AN INFORMATION SYSTEMS AUDITOR'S PROFILE

by

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ABSTRACT

The increasing dependence upon Information Systems (IS) in the last few decades by businesses has resulted in many concerns regarding auditing. Traditional IS auditing has changed from auditing "around the computer" to a hands-on approach (auditing through and with the computer). Technology is changing rapidly and so is the profession of IS auditing. As IS auditing is dependent on Information Technology (IT), it is essential that an IS auditor possesses IT and auditing knowledge to bridge the gap between the IT and auditing professions.

The aim of the study is to: 1) define the roles and responsibilities expected from IS auditors, based on the different types of audit assignments and the steps involved in performing an IS audit assignment; 2) describe the basic IT and audit knowledge required from IS auditors based on the roles and responsibilities identified; 3) describe the soft skills required from IS auditors to successfully perform an IS audit assignment; 4) define the main types of IS audit tools and techniques used most often to assist IS auditors in executing IS audit roles and responsibilities; and 5) establish an IS auditor's profile based on the 4 characteristics defined above.

Keywords: Information Systems; Information Technology; Auditing; Information Systems Auditing; Knowledge; Skills; Roles and responsibilities; CAATs.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The 80's and early 90's were characterised by the conversion from manual systems to computerised systems. Given this change, the auditing profession is in the midst of rapidly evolving developments and changes and the need for auditors to be proficient in both Information Technology (IT) and auditing is increasing rapidly. The International Federation of Accountants (2003) states the following: "In the past, accountants with internal and external auditing experience were needed in great numbers to vouch and trace documents, to perform a variety of analyses and to document audit work. Today (2003), the computerisation of business records and the availability of computer aided audit tools means these activities can be performed faster and more thoroughly, again reducing the demand for traditional ways of performing such activities". According to the Certified Information Systems Auditor (CISA) Review Manual (2006:23) "the Information Systems Audit Control Association (ISACA) Information Systems (IS) auditing standards require that the IS auditor is technically competent, having the skills and knowledge necessary to perform the auditor's work. Further, the IS auditor is to maintain a technical competence through appropriate professional education. Skill and knowledge should be taken into consideration when planning audits and assigning staff to specific audit assignments". It is therefore imperative that an IS auditor possesses adequate IT and auditing knowledge and skills to successfully perform an IS audit assignment. To be able to identify and define the basic IT and audit knowledge and skills needed by IS auditors, it is necessary to look at the roles and responsibilities of an IS auditor. Roles and responsibilities can be defined based on the different types of audits and the steps involved in a typical audit assignment. Taking these roles and responsibilities into account, the IT and auditing knowledge required can be defined. It is also important to define the basic soft skills needed by an IS auditor since IT and auditing knowledge is not the only enablers of a successful IS auditor. Furthermore, the IS auditor needs tools and techniques to support him/her in executing an IS audit.

Given the above rationale of main features needed to perform an IS audit, the main research question was derived: What are the IT and audit knowledge and soft skills required from an IS auditor, given that specific auditing tools and techniques are available to assist the auditor in executing an IS audit assignment, in order for an IS auditor to optimally perform his or her daily roles and fulfil his or her professional responsibilities?

1.2 BACKGROUND

In recent years, the majority of organisations started relying on computerised Information Systems which has resulted in many concerns and challenges. Some of these concerns include security vulnerabilities, fraudulent activities and the speed of transaction processing. According to Watne and Turney (2002), these concerns have a direct influence on the auditing process since data and programs are stored internally, modifications and manipulations can be made to data and programs, the diminishing of audit trails, the transmission speed of processes and the rapid emergence of artificial intelligence. According to Bedard, Jackson, Ettredge and Johnstone (2003), electronic work systems ("paperless office") are emerging rapidly for auditors. These systems reduce storage cost of paper-based files, facilitate the communication process and improve efficiency and effectiveness. As stated by Hall and Singleton (2005) "recent developments in Information Technology have had a tremendous impact on the field of auditing. IT has inspired the reengineering of traditional business processes to promote more efficient operations and to improve communications within the entity and between the entity and its customers and suppliers". Auditors need both computer and task proficiency to perform their daily task efficiently and effectively (Bedard et al., 2003). "… It is no longer possible to meet the expectations of users of financial and other business performance information without using Information Technology" (Ahmed, 2003:20). Although the objectives of an audit remain relatively unchanged, the process an IS auditor follows in executing the audit has been immensely affected.

Doughty and O'Driscoll (2002:33) support this statement by explaining that, "a fundamental requirement for effective auditing is to provide an opinion to the executive team and the board audit committee on the adequacy of the internal control framework operating within the organisation's Information Technology and telecommunications (IT&T) environment".

With the increasing use of Information Systems by most organisations and the concerns raised in the auditing profession, a new challenge emerged. Two, once independent, professions need to be integrated into a new emerging impartial profession, relying on the knowledge, skills, expertise and experience from both the audit and IT professionals. The problem is schematically shown in Figure 1.
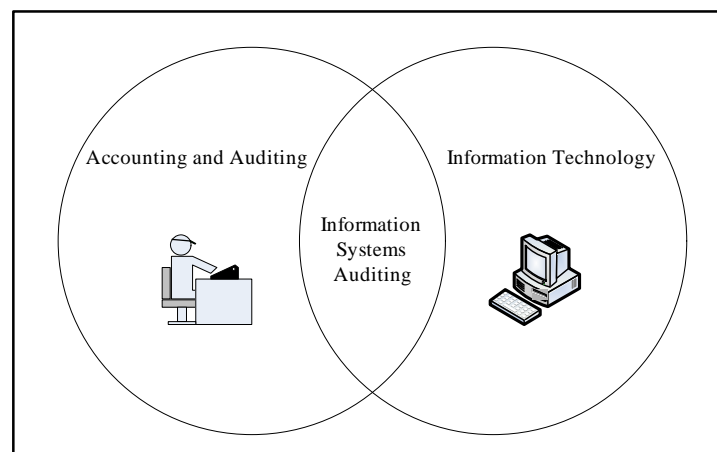
Figure 1: Integration of two professions

The integration of the two professions is supported by Pathak (2004) when he stated that "Information Technology (IT) auditing has been accepted as a distinct profession carved out of two distinctly separate professions of IT based data communications and auditing". The focus has shifted from traditional audits, where auditors evaluated the reasonableness of the financial statements by means of substantive testing and manual controls testing to include Information Systems audits, where auditors also evaluate the reasonableness of the Information Systems and the controls in and around the systems to be able to obtain assurance that the computer-generated information related to the financial statements is reliable, accurate, valid and complete.

Fink (1996:21) stated that "…organisations rely on auditors to evaluate and improve the integrity of their Information Systems and Information Technology. A specialist group of IS auditors has emerged to deal with systems which have become technology complex and diverse." This statement is elaborated on by Hall and Singleton (2005:3) who stated that an IT audit is associated with auditors who use technical skills and knowledge to audit through the computer system, or provide audit services where processes of data, or both, are embedded in technologies.

IS auditors are therefore faced with the challenge of being involved in the planning and organising of IT projects, implementation of proposed solutions, delivery and support of Information Systems and the monitoring of the process, the controls, assurance and evaluation (Kimpton & Martin, 2001:49). Furthermore, in the past auditors have audited "around the computer" by looking at manual processes and controls. This approach is no longer effective or efficient and it is essential for auditors to follow an approach of auditing through and with the computer.

To perform audits to evaluate the reasonableness of the IT processes and to test controls mitigating identified business risks, it is essential for IS auditors to possess some skills and knowledge from both the IT and auditing professions whether the auditor performs an internal or external audit assignment. Internal audit is mainly focused on the testing of IT processes and controls mitigating identified business risks and although also true of external auditors, external IT auditors' focus is the testing of controls related to the fair representation of the financial statements. The knowledge and skills required therefore remain the same whether for internal or external audit, with the exception that external auditors' should better understand the implications of weaknesses identified on accounts. It is therefore imperative for IS auditors, whether internal or external, to engage in learning and obtaining the knowledge of both IT and auditing to successfully execute IS audit assignments.

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1.3 RESEARCH PROBLEM

From the background information provided, it can be concluded that IS auditors need to understand the process flow of transactions or information in Information Systems, which include technical knowledge and an understanding of the controls needed to ensure accuracy, validity, timeliness and completeness of organisational information, resources and assets. For this reason the combined effort, knowledge, skills, experience and daily roles and responsibilities of IT and auditing professionals fall under the profession of IS auditing.

Thus, professionals coming from different backgrounds (IT and/or auditing) are forced to learn and develop the skills necessary to meet the demands of the IS auditing profession as they are unlikely to have both the required IT and auditing knowledge.

The following typical questions arose from this problem of having professionals from different backgrounds:

- Is there a difference in knowledge between IT professionals, audit professionals and IS audit professionals?
- Who will be the best candidate to perform IS audit assignments, someone with an IT or an audit background?
- What is the level of IT knowledge required from these professionals?
- What is the level of audit knowledge required from these professional?
- Is the field of IS auditing really as specialised as perceived?
- What are the typical daily roles and responsibilities of IS auditors?
- What IS audit tools and techniques are used in assisting IS auditors to perform IS audit evaluations and assessments?

From these questions the main research problem was derived: What are the IT and audit knowledge and soft skills required from an IS auditor, given that specific auditing tools and techniques are available to assist the auditor in executing an IS audit assignment, in order for an IS auditor to optimally perform his or her daily roles and fulfil his or her professional responsibilities?

1.4 RESEARCH OBJECTIVES

In order to answer the proposed research questions, the objectives of the study are to:

- Define the roles and responsibilities expected from IS auditors, based on the different types of audit assignments and the steps involved in performing an IS audit assignment;
- Describe the basic IT and audit knowledge required from IS auditors based on the roles and responsibilities identified;
- Describe the soft skills required from IS auditors to successfully perform an IS audit assignment;
- Define the main types of IS audit tools and techniques used most often to assist IS auditors in executing IS audit roles and responsibilities; and
- Establish an IS auditor's profile based on the 4 characteristics defined above.

1.5 RESEARCH DESIGN AND METHODOLOGY

The objective of the research design and methodology is to provide a solution to the problem statement as defined above. Based on the problem statement an IS auditor's profile will be developed. To be able to define the IS auditor's profile, a qualitative research approach will be followed, based on a combination of non-empirical (literature survey) and empirical studies (structured interviews). The qualitative research data which will be obtained in the study consist of two main sources:

- Firstly secondary information will be derived from the available body of knowledge through a literature review. An interaction research approach will be followed in conducting the literature review, this method is based on theory conditions (non-empirical), which will be used to set the direction for the research. The purpose of the literature review will be to present the results of the work of the existing literature regarding the IT and auditing professions, specifically the IS auditor's roles and responsibilities, the required IT and audit knowledge and the soft skills and available IS audit tools to assist the auditor in executing an IS audit assignment. The construction research method will be followed to derive, analyse and present a summary from the literature survey. According to Page and Meyers (2003:4) the construction research method is defined as "the structural framework linking a number of

Problem statement, significance, design and structure

concepts into a much more comprehensive concept, mega-concept, of a phenomenon that is not directly observable or measurable".

- Secondly, the study will derive an IS auditor's profile from following a survey approach. The survey approach will be based on the empirical study method. The characteristics of an IS auditor's profile will be identified by means of the research questions, the responses from the interviews will be regarded as qualitative responses (non numeric data). Structured interviews will be used as the preferred data collection method for this study.

Structured interviews will be constructed based on a distributed sample selection. The sampling design method, used to select the sample population, will be based upon judgmental samples. The sample selection will adhere to the following criteria:

- Background (IT or Auditing);
- Years experience in IS auditing (4 or more);
- Level (Management or higher); and
- Type of audit role (External or Internal).

The information obtained from the structured interviews (primary data) and through the literature review (secondary data) will be analysed by means of the qualitative research approach. The aim of the interpretation of the data, whether obtained from the literature surveys or interviews is to develop an IS auditor's profile.

1.6 SCOPE AND LIMITATIONS

The research study's goal is to establish an IS auditor's profile, based on 4 characteristics, namely: 1) Knowledge (including IT knowledge and auditing knowledge); 2) Soft skills; 3) Roles and responsibilities; and 4) Information Systems tools and techniques. The study will only focus on the key, high level characteristics identified by means of the research methodology and approach followed. The IS auditor's profile which will be established will only include these key characteristics. The identified characteristic will be generalised although these characteristics may differ according to individual, profession, organisation, circumstance and level of employment and will only be regarded as a guideline.

Interview responses will be restricted to South African organisations or firms only and will include internal and external auditing practises.

1.7 SIGNIFICANCE OF THE STUDY

This study focuses on defining an IS auditor's profile. The main advantage will be that an integrated framework will be established detailing the roles and responsibilities of an IS auditor, the audit process, basic IT and audit knowledge, the soft skills and IS audit analysis tools and techniques needed by an IS auditor.

In the past research has focused on how IT changes the role of IS auditors, the available tools for IS auditors, the scope of IS auditing, the importance of training, IT governance, IT security, General Computer Audits, Application Control Audits, CAATs (Computer Assisted Auditing Techniques) and the inclusion of audit software in the curricula for undergraduate and postgraduate students.

IS auditing is a relatively new field and a limited number of studies were done to define an IS auditor's profile by means of understanding the level of IT knowledge, audit knowledge, the soft skills required by IS auditors and the IS audit tools and techniques used to assist the IS auditor in executing an IS audit assignment. The main objective of the study will therefore be to summarise the main characteristics of an IS auditor's profile, as obtained through the literature study and interview responses.

By determining the following: 1) roles and responsibilities and the concepts applicable to IS auditing; 2) the knowledge and skills required by IS auditors; and 3) the tools and techniques used to enable the IS auditors to execute their roles and responsibilities, the following institutions and individuals may benefit by using an established IS auditor's profile:
1. Educational institutions may incorporate the concepts that will be represented in the IS audit profile in the curricula of students.

2. The auditing profession will be able to utilise the profile to assess employees and benchmark their progress according to the defined concepts. These professional institutions should be able to use the IS auditor's profile to recruit employees and use the roles and responsibilities that will be identified to define the job descriptions of employees.

3. Individuals in the IS auditing profession can define their roles and responsibilities to successfully execute their audit assignments and benchmark themselves in the IS auditing profession. They may use the knowledge and skills base that will be developed to evaluate their current knowledge and skills base and work towards the desired level.

1.8 DEFINITION OF TERMS

The following definitions of terms apply to this study as summarised according to the literature obtained and referred to in Section 2.3:

- **Information Systems Auditing**: Information Systems Auditing is defined as the examination of an Information System and surrounding procedures to express an opinion as to whether or not the data involved in processing, from the initiation of the transaction to its inclusion in the financial statements, are fairly represented at a specific date, to ensure completeness, accuracy, validity and timeliness of data and transactions and to scrutinise the controls implemented to mitigate identified risks as well as to provide assurance on the safeguarding of organisational assets and resources.

- **Information Technology**: IT is defined by Whitten, Bentley and Dittman (2001:8) as "… the combination of computer technology (hardware and software) with telecommunication technology (data, image, and voice networks)".

- **Information Systems**: IS is the combination of hardware, software (operating system), application software, data, networking and the procedures and people involved in programming, processing, maintenance and utilisation. The concept includes the term 'Information Technology'.

- **Knowledge**: Knowledge is defined as the combined result of formal education, experience and training, something one gains by listening, reading, learning and/or observation.

- **Skill**: Skill is defined as "what one can do" but it cannot exist without the knowledge ("what one knows"). Thus skill is the utilisation of one's knowledge in day-to-day operations.

- **IS Audit Tools and Techniques**: Help auditors to select, gather, analyze and report information and help add credibility to the findings, conclusions and recommendations.

- **Profile**: A set of data, often in graphical form, representing the extent or significant features and/or characteristics of something.

1.9 OUTLINE OF CHAPTERS

The structure of the research study is as follows:

CHAPTER OUTLINE	DESCRIPTIONS
Chapter 1	Introduction Introduction to the problem statement, a description of the significance of the study, overview of research design and methodology used and the structure of the research study.

Chapter 2	IS auditing concepts In this chapter all components necessary to define an IS auditor's profile as obtained from the existing body of knowledge, are determined and defined. Firstly the evolution of the IS auditing profession is described to understand the influence of Information Technology on traditional auditing and the way the auditing profession was changed and impacted by IS auditing. Secondly concepts that influence the IS auditing profession are defined. Lastly the main characteristics of the IS auditor's profile is defined by the literature review conducted.
Chapter 3	Research design and methodology Chapter 3 provides the reader with an understanding of the research design and methodology used to establish an IS auditor's profile.
Chapter 4	Presentation of interview data Chapter 4 elaborates on the population selected for the structured interviews, a description of the layout of the structured interview questions and presents the interview responses and primary data collected.
Chapter 5	Data interpretation, comparison and summation The primary data obtained through structured interviews is interpreted and compared with the secondary data obtained by means of the literature review conducted. The aim of this chapter is to combine the primary and secondary data in order to define an IS auditor's profile.
Chapter 6	An IS auditor's profile Chapter 6 provides an overview and conclusion on the research study conducted. With the aim of defining an IS auditor's profile the research questions are used to derive the 4 main characteristics or features of an IS auditor's profile.
Bibliography	Reference to all relevant literature used in this study.
Appendix	Detail on specific topics as indicated in the paper.

Table 1: Structure of research paper

1.10 CONCLUSION

This chapter gives an overview of the problem statement, provides a description of the significance of the study, presents an overview of the research design and methodology and describes the structure and outline of the remainder of the research study.

CHAPTER 2

INFORMATION SYSTEMS AUDITING

2.1 INTRODUCTION

In order to understand and appreciate the multiplicity of the IS audit profession and IS auditing concepts, it is essential to determine and define the existing body of knowledge by means of a literature review. The aim of the literature review is to set the background for the study as well as to contribute to a framework defining an IS auditor's profile. In order to define an IS auditor's profile, the roles and responsibilities, knowledge, skills and audit tools and techniques used in performing an IS audit are illustrated. In this chapter, the evolution of the IS auditing profession is first described in order to illustrate the IS auditing concepts and the differences between traditional audit, IT and IS audit. Thereafter the IS auditing concept definitions, as obtained from the literature, are determined and defined. These concepts' definitions set the outline for the detailed descriptions of the 5 components defining the IS auditor's profile, namely:

1. The IS auditor's daily roles and responsibilities and the main stages in performing a typical IS audit assignment;
2. The knowledge expected from an IS auditor regarding IT concepts;
3. The knowledge expected from an IS auditor regarding auditing concepts;
4. The essential soft skills which an IS auditor should possess; and
5. The Information Technology tools and/or Computer Assisted Audit Techniques (CAATs) used to assist the auditor in executing an IS audit assignment.

2.2 THE EVOLUTION OF IS AUDITING AS A PROFESSION

To understand IS auditing and all the components and different aspects involved in the IS auditing profession, it is necessary to review the important technological developments and the evolution of the IS auditing profession over the last decade and to identify the impact of these changes on the IT and audit professions.

According to an IS auditor's response in the article by Bagranoff and Vendrzyk (2000:33), IS auditing was a "fly on the back of a giant gorilla" about ten years before. But today "many believe that IS auditing is driving the audit".

According to the South African Institute of Chartered Accountants (SAICA) (1998) the objective of auditing is to evaluate the reasonableness of the financial statements, thus determining if the financial statements properly reflect the performance of the business. Hinson (2004:5) expands on this by defining auditing as "the independent examination of records and other information in order to form an opinion on the integrity of a system of controls and recommended control improvements to limit risks". This definition is broken down into further detail as the American Accounting Association Committee on Basic Auditing Concepts (1972) defines auditing as "a systematic process of objectively obtaining and evaluating evidence regarding assertions about economic actions and events to ascertain the degree of correspondence between those assertions and establishing criteria and communicating the results to interested users". Further to this and specifically related to internal auditing, auditing also includes the "reviews of the reliability and integrity of information, compliance policies and regulations, the safeguarding of assets, the economical and efficient use of resources, and established operational goals and objectives" (Gleim, 2004: 2).

Traditional audit's aim was therefore to evaluate controls, which was characterised by manual systems that used source documents like invoices, receipts and credit notes. These source documents were recorded in handwritten journals to capture information for the accounting systems. In these traditional systems the audit trail was visible and the audit procedures were applied on paper documents and records. The process of tracing documents from source (for example invoice) to the journals right through to the general ledger and reports was relatively easy since it was tangible.

