
6. Optimized—Processes have been refined to a level of good practice, based on the results of continuous improvement and maturity modelling with other enterprises. ICT is used in an integrated way to automate the workflow, providing tools to improve quality and effectiveness, making the enterprise quick to adapt.

10. **Please select the maturity level that your institution best identifies with.**

	1 – Non Existent	2 – Initial / Ad Hoc	3 – Repeatable but Intuitive	4 - Defined	5 – Managed and Measurable	6 - Optimized
PO1 - Define a Strategic Plan	◯	◯	◯	◯	◯	◯
PO2 - Define the Information Architecture	◯	◯	◯	◯	◯	◯
PO3 - Determine the Technological Direction	◯	◯	◯	◯	◯	◯
PO4 - Define the IT Processes, Organization and relationships	◯	◯	◯	◯	◯	◯
PO5 - Manage the IT Investment	◯	◯	◯	◯	◯	◯
PO6 - Communicate Management Aims and Direction	◯	◯	◯	◯	◯	◯
PO7 - Manage IT Human Resources	◯	◯	◯	◯	◯	◯
PO8 - Manage Quality	◯	◯	◯	◯	◯	◯
PO9 - Assess and Manage IT Risks	◯	◯	◯	◯	◯	◯
PO10 - Manage Projects	◯	◯	◯	◯	◯	◯
AI1 - Identify Automated Solutions	◯	◯	◯	◯	◯	◯
AI2 - Acquire and Maintain Application	◯	◯	◯	◯	◯	◯

Software						
AI3 - Acquire and Maintain Technology Infrastructure	◯	◯	◯	◯	◯	◯
AI4 - Enable Operation and Use	◯	◯	◯	◯	◯	◯
AI5 Procure ICT Resources	◯	◯	◯	◯	◯	◯
AI6 Manage Changes	◯	◯	◯	◯	◯	◯
AI7 Install and Accredit Solutions and Changes	◯	◯	◯	◯	◯	◯
DS1 Define and Manage Service Levels	◯	◯	◯	◯	◯	◯
DS2 Manage Third Party Services	◯	◯	◯	◯	◯	◯
DS3 Manage Performance and Capacity	◯	◯	◯	◯	◯	◯
DS4 Ensure Continuous Service	◯	◯	◯	◯	◯	◯
DS5 Ensure Systems Security	◯	◯	◯	◯	◯	◯
DS6 Identify and Allocate Costs	◯	◯	◯	◯	◯	◯
DS7 Educate and Train Users	◯	◯	◯	◯	◯	◯
DS8 Manage Service Desk and Incidents	◯	◯	◯	◯	◯	◯
DS9 Manage the Configuration	◯	◯	◯	◯	◯	◯
DS10 Manage Problems	◯	◯	◯	◯	◯	◯
DS11 Manage Data	◯	◯	◯	◯	◯	◯
DS12 Manage the Physical Environment	◯	◯	◯	◯	◯	◯
DS13 Manage Operations	◯	◯	◯	◯	◯	◯
ME1 Monitor and Evaluate ICT Performance	◯	◯	◯	◯	◯	◯
ME2 Monitor and Evaluate Internal Control	◯	◯	◯	◯	◯	◯
ME3 Ensure Compliance	◯	◯	◯	◯	◯	◯

with External Requirements						
ME4 Provide ICT Governance	◯	◯	◯	◯	◯	◯

Annexure D: ICT and Business Alignment Survey

This survey forms part of my ICT governance PHD studies at the Nelson Mandela Metropolitan University in Port Elizabeth.

My promoter is Professor Rossouw von Solms (NMMU) and co-promoter is Professor Stephen Flowerday (UFH). The responses to this survey will not be published in a manner that will identify individual institutions.

The responses will also be reported at the next ASAUDIT meeting. Only once all mandatory questions in the survey are completed will you be able to save the survey.

The save button is at the end of the form.

This survey should take no more than 20 minutes to complete. Thank you in anticipation of your response!

Chris Johl, CIO, University of Fort Hare, Cell No: 079 520 4414

11. **Which Tertiary Institution in South Africa are you the ICT Director/CIO of?**

- ◯ University of Stellenbosch
- ◯ University of Pretoria
- ◯ Tshwane University of Technology
- ◯ University of Cape Town
- ◯ Cape Peninsula University of Technology
- ◯ University of the Western Cape
- ◯ University of Fort Hare
- ◯ Walter Sisulu University
- ◯ Nelson Mandela Metropolitan University
- ◯ Rhodes University
- ◯ University of KwaZulu-Natal
- ◯ Mangosuthu University of Technology
- ◯ University of Zululand
- ◯ Durban University of Technology
- ◯ University of the North
- ◯ University of Johannesburg
- ◯ University of Limpopo

- ◯ Vaal University of Technology
- ◯ Central University of Technology
- ◯ University of the Free State
- ◯ University of South Africa
- ◯ University of Venda
- ◯ University of Witwatersrand
- ◯ Other (please specify)

12. **In which role are you employed?**

- ◯ CIO or ICT Director
- ◯ Senior Academic
- ◯ Administration Management
- ◯ Other (please specify)

Jerry Luftman's alignment maturity model has six components of alignment maturity: Assessing ICT and Business alignment in:

(1) Communication

(2) Metrics

(3) Governance

(4) Partnerships

(5) Technology

(6) Human resources practices.

The model has been adapted for the tertiary education environment

Please select the most appropriate level of alignment where the choices offered are matched to a level of alignment between 1 and 5 where:

Level 1 is without process or not aligned at all

Level 2 is beginning process

Level 3 is establishing process

Level 4 is improving process

Level 5 is optimized process or complete alignment

Component 1: Assessing ICT and Business alignment in COMMUNICATION PRACTICES

13. **Criterion 1: Understanding of the business (of tertiary education) by ICT**

- ◯ IT management lacks understanding
- ◯ Limited understanding by ICT management
- ◯ Good understanding by ICT management
- ◯ Understanding encouraged amongst ICT staff
- ◯ Understanding required of all ICT staff

14. **Criterion 2: Understanding of ICT by the business (of tertiary education)**

- ◯ Managers lack understanding
- ◯ Limited understanding by managers
- ◯ Good understanding by managers
- ◯ Understanding encouraged amongst staff
- ◯ Understanding required of staff

15. **Criterion 3: Organizational learning**

- ◯ Casual conversation and meetings
- ◯ Newsletters, reports and group email
- ◯ Training and departmental meetings
- ◯ Formal methods sponsored by senior management
- ◯ Learning monitored for effectiveness

16. **Criterion 4: Style and ease of access**

- ◯ Business to ICT only; formal
- ◯ One way, somewhat informal
- ◯ Two way, formal
- ◯ Two way somewhat informal
- ◯ Two way informal and flexible

17. **Criterion 5: Leveraging intellectual assets**

- ◯ Ad hoc
- ◯ Some structured sharing emerging
- ◯ Structured around key processes
- ◯ Formal sharing at all levels
- ◯ Formal sharing with partners

18. **Criterion 6: ICT and Business liaison staff**

- ◯ None or use only as needed
- ◯ Primary ICT and business link
- ◯ Facilitate knowledge transfer
- ◯ Facilitate relationship building
- ◯ Building relationships with partners

Component 2: Assessing ICT and Business alignment in METRICS practices

19. **Criterion 1: ICT metrics**

- ◯ Technical only
- ◯ Technical and cost; metrics rarely reviewed
- ◯ Review, act on technical, Value of Investment (VOI) metrics
- ◯ Also measure effectiveness
- ◯ Also measure business operations and partners

20. **Criterion 2: Business metrics**

- ◯ ICT investments measured rarely if ever
- ◯ Unit cost calculated but rarely reviewed
- ◯ Review and act on Value of investment (VOI) and cost
- ◯ Also measure customer value
- ◯ Balanced scorecard and partners included

21. **Criterion 3: Link between ICT and business metrics**

- ◯ Value of ICT investments rarely measured
- ◯ Business and ICT metrics not linked
- ◯ Business and ICT metrics becoming linked
- ◯ Formal, linked, reviewed and acted upon
- ◯ Balanced scorecard and includes partners

22. **Criterion 4: Service level agreements**

- ◯ Used sporadically
- ◯ Used with units for technology performance
- ◯ Used with units becoming enterprise wide
- ◯ Enterprise wide
- ◯ Includes partners

23. **Criterion 5: Benchmarking**

- ◯ Seldom or never
- ◯ Sometimes benchmark informally
- ◯ May benchmark formally but seldom act
- ◯ Routinely benchmark, usually act
- ◯ Routinely benchmark, act and measure results

24. **Criterion 6: Formally assess ICT investment**

- ◯ Don't assess
- ◯ Only when there is a problem
- ◯ Becoming a routine occurrence
- ◯ Routinely assess and act on findings
- ◯ Routinely assess, act and measure results

25. **Criterion 7: Continuous improvement practices**

- ◯ None
- ◯ Few, effectiveness not measured
- ◯ Few, starting to measure effectiveness
- ◯ Many, frequently measure effectiveness
- ◯ Practices and measures well established

Component 3: Assessing ICT and Business alignment in GOVERNANCE practices

26. **Criterion 1: Formal business strategy planning**

- ◯ Not done or done as needed
- ◯ At unit functional level ... slight ICT input
- ◯ Some ICT input and cross functional planning
- ◯ At unit and enterprise with ICT
- ◯ With IT and partners

27. **Criterion 2: Formal ICT strategy planning**

- ◯ Not done or done as needed
- ◯ At unit functional level ... slight business input
- ◯ Some business input and cross functional planning
- ◯ At unit and enterprise with business
- ◯ With partners

28. **Criterion 3: Organisational structure**

- ◯ Centralized or decentralised
- ◯ Central/decentralise some co-location
- ◯ Central/decentralise or federal
- ◯ Federal

29. **Criterion 4: Reporting relationships**

- ◯ CIO reports to CFO
- ◯ CIO reports to COO
- ◯ CIO reports to COO or CEO
- ◯ CIO reports to the Vice Chancellor

30. **Criterion 5: How ICT is budgeted**

- ◯ Cost Centre, spending is unpredictable
- ◯ Cost centre by unit
- ◯ Some projects treated as investments
- ◯ ICT treated as investment
- ◯ ICT profit centre

31. **Criterion 6: Rationale for ICT spending**

- ◯ Reduce costs
- ◯ Productivity, efficiency
- ◯ Also a process enabler
- ◯ Process driver, strategy enabler
- ◯ Competitive advantage, profit

32. **Criterion 7: Senior level ICT steering committee**

- ◯ Don't have
- ◯ Meet informally as needed
- ◯ Formal committees meet regularly
- ◯ Proven to be effective
- ◯ Also includes external partners

33. **Criterion 8: How projects are prioritized**

- ◯ React to business or ICT need
- ◯ Determined by ICT function
- ◯ Determined by business function

- ◯ Mutually determined
- ◯ Partner's priorities are also considered

Component 4: Assessing ICT and Business alignment in PARTNERSHIPS practices

34. **Criterion 1: Business perception of ICT**

- ◯ Cost of doing business
- ◯ Becoming an asset
- ◯ Enables future business activity
- ◯ Drives future business activity
- ◯ Partner with business in creating value

35. **Criterion 2: ICTs role in strategic business planning**

- ◯ Not involved
- ◯ Enables business processes
- ◯ Drives business processes
- ◯ Enables or drives business strategy
- ◯ ICT and business adapt quickly to change

36. **Criterion 3: Shared risks and rewards**

- ◯ ICT takes all the risks and receives no rewards
- ◯ ICT takes most risks with little reward
- ◯ ICT and business start sharing risks and rewards
- ◯ Risks and rewards always shared
- ◯ Managers incentivised to take risks

37. **Criterion 4: Managing the ICT and Business relationship**

- ◯ ICT and business relationship is not managed
- ◯ Managed on an ad hoc basis
- ◯ Processes exist but not always followed
- ◯ Processes exist and complied with
- ◯ Processes are continuously improved

38. **Criterion 5: Internal relationship/trust style**

- ◯ Conflict and mistrust
- ◯ Transactional relationship
- ◯ ICT becoming a valued service provider

- ◯ Long-term partnership
- ◯ Partner and trusted vendor of ICT services

39. **Criterion 6: Business sponsors/champions**

- ◯ Usually none
- ◯ Often have a senior ICT sponsor/champion
- ◯ ICT and business sponsor/champion at unit level
- ◯ Business sponsor/champion at Senior Management level
- ◯ Vice Chancellor is the business sponsor/champion

Component 5: Assessing ICT and Business alignment in TECHNOLOGY practices

40. **Criterion 1: Primary systems**

- ◯ Traditional office support
- ◯ Transaction oriented
- ◯ Business process enabler
- ◯ Business process driver
- ◯ Business strategy enabler/driver

41. **Criterion 2: Standards**

- ◯ Not enforced
- ◯ Defined and enforced at functional level
- ◯ Emerging coordination across functions
- ◯ Defined and enforced across functions
- ◯ Also coordinated with partners

42. **Criterion 3: Architectural integration**

- ◯ Not well integrated
- ◯ Within unit
- ◯ Integrated across functions
- ◯ Begins to be integrated with partners
- ◯ Integrated with partners

43. **Criterion 4: How ICT infrastructure is perceived**

- ◯ Utility run at minimal cost
- ◯ Becoming driven by business strategy

- ◯ Driven by business strategy
- ◯ Beginning to help business respond to change
- ◯ Enables fast response to changing market

Component 6: Assessing ICT and Business alignment in HUMAN RESOURCES practices

44. **Criterion 1: Innovative and entrepreneurial environment**

- ◯ Discouraged
- ◯ Somewhat encouraged at unit level
- ◯ Strongly encouraged at unit level
- ◯ Also at corporate level
- ◯ Also with partners

45. **Criterion 2: Key ICT HR decisions made by**

- ◯ Top ICT and business management at corporate
- ◯ Same with emerging functional influence
- ◯ Top business and unit management: ICT advises
- ◯ Top business and ICT management across the university
- ◯ Top management across the university and partners

46. **Criterion 3: Change readiness**

- ◯ Tend to resist change
- ◯ Change readiness programmes emerging
- ◯ Programmes in place at functional level
- ◯ Programmes in place at corporate level
- ◯ Also proactive and anticipate change

47. **Criterion 4: Career cross-over opportunities**

- ◯ Job transfers rarely occur
- ◯ Occasionally occur within the unit
- ◯ Regularly occur for unit management
- ◯ Regularly occur at all unit levels
- ◯ Also at corporate level

48. **Criterion 5: Cross functional training and job rotation**

- ◯ No opportunities
- ◯ Led by units
- ◯ Formal programmes run by all units
- ◯ Also across the university
- ◯ Also with partners

49. **Criterion 6: Social interaction**

- ◯ Minimal ICT and Business interaction
- ◯ Strictly a business only relationship
- ◯ Trust and confidence is starting
- ◯ Trust and confidence achieved
- ◯ Attained with customers and partners

50. **Criterion 7: Attract and retain top talent**

- ◯ No retention program and poor recruiting
- ◯ ICT hiring focused on technical skills
- ◯ Technology and business focus retention program
- ◯ Formal program for hiring and retaining
- ◯ Effective program for hiring and retaining

Annexure E: Survey on Final Validation of the Value Framework

Dear CIO/IT Director,

You are invited to participate in this survey, as the highest ranking ICT employee at your institution as it is the employee at this position in the organization that will be able to recognize the value of the ICT and business issues that span the governance and management domains.

This survey is aimed at validating the ICT governance Value Framework developed within this joint research project between the Nelson Mandela Metropolitan University in Port Elizabeth and the University of Fort Hare. This validation survey is the final step in this research project.

Please run and listen to the attached PowerPoint presentation that highlights core information used to build the ICT Value Framework.

A question on each aspect of the Framework will require a response on a Likert Scale of 5 choices between: strongly disagree, disagree, neutral, agree, and strongly agree. This will be followed by an opportunity to provide a semi-structured text response to submit any moderating information that you may wish to add.

The responses to this survey will be used in the research report respecting the anonymity of the participating institutions.

The PowerPoint presentation runs for 30 minutes and resultant survey should take no more than 30 minutes to complete!

Thank you in anticipation of your response!

Chris Johl, CIO, University of Fort Hare, Cell No: 079 520 4414

Please see the attached Power Point presentation; particularly slide 5 showing the ICT Value Framework for Public Higher Education in South Africa, to respond to this survey.						
1	The public higher education system can be seen as an open system that has 23 institutions as subsystems	Strongly Disagree ◯	Disagree ◯	Neutral ◯	Agree ◯	Strongly Agree ◯
Comments						
2	The direct-execute-control governance cycle first emerging in the ISO 38500 governance standard, and later adapted by Von Solms and Von Solms, is applicable *internally* to the 23 public higher education institutions as indicated by arrows 19, 20 and 21 in slide 5 of the attached Power Point presentation.	Strongly Disagree ◯	Disagree ◯	Neutral ◯	Agree ◯	Strongly Agree ◯
Comments						
3	The direct-execute-control governance cycle first emerging in the ISO 38500 governance standard , and later adapted by Von Solms and Von Solms, is applicable *externally* between the DHET and institutions as indicated by arrows 14, 31 and 16	Strongly Disagree ◯	Disagree ◯	Neutral ◯	Agree ◯	Strongly Agree ◯
Comments						
4	The direct element of the governance cycle indicated by arrow 14 from the DHET as the *principal* to institutions as the	Strongly Disagree ◯	Disagree ◯	Neutral ◯	Agree ◯	Strongly Agree ◯

	agents uses the Higher Education Act 101 of 1997 as the governance mechanism to pass the governance mandate from DHET to institutions more on Agency Theory					
Comments						
5	There is a barrier, indicated by arrow 13 to the transfer of the governance mandate indicated by the direct element of the governance cycle and shown by arrow 14 between the DHET and institutions (inter-system) and this barrier can be the interpretation of Act 101 of 1997 by institutions	Strongly Disagree ◯	Disagree ◯	Neutral ◯	Agree ◯	Strongly Agree ◯
Comments						
6	The internal direct-execute-control cycle indicated by arrows 19, 20 and 21 *is also* the external *execute* element of the inter-system governance cycle shown by arrow 31	Strongly Disagree ◯	Disagree ◯	Neutral ◯	Agree ◯	Strongly Agree ◯
Comments						
7	The inter-system *control* element of the governance cycle is regulation R691 as defined in the higher education Act 101 of 1997	Strongly Disagree ◯	Disagree ◯	Neutral ◯	Agree ◯	Strongly Agree ◯
Comments						
8	There are intra-system aspects of governance that can be used to increase the level of granularity of governance internally within an	Strongly Disagree ◯	Disagree ◯	Neutral ◯	Agree ◯	Strongly Agree ◯

	organization. The first of these is *Legislation* and is shown by callout 22. Legislation is the starting point of governance in a system such as the public higher education system					
Comments						
9	The second aspect of governance is *Translation to Policy* and is shown by callout 24.	Strongly Disagree ◯	Disagree ◯	Neutral ◯	Agree ◯	Strongly Agree ◯
Comments						
10	The third aspect of governance is *Application of Policy* and is shown by callout 24.	Strongly Disagree ◯	Disagree ◯	Neutral ◯	Agree ◯	Strongly Agree ◯
Comments						
11	The fourth aspect of governance is *Alignment/Fit* and is shown by callout 24.	Strongly Disagree ◯	Disagree ◯	Neutral ◯	Agree ◯	Strongly Agree ◯
Comments						
12	The fifth aspect of governance is *Acceptance of Technology* and is shown by callout 24.	Strongly Disagree ◯	Disagree ◯	Neutral ◯	Agree ◯	Strongly Agree ◯
Comments						
13	The first barrier to internal institutional governance is *institutional autonomy and academic freedom* and is shown by callout 23 (Legislation). (Please see the mapping of aspects of governance to layers of governance on slide 4: The first two layers of governance map to legislative aspects of governance, hence both question 13 and 14 refer to callout 23 on the diagram on slide 5)	Strongly Disagree ◯	Disagree ◯	Neutral ◯	Agree ◯	Strongly Agree ◯
Comments						