Whitten et al. (2001:8) define Information Technology (IT) as "the combination of computer hardware, software, telecommunications technology, data, image, and voice networks". Whitten et al. (2001:8) also define Information Systems as "the arrangement of people, data, processes, information presentation and Information Technology that interact to support and improve day-to-day operations in a business

as well as to support the problem-solving and decision-making needs of management and users". Thus from these definitions it can be concluded that the term 'Information Systems' encompasses Information Technology. Information Systems is characterised by high transmission speed of processes, internal processing of records, easily manipulated data, artificial intelligence, telecommunications, e-businesses, networks, the World Wide Web and many more. According to Hall and Singleton (2005:2), "IT has inspired the reengineering of traditional business processes to promote more efficient operations and to improve communications within the entity and between the entity and its customers and suppliers".

In the early 1980's, Information Systems were developed and implemented to ease the use of the existing manual systems and to reduce the time spent to develop and use these manual system processes. Information Systems (mainframes) were rapidly implemented by almost all major organisations, and this quickly filtered down to the smaller enterprises as well. The emergence of Information Systems have changed the way that businesses operate and have forced the audit profession to alter the traditional auditing processes since many facets of the audit also changed as a result. As stated by Gleim (2004: Study unit 9), "the use of computers in business Information Systems has fundamental effects on the nature of business transactions, the procedures followed, the risks incurred, and the method of mitigating those risks". The use of Information Systems has introduced the following characteristics, which distinguish computer-based processing from manual processing as described by Gleim (2004: Study unit 9):

- A complete trail useful for audit and other purposes might only exist for a short period or only in computer readable format and these trails are dependent on the transaction processing mode;
- Computer processing uniform subjects like transactions to the same processing instruction and therefore virtually eliminated clerical error, but programming errors may occur;
- Many controls once performed by separate individuals may be concentrated in the computer system, this increases the segregation of duties risk;
- The potential for individuals to gain unauthorised access to data, to alter data or to gain access to assets may be greater in computerised systems;

- Computerised systems increase the potential for increased management supervision since analytical tools for review and supervision of operations exist within these systems;

- Certain transactions may be automatically initiated or performed by the computerised system; and

- Computer processing may produce reports and other output that are used in performing manual control procedures. These reports are however dependent on the completeness and accuracy of the computer processing.

These changes have forced the audit profession to no longer only look at the financial records and source documents but to also focus on these systems that are responsible for creating almost all information and records in the organisation. According to Champlain (2002:A1-2) "technological developments have changed the scope and objectives of IT auditing". He further elaborates and states that the change began with the implementation of the first IBM PC and is driven today by the increasingly complex problems presented by the global computing community. It is no longer one large computer centre controlled by a Management Information System (MIS) but today organisations are dependent on a decentralised user-controller environment. The focus has shifted from a controlled mainframe environment to an open architecture / midrange system linking global offices". Champlain (2002:A1-13) also states that "auditors can no longer choose to ignore technology, because they simply cannot perform their function without understanding how their organisation is using technology to run the business". These statements are corroborated by Gallegos, Senft, Manson and Gonzales (2004:7) when they state that "technology has impacted the auditing profession in terms of how audits are performed (information capture and analysis, control concerns) and the knowledge required to draw conclusions regarding operational or system effectiveness, efficiency and integrity, and reporting integrity. Initially the impact was focused on dealing with a changed processing environment. As the need for auditors with specialised technology skills grew so did the IT auditing profession". Hall and Singleton (2005:2) also confirm this statement when they stated that "recent developments in Information Technology (IT) have had a tremendous impact on the field of auditing". They further elaborate on this statement by stating that although IT developments have come with a number of advantages, IT developments have introduced new risks which require unique internal controls.

These risks have engendered the need for new techniques for evaluating controls as well as providing assurance regarding the security and accuracy of corporate data and the Information Systems producing these data. Figure 2 represents the influence of IT and Information Systems on traditional audit.

The problem encountered was that financial auditors were suddenly faced with the audit of Information Systems of which they had little or no knowledge. And "although the overall audit objectives are not different for computerised systems, the methods and procedures that the auditor uses in conducting the audit are different" (Yang & Guan, 2004:554). Where traditional auditing has mainly focused on substantive testing, the focus has shifted to a more control based risk evaluation to identify possible risks and evaluate the controls implemented to mitigate the identified risks. Thus, the auditing profession needs to adapt to the changes that are being introduced by Information Systems.
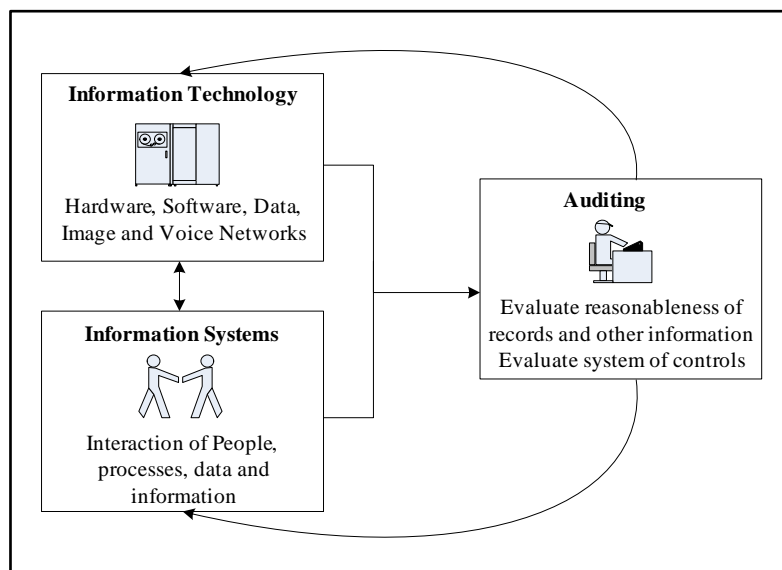
Figure 2: IT and IS influence on auditing

The evolution and growth of Information Systems caused major problems to traditional financial auditing since electronic processing was used to process data, which created difficulties since the physical observance of the auditing process was no longer possible as processing took place in a computer. Even if the process did not evaporate, the auditors had an inability to understand the electronic processing and

how to read the information that was processed. Another major problem was the internal storage of Information Systems data and programs, thus the auditors could not evaluate the processes and procedures (controls) that were being used. This caused the auditors to lose their ability to trace documents from source to reports and back as described by Watne and Turney (2002).

Another problem encountered with the introduction of Information Systems was the modification of data or programs without the auditor's knowledge, meaning that IT people had direct access to the database and would make changes without having formal change control processes in place. Another difficulty was the disappearance of the audit trail. The auditors were neither educated nor competent to deal with these changes, and regarded the computer as a threat.

According to Information Systems Audit and Control Foundation (ISACF) (1998) auditors have "recognised the need for an EDP audit function (IS auditing was formerly called electronic data processing (EDP) auditing) at this stage in time. This recognition came from two directions:

- Firstly, auditors realised that computers had impacted their ability to perform the attestation function; and
- Secondly, both corporate and information processing management recognised computers were valuable resources that needed controlling like any other valuable resources within the organization."

In these stages the auditors were auditing around the computer, meaning that they used the computer for calculations but then traced the transactions to the computer and picked up the trail on the other side by examining the printouts received from the computer processing. A new professional was born to cope with these problems and to assist the financial auditors in performing controls assurance around the computerised systems. These professionals were known as Information Systems Auditors. As Bagranoff and Vendrzyk (2000:33) stated that ten years ago, most IS auditors were actually financial auditors with some interest in Information Systems that was part of the audit division. These auditors conducted a review of IS-related controls and have reported on the strengths or weaknesses. These findings were then used to assist financial auditors to limit the scope of their audit testing.

But this situation was however only found in a few organisations. Financial auditors had little understanding of the work done by the IS auditors and the IS auditors did not always understand the implications of control weaknesses on the financial statements.

This situation improved about ten years ago according to Bagranoff and Vendrzyk (2000:33). IS audit was still largely supportive of financial audit, but beginning to spend time on developing and offering client services such as security, IS consulting, business continuity planning and technical reviews and risks assessments. Financial auditors still didn't understand the impact of control weaknesses on the financial statements but as audits shifted more towards a risk-based approach, this understanding gap narrowed. Auditors began to understand that Information Systems can be used to their advantage and used as a tool rather than be seen as an adversary. This was the beginning of auditing with the computer through Computer Assisted Audit Techniques (CAATs). Organisations began to recruit more experienced IS auditors with specialised skills but still it was unlikely that an IS auditor would be able to become a partner in the firm (Bagranoff & Vendrzyk, 2000:33).

Computer Systems reached the point where auditors could no longer audit around the computer and were forced to use computers as the target of their audit, since all information was processed internally which increased processing speed and storage capacity and was utilising artificial intelligence. By 2000 IS auditing was driving the audit according to Bagranoff and Vendrzyk (2000:33). With emerging technologies like e-commerce, data mining, digital signatures, the Internet and new legislations and statements, such as the Sarbanes-Oxley Act in the United States of America which impacted all companies listed on the New York Stock Exchange, the work for IS auditors keeps on increasing rapidly. IS auditors perform tasks like firewall audits, security diagnostics, system effectiveness, technology assurance and business continuity planning. IS auditors use tools like ACL, Microsoft Excel, SQL and IDEA to perform analyses on the controls to evaluate the reasonableness of the Information System processes and internal controls. The auditors now use the computer to submit data for processing. These results are then analysed to ensure that the Information System processes the data accurately, completely and in a timely manner.

This method is called 'auditing through the computer'. This enables the auditor to locate source documents or printouts and reconcile balances obtained from computer files.

With the evolution of IS auditing from traditional auditing to a profession on its own, many standards and control techniques were inherited from traditional auditing, IS management, behavioural sciences and computer sciences (ISACF, 1998). Weber (1999:18) states that "traditional auditing brought to Information Systems Auditing a wealth of knowledge and experience with internal control techniques. This knowledge and experience has had an impact on the design of both the manual and machine components of an Information System". Yang and Guan (2004:544) state that "because many businesses at present use computers to process their transactions, the auditing profession has been faced with a need to provide increased guidance for audits conducted in an IT environment". ISACF (1998) also states that knowledge of internal control practices as well as an overall control philosophy were contributed by traditional auditing. Information Systems Management provides methodologies necessary to achieve successful design and implementation of systems. Behavioural science indicates when and why Information Systems are likely to fail because of people problems. Computer science contributes knowledge about control theory and the formal models that underlie hardware and software design as a basis for maintaining data integrity.

This evolution in auditing and Information Systems has forced the profession of auditing to change from a reactive to a proactive continuous integrated service. This concept is supported as schematically shown in the CISA Review Manual (2006:58):
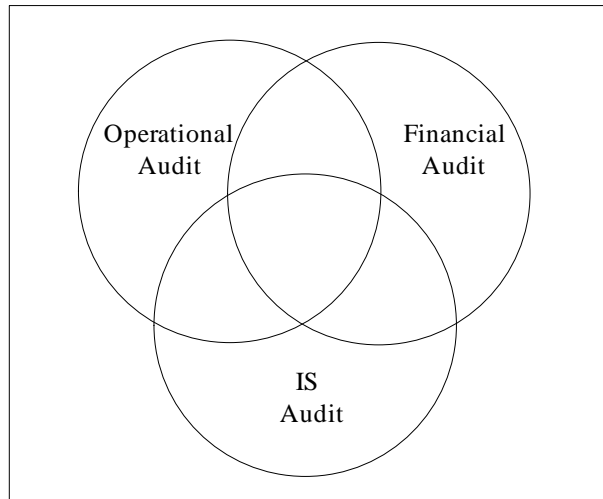
Figure 3: An integrated continuous audit (CISA, 2006:58)

The evolution in audit and Information Systems has also forced auditors from auditing around the computer to auditing with and through the computer by incorporating the necessary knowledge and skills from IT specialists. Technology has impacted the business environment in the following three significant ways according to ISACF (1998):

1. It has increased our ability to capture, store, analyse, and process tremendous amounts of data and information, as well as changing production and service processes;

2. Technology had a significant impact on the control process; and

3. While control objectives has remained fairly constant, except for some that are technology specific, technology has altered the way in which systems should be controlled. Safeguarding assets, as a control objective, remains the same whether manual or automated. However, the manner by which we meet the control objective is certainly impacted.

Technology had an impact on the auditing profession in terms of the knowledge required to draw conclusions and the skills to perform an audit. The need for auditors with specialised skills regarding technology was formally recognised by the founding of the EDP Auditors Association, now the Information Systems Audit and Control Association (ISACA) in 1969 as stated in the ISACA model curriculum for IS audit and controls (2004), "the evolution of Information Technology (IT) affects the business environment in many significant ways. It changes business practices, reduces

costs and alters the ways in which systems should be controlled. In addition, it raises the level of knowledge and skills required to control and audit Information Systems, and it increases the need for well-educated professionals in the fields of Information Systems (IS) governance, assurance, security and control".

Since IS auditors need to understand the process flow of Information Systems, which include technical knowledge and an understanding of the controls needed to ensure accuracy, validity and completeness, the following questions are posed:

- Is there a difference in knowledge between IT professionals, audit professionals and IS audit professionals?
- Who will be the best candidate to perform IS audit assignments, someone with an IT or an audit background?
- What is the level of IT knowledge required from these professionals?
- What is the level of audit knowledge required from these professional?
- Is the field of IS auditing really as specialised as perceived?
- What are the typical daily roles and responsibilities of IS auditors?
- What IS audit tools and techniques are used in assisting IS auditors to perform IS audit evaluations and assessments?

To better understand the criteria and demands in IS auditing towards answering the proposed questions, the next section will introduce and will define IS auditing concepts and evaluate the impact of these concepts on the IS audit profession and individuals in the profession.

2.3 IS AUDITING CONCEPTS

The term IS audit is defined by Raval and Gupta (1998) as "a set of technical, managerial and organisational services provided by a group of auditing experts in the area of Information Systems and technologies", they further elaborate and state that "the purpose of an IS audit is to maximise the leverage on the investments in the Information Systems and technologies and ensure that systems are strategically aligned with the overall goals and missions of the organisation".

This definition is further elaborated on by Hinson (2006:5) when he states that "computer auditors primarily study computer systems and networks from the point of view of examining the effectiveness of their technical and procedural controls to minimise risks". According to Hall and Singleton (2005:3) an IT audit is associated with "auditors who use technical skills and knowledge to audit through the computer systems, or provide audit services where processes or data, or both, are embedded in technologies". From these definitions the concepts and terms applicable to IS auditing will be described.

2.3.1 Concept descriptions

Distinguishing between the concepts concerning IS auditing for the purpose of this study should be done before we can consider the roles and responsibilities, knowledge, skills and audit tools and techniques required for IS auditors. The different role playing concepts for the purpose of this study is presented in Figure 4.
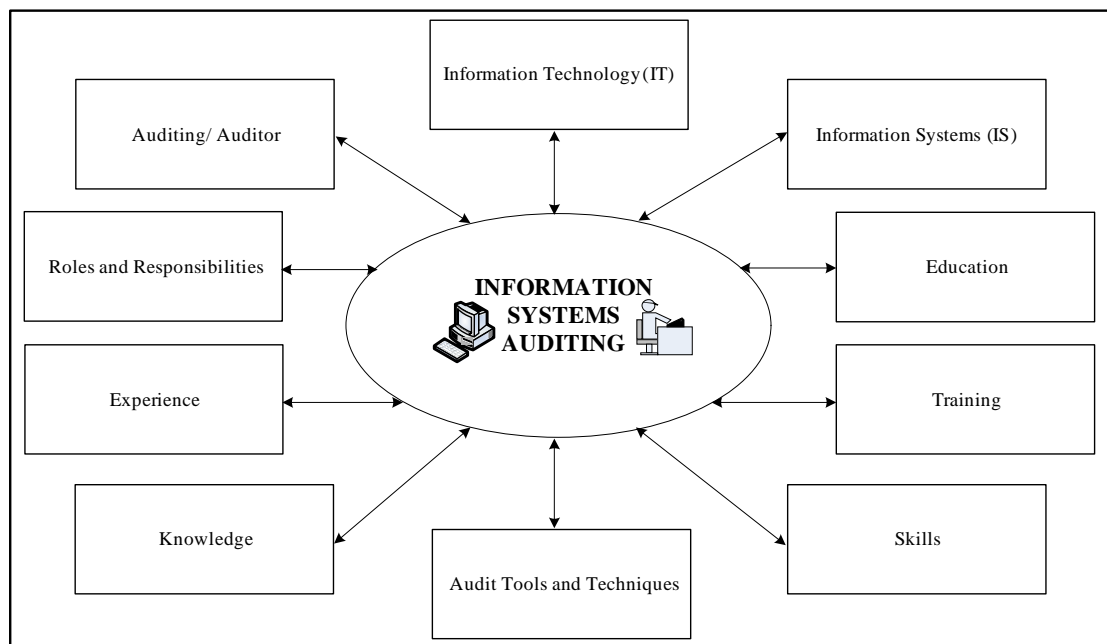
Figure 4: IS auditing concepts

IS auditing concepts include:

- Information Technology;
- Information Systems;
- Auditing;
- The roles and responsibilities of IS auditors;
- Skills required to perform an IS audit;
- Knowledge required to perform an IS audit;
- Training;
- Education in the field of IT and auditing;
- Experience which is gained through applying knowledge; and
- Audit tools and techniques that can be used to assist the auditors in analysing and evaluating the Information Systems.

These are not the only concepts that affect IS auditing since the IS auditing field consists of more detailed areas. The identification of other role-playing areas and concepts in IS auditing can be used for future research.

The concepts presented in Figure 4 are imperative for this study and need to be defined to eliminate mystification. After defining all the concepts, they will be represented in Figure 5 according to their impact on each other and on the IS auditing profession.

Before defining each concept it is essential to emphasise that the vocabulary used for IS auditing can consist of the following terms: Computer auditing, IT auditing, Auditing of EDP systems or Control assurance. For the purpose of this study the term 'IS auditing' will be used since the term Information Systems also encompasses Information Technology and therefore best defines the integration of the Information Systems and auditing professions.

It is important to define all the role playing concepts regarding IS auditing to determine their relationship to and impact on the IS auditing profession:

Information Technology and Information Systems

Firstly one should make a differentiation between Information Technology (IT) and Information Systems (IS). IT is defined by Whitten et al. (2001:8) as "… the combination of computer technology (hardware and software) with telecommunication technology (data, image, and voice networks)". Whereas Information Systems (IS) are defined as " …an arrangement of people, data, processes, information presentation, and Information Technology that interact to support and improve day-to-day operations in a business as well as to support the problem-solving and decision-making needs of managers and users" (Whitten et al., 2001:8). It can therefore be concluded that Information Systems is the umbrella term for all Information Technology concepts and resources.

For the purpose of this study the term Information Systems is defined as: The combination of hardware, software (operating system), application software, data, networking and the procedures and people involved in programming, processing, operations, maintenance and utilisation of these concepts.

Traditional Auditing

The objective of external auditing is to evaluate the reasonableness of the financial statements, thus determining if the financial statements properly reflect the performance of the business (SAICA, 1998). According to the South African Auditing Standards (SAAS) 200 (1996), "the objective of an audit of financial statements is to enable the auditor to express an opinion as to whether or not the financial statements fairly present, in all material respects, the financial position of the entity at a specific date, and the result of its operations and cash flow information for the period ended on that date, in accordance with an identified financial reporting framework and or statutory requirements".

The objective of internal auditing is defined by Gleim (2004:2) as "an independent, objective assurance and consulting activity designed to add value and improve an organisation's operations" by helping the company to achieve it's objectives through a "systematic, disciplined approach to evaluate and improve the effectiveness of risk management, control and governance processes". He further stated that " internal auditing reviews the reliability and integrity of information, compliance with policies

and regulations, the safeguarding of assets, the economical and efficient use of resources, establish operational goals and objectives and encompass financial activities and operations including systems, production, engineering, marketing and human resources" (Gleim, 2004:2).

Information Systems Auditing

Traditional auditing objectives as defined above are influenced by Information Systems, where manual inputs and outputs are no longer processed and more risks are threatening the financial statements and organisational processes as described in the evolution section above. The two professions of IT and auditing (whether internal or external) need to be integrated to execute an effective IS audit.

The Statement on Auditing Standards number 48 describes the effects of computer processing on the examination of financial statements as follows: "the auditor should consider the method the entity uses to process accounting information in planning the audit because such methods influence the design of the accounting system and the nature of the internal accounting control procedure", it further elaborates and states: "the auditor should consider whether specialised skills are needed to consider the effect of computer processing on the audit, to understand the flow of transactions, to understand the nature of internal accounting control procedures, or to design and perform audit procedures".