14	The second barrier to internal institutional governance is *Limited ICT Governance Expertise at Executive levels and CIO not usually on Council* and is shown by callout 23 (Legislation).	Strongly Disagree ◯	Disagree ◯	Neutral ◯	Agree ◯	Strongly Agree ◯
Comments						
15	The third barrier to internal institutional governance is *translation of governance aims to policy and procedure* and is shown by callout 25.	Strongly Disagree ◯	Disagree ◯	Neutral ◯	Agree ◯	Strongly Agree ◯
Comments						
16	The fourth barrier to internal institutional governance is *Knowledge of Policies and Framework Requirements* and is shown by callout 27.	Strongly Disagree ◯	Disagree ◯	Neutral ◯	Agree ◯	Strongly Agree ◯
Comments						
17	The fifth barrier to internal institutional governance is *Appropriate Technology and Labour with Appropriate Capacity* and is shown by callout 29.	Strongly Disagree ◯	Disagree ◯	Neutral ◯	Agree ◯	Strongly Agree ◯
Comments						
18	The direct-execute-control governance cycle is applicable *internally* to the ministerial level of governance as indicated by arrows 1, 2 and 3	Strongly Disagree ◯	Disagree ◯	Neutral ◯	Agree ◯	Strongly Agree ◯
Comments						
19	The same aspects of governance	Strongly	Disagree	Neutral	Agree	Strongly

	applicable at the institutional level are applicable at the DHET level and higher.	Disagree ○	○	○	○	Agree ○
Comments						
20	The public higher education **root of governance** is located at the DHET, where the Higher Education Act 101 of 1997, as amended, has its foundation	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○
Comments						
21	The normally singular reference to governance has been layered into six layers of governance. The increased granularity of governance allows for better identification of appropriate governance organs and mechanisms for more appropriate control	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○
Comments						
22	The architecture of the ICT Value Framework depicted on slide 5 helps to understand ICT governance in the context of public higher education in South Africa	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○
Comments						
23	The ICT governance value framework architecture detail diagram on slide 5, (with some detail on slide 4) fairly represents the layers of governance and their inhibitors, aspects, organs and	Strongly Disagree ○	Disagree ○	Neutral ○	Agree ○	Strongly Agree ○

	mechanisms of governance that are applicable in the public higher education sector in South Africa					
Comments						
24	The overall *Value Framework* depicted in this study has capacity to improve governance, specifically ICT governance in public higher education institutions.	Strongly Disagree ◯	Disagree ◯	Neutral ◯	Agree ◯	Strongly Agree ◯
Comments						

Annexure F: ICT Pervasiveness Factor Mappings

PERVASIVENESS FACTOR MAPPINGS TO KARAISKOS AND PUBLIC HIGHER EDUCATION SOUTH AFRICA, RATIONALE					
Factor	Pervasiveness Factors HE RSA	HE RSA Factor Classification	Pervasiveness Factors Karaiskos	Second Tier Factors Karaiskos	Rationale HE RSA
1	How many students were registered at your institution during 2010. The headcount is available in Hemis table 2.7 The headcount for 2010 may not be audited yet. Please provide the figure submitted to the Department of Higher Education and Training.	Size	Facilitating Conditions	Perceived Monetary Value	Cost per Graduate
2	Does the CIO/ICT Director in your university report to the Vice Chancellor?	Influence	Social Factors	Social Influence	IT Governance impact of second tier reporting
3	Does your Institution have a Council ICT Governance or Steering Committee?	Influence	Social Factors	Social Influence	IT Governance impact of second tier reporting
4	Does your Institutions CIO/ICT Director sit on the Council IT Governance or ICT Steering Committee?	Influence	Social Factors	Social Influence	ICT Governance impact of second tier reporting
5	Is your Institutions CIO/ICT Director a member of the Council Audit Committee?	Influence	Social Factors	Social Influence	ICT Governance impact of second tier reporting
6	What was your ICT spend in 2010 for operational expenses?	Budget	Facilitating Conditions	Perceived Monetary Value	Cost per Graduate
7	What was your ICT spend in 2010 for capital expenditure?	Budget	Facilitating Conditions	Perceived Monetary Value	Cost per Graduate
8	What was your ICT spend in 2010 for Personnel expenditure?	Budget	Facilitating Conditions	Perceived Monetary Value	Cost per Graduate
10	What was your ICT OPERATIONAL EXPENDITURE in 2010 as a percentage of total operational expenditure for the entire institution?	Budget	Facilitating Conditions	Perceived Monetary Value	Cost per Graduate
11	What was your ICT CAPITAL EXPENDITURE in 2010 as a percentage of total Capital expenditure for the entire institution?	Budget	Facilitating Conditions	Perceived Monetary Value	Cost per Graduate

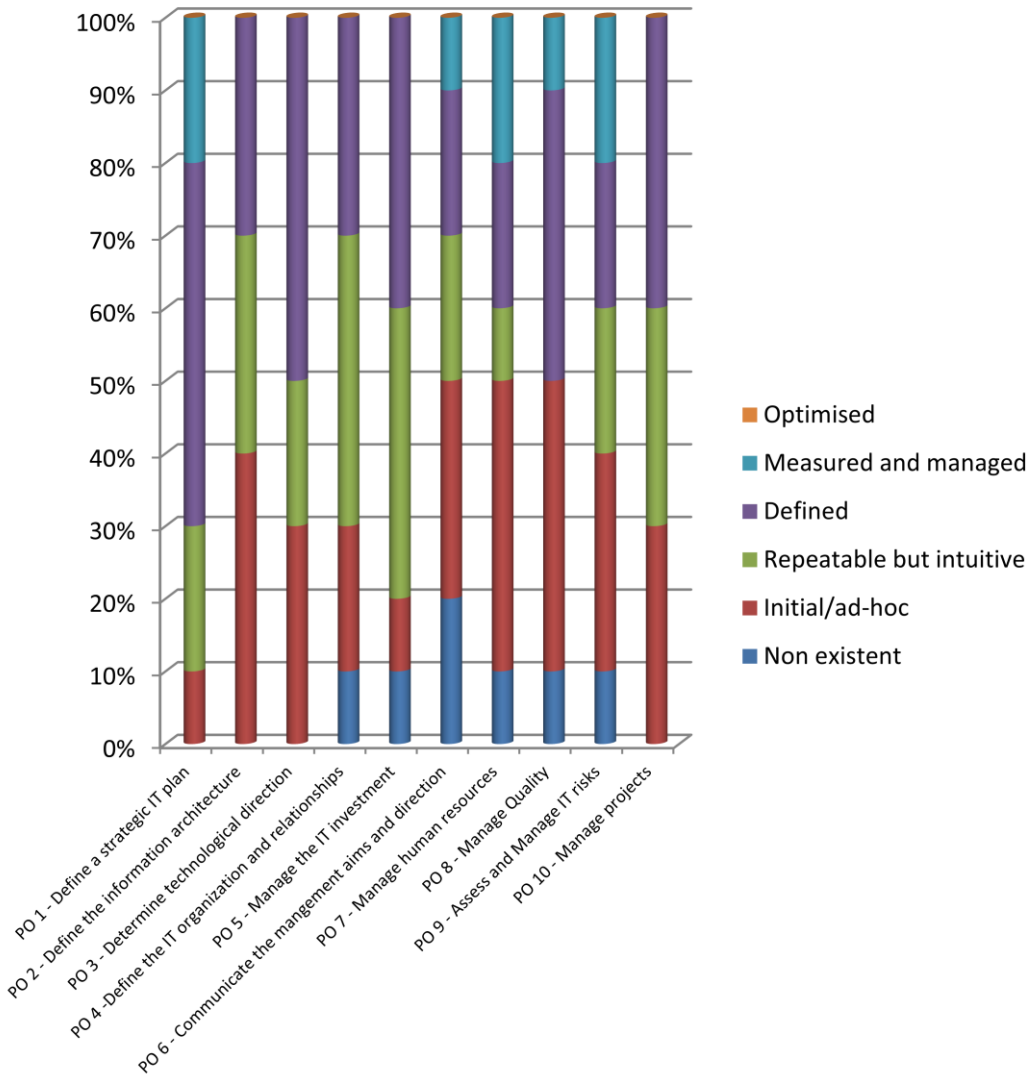
12	What was your ICT PERSONNEL EXPENDITURE in 2010 as a percentage of total personnel expenditure for the entire institution?	Budget	Facilitating Conditions	Perceived Monetary Value	Cost per Graduate
13	What was the total number of Employees at your institution at the end of 2010.	Size	Facilitating Conditions	Perceived Monetary Value	Cost per Graduate
14	Does your institution provide laboratory computers for students to access the Internet?	Access	Cognitive Factors	Performance Expectancy	Improved Throughput
15	How many laboratory computers provided by your institution were available to students during 2010? Include all open access laboratory computers, i.e., computers that any student can use at any time that the lab is open.	Access	Cognitive Factors	Performance Expectancy	Improved Throughput
16	How many FTE ICT staff members were employed by your institution during 2010? Please include all ICT staff that are both centralized and decentralized	Size	Facilitating Conditions	Perceived Monetary Value	Cost per Graduate
17	Does your institution provide students their own laptops as part of their study fee?	Technology	Cognitive Factors	Performance Expectancy	Improved Throughput
18	Does your institution provide any type of wireless connectivity to those students who have their own computers?	Connectivity	Cognitive Factors	Performance Expectancy	Improved Throughput
19	What is the BACKBONE bandwidth capacity that connects your institution to the Internet? (If yours is a multi-campus institution, the HIGHEST CONNECTION bandwidth of all access points) Please give the answer in Mega bytes	Connectivity	Cognitive Factors	Performance Expectancy	Improved Throughput
20	What is the INTERNATIONAL bandwidth capacity that connects your institution to the Internet? (If yours is a multi-campus institution, the SUM OF THE CONNECTION bandwidth of all access points) Please give the answer in Megabytes	Connectivity	Cognitive Factors	Performance Expectancy	Improved Throughput
21	Does your institution provide electronic mail for all staff?	Systems	Facilitating Conditions	Perceived Monetary Value	Efficiency
22	Does your institution provide electronic mail for all students?	Systems	Facilitating Conditions	Perceived Monetary Value	Efficiency
23	Do all staff have Internet access on campus?	Access	Facilitating Conditions	Perceived Monetary Value	Efficiency
24	Does your institution provide students with Internet access on campus?	Access	Facilitating Conditions	Perceived Monetary Value	Improved Throughput
25	Does your institution provide Internet access to students in the residences?	Access	Cognitive Factors	Performance Expectancy	Improved Throughput

26	How many teaching venues have presentation equipment, i.e., Video Projectors and/or sound fitted or available for use	Technology	Cognitive Factors	Performance Expectancy	Improved Throughput
27	How many full Video Conferencing suites/venues does your institution have installed? Include all suites that have typical meeting type video conferencing equipment such as Polycom or Tandberg etc.	Technology	Cognitive Factors	Performance Expectancy	Improved Throughput
28	What is the average occupation of these suites per day? (If there is a waiting list of users that cannot be accommodated, then a figure exceeding 100% but less than 200% can be captured)	Technology	Cognitive Factors	Performance Expectancy	Improved Throughput
29	For what purposes are the video conferencing suites used?	Technology	Cognitive Factors	Performance Expectancy	Improved Throughput
30	Does your institution make use of Smart Board technology?	Technology	Cognitive Factors	Performance Expectancy	Improved Throughput
31	Please estimate the percentage of teaching venues that make use of Smart Board technology.	Technology	Cognitive Factors	Performance Expectancy	Improved Throughput
32	Please estimate the percentage of meeting venues that make use of Smart Board technology.	Technology	Cognitive Factors	Performance Expectancy	Improved Throughput
33	Does your institution make use of clickers or student response systems?	Technology	Cognitive Factors	Performance Expectancy	Improved Throughput
34	Does your institution provide access to video sharing sites such as YouTube?	Resources	Cognitive Factors	Performance Expectancy	Improved Throughput
35	Does your institution make official use of social networking sites?	Resources	Social Factors	Social Influence	Improved Throughput
36	Estimate the percentage of your institutions telephones that are IP (network) telephones?	Technology	Facilitating Conditions	Perceived Monetary Value	Efficiency
37	Are your intercampus telephone calls routed over the internal IP network?	Technology	Facilitating Conditions	Perceived Monetary Value	Efficiency
38	How many servers do you have running in a virtual environment?	Technology	Facilitating Conditions	Perceived Monetary Value	Efficiency
39	How many servers do you have running on their own outside of a virtual environment?	Technology	Facilitating Conditions	Perceived Monetary Value	Efficiency
40	What is the total server storage capacity of your institutions SAN's in Terabyte's? Storage Area Networks or any disks that are not an integral part of a computer	Technology	Facilitating Conditions	Perceived Monetary Value	Efficiency
41	Does your institution provide e-book access?	Resources	Facilitating Conditions	Perceived Monetary Value	Efficiency
42	Does your institution provide on-line collaboration tools/suites such as Share Point?	Resources	Facilitating Conditions	Perceived Monetary Value	Efficiency
43	Are lecturers at your institution required to have competencies in	Competency	Cognitive Factors	Performance Expectancy	Improved Throughput

	Information Technology?				
44	Does your institution provide on-line lecturer assistance to students through a collaboration portal?	Resources	Cognitive Factors	Performance Expectancy	Improved Throughput
45	Does your institution provide technology to capture and store video clips of classes or tutorials for later download or review?	Technology	Cognitive Factors	Performance Expectancy	Improved Throughput
46	Does your institution make use of electronic learning management systems such as Blackboard, Moodle, Sakai, etc.?	Resources	Cognitive Factors	Performance Expectancy	Improved Throughput
47	Does your institution provide technology for students to submit assignments on-line?	Technology	Cognitive Factors	Performance Expectancy	Improved Throughput
48	Does your institutions library have electronic knowledge commons?	Resources	Cognitive Factors	Performance Expectancy	Improved Throughput
49	Does your institution's library provide on-line access to research journals and other electronic media	Resources	Cognitive Factors	Performance Expectancy	Improved Throughput
50	Does your institution provide electronic banking facilities for students to pay fees?	Systems	Facilitating Conditions	Perceived Monetary Value	Efficiency
51	Does your institution provide technology that allows students to register on-line?	Systems	Facilitating Conditions	Perceived Monetary Value	Efficiency
52	Does your institution provide electronic meal management systems?	Systems	Facilitating Conditions	Perceived Monetary Value	Efficiency
53	Does your institution provide electronic asset management systems?	Systems	Facilitating Conditions	Perceived Monetary Value	Efficiency
54	Does your institution make use of Electronic Access Control for staff and students?	Systems	Facilitating Conditions	Perceived Monetary Value	Efficiency
55	Are your institution's ICT assets monitored on the network?	Monitoring	Facilitating Conditions	Perceived Monetary Value	Efficiency
56	Has your institution tested or implemented Near Field Communication (NFC) for short range wireless application?	Innovation	Social Factors	Personal Innovativeness	Efficiency

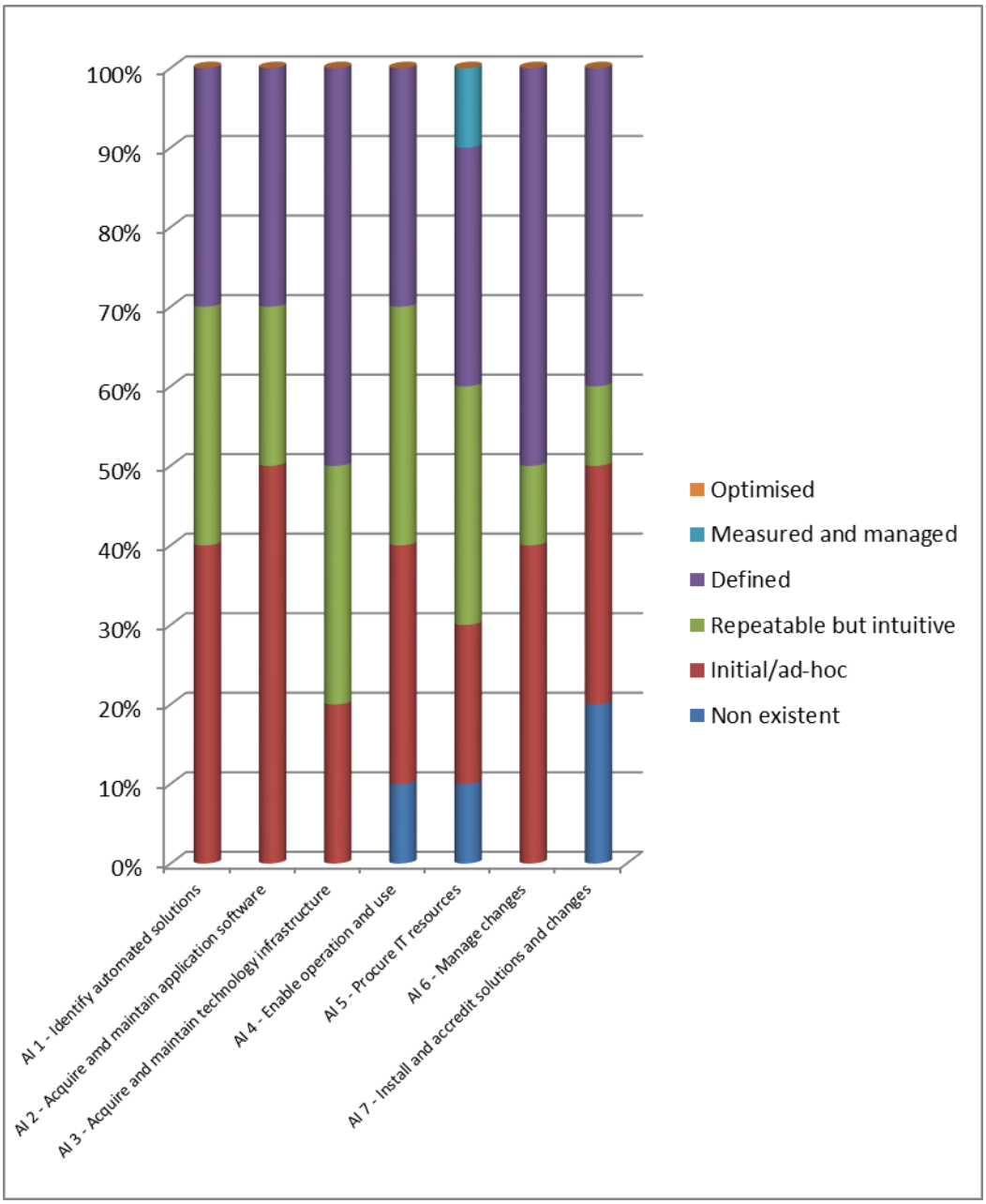
Annexure G: Primary Process Maturity Levels per COBIT 4.1 Domain