Weber (1999:10) defines IS auditing as: "the process of collecting and evaluating evidence to determine whether a computer system safeguards assets, maintains data integrity, and allows organisational goals to be achieved effectively and uses resources efficiently". Weber (1999:11) represents the impact of IS auditing on organisations when he explains that Information Systems auditing has brought about: 1) improved safeguarding of assets; 2) improved data integrity; and 3) improved system effectiveness and improved system efficiency. He also states that IS auditing is the intersection of traditional auditing, IS management, computer science and behavioural science. Hinson (2004:5) expands on this by stating that computer (IS) auditing is all about, "… a branch of general auditing concerned with governance (control) of information and communication technologies (computers). Computer auditors primarily study computer systems and networks from the point of view of

examining the effectiveness of their technical and procedural controls to minimize risks". Lucy (1999:44) summarises the definitions effectively when he stated that "management utilises Information Systems auditing as a tool for ensuring: 1) the reliability and integrity of information; 2) compliances with IT policies and procedures; 3) the safeguarding of IT assets; 4) the economical and efficient use of IT resources; and 5) the accomplishment of established IT objectives and goals (IAA, 1978)".

For the purpose of this study and as derived from the above definitions, Information Systems Auditing is defined as the examination of an Information System and surrounding procedures to express an opinion as to whether or not the data involved in processing, from the initiation of the transaction to its inclusion in the financial statements, is fairly represented at a specific date, to ensure completeness, accuracy, validity and timeliness of data and transactions and to scrutinise the controls implemented to mitigate identified risks as well as to provide assurance on the safeguarding of organisational assets and resources.

Knowledge and Skills

The above definition clearly implies that IS auditors need to have some knowledge, skills, education, experience and/or training in the fields of IT and auditing. The Statement on Auditing Standards states: "The auditor should obtain sufficient knowledge of the accounting system to understand…the accounting processing from the initiation of a transaction to its inclusion in the financial statements, including how the computer is used to process data".

It is important to determine what is meant by knowledge and skills and to differentiate between the two terms. According to Lucy (1999:44) knowledge is based on information whereas information is data that are presented in a usable format to the right person, at the right time and at the right place. In his book "What is Knowledge", Pearse (1972) defined knowledge by providing the following typology: 1) *Knowledge of facts* (which can be expressed as either true or false); 2) *Knowledge of acquaintance* (which entails knowledge of particulars); and 3) *Knowledge of how-to-do things* (alternatively described as skills).

For the purpose of this study knowledge is defined as the combined result of formal education, experience and training, something one gains by listening, reading, learning or observation. This is supported by Romiszowski (1981) when he stated that knowledge is the state of knowing something, while skills is the ability to use one's knowledge to perform a task. Knowledge is what one knows whereas skill is what one can do but skill cannot exist without knowledge. Thus skills are the utilisation of one's knowledge in day-to-day operations.

In conclusion, sufficient knowledge and skills required from IS auditors to successfully execute their responsibilities can only be obtained from formal education and on the job training. By means of applying the knowledge in daily operations, experience is gained which leads to better performance. This process enhances the individual's skills base as they become more experienced.

Skills for the purpose of this study will however refer to the soft skills (personality traits) of IS auditors. Soft skills are defined as a set of skills that influence how we interact with each other. It includes such abilities as effective communication, creativity, analytical thinking, diplomacy, flexibility, change-readiness, and problem solving, leadership, team building, and listening skills. The goal of soft skill training is to give students opportunity to learn and practice new patterns of behaviour and in so doing to enhance human relations. Soft skills drive the IS auditor to successfully complete IS auditing assignments.

Education and Training

"Accounting education systems within the Universities should give students the opportunity to acquire both IT/IS knowledge and IT/IS practical skills for both information processing and communication. The accounting education program should increase accountants' IT competency and their awareness of technological developments and the use of applications" (Ahmed, 2003:21). Theuri and Gunn (1998) stated that there are many variations of what constitutes an Accounting Information Systems course but the challenge remains to design a curriculum that considers both educational needs and employer expectations.

According to Coetzee and du Bruyn (2003:28) "…the basic (computer) knowledge of students is increasing as a result of increased computer accessibility, the need for

subject-related computer training still exists". Davies (2000) expands on this and stated that: "In the workplace auditors also need to be familiar with accounting systems… auditing involves auditing through the computer and not merely around the computer and for this reason it is important for students to have the opportunity to audit data and draw conclusions…"

Bedard et al. (2003) found that with training, auditors could accept an electronic work system and increase ease of use. Training is also fundamental in the learning of IT tools. Braun and Davis (2003:731) have found in their research that "… additional training is needed and desired by auditors".

The difference between education and training for the purpose of this study is that education is defined as the activity of educating, instructing or teaching, thus formal education from academic institutions. Training has more of a work base than education. Training is career oriented and represents the so-called on-the-job training. Training usually does not involve examinations and does not need an academic setting. Training is the development of knowledge into skills through physical work, instruction and practice.

Experience

Experience is gained from applying the knowledge obtained from formal education and training in a suitable IS audit environment. This experience is usually the starting point for merging the two professions given that IS audit professionals come from different backgrounds.

Hinson (2004:18) states that: "Being experienced – there really is no substitute for understanding the auditees' point of view and it certainly makes one think twice before recommending actions one would not be prepared to take oneself". He expands on this by saying that: "…practical on the job experience is a major advantage, particularly for the softer skills such as interviewing techniques and establishing rapport especially with evasive or nervous auditees".

Computer Assisted Audit Techniques (CAATs) and Tools

According to Hinson (2006:18) "CAATs are tools/utilities to help auditors select, gather, analyse and report audit findings". Examples of such tools are ACL (Audit Command Language), IDEA (Interactive Data Extraction and Analysis), Microsoft Excel and SQL queries. Hinson (2006:18) further elaborates and states that "information security applications such as intrusion detection systems, penetration testing and vulnerability assessment tools could also be considered CAATs since they can be used by auditors to find information security control weaknesses".

According to Sayana (2003) CAATs can be classified into four broad categories:
- Data analysis software (including generalised audit software (GAS), encompassing queries and other analysis on data);
- Network security evaluation software / utilities;
- Operating system and database management system security evaluation software / utilities; and
- Software and code testing tools.

CAATs therefore help auditors to select, gather, analyse and report information and help add credibility to the findings, conclusions and recommendations. CAATs are one way to close the gap between the two professions and the knowledge and skills required from IS auditors since one needs to have IT knowledge and an audit understanding to analyse and run the data through CAATs. According to Braun & Davis (2003:726) "a likely path that audit managers could use to bridge the gap between the current technological skills of an auditor and the skills that would be needed in a continuous audit is to increase the usage and understanding of computer assisted audit tools and techniques especially generalised software". Sayana (2003) also states that the benefits of using audit software includes: "the use of audit software ensures a 100 percent scrutiny of transactions in which there is audit interest and pointed identification and zeroing on erroneous / exceptional transactions, even when data volumes are high. Furthermore all of this can be done in a fraction of the time required with manual methods. Audit software also has a uniform user-friendly interface. The audit software maintains logs of the tests done for review by peers or senior management".

It can therefore be concluded that CAATs are a support feature assisting IS auditors to select, gather, analyse and report information. From the literature as described above, it can be concluded that the IS audit tools and techniques, currently available, fall into the following main categories:

- Generalised audit software (e.g. ACL, IDEA, Microsoft Excel or SQL queries);

- Security analysis tools (used to assist the auditor in analysing the security settings at domain level of operating systems and networking software);

- Application analysis tools (used to ensure that proper validation and controls are implemented at application or database level);

- Audit Methodologies (assisting the auditor in all areas of the audit by means of evaluating organisational controls against control objectives, audit guidelines and best practices); and

- General applications (includes document management and planning management and enabling the auditor to create work papers, reports and other relevant documentation e.g. Microsoft word, Microsoft projects).

2.3.2 The impact of the concepts on IS auditing

IS auditing consists of traditional auditing incorporating the attendant, possible risk of Information Systems and Technologies. Information Systems have changed the way in which an audit is performed. Individuals in the IS auditing profession need to be educated and trained in IS auditing to obtain the required experience to successfully execute their roles and responsibilities and to effectively use the audit tools and techniques (CAATs) to assist them. This cycle is represented in Figure 5. The cycle is drawn based on the $IDEF_0$ modelling method.

According to Gingele, Childe and Miles (2002:239-240), $IDEF_0$ is one of the most widely known tools for functional modelling and is based on structured analysis and design techniques. $IDEF_0$ models are presented as an ordered series of related diagrams and text. Activities are described within a box. Arrows are used to represent flows. The four main flows are (I)nput (entering a box), (C)ontrol (influencing transformation of an activity), (O)utput (leaves box) and (M)echanism (a person or device needed to successfully complete an activity) (Gingele et al., 2002:239-240).

Input

IT and IS, as described above, have had a tremendous influence on traditional auditing. The combination of Information Technology, Information Systems and auditing are regarded as the input to the model. The input is needed to produce the desired output. (See the above section for definitions.)

Controls

The controls, namely auditing standards and guidelines, have a direct influence on the IS auditing process by means of guiding and describing the processes to follow and the involvement of IS auditors in a financial audit. The Statement of Auditing Standards states that "the auditor should obtain sufficient knowledge of the accounting system to understand the accounting processing from the initiation of a transaction to its inclusion in the financial statements, including how the computer is used to process data". This means that IS auditors should be invited to participate in financial audits.

Furthermore IS auditors should have the appropriate IT knowledge and skills to perform the assessment of automated transactions and Information Systems. Hinson (2006:8) states that most IS audit assignments make use of the following best practise guidelines and frameworks to compare and assess risks and controls:

- National standard bodies such as NIST
- Professional bodies such as ISC, ISACA which promote frameworks such as COBIT and GASSP (generally accepted information / system security)
- Industry bodies such as SAS70 financial services
- Government legislation (e.g. electronic signatures, copyright and governance)
- Consultancies using ISO 270000 (security standard, previously known as ISO17799)
- Information security professionals (e.g. CISA and CISMs).
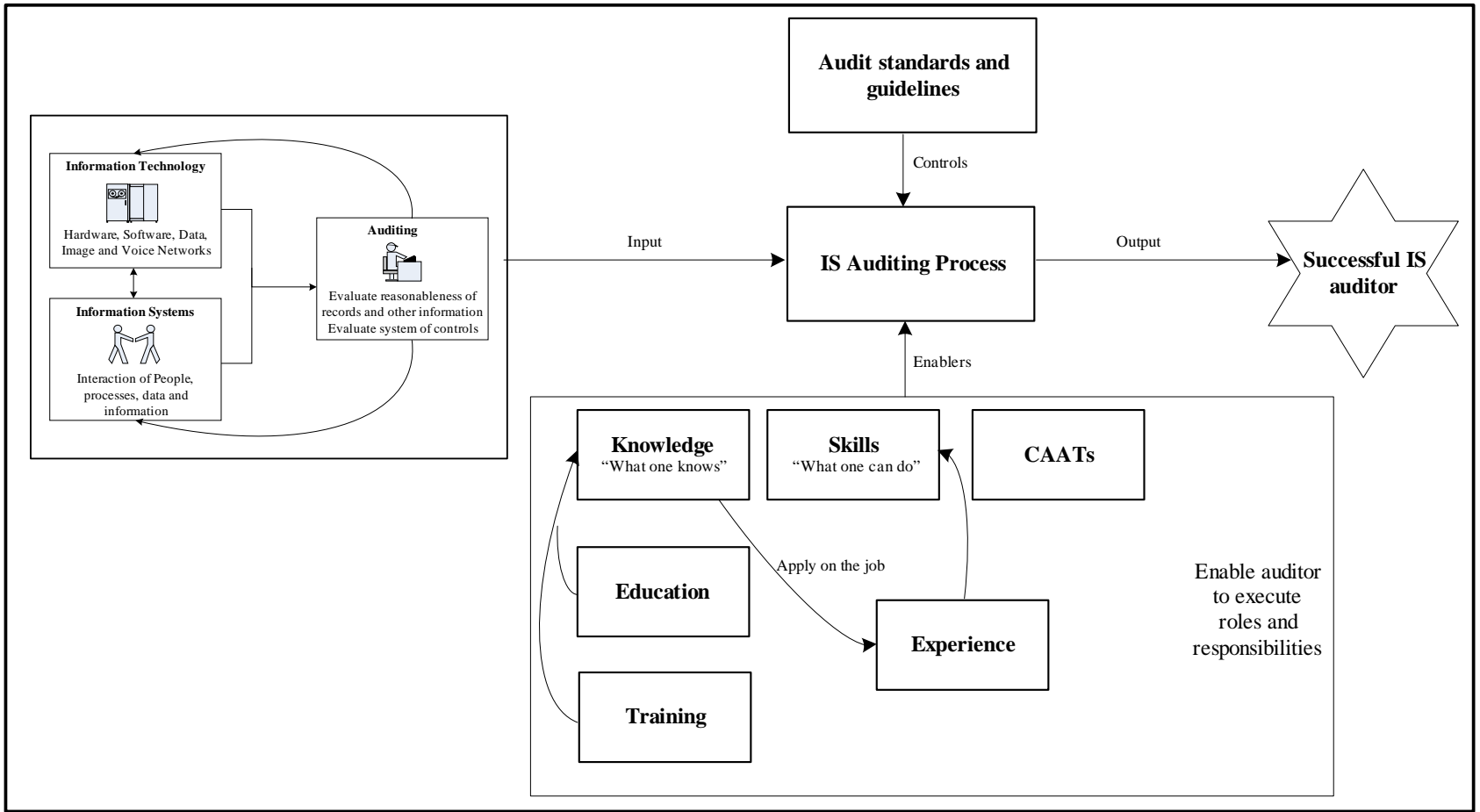
Figure 5: Impact of concepts on IS auditing

Enablers (mechanism)

The mechanism/enablers represent either a person or device needed to successfully complete an activity. The enablers include the IT knowledge obtained from formal education and on the job training. This represents "What one knows". Through appliance of this knowledge, experience is gained. Through this process the knowledge is transformed into skills. Skills represent "What one can do". Another enabler is Computer Assisted Audit Techniques (CAATs) which are used to analyse audit findings and assist the IS auditor to perform an effective IS audit. Knowledge, skills and/or CAATs are of utmost importance to successfully execute an IS auditing function according to the roles and responsibilities assigned to an IS auditor.

Output

Combining the input, controls and enablers will deliver the desired output which is a successful IS audit.

In the next section the roles and responsibilities needed to perform an IS audit assignment will be evaluated and combined into a roles and responsibility framework which will set the basis for defining the IT and audit knowledge, soft skills and IS audit tools and techniques required by an IS auditor.

2.4 ROLES AND RESPONSIBILITIES OF IS AUDITORS

It is essential to determine the roles and responsibilities of an IS auditor before determining the IT and audit knowledge and skills needed by IS auditors, as the required knowledge and skills can only be known according to certain roles and responsibilities. According to Watne and Turney (2002) the Generally Accepted Auditing Standards (GAAS) state that auditors are required to have an understanding about underlying computerised systems as a basic competency. This statement is expanded by the Public Oversight Board (2000:2.78) when they state that "they should focus particularly on: … obtaining a more thorough understanding of Information Systems relevant to financial reporting and the related risks and controls …". This statement is further expanded by Pathak (2004) when he states that "the IT (IS) auditor needs to have a reasonable understanding of the environment and, more importantly, a good practical and pragmatic

approach to the work while reviewing the effectiveness of internal and external controls and the standards that the organisation intends to follow".

An IS auditing assignment can be seen as a project undertaken with the specific outcome of assessing the controls implemented to minimise risks. The stages in such a project can be compared against the value engineering approach. "Value engineering dates back to the 1940s and is concerned with the achievements of a project's functional objectives at minimum cost, whilst ensuring that the constraints of time, quality, performance and reliability are met" (Cadle & Yeates, 2001:240).

Since an IS audit assignment is seen as a project, it is essential to first establish the steps required in performing an IS audit. Champlain (2002) describes the typical steps in the IS audit as follows:

- Planning an IS audit
    - Research and gathering information (e.g. policies and procedures and manuals);
    - Interviews (who, when, where, how and what questions);
    - Control objectives (quality and relevance of control objectives to be tested);
    - Audit program and checklists (effective tool in IS auditing to determine if the company is achieving the control objectives);
- Staffing an IS audit;
- Organisation and management;
- Evaluating the organisational policies and procedures;
- Evaluation of software project management, development and maintenance;
- Evaluation of data safety;
- Evaluation of security;
- Auditing of new IT technologies; and
- Reporting of findings and communication to management.

Gallegos et al. (2004:70) agreed with these steps when they described them as:

- Planning the audit (define scope, state objectives, structure of orderly approach, provide for measurement of achievements, assure reasonable comprehensiveness, provide flexibility in approach);

- Using the plan to identify problems;
- Organising the audit (scope and deliverables);
- Preliminary review (obtain information to formulate the audit plan (fact gathering));
- General data gathering;
- Identify financial application areas;
- Preparing the audit plan and tests;
- Field work and implementing audit methodology;
- Audit tools and techniques;
- Validation of work performed;
- Audit report and follow-up; and
- Post-audit (notes for future audit).

Hall and Singleton (2005:13) categorise the phases of an IS audit and summarise them as follows:

- Audit planning phase
    - Review organisation's policies, practices and structure;
    - Review general controls and application controls;
    - Plan test of controls and substantive testing procedures;
- Test of controls phase
    - Perform test of controls;
    - Evaluate test results;
    - Determine degree of reliance on controls; and
- Substantive testing phase
    - Perform substantive tests;
    - Evaluate results and issue auditor's report; and
    - Audit report.

Hinson (2004:8) draws a typical example of the main stages of a IS audit assignment and elaborates on that in a later publication (2006:11) where the steps in an IS audit assignment are described as:

- Scoping and pre-audit survey (main area/s of focus and any areas that are explicitly out-of-scope and risk-based assessments);

- Planning and preparation (greater level of detail involving the generation of an audit work plan or risk-control-matrix);

- Fieldwork (gathering evidence, interviewing staff and managers, reviewing of documents, printouts and data, observing processes, may also include the use of CAATs);

- Analysis (sorting out, reviewing and trying to make sense of all the evidence gathered earlier);

- Reporting; and

- Closure (preparing notes for future audits and chasing-up management to complete the actions they promised months earlier).

Taking into account the main stages as defined above by the different authors and applying them to the value engineering approach, an IS auditor's roles and responsibilities can be summarised in the following main stages as presented in Figure 6. The stages may however differ according to the varying needs of organisations and/or individuals.
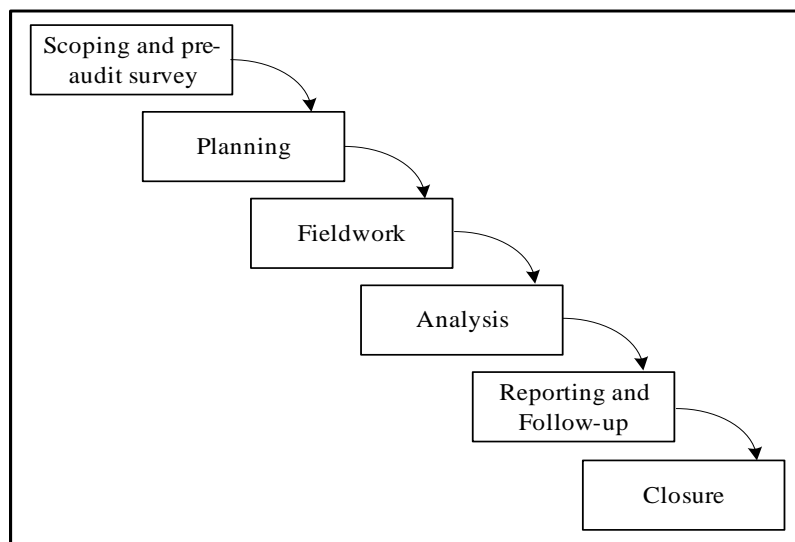
Figure 6: Main stages in an IS auditing assignment

The main stages can be described as follows:

1. **Scoping and pre-audit survey**: Evaluation of client conditions (especially for new clients), identify the main focus areas, usually actual and potential risks to the business associated with computer systems, networks, IT installations, applications, development projects, obtain information about the client and requirements for the audit.

2. **Planning**: Define the scope, state audit objectives, ensure comprehensiveness, decide on control objectives and activities to test, develop an appropriate audit program and checklists, risk-control-matrix assessment, identify financial application areas and assigning adequate resources to the assignment.

3. **Fieldwork**: Gathering of evidence by interviewing staff, users and managers. Reviewing of documents, printouts and other data, observing processes and using CAATs to perform analyses and detailed testing of data. The fieldwork includes reviewing and evaluation, for example policies and procedures, software project management, developments and maintenance, data safety and security.

4. **Analysis**: Assess whether the level of risk is reasonable or whether control improvements are required, by the sorting, validation and reviewing of evidence. Make use of data analysis tools, such as ACL, IDEA, Excel, access or in-house development queries and methodologies.

5. **Audit Report and Follow-up**: Audit findings are summarised, analysed and recommendations are made to client management, persuading management to commit to resourcing and making changes within a sensible timeframe. Perform follow-ups to ensure that management has committed and implemented the recommendations within the specified allocated timeframe.