1. **COBIT 4.1 DOMAIN: PLANNING AND ORGANISING SURVEY RESPONSES PER LEVEL OF ICT GOVERNANCE MATURITY**

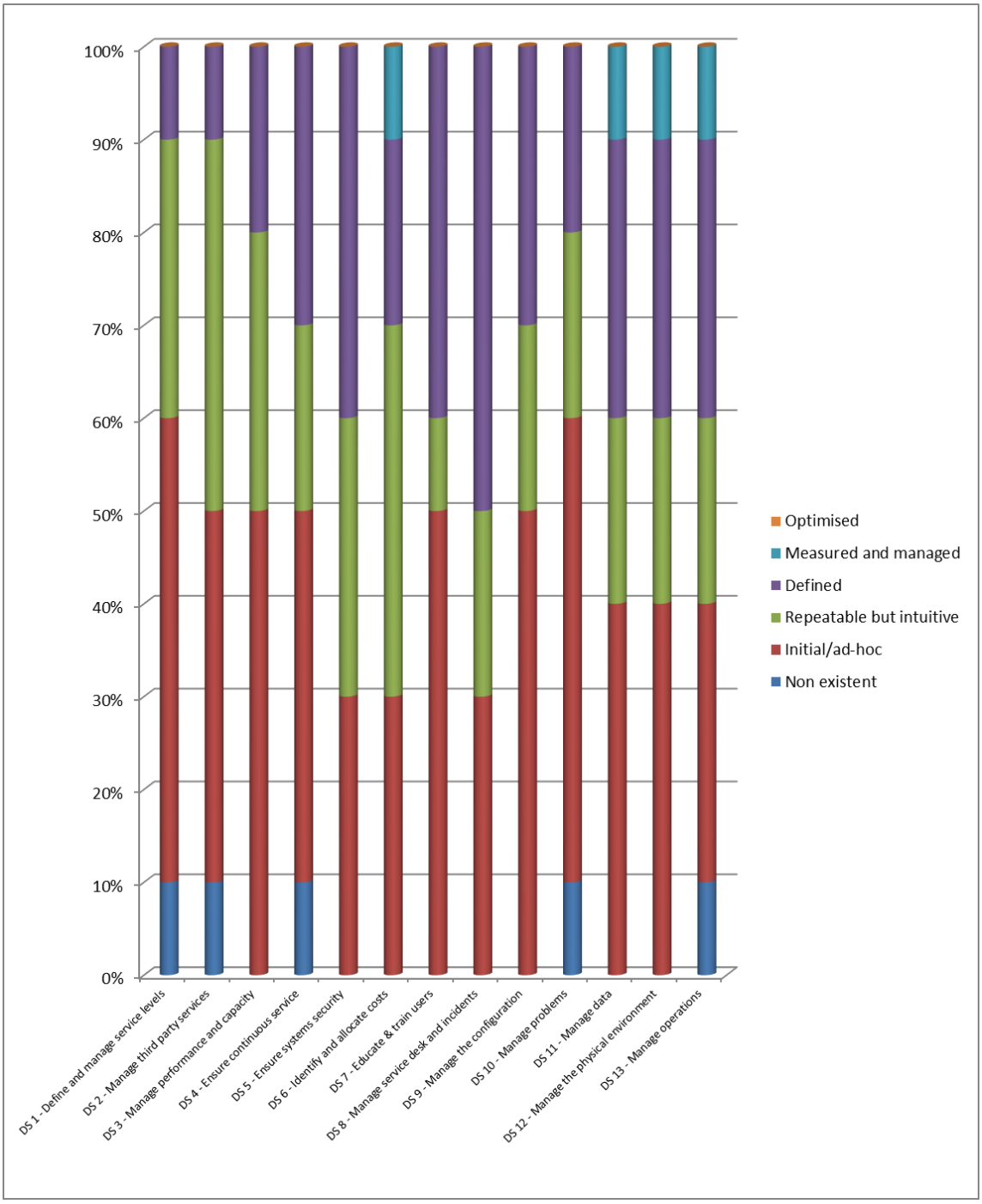


2. **COBIT 4.1 DOMAIN: ACQUIRE AND IMPLEMENT SURVEY RESPONSES**

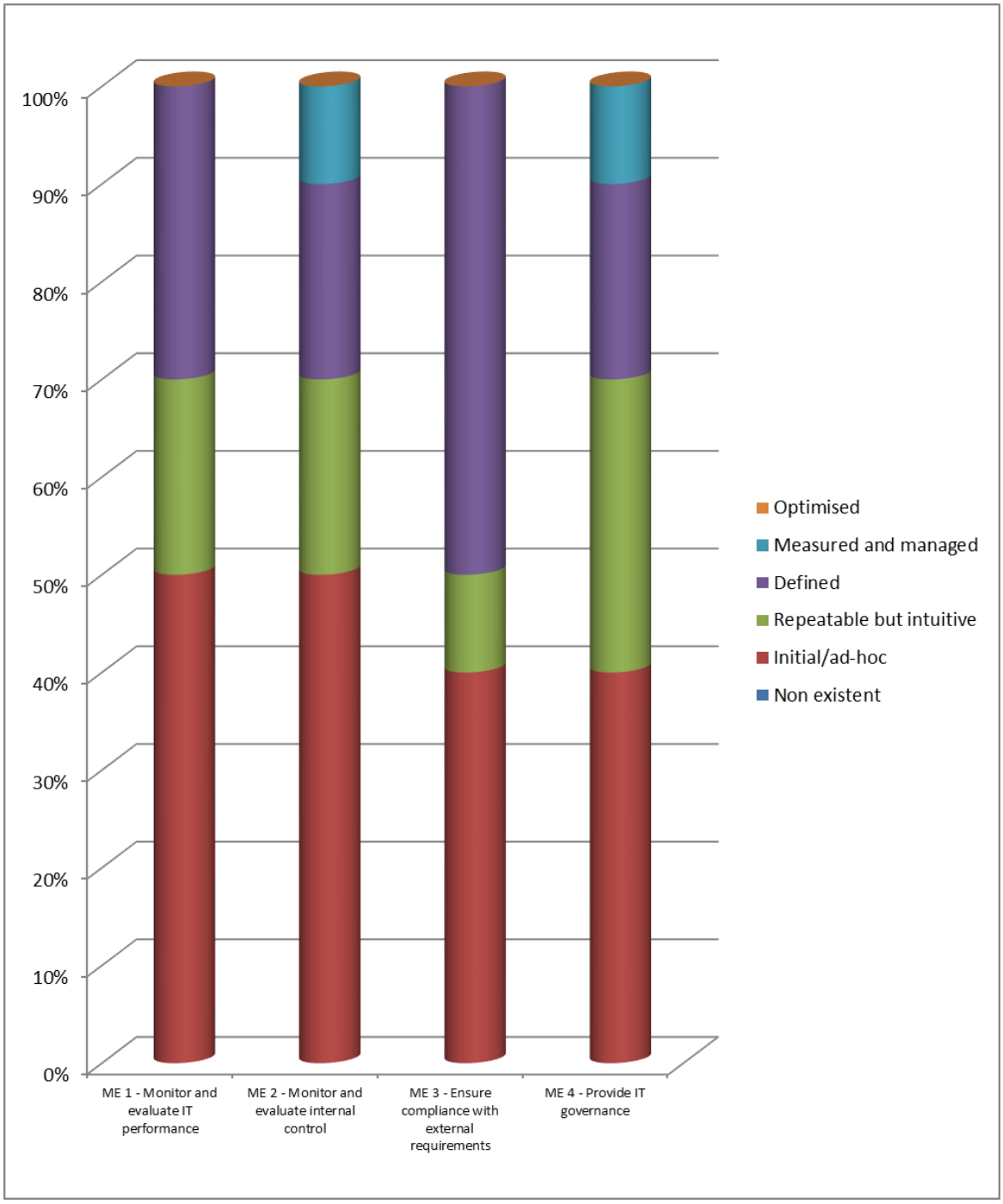
PER LEVEL OF ICT GOVERNANCE MATURITY



3. COBIT 4.1 DOMAIN: DELIVERY AND SUPPORT SURVEY RESPONSES PER LEVEL OF ICT GOVERNANCE MATURITY

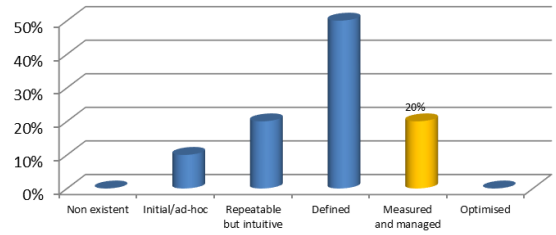


4. COBIT 4.1 DOMAIN: MONITOR AND EVALUATE SURVEY RESPONSES PER LEVEL OF ICT GOVERNANCE MATURITY

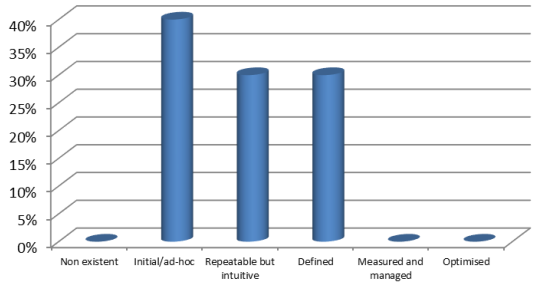


Annexure H: Domain Survey Responses per level of ICT Process Maturity

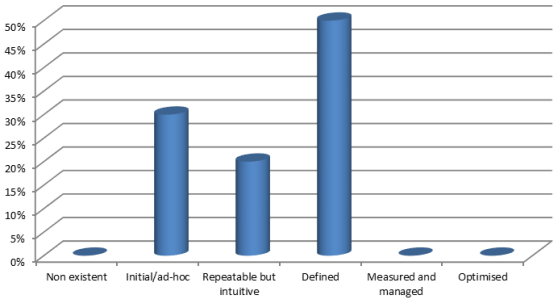
1. Define a strategic IT plan



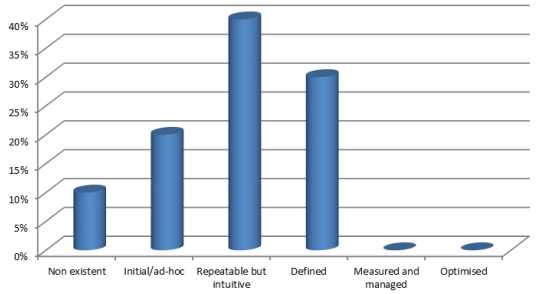
2. Define the information architecture



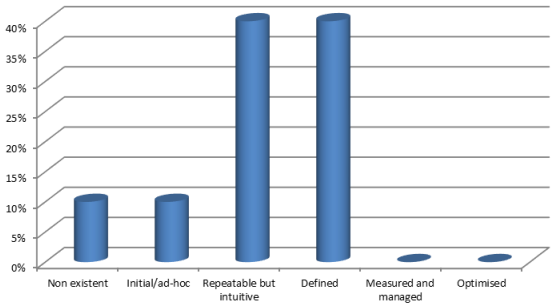
3. Determine technological direction



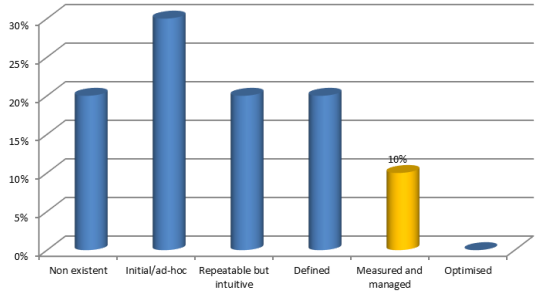
4. Define the IT organization and relationships



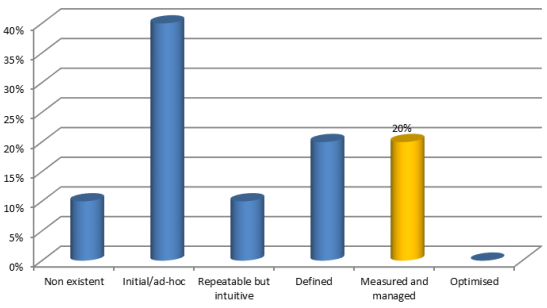
5. Manage the IT investment



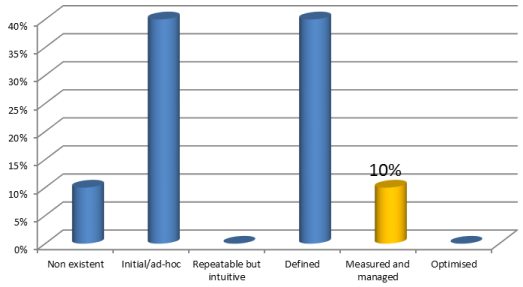
6. Communicate the mangement aims and direction



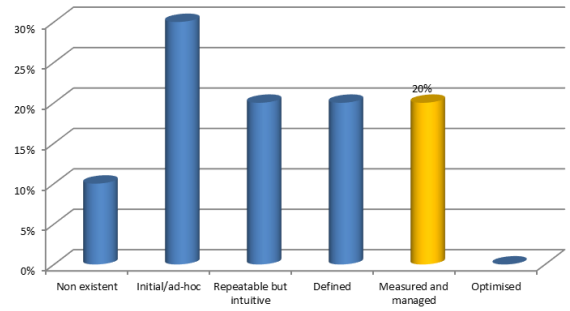
7. Manage human resources



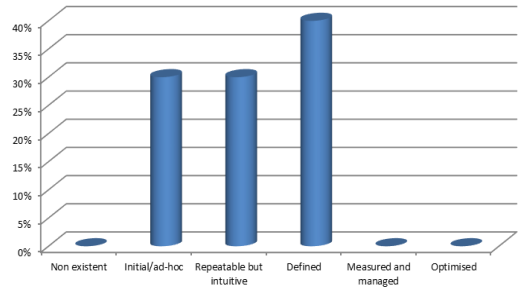
8. Manage Quality



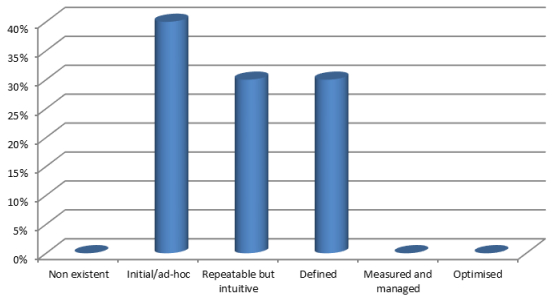
9. Assess and Manage IT risks



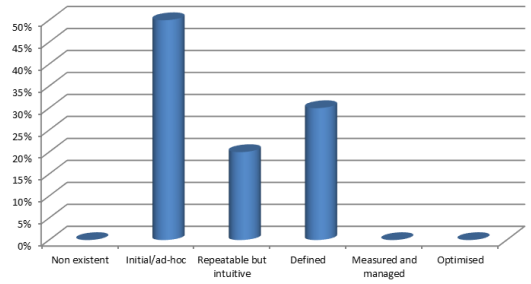
10. Manage projects



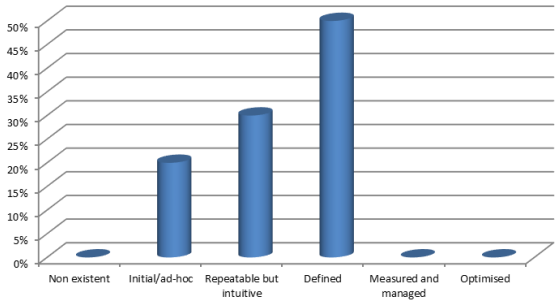
11. Identify automated solutions



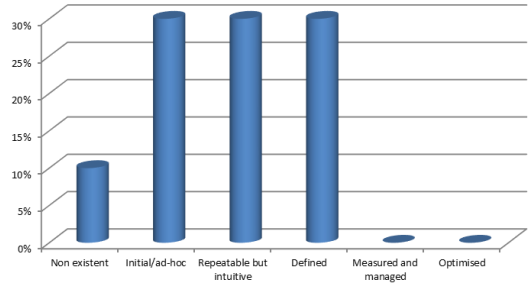
12. Acquire amd maintain application software



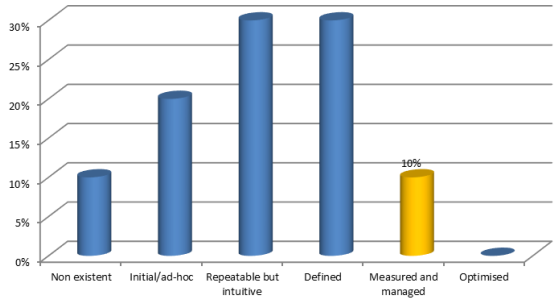
13. Acquire and maintain technology infrastructure



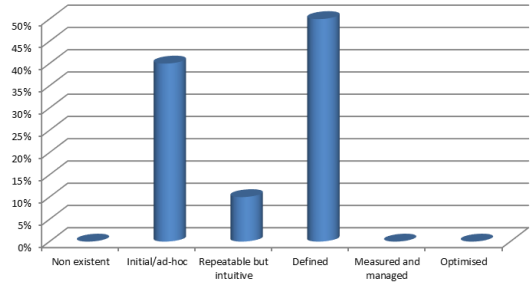
14. Enable operation and use



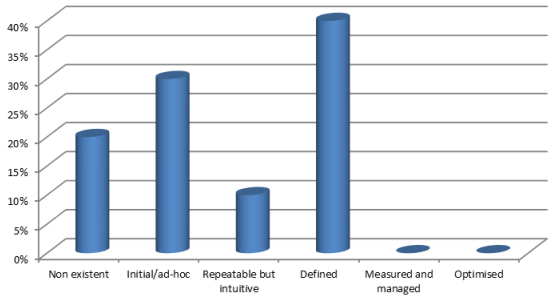
15. Procure IT resources



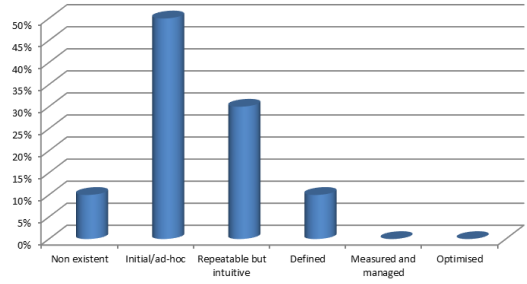
16. Manage changes



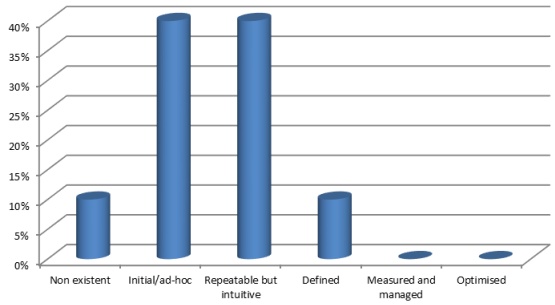
17. Install and accredit solutions and changes