6. **Closure**: Preparing notes for future audits and staff assessments.

According to Hinson (2004:10-12) and (2006:16-17), the audit program by Burbage (2001), Champlain (2002), Weber (1999), Watne and Turney (2002), ISACA CISA Review Manuals (2005 and 2006), Warren, Edelson and Parker (2001:A2-5:7), Hall and Singleton (2005), Marx, van der Watt, Bourne and Hamel (2002), Raval and Gupta (1998) and Lucy (1999:44) there are several types of audits that need to be covered by the IS auditing function. These different types of audit assignments need to be executed according to the approach as described above or variations as per organisation. The types of assignments as derived from the above sources are summarised in Table 2.

TYPE OF AUDIT ASSIGNMENT	DESCRIPTION
Operation computer system / network audits	Review the controls within and surrounding operational computer systems (servers and workstations), networks (LAN's and WAN's) and data. For example: scheduling of operation, maintenance of manuals, reviews of overall performance, console logs, housekeeping procedures, help-desk procedures, order of runs, file controls, etc.
IT installation audits (environmental controls)	Take a look at the facilities (building, room…), physical security (walls, doors…), environmental controls (fire, flood…), communication, computer and operations processes, management systems and IT equipment.
Developing systems audits	Project/ program management controls and the specification, planning, development, testing, implementation and operation of technical and procedural controls as well as system development methodologies and life-cycle approaches.
IT process audits	Application development, testing, implementation, operation, maintenance, housekeeping, support and recovering.
Change management audits	Review the planning, control, development and implementation of changes to systems, networks, applications, processes, facilities, etc. Ensure that all changes are authorised and ensure that all authorised changes are completed, tested and implemented.
Information security and control audits	Review controls relating to confidentiality, integrity and availability of systems and data. Ensure authorisation of processes. Providing technical, control and security guidance to IS personnel.

TYPE OF AUDIT ASSIGNMENT	DESCRIPTION
IT legal compliance audits	Review legal and regulatory aspects of the IT systems. Ensure compliance with statutory requirements, standards, policies and procedures.
Disaster contingency/ business contingency planning/ disaster recovery audits	Review arrangements to restore some semblance after disaster. Backup methodologies and contingency planning.
IT strategy audits	Review IT strategy (vision, mission, objectives and plans).
Organisational audits	Determine whether central or distributed and the IT department's relationship with managers, user departments, end-users, support and administration, customers, suppliers, partners, regulators, etc. Review access rights and user profiles.
Contract compliance and quality assurance audits	Software/ hardware providers and outsourcing arrangements.
Value-added support	Providing technical support and training to internal financial or other auditors. Facilitating the implementation of control self-assessment programs. Guidance to IS personnel. Cross-training with financial audit staff and continuous professional education.
Personnel practice audits	The appointment and retention of competent staff to work in the computerised environment.
Hardware and software audits	Identify weaknesses associated with hardware. For example: faulty hardware or communication equipment. Protect the integrity of the system through system software controls.
Special ad hoc assignments	Specifically requested by management (e.g. investigating suspected fraud or information security breaches).
Financial audit assignments	Specifically related to applications and business cycles. Input, processing and output audits (application audits). Manual and computerised control audits (e.g. limit checks or completeness checks). Assisting financial audit team (e.g. CAATs).
Emerging technology audits	Feasibility analysis of electronic data interchange, web technology, telecommunications, imaging, warehousing or data mining.

Table 2: Types of audit assignments

IS auditor's roles and responsibilities also go beyond the tasks they need to perform, as stated by Raval and Gupta (1998,) the following points also reside within the roles and responsibilities framework of an IS auditor:

- Internal Consultants (understanding of the business and serves as a consultant on a wide variety of projects);
- Change agents (auditors are a powerful tool in driving the implementation of changes, especially when a lack of top management buy-in is experienced);
- Experts (specialise in a certain area of the business);
- Advisors (serve as an advisor to business management on IS issues that have an enterprise-wide effect. This includes technical and managerial issues);
- Advocates (to promote Information System needs and the functions of business units to top management);
- Role of executives in capitalising IS audit function (successful and pragmatic companies view the IS audit function as an integral and vital element in corporate decision making);
- Be proactive (IS audit functions should not be viewed as static or passive functions in an organisation that are called to act on a need-only basis. Instead the IS audit function should be managed proactively and should be made an integral part of all decision making in the organisation);
- Increase visibility of the IS audit function (executives must play an active role in promoting the critical roles and significant contribution of IS auditors); and
- Communication (effective communication between business units or clients and IS auditors is vital for a healthy relationship between the two groups).

Taking the literature as presented above, the typical roles and responsibilities of an IS auditor can be summarised as follows:

- Understand Information Systems operations and policy and procedures and processes in place;
- Review control objectives;
- Compile audit programs to fit specific needs and risks;
- Identify risks and weaknesses in controls;
- Compile findings and make recommendations on weaknesses;
- Advise management on findings;
- Follow-up on previous findings and recommendations;

- Client relationship management (consultant, change agent, expert, advisor and advocate);
- Quality Assurance (adhere to standards, legislations and guidelines); and
- Control Assurance.

2.5 KNOWLEDGE

The knowledge required by IS auditors is in essence complex as it will differ according to organisations as well as individuals and according to the type of audit assignment. "The challenge facing organisations is that they now require the skills of a special kind of accountant… (Combining IT/IS competencies and mainstream accounting capabilities)" (Ahmed, 2003:20). Furthermore IS auditor's need to posses auditing as well as IT knowledge to successfully execute their roles and responsibilities as defined in the previous section. As observed by Champlain (2002:A1-2) "increasingly complex systems challenge the talent and experience of the IT auditor.
The risks of data loss, compromise, destruction and identity theft are greater than they have ever been. The IT auditor can meet these new challenges if he or she is armed with appropriate knowledge and practical tools."

As defined in the IS auditing concepts, Section 2.3, knowledge is the combined result of formal education, experience and training, something one gains by listening, reading, learning and/or observation. Skill can be defined as the conversion of knowledge through execution of one's daily roles and responsibilities.

A problem exists however in defining the *level* of knowledge and skills as individuals come from different backgrounds and the knowledge required is extensive. According to Hinson (2006:24) the following qualifications specific to information security and computer audit are widely preferred by IS audit professionals or as prerequisites for employment as an IS auditor:
- BSc in Information Systems or Computer Auditing;
- CISA;
- Certified information security management;
- Certified fraud examiner;
- Certified internal auditor;

- Certified financial services auditor;
- Certification in control self assessment;
- General management qualification; or
- Accountancy qualifications (CA, ACA, CPA or CIMA).

Hinson (2006:23) states that "there are two main routes into computer audit: firstly from technology (often information security, operations, project management, development or business analysis), and alternatively from accountancy (general or financial audit, financial management or management accounting). Other accepted entry routes include risk management, quality assurance and general management".

Hinson (2006:27) further elaborates and states that the most common routes into the computer auditing profession are:
- Directly from IT (developers, operations, IT security, technical architecture, business analysts, IT managers);
- Accountancy (traditional audit);
- Other types of auditing (quality audit, health and safety);
- IT and/or management consultancy;
- Risk management;
- Security;
- Other technical management roles; or
- University or college graduates.

The objective of this study is to define the knowledge required by IS auditors, which will enable them to successfully execute their roles and responsibilities. For the purpose of the study a differentiation will be made between IT knowledge and audit knowledge based on the majority of entry routes represented by these two backgrounds.

Knowledge in this area according to Champlain (2002:A1-12) is described as: "1) being proficient in a wide range of hardware and software systems; 2) audit planning techniques; 3) high-tech audit tools; 4) PC networks; 5) a solid background in PC's, open/midrange systems and client/server environments are ideal; and 6) the reviewing of vendor contracts".

Gallegos et al. (2004:4) define the following knowledge requirements for IS auditors:

- Application of risk-oriented audit approaches;
- Use of computer-assisted audit tools and techniques;
- Application of standards such as ISO software development and security standards;
- Understanding of business roles and expectations in the auditing of systems under development as well as the purchase of software packaging and project management;
- Assessment of information security and privacy issues which can put the organisation at risk;
- Examination and verification of the organisation's compliance with any IT-related legal issues which may jeopardises or place the organisation at risk;
- Evaluation of complex systems development life cycles or new development techniques;
- Reporting to management and performing follow-up reviews to ensure actions taken at work; and
- Complex specialised technologies (e.g. Internet, intranet, extranet, electronic data interchange, client servers, local and wide area networks, data communications, wireless technology and integrated voice / data / video systems).

Gallegos et al. (2004:40) further elaborate on the knowledge required by IS auditors by categorising the knowledge in basic areas expected from a person with a bachelor's degree according to the suggested courses in the IFAC study and the knowledge requirements for a program beyond bachelor's degree, as presented in Table 3.

According to Champlain (2003:3) "before performing an audit of a computing system or assessing the adequacy of an audit that was performed on a computing system, there are a few basics that one must understand about how a computing system functions", these basics include:

- Central processing unit;
- Operating systems;
- Application programs;
- Database management systems;

- Physical security controls (physical computer equipment must be adequately protected against physical damage resulting from natural disasters as well as other dangers such as bombings, fires, theft, unauthorized tampering and power surges); and

- Logical security controls (computing systems need to be protected against unauthorised access and accidental or intentional destruction or alteration of the system software, programs, application programs and/or data).

Bachelor's degree (undergraduates)	Program beyond bachelor's degree (post-graduates)
- IT and its applications - System analysis, design, development and implementation - Internal controls and documentation of Information Systems - Data structures and database concepts and management - Information System applications and processing cycles - Management of Information Systems and technology - Computer programming languages and procedures - Computer communication and networks - Model-based systems (decision support and expert systems) - System security and disaster recovery planning - Auditing of IT and its role in business	- Proficiency as an auditor - Ability to review and evaluate IT internal controls and recommend the extent of audit procedures required - Understanding of IT system design and operations - Knowledge of programming languages and techniques and the ability to apply computer-assisted audit techniques and assess their results - General familiarity with computer operating systems and software - Ability to identify and reconcile problems with client data file format and structure - Ability to bridge the communications gap between the auditor and the IT professional, providing support and advice to management - Knowledge of when to seek the assistance of an IT professional

Table 3: Knowledge requirement for undergraduates and post-graduates

Furthermore, the CISA Certification Manual (2006) states the following areas in which an IS auditor should be well acquainted:

- IT governance;
- System and Infrastructure Life Cycle Management (applications and software);
- IT Service Delivery and Support (monitoring use of resources, support, change management, Information Systems hardware, Information Systems architecture and software, Information Systems network infrastructure);
- Protection of Information Assets (physical and logical security); and
- Business Continuity and Disaster recovery.

Knowledge according to Hinson (2006:29) is categorised in three categories as follows:

- *Category 1* – All auditors from new recruits up through to the chief audit executive
    - o Basic IT knowledge (understanding concepts such as the difference in software as used in applications, operating systems, system software and networks; basic IT security and control components such as perimeter defences; intrusion protection, authentication and application system controls; and an understanding of how business controls and assurance objectives can be impacted by vulnerabilities in business operations and the related and supporting systems, networks and data components).

- *Category 2* – Audit supervisors
    - o Basic knowledge and an understanding of IT issues and the elements sufficient to address them in audit planning, testing, analysis, reporting, follow-up and the assignment of auditor skills to the elements of audit projects;
    - o Understand the threats and vulnerabilities associated with automated business processes;
    - o Understand business controls and risk mitigations;
    - o Plan and supervise audit task;
    - o Ensure the audit team has sufficient competence, including IT proficiency;
    - o Ensure the effective use of IT tools in audit assessments and testing;
    - o Approve plans and techniques for testing of controls and information;

- Assess audit test results for evidence of IT vulnerabilities or control weaknesses;
- Analyse symptoms detected and relate them to causes; and
- Provide audit recommendations based on business assurance objectives.

- *Category 3* – Technical IT audit specialist
  - Specialise in certain areas of technology;
  - Be familiar with threats and vulnerabilities associated with technologies; and
  - Understand the underlying technologies supporting business components.

Ahmed (2003:40-43) describes the following knowledge and skills per manager, evaluator (auditor) and general levels:

- Manager
  - Data resource structure and administration;
  - Management of accounting Information Systems;
  - Global information management;
  - Executive Information System management;
  - Ability for selection and the acquisition of hardware/software;
  - Ability for reinforcement of investment analysis using software;
  - Ability to participate as part of team with an appreciation for information and methods, behavioural consequences and project management;
  - Understanding the methods of operating and managing business systems once implemented;
  - Understanding the system development lifecycle, its phases, and management principles for the system development process;
  - Appreciation of the social, economical and legal implications of computer technology, including effects of automation on work institutions;
  - Decision support systems;
  - Strategic considerations of IT/IS development; and
  - Administrative issues.

- Evaluator (auditor)
  - Ability to design and apply computer-assisted audit techniques for a variety of audit purposes;
  - Ability to specify, identify and document financial and operational controls in computer-based systems;
  - Ability to evaluation effectiveness and efficiency of management and operations in a computer-based system;
  - Auditing of accounting Information Systems;
  - Evaluation of decision support systems;
  - Legal, ethical, auditing and Information System control standards;
  - Evaluation methods and techniques;
  - Communicating results of evaluations;
  - Specific types of evaluations;
  - Internal control in the computer-based system;
  - Evaluation objectives; and
  - Computer Assisted Audit Techniques (CAATs).

- General knowledge
  - Basic IT knowledge;
  - Computer based accounting systems;
  - Files / databases;
  - Communication technology;
  - Role of information within business and information management;
  - Electronic commerce; and
  - Administrative issues.

After taking into account the above described and defined knowledge criteria and by reviewing the available literature from various sources, the following summary is presented in Figure 7 as based on the differentiation between IT knowledge and audit knowledge. No sequence was followed and the types of knowledge presented are in no particular order of importance. It is important to take into account that the overall knowledge base of an IS auditor is much bigger and more complex.

This study only focuses on the basic IT and audit knowledge and skills for the purpose of defining an IS auditor's profile. The sources used to develop Figure 7 include, Ahmed (2003); The Institute of Internal Auditor's (IIA) International Advanced Technology Committee, ISACF (1998), Hinson (2004 and 2006), Weber (1999), Watne and Turney (2002), ISACA CISA Review Manuals (2005 and 2006), Warren, Edelson and Parker (2001:A2-5:7), Hall and Singleton (2005) and Marx et al. (2002) and Champlain (2002).
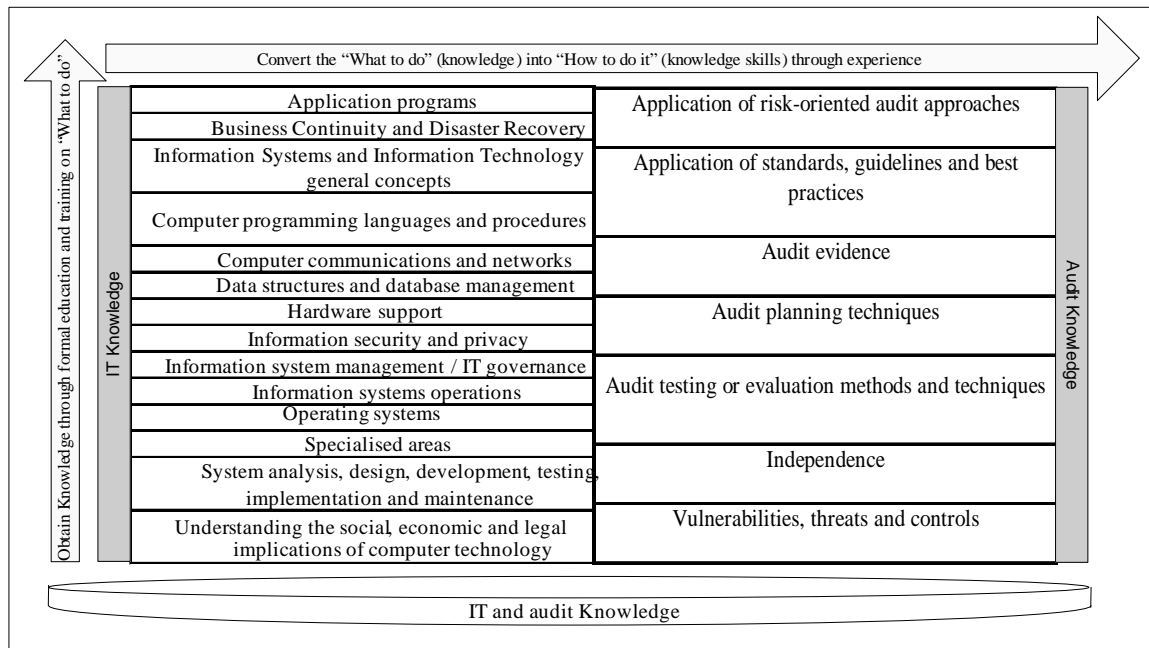
Figure 7: IT and audit knowledge and skills

2.5.1 The IT knowledge required from an IS auditor

The following section provides an overview of the IT knowledge concepts as illustrated in Figure 7:

Application Programs

Application software is a program or set of programs that contains the instructions to perform a specific task. Examples include Word processors, Excel and statistical packages. According to Watne and Turney (2002:31) "the auditor (is) interested not only in *how* the application software performs tasks but also in *what* controls over these tasks may be included in the software".

Thus the IS auditor needs to have a thorough understanding of how a computer's application software operates but more importantly needs to evaluate and implement application controls to ensure the accuracy, completeness, validity and timeliness of input, processing and output of data into and from the application programs. This ensures information integrity, the safeguarding of assets and that data is processed effectively.

Business Continuity and Disaster Recovery

According to the CISA Review Manual (2006) the "purpose of business continuity / disaster recovery is to enable a business to continue offering critical services in the event of a disruption and to survive a disastrous interruption to their Information Systems. Rigorous planning and commitment of resources is necessary to adequately plan for such an event". It is further elaborated on and the term Business Continuity Planning (BCP) is defined as "a process designed to reduce the organisation's business risk arising from an unexpected disruption of the critical functions / operations necessary for the survival of the organisation". It is further stated that BCPs include the Disaster Recovery Plan (DRP). DRP is defined as "the general plan followed by business units to recover an operational facility" (CISA Review Manual, 2006). It is essential for an IS auditor to understand the differences in the terminology as well as the importance of having a BCP and DRP in any organisation.

Information Systems and Information Technology general concepts

The IS auditor only needs to have a basic understanding regarding Information Systems and Information Technology and should obtain IT professionals for expert knowledge. Information Systems include: Transaction Processing System (TPS); Management Information System (MIS); Decision Support System (DSS); and Expert System (ES). Information Systems technology is the umbrella term which includes in essence all the IT knowledge required from an IS auditor. This includes the components of IS and IT technology, IS processing and operation methods, data flow, data file organisations, subsystems, resources and structures of the IT department. The IS auditor needs to have a basic understanding of all these concepts to evaluate the controls to ensure accuracy, completeness and validity of data.

Computer programming languages and procedures

The IS auditor needs to have a basic understanding about computer programming languages and procedures. IS auditors are not expected to have expert knowledge in this area and the expertise of IT specialists should be used. The IS auditor, however, needs to have a basic understanding to be able to evaluate the effectiveness and efficiency of operations (processing) and procedures in computer-based systems and to ensure the correctness and dependability of the IT specialist's work.

Computer communications and networks

IS auditors need to understand the concepts of data communications between the same or different systems over a network. Knowledge about the communication technology used, as well as the design and risks associated with data transmission is essential, since important information and confidentiality of information might be sent across business lines and should not to be accessible by unauthorised users. As stated in the CISA Review Manual (2006: 329), "the IS auditor should review controls over network implementations to ensure that standards are in place for designing and selecting a network architecture and for ensuring that the costs of procuring and operating the network does not exceed the benefits". The different types of business communication topologies available include Local Area Networks (LANs), Wide Area Networks (WANs), Value Added Networks (VAN's) and the Internet.

Data structures and database management

A database is a series of related files combined to eliminate unnecessary redundancy of data items. "The database subsystem provides functions to define, create, modify, delete, and read data in an Information System" (Weber, 1999:563). In database systems a single integrated Information System allows for increased data accessibility. Watne and Turney (2002:59) state that "the auditor should understand these terms (database, database management system (DBMS), and database administration), be aware of the benefits to management and users of such systems, and be familiar with the means of organising and referencing data within the data base". The CISA Review Manual (2006:329) states that "when auditing a database, an IS auditor should review the design, access, administration, interfaces and portability". Since data is one of an organisation's most important assets, it is essential to have basic knowledge about the database

concepts, controls and security issues regarding the database to ensure data integrity, accuracy, validity and the privacy of information.