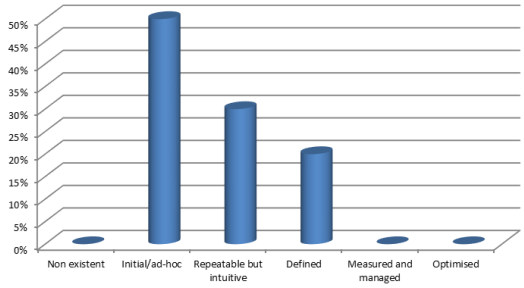
18. Define and manage service levels



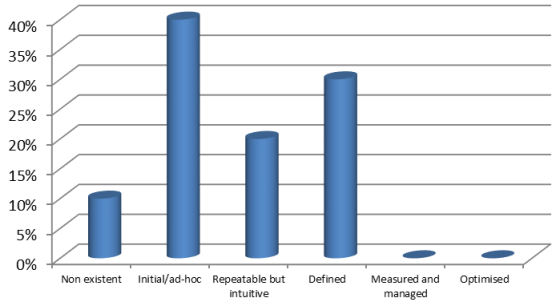
19. Manage third party services



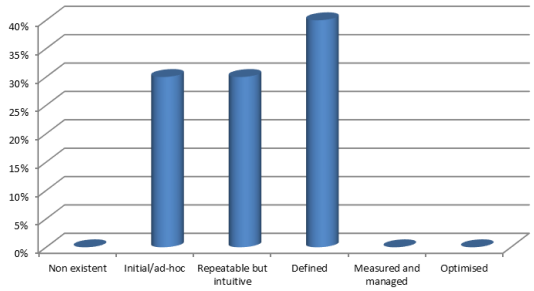
20. Manage performance and capacity



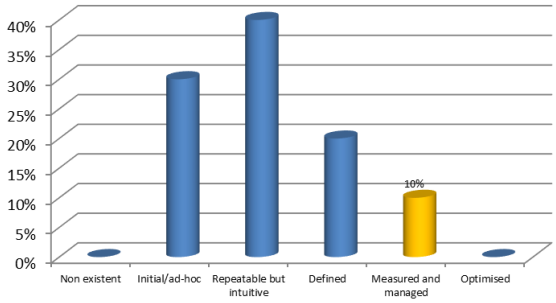
21. Ensure continuous service



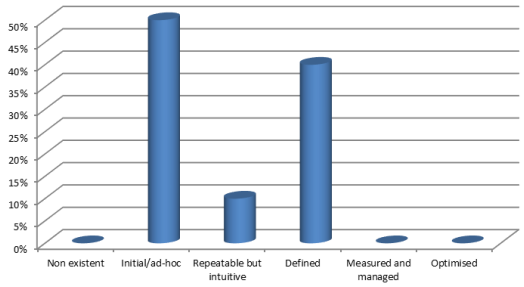
22. Ensure systems security



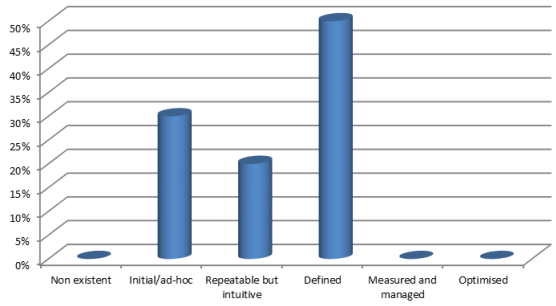
23. Identify and allocate costs



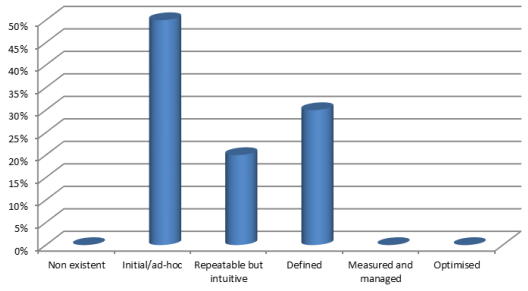
24. Educate & train users



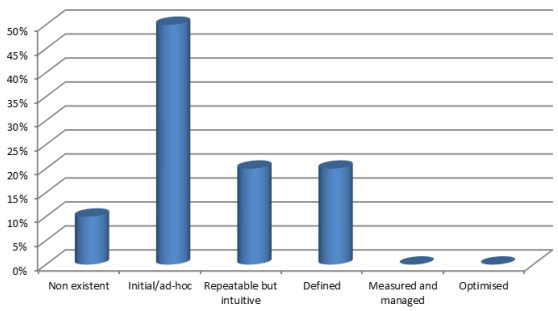
25. Manage service desk and incidents



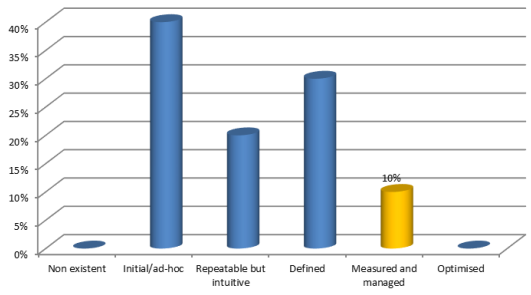
26. Manage the configuration



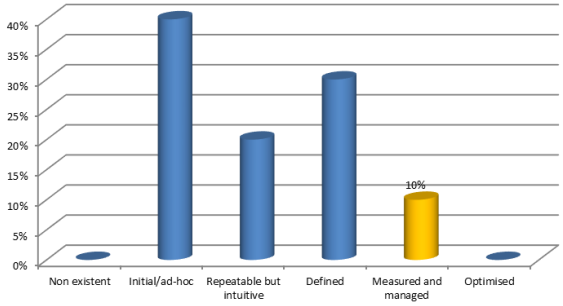
27. Manage problems



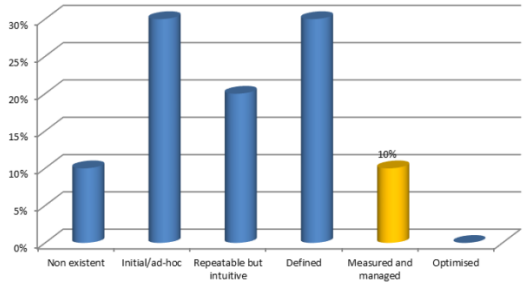
28. Manage data



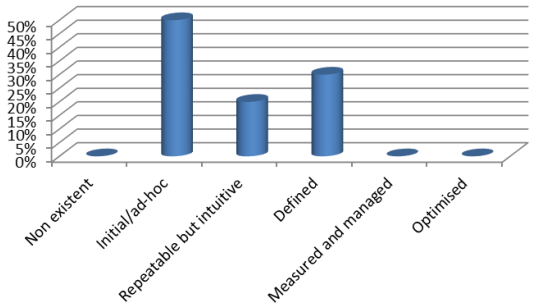
29. Manage the physical environment



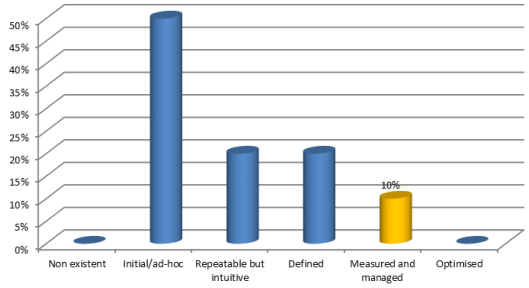
30. Manage operations



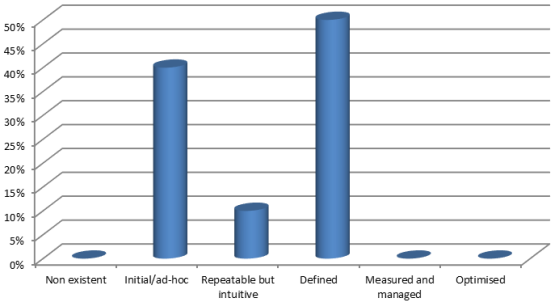
31. Monitor and evaluate IT performance



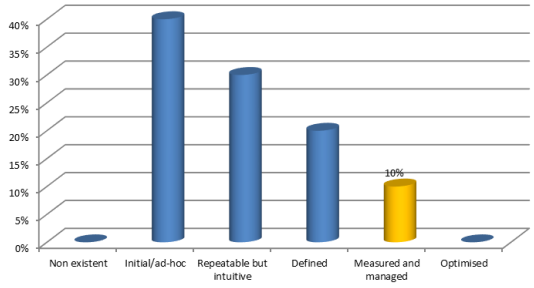
32. Monitor and evaluate internal control



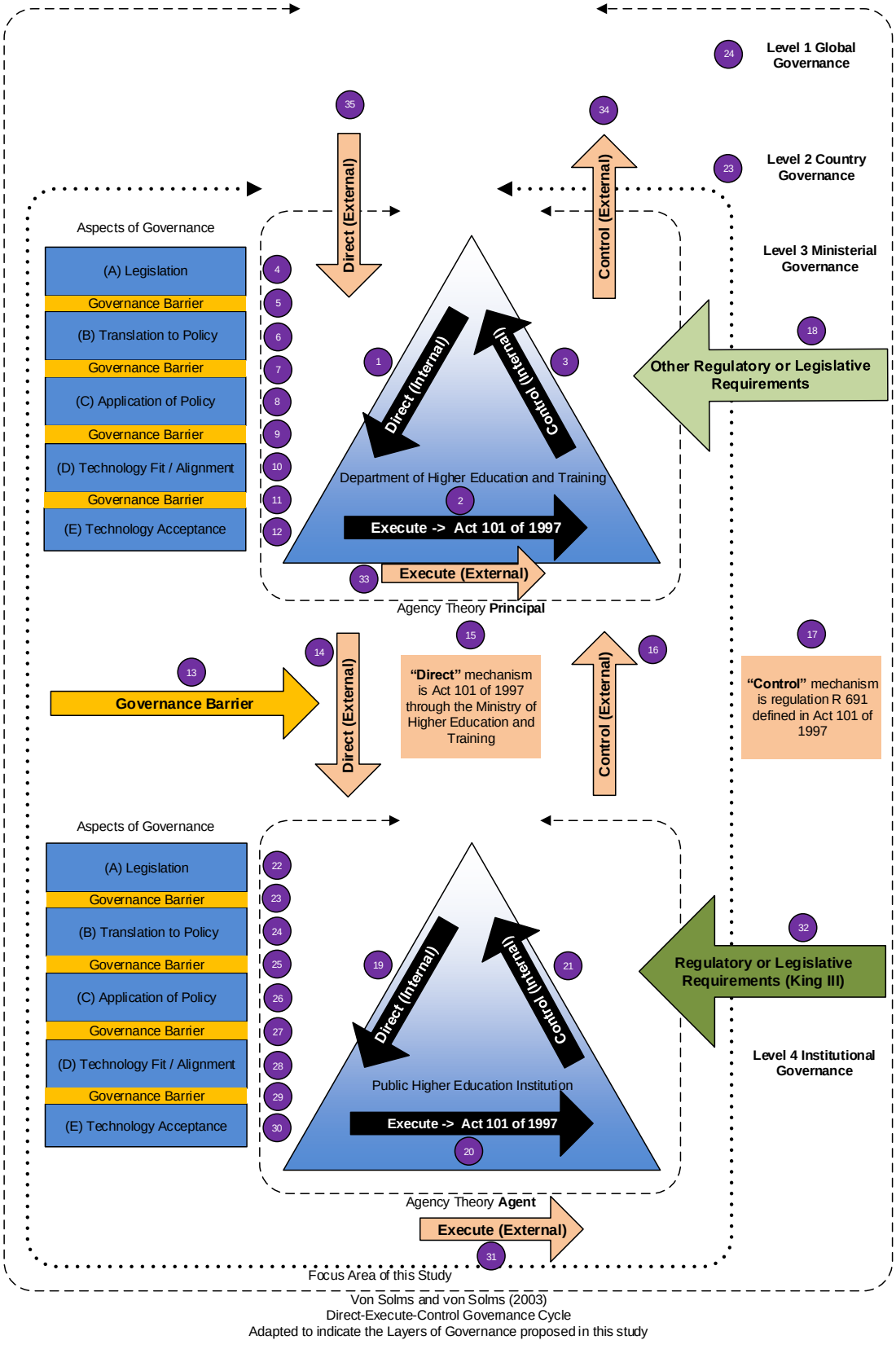
33. Ensure compliance with external requirements



34. Provide IT governance

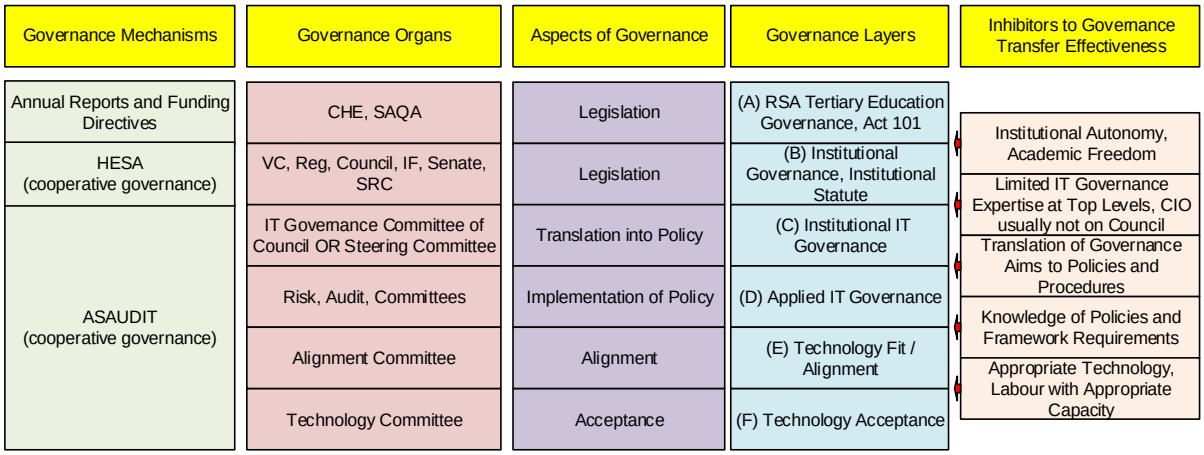


Annexure I: Value Framework for ICT Governance in Higher Education, South Africa



Von Solms and von Solms (2003)
Direct-Execute-Control Governance Cycle
Adapted to indicate the Layers of Governance proposed in this study

Annexure J: Detailed Level of the Aspects of Governance and Links within the Value Framework



Annexure K: Final Validation of Value Framework Survey Responses

Respondent ID	The public higher education system can be seen as an open system that has 23 institutions as subsystems	Responses	The direct-execute-control governance cycle first emerging in the ISO 38500 governance standard, and later adapted by Von Solms and Von Solms, is applicable internally to the 23 public higher education institutions as indicated by arrows 19, 20 and 21 in slide 5 of the attached Power Point presentation.	Responses
	CommentsQ1		CommentsQ2	
7		Agree		Agree
6		Agree		Agree
5		Disagree		Agree
4		Strongly agree		Strongly agree
3		Strongly agree		Strongly agree
2		Neutral		Agree
1		Strongly agree		Strongly agree
Respondent ID	The direct-execute-control governance cycle first emerging in the ISO 38500 governance standard , and later adapted by Von Solms and Von Solms, is applicable externally between the DHET and institutions as indicated by arrows 14, 31 and 16	Responses	The direct element of the governance cycle indicated by arrow 14 from the DHET as the principal to institutions as the agents uses the Higher Education Act 101 of 1997 as the governance mechanism to pass the governance mandate from DHET to institutions	Responses
	CommentsQ3		CommentsQ4	
7		Agree		Neutral
6		Agree		Agree
5		Neutral		Agree
4		Strongly agree		Strongly agree
3		Agree	Act gives mandate to DHET, mechanisms include directives and conditional funding.	Agree
2		Agree		Agree
1		Strongly agree		Strongly agree
Respondent ID	There is a barrier, indicated by arrow 13 to the transfer of the governance mandate indicated by the direct element of the governance cycle and shown by arrow 14 between the DHET and institutions (inter-system) and this barrier can be the interpretation of Act 101 of 1997 by institutions	Responses	The internal direct-execute-control cycle indicated by arrows 19, 20 and 21 is also the external execute element of the inter-system governance cycle shown by arrow 31	Responses

	CommentsQ5		CommentsQ6	
7		Agree		Agree
6		Neutral	I don't know how to interpret statement 6	
5		Neutral		Neutral
4		Agree		Agree
3	Not just interpretation. Act is very high level governance and silent on many areas left to discretion.	Agree		Agree
2		Agree		Agree
1		Strongly agree		Strongly agree
Respondent ID	The inter-system control element of the governance cycle is regulation R691 as defined in the higher education Act 101 of 1997	Responses	There are intra-system aspects of governance that can be used to increase the level of granularity of governance internally within an organization. The first of these is Legislation and is shown by callout 22. Legislation is the starting point of governance in a system such as the public higher education system	Responses
	CommentsQ7		CommentsQ8	
7		Strongly agree		Agree
6	Not my area of expertise			Agree
5		Neutral		Disagree
4		Strongly agree		Strongly agree
3		Agree		Agree
2		Neutral		Agree
1		Strongly agree		Strongly agree
Respondent ID	The second aspect of governance is Translation to Policy and is shown by callout 24.	Responses	The third aspect of governance is Application of Policy and is shown by callout 26.	Responses
	CommentsQ9		CommentsQ10	
7		Agree		Agree
6	I see translation to Policy as a management responsibility, mandated by governance	Disagree	I interpret application of policy is a management activity	Disagree
5		Agree		Agree
4		Strongly agree		Strongly agree
3		Agree	Application through governance structures of management and reporting.	Agree
2		Agree		Agree
1		Strongly agree		Strongly agree

Respondent ID	The fourth aspect of governance is Alignment/Fit and is shown by callout 28.	Responses	The fifth aspect of governance is Acceptance of Technology and is shown by callout 30.	Responses
	CommentsQ11		CommentsQ12	
7		Agree		Agree
6	This is exactly the role of Enterprise Architecture, including EA governance		Acceptance of technology means compliance with technology (or EA) governance	Disagree
5		Agree		Agree
4		Agree		Agree
3		Agree	Governance mechanisms include procurement policies and processes. Is acceptance not an outcome or a barrier?	Neutral
2		Agree		Agree
1		Strongly agree		Strongly agree
Respondent ID	The first barrier to internal institutional governance is institutional autonomy and academic freedom and is shown by callout 23 (Legislation). (Please see the mapping of aspects of governance to layers of governance on slide 4: The first two layers of governance map to legislative aspects of governance, hence both question 13 and 14 refer to callout 23 on the diagram on slide 5)	Responses	The second barrier to internal institutional governance is Limited ICT Governance Expertise at Executive levels and CIO not usually on Council and is shown by callout 23 (Legislation).	Responses
	CommentsQ13		CommentsQ14	
7		Agree		Strongly agree
6		Agree	I do agree for now, but King III requires it, so it should not be a barrier in future	Disagree
5		Neutral		Agree
4		Agree		Strongly agree
3		Agree		Agree
2		Agree		Agree
1		Agree		Strongly agree
Respondent ID	The third barrier to internal institutional governance is translation of governance aims to policy and procedure and is shown by callout 25.	Responses	The fourth barrier to internal institutional governance is Knowledge of Policies and Framework Requirements and is shown by callout 27.	Responses
	CommentsQ15		CommentsQ16	
7		Neutral		Strongly agree
6	I interpret application of policy as management, not governance	Agree		Agree
5		Disagree		Agree
4		Agree		Agree

3	Not just translation. Perceived autonomy of departments similar to institutions at the higher level.	Agree		Agree
2		Agree		Neutral
1		Strongly agree		Strongly agree
Respondent ID	The fifth barrier to internal institutional governance is Appropriate Technology and Labour with Appropriate Capacity and is shown by callout 29.	Responses	The direct-execute-control governance cycle is applicable internally to the ministerial level of governance as indicated by arrows 1, 2 and 3	Responses
	CommentsQ17		CommentsQ18	
7		Neutral		Neutral
6	It is a management or execution barrier not a governance barrier	Disagree		Agree
5		Strongly agree		Neutral
4		Agree		Agree
3		Agree		Agree
2		Agree		Neutral
1		Strongly agree		Strongly agree
Respondent ID	The same aspects of governance applicable at the institutional level are applicable at the DHET level and higher.	Responses	The public higher education root of governance is located at the DHET, where the Higher Education Act 101 of 1997, as amended, has its foundation	Responses
	CommentsQ19		CommentsQ20	
7		Agree		Strongly agree
6		Neutral		Agree
5		Disagree		Agree
4		Agree		Agree
3	Maybe similar more appropriate than the same.	Agree	But it is an open system. Other stakeholders and legislation govern policy at different levels.	Agree
2		Disagree		Strongly agree
1		Strongly agree		Strongly agree
Respondent ID	The normally singular reference to governance has been layered into six layers of governance. The increased granularity of governance allows for better identification of appropriate governance organs and mechanisms for more appropriate control	Responses	The architecture of the ICT Value Framework depicted on slide 5 helps to understand ICT governance in the context of public higher education in South Africa	Responses
	CommentsQ21		CommentsQ22	
7		Strongly agree		Agree

6	I see the top three layers as governance, the bottom 3 as management responsibility or at the most internal governance mandated by management	Neutral		Agree
5		Agree		Neutral
4		Strongly agree		Strongly agree
3		Strongly agree		Strongly agree
2		Agree		Agree
1		Strongly agree		Strongly agree
Respondent ID	The ICT governance value framework architecture detail diagram on slide 5, (with some detail on slide 4) fairly represents the layers of governance and their inhibitors, aspects, organs and mechanisms of governance that are applicable in the public higher education sector in South Africa	Responses	The overall Value Framework depicted in this study has capacity to improve governance, specifically ICT governance in public higher education institutions.	Responses
	CommentsQ23		CommentsQ24	
7		Agree		Strongly agree
6		Agree		Agree
5		Neutral		Neutral
4	Indeed, and is not understood at the various governance levels	Strongly agree	HE in SA is immature in its understanding of the value of governance	Strongly agree
3	The system is open, maybe the role of other stakeholders and legislation could be given more recognition.	Agree	Well thought out. Good contribution! Hope this work has significant impact.	Strongly agree
2		Agree		Agree
1		Strongly agree	Governance is made successful by the implementation of relevant policy whose application is monitored and reported on to governors. This value framework recognised multi layers of governance that will assist at each layer to reduce misalignment of governance mandate to governance execution and reporting	Strongly agree