Hardware

Since computer software cannot exist without the tangible hardware, the IS auditor needs to have an understanding of the components of computer hardware to ensure that proper controls and physical security are established around these components. The IS auditor also needs to become familiar with all the hardware in a data processing system as each individual piece of hardware has its own operating characteristics and control requirements (Watne & Turney, 20002:30). The IS auditor needs to familiarise himself/ or herself with the environment in which the hardware operates as well. According to the CISA Review Manual (2006:326) the audit of hardware also includes:

- The review of capacity management procedures for hardware and performance evaluations;
- Review of hardware acquisition plans;
- Review of PC acquisition criteria; and
- Review of hardware change management controls.

Information security and Privacy

"With the continuing move toward data communications and open systems interconnection, more people are gaining access to data stored on computers" (Pathak, 2004). Security and privacy controls are therefore becoming very important. The IS auditor needs to understand the controls and risks associated with privacy and the integrity of the data and the security of hardware, software and data to ensure safeguarding of IT assets. Some of the risks that IS auditors need to take into account are the destruction or damage of assets, the theft of assets, modification of assets, privacy violations, disruption of operations and unauthorised use of assets (Weber, 1999:8). IS auditors need to ensure that proper controls are in place to minimise these types of risks and that legislative requirements are taken into account.

When auditing information security, the basic knowledge requirements of the IS auditor can be drawn based on the baseline security plan as presented in the CISA Review Manual (2006:423):

Topics	Objectives
Inventory	Establish and maintain inventory (software loaded on desktops and/or laptops by users)
Antivirus	Install antivirus software with automatic updating
Passwords	Recognise the importance of passwords and the appropriate password settings according to best practise
Patching	Make it automatic: less work for you, less chance for compromise
Minimising services offered by systems	Eliminate unnecessary services, reducing security risk and saving time in the long run
Addressing vulnerabilities	Eliminate many vulnerabilities with good system administration
Backups	Allow easy recovery from user mistakes and hardware failure with backups

Table 4: IT security baseline (CISA Review Manual, 2006)

Information Systems Management / IT Governance

According to the CISA Review Manual (2006:77), "IT governance is an inclusive term that encompasses Information Systems, technology and communications; business, legal, and other issues; and all concerned stakeholders, directors, senior management, process owners, IT suppliers, users and auditors". Governance helps with the alignment of IT and business objectives and the effective management of Information Systems. The CISA Review Manual (2006:79) further elaborates and states that in accordance with the defined role of the IS auditor, the following aspects related to IT governance need to be assessed:

- IS function's alignment with business mission, vision, values, objectives and strategies;
- IS function's achievement of performance objectives;
- Legal, environmental, information quality and fiduciary and security requirements;
- The control environment of the organisation; and
- The inherent risks within the IS environment.

To be able to assess these aspects, the IS auditor should have a thorough understanding of these concepts. Furthermore, Information Systems Management also encompasses the following:

- Personnel Management: No organisation can survive without human resources. The IS auditor needs to have extensive knowledge about IT departmental structures, including the developments and approaches undertaken by the IT department. Watne and Turney (2002:31) state that "the proper functioning of a computer data processing system requires personnel with sufficient training and experience to handle the many specialised tasks. The auditor should be familiar with the titles and job descriptions of such positions as system analyst, system programmer, application programmer, computer operator and librarian". The IS auditor needs to ensure that proper segregation of duties in the computerised environment is adhered to and that controls are implemented to ensure the no one person has knowledge of the entire business process.

- Relationships with outsourced vendors: According to the CISA Review Manual (2006:92) "sourcing practises relate to the way in which the organisation will obtain the IS functions required to support the business…outsourcing practises relate to contractual agreements under which an organisation hands over control of part or all of the functions of the IS department to an external party". It is important for the IS auditor to identify these relationships and assess whether these relationships are appropriately acquired, and to establish if management monitors performance according to pre-defined service level agreements. This statement is supported by the ISACA model curriculum for IS audit and control (2004) where it is stated that management is responsible for "monitoring service-level performance against service-level agreements, quality of service, availability, response time, security and controls, processing integrity, privacy, remedies and amending SLAs".

Information System Operations

Information System operations typically includes assessing whether: 1) all production programs needed to process batch and on-line transactions and prepare related reports are executed timely and to normal completion; 2) only valid production programs are executed; 3) data is retained in accordance with laws, regulations, and company policy to enable retrieval when needed; 4) computer processing environment service levels meet or exceed management's expectations; 5) users receive appropriate training in the use of application systems; and 6) users receive appropriate support to ensure that application systems function as intended (PCAOB Auditing Standards no 2 (2004)). The IS auditor should possess more than the basic knowledge to understand and evaluate the above mentioned concepts regarding system operations. According to the ISACA model curriculum for IS audit and control (2004), system operations also include knowledge regarding "service centre management and operations standards/guidelines: COBIT, ITIL, and ISO17799".

Operating Systems

The operating system represents the program that provides the infrastructure that allows the hardware and system software to function. Microsoft Windows and UNIX are examples of widely used operating systems.

IS auditors need to have "basic knowledge" of operating systems as stated by the Institute of Internal Auditor's (IIA) International Advanced Technology Committee to be able to specify, identify and document financial and operational computer based systems. IS auditors need to evaluate the scheduling of processing, assignment of the use of equipment to different users, the monitoring and synchronising procedures, the storage, accessing and decoding of data and instructions, as well as the handling of errors and the protection of programs and data from unauthorised use or destruction (Watne & Turney, 2002:31). All these functions are executed by the operating system.

Specialised Areas

Although the IS auditor does not need to possess extensive knowledge of all specialist IT areas, it is recommended that IS auditors specialise in specific areas. If the IS auditor is not a specialist himself, he or she should however know of the specialist areas to be able to obtain support from a specialist if necessary.

Specialist areas includes the following IT areas as described by Raval and Gupta (1998): "emerging technologies, computer security, electronic commerce, outsourcing reengineering, electronic data interchange, off-shore software contracts, data warehousing, intranets, web page design and maintenance, business intelligence systems, retention of IS personnel, migrations and the development of strategic Information System plans".

Systems analysis, design, development, testing, implementation and maintenance

IS auditors are required to obtain knowledge about systems analysis, design, development, testing, implementation and maintenance and all the risks and controls associated with each stage. This knowledge is required to assess and evaluate the System Development Life Cycle (SDLC). "Accountants need to have the appropriate transferable skills to achieve relevant competence in these newer areas of expertise, such as in systems analysis, design, development, implementation, use of management of telecommunications systems, and the management of end-user computing" (Ahmed, 2003:45). IS auditors are responsible for evaluating and monitoring management's project plans; assessing the completeness and appropriateness of management's systems and database designs; user acceptance and parallel test planning; reviewing the start-up of production systems and associated client data to ensure data integrity; accuracy and completeness of the system and data requirements; completeness of the appropriateness of the operational policies and procedures that are developed; assess risk-management processes and ensure that the IT solution is controlled and accurate (Swanson, 2004). It can therefore be concluded that IS auditors need to have proper knowledge in the areas of systems analysis, design, development, testing, implementation and maintenance to be able to perform the above-mentioned responsibilities.

Understanding the social, economical and legal implications of computer technology

The IS auditor should be aware of the social, economical and legal implications applicable to the specific financial area, country or internationally. This statement is supported by the ISACA model curriculum for IS audit and control (2004) when it is stated that the IS auditor should be familiar with "legal issues relating to the introduction of IT to the enterprise (international and country specific)".

2.5.2 The audit knowledge required from an IS auditor

The following section provides an overview of the audit knowledge concepts as illustrated in Figure 7:

Application of risk-oriented audit approaches

According to the CISA Review Manual (2006:39) more and more organisations are moving towards a risk-based approach, which is adapted to develop and improve the continuous audit process. The CISA Review Manual (2006:39) defines a risk-based audit approach as "an approach assisting the auditor in determining the nature and extent of testing, besides helping to make the decision to complete a compliance or substantive test". The IS auditor should be familiar with the risk-based audit approach and understand the differences between the different types of audit risks (e.g. Inherent risk, Control risk, Detection risk and Audit risk). Related to risk is the term 'materiality'. According to the ISACA Review Manual (2006:63) materiality is defined as "the importance of an item of information with regards to its impact or effect on the functioning of the entity being audited. An expression of the relative significance or importance of a particular matter in the context of the organisation as a whole". The concept of materiality requires sound judgment from the IS auditor and it is therefore essential to understand these concepts and their implications.

Application of standards, guidelines and best practice

According to Hinson (2006:8) "all audits are performed in relation to certain identified risk… analysis of risks leads to the definition of control objectives… the control objectives are derived from the auditor's experience or from best practice". It is therefore essential for an IS auditor to be familiar with the most commonly used and accepted standards, guidelines and best practice.

Audit planning techniques

To enable the IS auditor to successfully execute an audit assignment, it is essential to have a basic background understanding of the required audit planning techniques. The following basic concepts presented in Table 5 were derived from the ISACA model curriculum for IS audit and control (2004:13):

Topic	Subtopics
Audit planning process	▪ Strategic/tactical audit planning; ▪ Engagement letter: purpose and content of engagement letters; ▪ Risk assessment: risk-based auditing; risk assessment methods; ▪ Preliminary evaluation of internal controls: information gathering and control evaluation techniques; ▪ Audit plan, program and scope: compliance vs. substantive testing, application of risk assessment to audit plan; and ▪ Classification, scope of audits: e.g., financial, operational, general, application, OS, physical, logical.

Table 5: Audit testing or evaluation methods and techniques

It is stated in the CISA Review Manual (2006:37) that "the IS auditor must understand the procedures for testing and evaluation of Information Systems controls".

The authors elaborate on the statement and describe the following examples of testing and evaluation of Information System controls:

- The use of generalised audit software;

- The use of specialised software (e.g. security reviews);

- Flow-charting techniques for documenting automated application and business processes;

- Documentation review; and

- Observation.

Vulnerabilities, threats and controls

It is of utmost importance for the IS auditor to understand the terms vulnerabilities, threats and controls. Pfleeger and Pfleeger (2003:6-7) define these terms as follows: "a *vulnerability* is a weakness in the security system that might be exploited to cause loss or harm… a *threat* to a computing system is a set of circumstances that has the potential to cause loss or harm… and a *control* is an action, device, procedure or technique that removes or reduces a vulnerability". It can therefore be concluded that a threat is blocked by the control of vulnerability.

Audit evidence

Audit evidence is defined in the CISA Review Manual (2006:62) as "the information an auditor gathers in the course of performing an IS audit. Evidence is relevant if it pertains to the audit objectives and has a logical relationship to the findings and conclusions it is used to support". It is important for the IS auditor to be familiar with the methods of obtaining relevant audit evidence which includes: observation, inquiry, interview and testing.

Independence

It is essential that an IS auditor understands the concepts of independence. The CISA Review Manual (2006:63) defines independence as "an IS auditor's self-governance and freedom from conflict of interest and undue influence. The IS auditor should be free to make his/her own decisions, not influenced by the organisation being audited and its people (managers and employees)".

2.6 SOFT SKILLS

Champlain (2002:A1-12) states that "the auditor requires new levels of skill to effectively audit today's complex and varied systems". To be able to perform an IS audit assignment it is not enough to possess the required knowledge as described in the above section. It is of utmost importance to have the ability to adapt to the situation and obtain the required information from the client or source of information, since the audit is dependent on the cooperation of team members and clients. Since most information is obtained through interviews, inquiry or observation, the soft skills needed by an IS auditor are essential in successfully completing the IS audit assignment. As stated by Gallegos et al. (2004:41) the soft skills required of IS auditors include: "1) the ability to gather information of comparable importance; 2) presenting information to people; 3) effective and efficiently delivered report (oral and written communication skills); 4) experience (broad scope); 5) rapport with the client (people skills); reviewing the work of others (non-critical of the individual); and 6) objectivity".

Gallegos et al. (2004:70) further elaborate on the soft skills required of an IS auditor and describe the following characteristics or soft skills of the IS auditor:

- Timeliness (punctual and finish work within time objectives);
- Inquisitive (need to understand all aspects of systems under investigation);
- Decisive (willing and able to make timely decisions);
- Initiative (self-reliant and works well with minimal supervision);
- Resourceful (seeks alternative paths when initial plans are precluded or impeded);
- Communication skills (writes, speaks and relates to others clearly and effectively);
- Judgement (choose proper and timely courses of actions and makes sound decisions based on best data available);
- Tact (helpful and respectful towards others); and
- Auditing knowledge (understands and conducts the audit according to generally accepted audit techniques and procedures).

Champlain (2003:339-341) also discussed the soft skills required by IS auditors. According to him the following are essential soft skills which an IS auditor should possess: "1) verbal and written communication skills; 2) interpersonal relations; 3) analytical skills; 4) negotiations skills; 5) consultative role; 6) liaison between management and staff and other departments; and 7) likable, approachable and able to befriend people".

The following soft skills are regarded as essential according to Hinson (2006:27) in support and enhancement of the above:

- Experience (there is no substitute for understanding the auditees' point of view);
- Language skills (ability to write in formal, objective yet persuasive style);
- Interviewing techniques;
- Establish rapport;
- Ability to gain management commitment to action the recommendations involves persuading and negotiating;
- Tenacity;
- Resilience;
- Strength of character to stand up for what is right;
- Understand the concepts of risks and controls;

- Competence in bridging between the world of technology and business;

- Reasonable understanding of and respect for change management concepts and business management in general;

- Cognitive abilities, coupled with the dedication for systematic, insightful analysis;

- Presentational skills (presenting audit findings and recommendations to senior management);

- Reactivity and diligence;

- Eye for detail as well as the ability to see "the bigger picture";

- Ability to put findings into context and work with management to find pragmatic solutions;

- Incessant thirst for knowledge;

- Constant learning and updating of skills;

- Awareness of corporate politics to deal efficiently with strong personality characteristics of most senior managers;

- Thick skin;

- Inquisitiveness (urge to find out how things work and why they don't work better);

- Independence of thought (think outside the box);

- Assertiveness (must be a subtle blend of charm, wit and a forceful personality); and

- Analytical (making sense of the information gathered).

The ISACA model curriculum for IS audit and control (2004) also lists the soft skills required by IS auditors, although it is explicitly stated that these skills are not only applicable to IS auditing but to all professions in general. The soft skills include:

- Managerial Communications and/or Public Speaking (these are communication skills that are employed when discussing audit scope, findings and recommendations);

- Interviewing Skills (this includes the effective gathering of information when interviewing management and completing control questionnaires);

- Negotiation Skills and/or Personal Selling (this is needed to convince management to implement recommendations for positive change);

- Business Writing (this is useful for producing understandable and usable reports and other written communications);

- Industrial Psychology and/or Behavioural Science (this includes the ability to understand and effectively manage human behaviour throughout the audit process);

- Project Management/Time Budgeting (this includes the essential ability to effectively and efficiently manage time and tasks during audits. Auditors are frequently evaluated on meeting budgets); and

- Team Building and Team Leading (this includes effectively managing team activities with proper coordination and utilisation of knowledge and skills of individual team members in the performance of an IS audit).

As stated by Hinson (2006:27) " aside from formal qualification, of course, practical on-the-job experience is a major advantage, particularly for the softer skills such as interviewing techniques and establishing rapport… whilst the computer can provide a lot of information, very few computer audits can be completed successfully without actually talking to real people such as end-users, managers and operations staff…".

For this reason it is essential to include the softer skills required by IS auditors in the IS audit profile, although these skills are learned through experience or inherent in the auditor's personality and not acquired through a medium such as education or training. As stated in the concept description section, skills are the "How to do it".

In summary, Figure 8 presents the soft skills required by an IS auditor as derived from the above described literature.
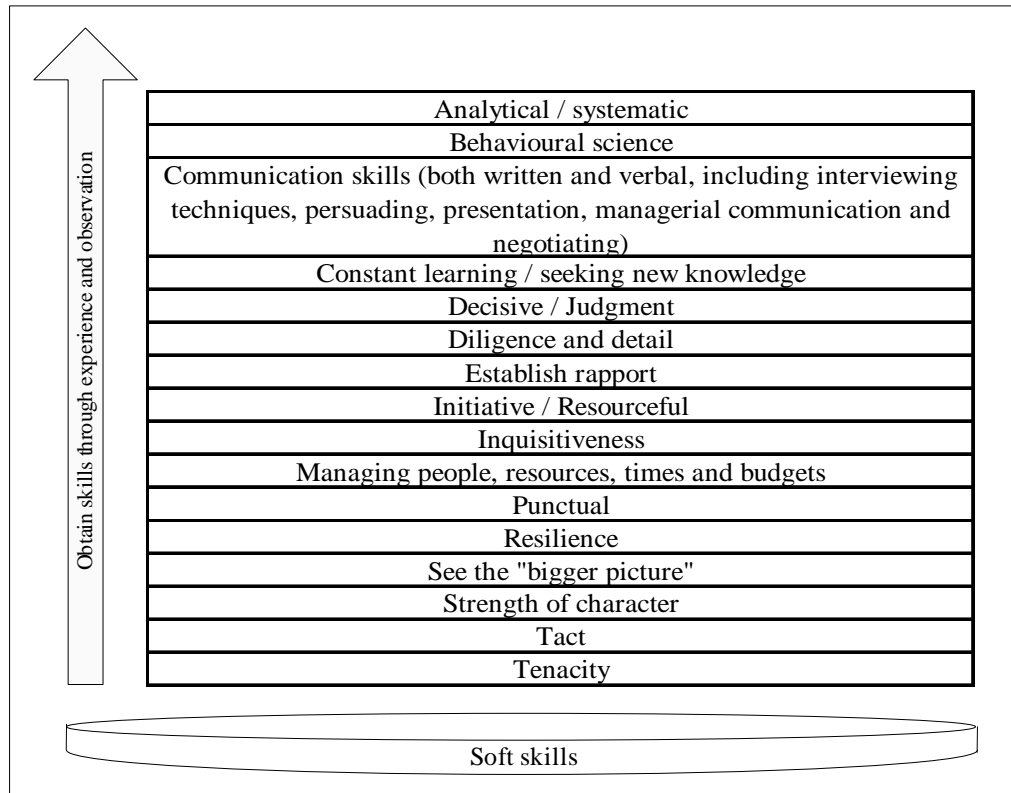
Figure 8: Soft skills required by an IS auditor

The figure contains the following items (top to bottom), with a vertical arrow labelled "Obtain skills through experience and observation" and a base labelled "Soft skills":

Analytical / systematic
Behavioural science
Communication skills (both written and verbal, including interviewing techniques, persuading, presentation, managerial communication and negotiating)
Constant learning / seeking new knowledge
Decisive / Judgment
Diligence and detail
Establish rapport
Initiative / Resourceful
Inquisitiveness
Managing people, resources, times and budgets
Punctual
Resilience
See the "bigger picture"
Strength of character
Tact
Tenacity

2.7 IS AUDIT TOOLS AND TECHNIQUES

IS audit tools and techniques are described for the purpose of this study as enablers or support functions, with the main focus on assisting the IS auditor to select, gather, analyse and report information and help add credibility to the findings, conclusions and recommendations. IS audit tools and techniques include, for this purpose, the following main categories:

- Generalised audit software (e.g. ACL, IDEA, Microsoft Excel or SQL queries);
- Security analysis tools (used to assist the auditor in analysing the security settings at domain level of operating systems and networking software);
- Application analysis tools (used to ensure that proper validation and controls are implemented at application or database level);
- Audit methodologies and programs (assisting the auditor in all areas of the audit by means of evaluating organisational control against control objectives, audit guidelines and best practices); and

- General applications (which enable the auditor to create work papers, reporting, document management and planning management, e.g. Microsoft Word, Microsoft Projects).

The above categories are supported by Sayana (2003) when he states that CAATs can be classified into four broad categories: 1) Data analysis software (including generalised audit software (GAS), encompassing queries and other analysis on data); 2) Network security evaluation software / utilities; 3) Operating system and database management system security evaluation software / utilities; and 4) Software and code testing tools.

The following section will described the 5 categories as defined above in more detail:

Generalised audit software

CAATs (Computer Assisted Audit Techniques) can be defined as the tools and techniques used to directly examine the internal logic of an application as well as the tools and techniques used to indirectly draw inferences about an application's logic by examining the data processed by the application (Hall, 2000).

According to Braun and Davis (2003:731) auditors need to implement auditing software applications in the audit process as this will not only enable the auditor to perform traditional examinations, where audits are based on paper source documents and audit trails, in an increasingly paperless environment, but also enable the audit process to be more effective because the scope of the transactions being analysed can be increased at a minimal marginal cost. IS auditors use CAATs to assist them in analysing the data processed by an Information System as the traditional method of source documents and audit trials are internally processed. Another advantage of using CAATs is that they assist the auditor in identifying patterns in data. In today's business environment the amounts of data processed is tremendous, auditors need assistance to analyse this data while managing their time effectively. Sayana (2003) elaborates and states that the benefits of using audit software include: "the use of audit software ensures a 100 percent scrutiny of transactions in which there is audit interest and pointed identification and zeroing on erroneous / exceptional transactions, even when data volumes are high. Furthermore all this can be done in a fraction of the time required with manual methods. Audit software also has a uniform user-friendly interface.

The audit software maintains logs of the tests done for review by peers or senior management". With the increasing complexity of Information Systems, it is virtually impossible to audit without the use of CAATs. Today the most popular applications used are ACL, IDEA, Microsoft Excel or in-house developed SQL queries.

Security analysis tools

According to the information provided in the reports produced by Sekchek (2006) (a security analysis tool) security analysis tools are automated tools specifically developed to evaluate computer security against accepted standards, best practice and other industry averages or the organisation's own security standards. These tools provide a comprehensive set of reports, analysing the security settings at a given point in time. These reports can be used to identify weaknesses as well as risk ratings and suggested corrective actions. Furthermore, the tools are usually available for a wide variety of platforms, including AS/400, Netware, Windows NT, 2000 / 2003, and UNIX. These statements are supported by Mookhey (2004) when he asserts that "the use of tools for security auditing is prevalent and driven mainly by the inherent complexity within Information Systems. This complexity makes it almost impossible for any auditor to have the ability to completely test all the possible systems for vulnerabilities… the increasing use of tools makes the auditor more efficient and reports more comprehensive… by becoming familiar with the tools, their usage, features and options, auditors will be able to derive maximum benefit from their usage".

Application analysis tools

Working on more or less the same principles as security analysis tools the purpose of application / database analysis tools "is to analyse common and complex security related settings within the application specific database. Security in the database is critical to the overall integrity of the system" according to a report obtained from Appchecker™ (2006). The aim of application analysis tools is to provide the auditor with information about logical access to the application, the integrity of data, the validity of data in the database and the accuracy of information recorded through the application.

Audit methodologies and programs

Audit methodologies are defined as "a set of documented audit procedures designed to achieve planned audit objectives. Its components are a statement of scope, a statement of audit objectives and a statement of work programs" according to the CISA Review Manual (2006:37). "Audit programs for financial, operational, integrated, administrative and IS audits are based on the scope and objectives of the particular audit assignment" as defined by the CISA Review Manual (2006:37).

Hinson (2006:8) also states that most IS audit assignments make use of the following best practise guidelines and frameworks to compare and assess risks and controls. These include:

- National standard bodies such as NIST;
- Professional bodies such as ISC, ISACA which promote frameworks such as COBIT and GASSP (generally accepted information/ system security);
- Industry bodies such as SAS70 financial services;
- Government legislation (e.g. electronic signatures, copyright and governance);
- Consultancies using ISO 270000 (security standard, previously known as ISO17799); and
- Information security professionals (e.g. CISMs).

A combined effort between the audit methodologies and the development of an audit program based on the methodology requirements, audit scope and standards, guidelines and best practice therefore assist and enable the IS auditor to successfully complete an IS audit assignment.

General applications

To enable the auditor to perform and especially document audit procedures, processes, findings and reporting as well as the planning of the audit, general application systems are used as a resource in the IS audit assignment. Theses include applications such as Microsoft Office tools, document management applications and audit methodology specific developed applications.

2.8 CONCLUSION

The objective of this chapter was to determine and describe all components necessary to define an IS auditor's profile. It was first of all important to understand the evolution of the IS auditing profession and the influence of IT on traditional auditing and the way the auditing profession has been changed and impacted by IS auditing.

All the concepts that influence the IS auditing profession were defined by distinguishing between IS, IT, audit, skills, knowledge, training, experience, education, the IS auditor's roles and responsibilities and CAATs . The impact of these concepts on IS auditing were represented in a model that was developed according to the $IDEF_0$ modelling technique. The concepts were divided into input, controls, enablers and output.

The roles and responsibilities of IS auditors were discussed according to the value engineering approach. The roles and responsibilities of IS auditors were defined by looking at the audit approach, the different types of audit assignments and the steps in performing an IS audit.

The IT and audit knowledge and skills which an IS auditor should possess were described. It is important to understand that the concepts of knowledge are obtained through formal education and continuous training which can be summarised in the phrase "What to do". Whereas skills are obtained through applying this knowledge in a working environment, "How to do it". After continuous execution of work (skills), experience is obtained. This excludes the soft skills needed by IS auditors.

The soft skills which an IS auditor should possess were also described. Since most information is obtained through interviews, inquiry or observation, the soft skills needed by an IS auditor are essential in successfully completing the IS audit assignment and therefore in defining an IS auditor's profile.

Lastly IS audit tools and techniques were described as enablers or support functions, with the main focus on assisting the IS auditor to select, gather, analyse and report information and help add credibility to the findings, conclusions and recommendations.

It can be concluded that a new independent profession has emerged with the rapid development, implementation and utilisation of IS by almost all organisations. This has lead to numerous business risks, which need to be scrutinised and for which controls need to be implemented to mitigate these risks. To be able to assess, evaluate and identify risks and controls, IS auditors require a specific set of IT and audit knowledge, soft skills and the assistance of IS audit tools and techniques which will enable them to fulfil the required IS audit roles and responsibilities.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

With the increasing global expansion of IT and the use of Information Systems by almost every business, it is no longer possible to overlook the changes and demands that came with this information age explosion. According to Lucy (1999:44) this expansion of the IT universe is placing greater demands on the IT control environment (auditing). He supports this statement by referring to the following specific demands: "increased system complexity, a rise in low-cost end-user computing, a trend towards decentralized architectures, increased utilisation of IT outsourcing, demands for reduced system development time, the growth in use of strategic non-financial systems and the increased utilisation of electronic commerce". With this increasing demand and the risks of fraud, error or theft, auditors are faced with a problem. Two once independent professions were obliged to converge to be able to control these increasing business demands and risks. A new profession 'IS auditing' emerged from the two independent professions, as indicated in the "evolution of the IS auditing profession" described in Chapter 2. The professionals from both professions need to engage in learning and obtaining the knowledge of both IT and auditing to successfully execute IS audit assignments. As specified in Chapter 2, IS auditing is defined for the purpose of this study as "the examination of an Information System and the surrounding procedures to express an opinion as to whether or not the data involved in processing, from the initiation of the transaction to its inclusion in the financial statements is fairly represented at a specific date, to ensure completeness, accuracy, validity and timeliness of data and transactions and to scrutinise the controls implemented, to mitigate identified risks, to safeguard assets, to maintain data integrity and to achieve organisational goals by means of available resources".

IS auditors therefore need to understand the process flow of transactions or information in Information Systems, which include technical knowledge and an understanding of the controls needed to ensure accuracy, validity, timeliness and completeness of all organisational information and assets. For this reason the combined effort, knowledge, skills, experience and daily roles and responsibilities of IT and auditing professionals are contained in the profession of IS auditing. Thus, people coming from different backgrounds (IT and/or auditing) are forced to learn and develop the knowledge and skills necessary to meet the demands of IS auditing. The following typical questions arose from this problem of having people coming from different backgrounds:

- Is there a difference between the required knowledge of IT professionals, audit professionals and IS audit professionals?
- Who will be the best candidate to perform IS audit assignments, someone with an audit or an IT background?
- What is the level of IT knowledge required from these professionals?
- What is the level of audit knowledge required from these professionals?
- Is the field of IS auditing really as specialised as perceived?
- What are the typical daily roles and responsibilities of IS auditors?
- What IS audit tools and techniques are used in assisting IS auditors to perform IS audit evaluations and assessments?

From these questions the main research problem was derived: What is the IT and audit knowledge and soft skills required from an IS auditor given that specific auditing tools and techniques are available to assist the auditor in executing an IS audit assignment by evaluating these knowledge and skills according to their daily roles and responsibilities?

The objective of this chapter is to provide the reader with an understanding of the research design and methodology needed to provide a solution to the problem statement as defined above. Based on the problem statement an IS auditor's profile will be developed. A profile is defined for the purpose of this study as a set of data, often in graphical form, representing the extent or significant features and/or characteristics of something.

The IS auditor's profile will be based upon IS auditor's daily roles and responsibilities. The roles and responsibilities will then be considered in terms of Knowledge, Skills and IS Auditing Tools and Techniques.

To be able to define an IS auditor's profile, a qualitative research approach will be followed, based on a combination of non-empirical (literature survey) and empirical studies (interviews). This chapter fully elaborates on the research design method and research methodology which will be conducted in order to conclude on the IT and audit knowledge, soft skills and the IS audit tools required by IS auditors.

3.2 RESEARCH DESIGN

According to Mouton (2005:55) "a research design is a plan or blueprint of how you intend conducting the research". From the literature provided by Page & Meyers (2003), Mouton (2005) and Olivier (2004), the research design layout will follow the following two research design principles:
1. Defining research questions; and
2. Determining the research approach and strategy.

3.2.1 Defining the research questions
To be able to determine the research approach and methodology it is important to first determine the research questions as derived from the research problem (Olivier, 2004:35). This statement is also supported by Mouton (2005:53) when he stated that "we often formulate research problems in the form of questions as a way of focusing the research problem". He further distinguishes between two types of questions, i.e. empirical and non-empirical questions. Empirical questions are defined as "questions which addresses real-life problems (world 1)" whereas non-empirical questions are defined as "questions about entities, for example scientific concepts or questions about trends in scholarship (world 2)" (Mouton 2005:53). Mouton (2005) defines world 2 objects as the selections of world 1 phenomena (ordinary social and physical reality) to make these into objects of inquiry, therefore the aim of the world 2 science is to generate truthful descriptions, models and theories of the world.

The research questions derived from the research problem for this study therefore comply with the definition of non-empirical questions since the aim of this study is to generate a description of an IS auditor's profile, which is the object of inquiry.

In order to establish an IS auditor's profile the following non-empirical research questions should be answered:

- What is IS auditing?
- What are the typical roles and responsibilities of an IS auditor?
- What IT and auditing knowledge is expected from an IS auditor?
- Which soft skills should an IS auditor possess?
- Which IS audit tools are mostly utilised to assist IS auditors in executing their roles and responsibilities?

3.2.1 Determining the research approach

To conduct a research study, an appropriate research approach should be adopted. The appropriate research approach will be determined based on the research questions as defined in the above section. The objective of the research approach is to enable the researcher to answer the research questions (Mouton, 2005 & Olivier, 2004).

To be able to answer the above specified research questions, the research study will be two-folded. First, secondary information will be derived from the available body of knowledge through a literature review. A literature review is defined as a non-empirical study by Mouton (2005) and Olivier (2004). Non-empirical studies are based on theory conditions whereby the unit of analysis is data coming from an academic body of knowledge (world 2), rather than from everyday knowledge (world 1). An interaction research approach will be followed in conducting the literature review. This method is based on theory conditions (non-empirical), which will be used to set the direction for the research. The purpose of the literature review is to present the results of the work of the existing body of knowledge regarding the auditing and IT professions, specifically the IS auditor's roles and responsibilities, the required IT and audit knowledge and soft skills and available IS audit tools to assist the auditor in executing an IS audit assignment.

The literature review is therefore an overview of previous research and the results derived from the information obtained. Mouton (2005:179) supports this statement by saying that literature reviews are "studies that provide an overview of scholarship in a certain discipline through analysis and trends and debates".

The literature study is founded on secondary data which is based on inductive reasoning, in other words, only selecting a sample of work or texts in order to understand and conceptualise the necessary information and is therefore based on representative sources (Mouton, 2005). Available databases in the University of Pretoria's and University of South Africa's online library catalogues as well as published articles, relevant textbooks and the Internet will be used to conduct the literature survey.

The construction research method will be followed to derive, analyse and present a summary from the literature survey. According to Page and Meyers (2003:4) the construction research method is defined as "the structural framework linking a number of concepts into a much more comprehensive concept, mega-concept, of a phenomenon that is not directly observable or measurable".

Secondly, the study will provide the research answer from the survey approach, which is used to "enable the researcher to study a population sample in order to infer characteristics of a population (generalise findings)" (Page & Meyers, 2003:111). The survey approach is based on the empirical study method. "Empirical or social studies are set based on data about everyday objects (world 1) as the unit of analysis" (Mouton, 2005). Since this study focuses on the IS auditor's profile as the unit of analysis, the survey approach is best suited to infer the necessary characteristics (knowledge, skills and tools). "Surveys are conducted using questionnaires that are either distributed to a sample (or to the entire population) for completion, or completed by means of interviews" as explained by Olivier (2004:10). Structured interviews and questionnaires are described as "specific items that are asked of all participants, and responses are restricted to the range imposed by the researcher, often with the opportunity to qualify responses" according to Page and Meyers (2003:111).

Since specific items were identified by means of the research questions, the responses from the interviews will be regarded as qualitative responses (non-numeric data).

Structured interviews have been selected as the best suited data-collection method for this study. Structured interviews consist of standardised fixed-format questions. The objective of the structured interviews is to obtain answers to the above defined research questions.

The structured interviews will be constructed based on a distributed sample selection and not the entire population since it will be impossible to conduct interviews with the entire IS audit population around the globe. Since generalisation will be used as the method to generalise the information obtained from the selected sample, the selection of an equal and representative sample is important (Olivier, 2004). According to Page and Meyers (2003:108) "there should be at least four sample elements for every variable included in the study" when generalising a population. Page and Meyers (2003:63) define a variable as "anything in the universe that has the capacity to vary in attributes or characteristics and it is therefore an object, event or phenomenon that can be expressed as different values or levels of the same thing." For the purpose of this study the IS auditor's profile is defined as the key research variable. The sample size is furthermore referred to as the responding elements. For the purpose of this study a 100% response rate is expected since structured interviews are the selected research method. The expected response rate also influences the sample size selection, since the sample size should be divided by the expected response rate. In support of this reasoning, Jakob Nielsen (2006) states that "you can usually run a qualitative study with 5 users…" Since only one key variable was identified for this study and a response rate of 100% is expected, it can be concluded that a sample size of at least 4 interviews should be sufficient.

The sampling design method to select the sample population will be based upon judgmental samples. Judgmental samples are defined by Page and Meyers (2003:99) as "consisting of respondents who, in the judgment of the researcher, will best supply the necessary information". To be able to develop the IS auditor's profile and obtain reliable information which can be generalised, it will be necessary to rely on people with more than 4 to 5 years IS auditing experience.

From the researcher's own experience, previous studies and the available literature it can be concluded that people with 4 to 5 years experience should be on a manager level or higher.

The population selected for the purpose of this study will therefore only consist of people currently working as an IS auditor at a management level or higher with at least 4 to 5 years experience in the IS auditing field. It is furthermore important to select a sample which is representative of the entire population, therefore including individuals coming from different backgrounds (IT or auditing) and currently in different roles (external audit or internal audit).

To conclude, the sample selection will be based on the following criteria:

- Background (IT or auditing);
- Years experience in IS auditing (4 or more);
- Level (management or higher); and
- Type of audit role (external or internal).

The information obtained from the structured interviews will be analysed by means of the qualitative research approach. The qualitative approach can be conceptualized "as the focus on words or feelings – the quality of an event or experience" according to Page and Meyers (2003:18). Since the main focus of the study is based on a professional organisation where auditors and IT experts interact on a daily basis the answers will best be determined from the point of view of the participants. Their responses cannot be presented as quantitative data (numerical data) and since the information will be obtained as "words and feelings", the qualitative approach is best suited for this study.

Qualitative research is seen from an insider or participatory perspective. The researcher needs to obtain a deep understanding of the situation (research subject) and even work together with the research subject which influences the objectivity of the researcher. This could however be controlled in an environment where structured questionnaires are used as opposed to unstructured dialogue. Qualitative research is based on investigation and understanding of a subject by means of assessment of the important characteristics of the subject in their natural (field) environment (Page &

Meyers, 2003; Olivier, 2004 and Mouton, 2005). Since structured interviews will be conducted, the objectivity of the researcher will not be impaired.

The techniques to be used to conduct the study of qualitative research will be based on structured interviews selected on judgmental sampling and an in-depth literature review as described above. The conclusion of this study will be based upon secondary data (literature review) supported and confirmed by the primary source data (structured interviews).

3.3 RESEARCH METHODOLOGY

The research methodology is defined by Mouton (2005:57) as the "focus on the research process and the kind or tools and procedures to be used". The methodology applicable to this study will be discussed according to the stages in the research process as combined from the literature obtained from Mouton (2005), Olivier (2004) and Page and Meyers (2003). The research process is presented in Figure 9.
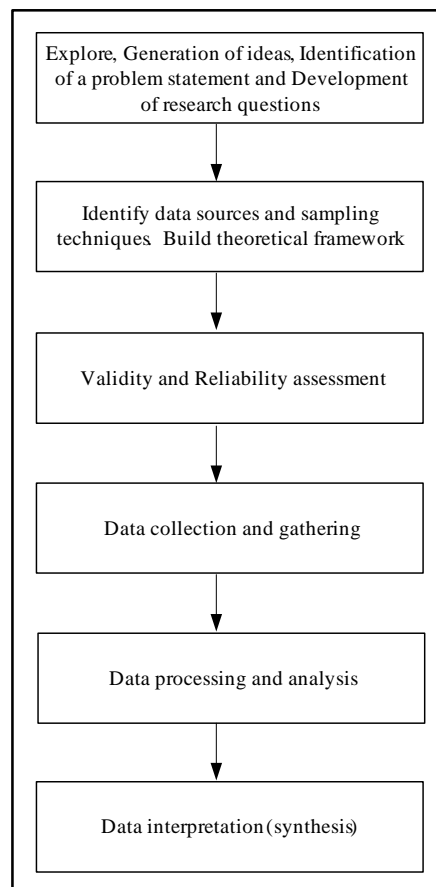
Figure 9: Research process (methodology)

The research method will be described according to the process as illustrated in Figure 9:

3.3.1 Explore, generation of ideas, identification of a problem statement and development of research questions into research variables

Before the research can start, a research idea must be generated. For the given study a prerequisite was that the idea needs to be closely related to IT issues and needs to contribute to the field of IT. The research idea and later questions were derived from the personal observation of the gap between the IT and auditing professions from studies in both fields. By consulting the literature and experts in the field, the observation was supported and a formal research proposal was developed. This process is not described in more detail since the research methodology focuses on the actual execution of the research to be conducted.

3.3.2 Identify data sources and sampling techniques. Build a theoretical framework

The following sources of data will be used to obtain secondary data (as explained in the Research Design section above):

- Available databases in the University of South Africa's and University of Pretoria's online library catalogues;
- Published articles in journals in the library;
- Relevant textbooks; and
- The Internet.

Through the literature evaluation, a theoretical framework will be developed. The theoretical framework will be broken down into the key research questions per area as specified:

- Roles and responsibilities of IS auditors;
- Knowledge;
- Soft skills; and
- IS audit tools and techniques.

Structure interviews will be used to obtain primary data.

As defined in the above section, a sample size of at least 4 professionals should be included in the population to obtain the primary data through structured interviews since the study will rely on judgmental sampling based upon generalisation. A sample of 10 interviewees will be selected to ensure that different business sectors are represented in the sample as well as internal and external audit firms or companies. Two interviewees will be selected (one from internal audit and one from external audit) to participate in a pilot study before the final interviews are conducted. The purpose of a pilot study is to "establish whether all the procedures and instruments are going to work in the expected manner" according to Page and Meyers (2003:118). Refer to point 3.3.3 below for the rationale behind pilot studies.

As per the criteria, the interviewee selection will be taken from individuals in the following business sectors, companies and the type of audit roles performed to ensure that the population is equally distributed across the IS auditing field:

Company Name	Type of audit role	Business Sector
Auditor General	External	Government
Edcon	Internal	Retail
Deloitte & Touche	External	Audit Firm
KPMG	External	Audit Firm
Post Office	Internal	Government
Price Waterhouse Coopers	External	Audit Firm
Rand Merchant Bank	Internal	Banking
SAB&T	External	Audit Firm
Sizwe Ntsaluba VSP	External	Audit Firm
Telkom	Internal	Telecommunications

Table 6: Sample population

3.3.3 Validity and reliability assessment

The adequacy of the research design and the quality of the tools and techniques used to obtain and analyse the data are critical measures since the quality of the research project is dependent on these methods. "In order to collect data, some form of measuring instrument has to be used" (Mouton, 2005:100). For a measuring instrument to be reliable, it must be proven to provide consistent results.

For the data to be useful and adequate, it is essential that the data-collection method (e.g. interviews) must be proven to be reliable and valid. For the measuring instrument to be valid, the instrument must be proven to accurately measure a situation, as intended by the researcher.

To obtain assurance that the measuring instruments used are reliable and valid, it is important to conduct a pilot study or pre-testing, especially in the case of questionnaires (Mouton, 2005:103). Mouton (2005) further elaborates and states that to ensure reliability and validity in questionnaires or scale construction, the following sources of errors should be avoided: ambiguous or vague items; double-barrel questions; item order effects; fictitious constructs; leading questions; negatively phrased questions or double negatives; poor and confusing layout of questionnaire; instruments that are too long; sensitive or threatening questions; and mono-operational bias.

Pre-testing or pilot testing of the intended questionnaires and structured interview questions will therefore be conducted prior to the fieldwork being conducted. Two individuals will be asked to perform the pilot study. It is preferable to select one individual from internal audit and one from external audit, who comply with the selection criteria. If the results are not satisfactory, the measuring instruments will be adjusted and re-tested before they are applied to the actual research.

3.3.4 Data collection and gathering

The methods or measuring instruments which are applied in this research study for the collection and gathering of data will consist of structured interviews. In the following section the measuring instrument will be discussed in greater detail:

The Interview

Structured interviews are defined as "specific items that are asked of all participants, and responses are restricted to the range imposed by the researcher, often with the opportunity to qualify responses" according to Page and Meyers (2003:111).

Interviews are conducted with the aim of gathering valid and reliable information through the beliefs, perspectives, orientations, feelings, knowledge and preferably the expertise of the respondents. The purpose of the interview is to gain as much information as possible from the respondent to be able to convert the information into useable knowledge which is relevant and of importance to the research. Although the researcher is participating in obtaining the information, the objectivity of the information can still be obtained through open-ended but structured questions, which do not direct the respondent in any notion (Mouton, 2005). This is supported by Patton (2003:348) where it is stated that "open-ended interviewing offers the persons being interviewed the opportunity to respond in their own words and to express their own personal perspectives". The use of structured questions means that a pre-determined list of questions is prepared and applied to all respondents, irrespective of gender, age, race, job title, background, years experience or location. This ensures that data can be compared and reduces the subjectivity of the interviewer.

In support of the above described methods of interviewing, open-ended questions will be prepared in advance. "Open-ended questions allow the respondent to supply any appropriate answer…" (Olivier, 2004:83). These questions supported by the research design will enable the interviewer and interviewee to have a comprehensive discussion around the problem statement and research questions. In this way objective, in-depth information can be obtained.

The interview questions will be designed to ensure the following, as described by Olivier (2004:81):

- Questions must be precise (and unambiguous);
- Sensitive questions should be avoided, if possible;
- Questions should be short and simple;
- The appearance (organisation) of the questionnaire is important; and
- The questions must be written and structured in such a way as to facilitate the collection of data at a later stage.

It is important to only develop questions relevant to the research problem. The interview questions will therefore be designed based on the research question; and sub-questions will be identified based on the problem statement and pre-literature survey conducted in the proposal stages of the research. The main research question is as follows: What are the IT and audit knowledge and soft skills required from an IS auditor, given that specific auditing tools and techniques are available to assist the auditor in executing an IS audit assignment, in order for an IS auditor to optimally perform his/her daily roles and fulfil his/her professional responsibilities?

The following represents the sub-issues identified regarding the research question as posed above:

- What is IS auditing?
- What are the typical roles and responsibilities of an IS auditor?
- What IT and auditing knowledge is expected from an IS auditor?
- Which soft skills should an IS auditor possess?
- Which IS audit tools are most commonly utilised to assist IS auditors in executing their roles and responsibilities?

The interview questions will be structured and grouped according the following categories:

1. **Interviewee Information and Background**: It is necessary to determine the background and level of experience of the interviewee to be able to assess the reliability and validity of the interviewee according to the pre-established criteria. Personal questions will include:
   - Company name;
   - Job title;
   - Job description;
   - Qualifications; and
   - Years experience in IS auditing.

2. **Knowledge**: These questions will focus on the IT and audit specific knowledge required from individuals in the IS auditing profession according to the interviewee's opinion and experience as well as the IT and audit knowledge expected from the interviewee's employer (background).

3. **Skills**: These questions will aim to derive the soft skills needed from IS audit professionals.

4. **Roles and Responsibilities**: These questions will be based on the functions and services provided by IS auditors. This will include the steps involved in performing IS audits.

5. **IS auditing Tools and Techniques**: These questions will aim to establish the available and most commonly utilised audit tools and techniques used to assist the IS auditors in executing their daily roles and responsibilities.

For the list of detailed questions to be used in the interview process, refer to Appendix A.

Pilot testing or pre-testing will be performed before the execution of the interviews. A sample of two interviewees (one internal and one external auditor) will be selected to conduct the pre-testing. The aim of the pilot testing will not be to analyse the data obtained, but to measure the accuracy and success of the questionnaires. If any problems are encountered, interview questions will be amended accordingly.

3.3.5 Data processing and analysis

Through the structured interviews textual data will be obtained. Textual data is defined by Mouton (2005:108) as "data rich in meaning and difficult to capture in a short and structured manner". The questions will be structured in such a way as to ease the processing of the open-ended questions.

All data culminate in an analysis and interpretation of some sort to be able to draw conclusions and add new knowledge to the existing body of knowledge. Mouton (2005:108) defines analysis as the "breaking-up" of the data into "manageable themes, patterns, trends and relationships". The aim of analysis is to be able to understand the various constitutive elements within the data.

This is achieved according to Mouton (2005:108) by means of "inspection of the relationship between concepts, constructs, construct variables and to see whether there are any patterns or trends that can be identified or isolated, or to establish themes in the data". The analysis of the data to be obtained will represent the term 'interpretive research'. Mouton (2005:108) defined interpretive research as "the understanding of that which is being studied". The analysis stage in the research project is imperative, since this is the stage where the researcher processes and converts data into meaningful knowledge.

The aim of the data analysis phase will be:
1. To establish an IS auditor's profile, by means of an exploratory and descriptive study, as provided by the ability of the interviewee to identify and describe concepts and features of relevance to the research and the ability of the researcher to analyse and interpret these concepts and features in meaningful knowledge; and
2. To confirm the accuracy and completeness of existing theories and their current relevance.

3.3.6 Data interpretation (synthesis)

Data interpretation is defined by Mouton (2005:109) as "the synthesis of one's data into larger wholes". This is usually conducted by the formulation of a hypothesis or a theory obtained or developed from a literature survey. The data is then measured against the hypothesis to observe any patterns or trends. In this case, the results obtained will be interpreted and linked to the theoretical models and frameworks that will be derived from the literature survey. These theoretical models will include an IS auditor's roles and responsibilities framework, an IT and audit knowledge and soft skills base for IS auditors and available IS audit tools.

The responses from the interviews will be measured against these models to support the development of an IS auditor's profile. The aim of the interpretation of the data, whether the data is obtained from the literature surveys or interviews, is to develop an IS auditor's profile by identifying the key IT and audit knowledge and the soft skills required from an IS auditor given that specific auditing tools and techniques are

available to assist the individual in executing an IS audit assignment by classifying this knowledge and these skills according to daily roles and responsibilities.

3.4 CONCLUSION

This chapter defined the research design and methodology employed to enable the researcher to investigate IS audit roles and responsibilities, IT and audit knowledge, the soft skills required from IS auditors and the available IS audit tools and techniques needed to perform a successful IS audit assignment.

A brief discussion was given on the problem statement and research questions and sub-questions stemming from the research problem. The research design was described and a rationale given for the choice of design. The research methodology to be followed was discussed according to a process developed from the existing literature regarding research methodologies and includes:

1. Explore, generation of ideas, identification of a problem statement and development of research questions into research variables;
2. Identify data sources and sampling techniques. Build a theoretical framework;
3. Validity and reliability assessment;
4. Data collection and gathering;
5. Data processing and analysis; and
6. Data interpretation (synthesis).

The results of the structured interviews and fieldwork will be described in detail in the next chapter.

CHAPTER 4

PRESENTATION OF INTERVIEW DATA

4.1 INTRODUCTION

Since IS auditing is a relatively new field it is imperative to provide a framework bridging the gap between the separate and independent professions namely IT and auditing. The objective of this study is to provide the IT and audit body of knowledge with a profile which specifies the characteristics of an individual understanding the concepts and demands of both fields to enable this professional to successfully execute an IS audit assignment.

All data, specifically gathered, culminate in an analysis and interpretation of some sort to be able to draw conclusions and add new knowledge to the existing body of knowledge. From the analysis and interpretation of the data the study draws conclusions and adds new knowledge to the existing body of knowledge relevant to IS Auditing. Mouton (2005:108) defines analysis as the "breaking-up" of the data into "manageable themes, patterns, trends and relationships". The aim of the data analysis phase, as described in Section 3.3.5, is:

1. to establish an IS auditor's profile, by means of an exploratory and descriptive study, as provided by the ability of the interviewee to identify and describe concepts and/or features of relevance to the research and the ability of the researcher to analyse and interpret these concepts and/or features into meaningful knowledge; and

2. to confirm the accuracy and completeness of existing theories and their current relevance.

The primary data were collected through structured interviews, which were designed as described in Chapter 3 according to the research methodology (refer to Appendix A). The data analysis will aid in answering the research questions from the primary data that were collected and the comparison and enhancement thereof by means of the theory framework obtained from the existing body of knowledge. By answering the research questions an IS auditor's profile will be developed.

This chapter elaborates on the population selected for the structured interviews, as well as the development of the layout of the structured interview questions. This chapter will also present the interview responses and primary data that were collected.

4.2 INTERVIEW POPULATION

The criteria for selection of the interview population were established in the research design and methodology, Chapter 3, point 3.2.1. The interview population was selected based on compliance with the following criteria:

- Background (IT or auditing);
- Years experience in IS auditing (4 or more);
- Level (management or higher); and
- Type of audit role (external or internal).

A sample of 10 interviewees was selected based on different business sectors and whether the company performs internal or external audits. The interview population has furthermore comprised the following business industries containing IS auditing divisions:

- Audit Firm;
- Government Department;
- Retail Industry;
- Banking Industry; and
- Telecommunications Industry.

Since most IS auditing functions, whether as an external assurance function or internal outsourcing function, are performed by one of the audit companies, a bigger sample was selected from the audit company profile group.

Based on a judgmental sample and as per the pre-defined criteria, the interviewee selection has included individuals from the following companies as defined in Chapter 3, Table 6:

- Auditor General;
- Edcon;
- Deloitte & Touche;
- KPMG;
- Post Office;
- PricewaterhouseCoopers;
- Rand Merchant Bank;
- SAB&T;
- Sizwe Ntsaluba VSP; and
- Telkom.

Given the small selected population it was important to ensure that interviews were scheduled with individuals in all selected companies, as listed above. Interviews were scheduled accordingly by contacting the relevant managers, senior managers or directors in the respective selected companies.

All individuals selected conformed to the criteria as defined in the research and design section, Chapter 3. It is important to note that the sample has become the interview population and that all results would refer to this population.

The interview population consisted of the following individuals according to the selection criteria:

Interviewee	Background	Years experience IS auditing	Level	Type of audit role
A	IT	9 Years	Senior Manager	External
B	IT / Internal audit	7 Years	Manager	Internal
C	Audit	4 Years	Manager	External
D	IT	11 Years	Audit Manager	External
E	IT	8 Years	Specialist: ICT Audit	Internal
F	Audit	5 Years	Director	External
G	Audit	5 Years	Manager	Internal
H	IT	12 Years	Director	External
I	IT	6 Years	Manager	External
J	Audit	8 Years	Senior Manager	Internal

Table 7: Interview population

4.3 DESCRIPTION OF THE STRUCTURED LAYOUT OF THE INTERVIEW QUESTIONNAIRE

As an introduction and to ensure that the interviewee understands the concepts and definitions of terms as used in this study, the structured interview questionnaire provides definitions for the following terminology: 1) Information Systems Auditing; 2) Information Technology; 3) Knowledge; 4) Skill; 5) IS Audit Tools; and 6) Profile. These definitions were extracted from the literature review conducted and described in Chapter 2. Secondly the objective of the interview was stated as described in Chapter 3, Section 3.3.5. A statement of participation and a confidentiality statement were also included, which were signed by all interviewees.

The interview questions were compiled and grouped according to the following categories:

1. **Interviewee Information and Background**: It was necessary to determine the background and level of experience of the interviewee in order to assess the reliability and validity of the answers supplied by the interviewee according to the pre-established criteria. Personal questions included:
   - Company Name;
   - Job title;
   - Job description;
   - Qualifications; and
   - Years experience in IS Auditing.

2. **Knowledge**: These questions focused on the IT and audit specific knowledge required from individuals in the IS auditing profession according to the interviewee's opinion and experience as well as the IT and audit knowledge expected from the interviewee's employer (background).

3. **Skills**: These questions aimed to derive the soft skills needed from IS audit professionals.

4. **Roles and Responsibilities**: The roles and responsibilities questions were based on the functions and services provided by the IS audit function. It also included the steps involved in performing IS audits.

5. **IS Auditing Tools**: These questions aimed to establish the available and most universal audit tools and techniques used to assist the IS auditors in executing their daily roles and responsibilities.

The main objective of the design of the structured interviews was to achieve clear and unambiguous answers to the research questions, as presented in Chapter 3, Section 3.3.4.

A pilot study was conducted to ensure the reliability and validity of the research questions. It was found that the aim of answering the research questions was accomplished according to the response and test answers obtained from the questionnaire. There was a level of redundancy however in some of the information obtained as the information was already provided in preceding questions and would have lead to duplication of answers. These questions were omitted from the questionnaire. For the list of detailed questions used in the interview process, refer to Appendix A.

4.4 INTERVIEW RESPONSES

Due to the qualitative nature of the interview responses, the results of the structured interview responses are summarised and discussed based on the questionnaire questions as stated above. The results are not mutually exclusive and are based upon the population as described above.

4.4.1 Knowledge

4.4.1.1 Expected IT knowledge from an IS auditor

The goal of the question was to establish and understand the IT specific knowledge required from IS auditors in the opinion of the interviewee gained from past experience and observation in the field of IS auditing. The emphasis was on the IT technology concepts and basic knowledge required from IS auditors in performing IS audits. The relevant question therefore focused on what knowledge is required to interview clients and obtain sufficient evidence to meet control objectives and activities as defined in the audit programs to enable the auditors to identify risks and control weaknesses. IT knowledge is an essential feature or characteristic needed to developed and define the IS auditor's profile.

The interview responses were summarised and a list containing responses from more than one person ($\geq$ 20%) were drafted as shown in Table 8, the isolated (non-generalised) answers are also provided as a means of completeness, refer to Table 9. The isolated responses may correspond to the concepts and/or terms obtained from the literature study and may therefore be valid for the overall IT knowledge framework which will be presented in Chapter 5.

IT knowledge	Interview Responses									
	A	B	C	D	E	F	G	H	I	J
Application programs / ERP systems			✓	✓	✓	✓			✓	
Basic Information Systems and Information Technology general concepts	✓				✓	✓	✓	✓	✓	
Programming languages and procedures	✓				✓				✓	
Networks (including routers, switches and Internet)	✓	✓		✓	✓	✓	✓		✓	
Data structures and database	✓	✓	✓		✓		✓		✓	✓
Information security (logical access)	✓			✓				✓		✓
Information Systems Management			✓		✓			✓	✓	
Operating Systems	✓	✓	✓	✓	✓		✓		✓	✓
System analysis, design, development, testing, implementation and maintenance (SDLC)	✓			✓	✓				✓	✓

Table 8: IT knowledge interview responses

The following table presents relevant isolated IT knowledge as stated by the interviewees:

Interview Response	IT knowledge
A	It is important to understand the fundamentals of IT and the workings thereof to be able to identify the policies and procedures and risks associated within the domains of IT Auditing, the process within these domains and the performance thereof. This will enable the auditor to understand the client's IT environment and to establish the type of business. The domains of IT audit consist of: service delivery, management or monitoring, service support and reporting
C	Basic knowledge with regards to domain controllers
	"Know how" knowledge to be able to perform data management (e.g. number crunching – ACL)

D	Business Process and Key Control identification
	In-depth knowledge of specialist areas (e.g. security firewalls)
E	A degree in IT or Information Systems will provide the appropriate background knowledge. For more in-depth technical knowledge, at least a BSc degree is required. The following basic IT knowledge is taught on bachelors degree level (BSc): (not specified in Table 8) ▪ Theoretical computer science concepts; ▪ Formal logic; ▪ Programming: contemporary; ▪ Computer organisation concepts; ▪ Numerical methods; ▪ Techniques of artificial intelligence; ▪ End-user computing; and ▪ Human-computer interaction.
G	A general understanding of Information Technology is required, that includes: data capturing, reporting, how a computer operates and networking concepts
H	An overall understanding of IT concepts ▪ Roles and responsibilities of the IT department ▪ Practicality of implementing IT best practice
	Keep up to date with technical knowledge (e.g. ISACA journals)
I	Same as interview response for interviewee E.
J	Disaster recovery and back-ups

Table 9: Isolated IT knowledge interview responses

4.4.1.2 Expected auditing knowledge from an IS auditor

The aim of this question was the same as stated in Section 4.4.1.1, with the exception being that the interviewees were requested to respond to the auditing knowledge required by an IS auditor in their opinion and from previous experience or observation. The term 'audit knowledge' was explained to the interviewees as the knowledge required to assess or evaluate risks and controls (as derived from the literature study) to ensure that the responses were accurate.

Again, the interview responses are summarised and a list containing responses from more than one person ($\geq 20\%$) are shown in Table 10, the isolated (non-generalised) answers are also provided as a means of completeness, refer to Table 11.

The isolated responses may correspond to the concepts and/or terms obtained from the literature study and may therefore be valid for the overall audit knowledge framework, which will be presented in Chapter 5.

Audit knowledge	Interview Responses									
	A	B	C	D	E	F	G	H	I	J
Understanding of the concept of risk		✓	✓	✓	✓	✓		✓	✓	✓
Know about applicable standards and best practices					✓			✓	✓	
Audit planning (Understanding the objectives of the audit, the scope of the audit and the areas of significance)	✓				✓				✓	
Audit testing methods (including compliance testing, substantive testing and analytical review procedures)	✓	✓			✓	✓	✓		✓	✓
Understanding of the concept of control	✓	✓	✓		✓	✓			✓	✓
Understand basic accounting principles				✓			✓	✓	✓	
Business understanding	✓			✓				✓		
Understanding of relevant audit evidence					✓				✓	
Independence concepts					✓				✓	

Table 10: Audit knowledge interview responses

The following table presents the relevant isolated audit knowledge stated by the interviewees:

Interview Response	Audit knowledge
A	To be able to perform and evaluate design and process flows
	Obtain a background information regarding the relevant qualifications, skills and experience of the IT personnel in the specific client environment
B	A basic level of knowledge with regards to validation of controls, the integrity of data, fraudulent activities, control risk, change control and operating system risk identification
C	Understanding the relation between IT and audit risks
H	Understanding of legal requirements

Table 11: Isolated audit knowledge interview responses

4.4.1.3 Most relevant education or background for an IS auditor

The aim of this question is to establish the most relevant education or background for IS auditors according to the interviewees' own experience and observations in the field. Knowledge is defined for the purpose of this study as the combined result of formal education, experience and training, an attribute gained by listening, reading, learning and/or observation. It is essential to understand the education (formal education/ qualification and training) and background (experience) of IS auditors to fully explain and define the IT and auditing knowledge required from IS auditors.

The interview responses were as follows:

Education/background	Number of responses	Percentage
General IT / IS related background (BSc / BCom Information Systems degree or related IT diploma)	9	90%
Auditing background (BCom degree)	7	70%
CISA (Certified Information Systems Auditor)	5	50%
CA (Certified Accountant)	1	10%
Other	2	20%

Table 12: Most relevant education or background

"Other" comprises CISM (Certified Information Systems Management) and Project Management.

4.4.1.4 Level of education for IS auditors expected from the interviewee's employer
The objective of this question is to elaborate and generalise on the previous question and to provide more reliability and validity to the opinions and observations of the interviewees by comparing the education and background as obtained in 4.4.1.3 with the education and background expected from employers. Therefore what level of knowledge (education) or background should an individual have to be appointed as an IS auditor?

The interview responses were as follows:

Education/background	Number of responses	Percentage
General IT / IS related background (BSc / Bcom Information Systems degree or related IT diploma)	9	90%
Auditing background (Bcom degree)	9	90%
CISA (Certified Information Systems Auditor)	4	40%
Relevant experience	4	40%
Compliance to the company profile	2	20%
Other	2	20%

Table 13: Education expected from employers

"Other" would be from: CISM (Certified Information Systems Management); Empowerment; Skills in data analysis and technical capabilities; and Project Management.

It should however be stated that most interviewees responded saying that for entry level, the first two responses are applicable (BCom or BSc degrees). The 40% response on CISA is required for new employees entering at manager level or higher. It was also stated that an honours degree is recommended for management entry levels.

4.4.2 Skills

4.4.2.1 Soft skills required from an IS auditor

The objective of the question is to determine the soft skills which in the opinion of the interviewee, an IS auditor should possess to be able to successfully execute the assigned roles and responsibilities. Since an audit assignment cannot be completed without the support and involvement of people, it is of utmost importance for the IS auditor to possess the necessary soft skills. The success of an audit assignment is directly impacted by the ability of the IS auditor to collaborate with the relevant

people. To define an IS auditor's profile, it is therefore essential to understand the soft skills required from IS auditors.

The same approach as in 4.4.1.1 and 4.4.1.2 is followed whereby the interview responses are summarised and a list containing responses from more than one person ($\geq 20\%$) are drafted as shown in Table 14. The isolated (non-generalised) answers are also provided as a means of completeness and are detailed in Table 15. The isolated responses may correspond with the concepts and terms obtained from the literature study and may therefore be valid for the overall soft skills base, which will be presented in Chapter 5.

Soft Skills	Interview Responses									
	A	B	C	D	E	F	G	H	I	J
Analytical / systematic		✔						✔	✔	✔
People's person / people knowledge	✔		✔	✔			✔	✔		✔
Communication skills (both written and verbal, including interviewing techniques, persuading, presentation, managerial communication and negotiating)	✔	✔	✔		✔	✔	✔		✔	
Initiative	✔	✔								✔
Managing people, resources, time and budgets (leadership)			✔	✔		✔			✔	✔
Resilience	✔			✔				✔		
Good listener	✔								✔	
Passion for auditing	✔						✔			
Understand client environment / business	✔	✔								✔
Team player							✔		✔	
Conflict resolution						✔				✔

Table 14: Soft skills interview responses

The following table presents the relevant isolated soft skills stated by the interviewees:

Interview Response	Soft Skills
A	- Maturity (auditors communicate with people at different levels and from different backgrounds); - Patience; - Tolerance; and - Transparency
D	Practical experience is the most important attribute (IT knowledge of the business, preferably worked in a IT department)
E	Basic computer skills – computer literate (e.g. Microsoft)
F	Corporate responsibility (director level)
H	- Ability not to take things personally; - Tenacity (ability to get things done despite lack of cooperation); - Strong work ethic; - Ability to understand other perspectives or practicality in real life; - Courage of convictions (stand-up to people); - Ethics; and - Engaging personality
I	- Learn and interpret (analyse); - Transformed (relate to different levels of staff, people, taking into account the person as an individual); and - Confidence
J	- Customer focus; - Mentoring role (knowledge transfer); - Forward thinking; - Decision making; - Business and commercial awareness; - Creative and innovative thinking; - People networking; - Quality orientation; and - Delivery focused

Table 15: Isolated soft skills interview responses

4.4.3 Roles and Responsibilities of an IS Auditor

4.4.3.1 Services provided by the IS audit function

The goal is to establish what types of services are provided by the IS audit function where the interviewee is currently employed. By obtaining the services provided by the IS audit function, the roles and responsibilities of IS auditors can be derived.

The same approach as in 4.4.1 is used, whereby the interview responses are summarised and a list containing responses from more than one person ($\geq$ 20%) are drafted as shown in Table 16, the isolated (non-generalised) answers are also provided as a means of completeness, refer to Table 17. The isolated responses may correspond to the concepts and terms obtained from the literature study and may therefore be valid for the overall roles and responsibilities framework, which will be presented in Chapter 5.

Services provided by the IS audit function	Interview Responses									
	A	B	C	D	E	F	G	H	I	J
General computer controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Application control reviews	✓	✓		✓		✓	✓	✓	✓	✓
Data analysis audits	✓			✓		✓		✓		✓
Technical reviews (Security and network reviews)	✓	✓	✓	✓			✓			✓
SDLC reviews		✓		✓			✓			✓
Process / Project audits		✓	✓						✓	
IT governance					✓			✓	✓	
Special ad hoc outsourced consulting services	✓				✓	✓		✓		
Financial audit assignments					✓			✓		
Compliance audits	✓				✓					
Risk assessments	✓				✓					

Table 16: IS audit services provided

From the interview responses the following concepts and areas detailed in Table 16 were described:

- Application Control Reviews (including report and output validations)
  - Manage data (input, processing, output and master file maintenance)
- General Computer Control Reviews (as per COBIT items)
  - Ensure security of systems;
  - Provide continuous IT services;
  - Provide safe and sound IT facilities;
  - Manage change to IT systems;
  - Manage data;
  - Manage third party services;
  - Ensure compliance with external requirements;
  - Define and manage service levels;
  - Assess and manage risks;
  - Manage problems and incidents;
  - COSO reviews (Control environment, risk assessment, monitoring);
  - Development reviews;
  - Security reviews;
  - Operations reviews; and
  - Change management reviews.
- Financial Audit: A financial audit assesses the effectiveness and adequacy of financial controls.
- Compliance Audit: A compliance audit is an audit of controls to counter: 1) Adverse legal/financial and image risks of not complying with laws and regulations; and 2) Certain financial or operating activities of the organisation not conforming to specified conditions, rules and regulations.
- Technical reviews: Assessment of risks and controls regarding the Operating System, Database and Networks (Routers and Switches).

The following table presents the isolated Audit knowledge stated by the interviewees:

Interview Response	Audit knowledge
A	▪ IT forensics; and ▪ Due diligence review
B	▪ Competitions (conducting and verifying competition draws)
E	▪ Management Assistance Requests: Reviews of specialised nature requested by the client. The scope of these reviews is generally narrower than a regular audit; ▪ Consulting Services: Assurance, related consulting work is designed to provide the client with advice and research regarding appropriate operational, Information Technology, compliance and financial controls to counter the risks involved in the achievement of objectives; ▪ Continuous Risk Monitoring: Through this activity CAATS are used to monitor and analyse data to identify unusual trends. Management are then alerted to emerging issues as soon as possible. It also acts as an enabler to our understanding of the business. Follow up of outstanding audit issues also forms part of our continuous risk monitoring. As a result, our planned activities continue to have an appropriate risk-based focus; ▪ Corporate Governance Reviews: Assists the board of directors and management in achieving the goals of the organisation by evaluating and approving the process; and ▪ Continuous Auditing: Continuous auditing is a detective control (but can also be preventative) that is independent of the underlying business application system. It provides improved timeliness of response to problems and an additional level of control by identifying problems in early stages.

Table 17: Isolated IS audit functions

4.4.3.2 Steps involved in performing an IS audit

The objective of this question was to establish the steps involved, from planning to conclusion of a typical IS audit assignment. As with the services provided by the IS audit function, the steps involved in performing these different types of audits will be used to define and develop the roles and responsibilities of an IS auditor.

The interview responses are described according to five main general sections which are:

- Pre-planning;
- Planning;
- Fieldwork;
- Audit report and follow-up; and
- Closure.

The interview responses are detailed in Table 18. Interviewees F and H have not provided any detail and are therefore not listed in Table 18. These interviewees have only stated that the steps consist of the following high-level terms:

- Planning;
- Execution; and
- Reporting.

IS audit steps	Interview response							
	A	**B**	**C**	**D**	**E**	**G**	**I**	**J**
Pre-planning	▪ Understand the client environment ▪ Establish requirements of audit ▪ Obtain buy-in from client ▪ Opening meeting with client and audit team	N/A	▪ Identify opportunities ▪ Arrange meeting with client to discuss and agree on scope, timing and objectives	▪ Previous years audits and information ▪ System changes ▪ Risk ▪ Business knowledge	▪ Research and benchmarking ▪ Understand client / audit area	▪ Draft engagement letter (Scope, planning, timing and resources) ▪ Discussions with client (audit scope and additional requirements)	▪ Opportunity identification ▪ Selling	▪ Planning (critical system identification) ▪ IT risk meetings ▪ Meeting with client with regards to generic scope and any additional work
Planning	▪ Establish and agree on purpose and objective of audit and clearly communicate to audit team ▪ Prepare client requirements ▪ Manage timing of the audit (available time, people and budget) ▪ Prepare audit plans and questions according to the	▪ Planning (Project assignment, project planning and scoping, client contacts and process description (walkthroughs) and obtaining detailed information about processes) ▪ Brainstorming (the objective of brainstorming session is to	▪ Ensure compliance with appropriate risk management procedures (independence) ▪ Arrange for appropriate access to resources ▪ Perform client information gathering ▪ Prepare budget and obtain confirmation of budget	▪ Scoping ▪ Resource planning ▪ Timing ▪ Budget ▪ Selection of audit procedures applicable and adequate to audit	▪ Develop audit program ▪ Project Management (Timing, scope and budget)	▪ Compiling of planning documentation (gain understanding of entity, management structure of the auditee, strategy plans, policies and procedures, job descriptions and budgets (key strategic documentation)	▪ Scoping	▪ Audit planning (background, draft process flow) ▪ Scope sign-off ▪ Risk identification and controls to mitigate the risks

IS audit steps	Interview response							
	A	**B**	**C**	**D**	**E**	**G**	**I**	**J**
	methodology	identify risk by accommodating individuals from IT, Audit, Risk Management and Investigations (Forensics) ■ Risk and Control Assessment (assess risks, identify controls to mitigate the risks, determine the audit objectives to which the relevant controls relate, design the audit program)	■ Staff bookings ■ Contact client, communicate objectives and scope and timing (kick-off meeting) ■ Brief staff and agree on appraisal objectives, responsibilities and reviewing ■ Plan and prepare for fieldwork (research if applicable) ■ Introduce staff to client ■ Set-up feedback meeting with client					
Fieldwork	■ Perform Fieldwork	■ Identify controls per risk area and test for adequacy and effectiveness ■ Test and evaluation of process and	■ Staff coaching ■ Perform fieldwork ■ Provide regular feedback to manager/ partner / client ■ Prepare and	■ Fieldwork execution ■ Reviewing ■ Conclusions ■ Exceptions / findings ■ Factual correctness	■ Execution of audit program (fieldwork)	■ Execution of the audit (interview client to obtain and understand business processes) ■ Identify risks ■ Identify controls	■ Discussions and Interviews ■ Site visits ■ Testing and evidence gathering	■ Testing of controls

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IS audit steps	Interview response							
	A	**B**	**C**	**D**	**E**	**G**	**I**	**J**
		procedures and controls	provide assignment provisions ▪ Complete working papers and report to management ▪ Review and sign-off on fieldwork ▪ Partner review and final assurance	(revise findings)		in place to mitigate risks ▪ Identify weaknesses ▪ Compile findings and recommenda-tions		
Audit Report and Follow-up	▪ Identify weaknesses ▪ Reporting (communication to client management) ▪ Establish consensus on findings with client management ▪ Formally communicate audit outcome to management ▪ Closure meeting	▪ Reporting ▪ Follow-up	▪ Review report to management ▪ Provide client with draft report ▪ Update knowledge sharing and client records ▪ Arrange and attend final clearance meeting ▪ Clear all open notes and follow-up items ▪ Obtain comments from	▪ Issue report with management comments	▪ High risk areas and positive points	▪ Issue draft report ▪ Review and address queries ▪ Issue draft report to client (grace period allowed for comments) ▪ Compile final report to general management at the highest level	▪ Report writing ▪ Factual accuracy	▪ Anomalies reporting ▪ Management comments and sign-off ▪ Report issuing – audit committee and risk committee

IS audit steps	Interview response							
	A	**B**	**C**	**D**	**E**	**G**	**I**	**J**
			client					
Closure (after audit)	▪ Evaluation of audit and staff performance (mentorship program: understanding shortfalls and areas of improvement	N/A	▪ Client satisfaction survey ▪ Complete and discuss staff appraisals	▪ Closure	▪ Exit Interviews ▪ Clear review notes and follow-up findings	▪ Issue end of audit questionnaires (measure performance) ▪ Follow-up on resolution of findings	▪ Delivery and closeout	N/A

Table 18: Steps in an IS audit assignment

4.4.3.3 Roles and responsibilities of IS auditors

The aim of the question is to establish the typical roles and responsibilities of an IS auditor according to the experience, opinion and observation of the interviewee. The roles and responsibilities of an IS auditor are key features or characteristics of the IS auditor's profile, since the roles and responsibilities form the foundation for the knowledge, skills and auditing tools and techniques required and used by IS auditors.

Most responses were divided into the different job responsibility levels, namely trainee or entry-level consultant and manager. Only one interviewee responded on director's level roles and responsibilities. The director level roles and responsibilities will be listed in the isolated response table (Table 20).

The same approach as in the above sections will be used, whereby the interview responses are summarised and a list containing responses from more than one person (≥ 20%) as shown in Table 19. The isolated (non-generalised) answers are also provided as a means of completeness and will be listed in Table 20. The isolated responses may correspond to the concepts and terms obtained from the literature study and may therefore be valid for the overall roles and responsibilities framework, which will be presented in Chapter 5. Table 19 will be divided according to the main job responsibility levels.

Roles and Responsibilities	Interview Responses									
	A	B	C	D	E	F	G	H	I	J
Entry level/ trainee consultant										
Perform fieldwork (execution of audit programs)	✓	✓	✓	✓		✓	✓	✓		
Gathering of evidence	✓						✓	✓		
Testing of controls	✓	✓	✓							✓
Identify risks and controls and report on risk areas	✓	✓	✓	✓	✓			✓		✓
Reporting of control weaknesses	✓	✓				✓	✓	✓		✓

	Interview Responses									
Roles and Responsibilities	A	B	C	D	E	F	G	H	I	J
Management level										
Review of audit programs and working papers	✓			✓		✓	✓	✓		✓
Engagement planning	✓	✓	✓			✓	✓	✓		
Management of client, audit team, resources, time and budget	✓		✓	✓		✓	✓	✓	✓	
Reporting to management	✓	✓				✓	✓	✓		✓
Identify risks and controls and report on risk areas	✓	✓	✓	✓	✓	✓				

Table 19: Roles and responsibilities

The following table presents the relevant isolated roles and responsibility concepts stated by the interviewees:

Interview Response	Audit knowledge
A	Junior staff: ■ Discussions with management (both internally and externally) Management ■ Approval of audit programs; and ■ File compilation (Working papers, audit procedures and control assessments)
B	The auditor will also be involved in the Requirements, Design, User Acceptance Testing and/or Selective Process with regards to the SDLC audit.
C	■ On-time service delivery; and ■ Selling

E	The mission of IS internal audit is to provide independent, objective assurance and consulting services designed to add value to and improve the organisation's operations. It helps the organisation to accomplish its objectives by bringing a systematic, disciplined approach to the evaluation and improvement of the effectiveness of risk management, internal controls and corporate governance processes. The scope of work of IS internal audit is to determine whether or not the organisation's network of risk management, control and corporate governance processes, as designed and represented by management, is adequate and functioning in a manner to ensure that: ▪ risks are appropriately identified and managed; ▪ significant financial, managerial and operating information is accurate, reliable and timely; ▪ employees' actions are in compliance with policies, standards, procedures and applicable laws and regulations; ▪ resources are acquired economically, used efficiently, and are adequately protected; ▪ programs, plans, and objectives are achieved effectively; ▪ quality and continuous improvements are fostered in the organisation's control processes; and ▪ significant legislative or regulatory issues applicable to the organisation are recognised and addressed appropriately
G	Trainee / Junior level ▪ Understanding the audit objectives Manager ▪ Continuous encouragement of the audit team; ▪ Cross-checking of audit work to the report; and ▪ Continuous market service
H	Consultants ▪ Understanding the client's business; ▪ Understanding consultant responsibility and team role; ▪ Discussions with client; ▪ Test mitigating controls; ▪ Keep management informed (progress, findings and obstacles); ▪ Address review comments; ▪ Support manager or director in report discussions; ▪ Relationship management with clients; ▪ Enhancement of skills; ▪ Broadening of technical skills; and ▪ Understanding of methodologies

	Manager • Training of staff (upfront / through out the engagement and performance appraisals after the completion of the audit); • Technical evaluation; • Adherence to firm policies and procedures (e.g. risk management); • Staff development; • Practice management; and • Identification of opportunities and sales
	Director • Assessment of risks; • Management of risks; • Ensure independence; • Practice management; • Building relationships with clients; • Development of staff; • Enhancement of the brand; • Assist in engagement setup; • Monitoring of findings, conclusions and engagement quality; • Identification of client needs (within independence); and • Firm strategic objective
I	• Support external audit (in relation to standards, to identify audit risks); • Assurance over the IT environment; • Audit (Project risk, IS governance and security); • Consulting (Specialised jobs); and • Link between IT and business
J	Manager • Workable solutions; and • Compliance to all international standards applicable to the audit

Table 20: Isolated roles and responsibilities

4.4.4 IS Audit Tools and Techniques

4.4.4.1 Auditing standards, guidelines or frameworks

The objective of the question is to establish the most commonly used standards, guidelines and frameworks. IS auditors make use of best practise standards, guidelines and frameworks to compare and assess risks and controls. A combined effort between the audit methodologies and the development of an audit program based on the methodology requirements, audit scope and standards, guidelines and best practices therefore exists and enables the IS auditor to successfully complete an IS audit assignment.

The interview responses were as follows:

Auditing standards, guidelines and/ or frameworks	Number of responses	Percentage
International auditing standards	5	50%
Internal audit standards	6	60%
COBIT	10	100%
COSO	6	60%
ISO17799 (2700000)	2	20%
Itil	4	40%
In-house developed methodology	7	70%
Sarbanes Oxley Act	2	20%
ISACA guidelines and frameworks	4	40%
Public Audit Manual (PAM) – Guideline to audit public entities	1	10%
International Financial Statement Reporting Standards (IFRS)	1	10%
IRB standard	1	10%
PM1	1	10%

Table 21: Auditing standards, guidelines and frameworks

4.4.4.2 IS auditing tools and techniques

The objective of the question is to identify the most valuable IS audit tools and techniques in assisting the IS auditor to meet audit objectives in time, efficiently and effectively. IS audit tools and techniques are described for the purpose of this study as the enablers or support function, with the main focus on assisting the IS auditor to select, gather, analyse and report information and help add credibility to the findings, conclusions and recommendations.

The same approach as in the above sections will be used, whereby the interview responses are summarised and a list containing responses from more than one person ($\geq 20\%$) is shown in Table 22. The isolated (non-generalised) answers are also provided as a means of completeness and will be listed in Table 23. The isolated responses may correspond to the concepts and terms obtained from the literature study and may therefore be valid for the overall IS auditing tool and techniques, which will be presented in Chapter 5.

IS audit tools and techniques	Interview Responses									
	A	B	C	D	E	F	G	H	I	J
In-house developed software specific to methodology and planning methods or technical reviews	✓	✓	✓					✓	✓	✓
Specialised information Security analysis tools	✓	✓	✓	✓		✓		✓	✓	✓
CAATs (e.g. ACL, IDEA, SQL queries)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Microsoft Office (Word, Excel, Vision, Power Point, Projects and Outlook)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
AuditPro		✓					✓			
Myclient (Teammate)			✓	✓	✓					✓
Peoplesoft (billing and project management)				✓				✓		

Table 22: IS audit tools and techniques

The following table presents the relevant isolated IS audit tools and techniques used by IS auditors as stated by the interviewees:

Interview Response	Audit knowledge
A	Tools to assist in evaluating applications (e.g. SAP)
B	For data analytics the following tools are used: Brio Query, Business objects, Microsoft MDX, MS Access, SQL and Oracle Analyser
C	AceAbab (technical tool)
F	Caseware (audit tool)
H	- AS/2 (Document management); - Qsmart; - Internet tools (freeware) (IT security); - Staff track (planning); and - Global independent monitoring system (practice management)
I	Vector (audit tool, document management)

Table 23: Isolated IS audit tools and techniques

4.5 CONCLUSION

This chapter aimed at presenting the primary data obtained though structured interviews. The interview population selection and criteria was first described. Secondly the layout of the structured questionnaires used during the interviews was illustrated. The questionnaires were based on the main research questions as described in Chapter 3. Lastly the interview responses were detailed according to the layout and questions in the structured interview questionnaire. The main sections of interview responses included: 1) Knowledge; 2) Skills; 3) Roles and responsibilities; and 4) IS auditing tools and techniques. Common interview responses were grouped together and listed. Isolated interview responses were documented in separate tables giving the detail of the isolated responses. These isolated responses were not omitted since they might be relevant and valid once compared to the literature review results.

The primary data presented in this chapter will be interpreted in the next chapter. After interpretation, the primary data will be combined with and compared against the secondary data presented in Chapter 2. By means of the interpretation, comparison and summation of the primary and secondary data, an IS auditor's profile will be established in the next chapter.

CHAPTER 5

DATA INTERPRETATION, COMPARISON AND SUMMARY

5.1 INTRODUCTION

With the rapidly growing computerisation of transactions and processes and continuous changes in computer environments, a significant number of changes in the nature of auditing practices has occurred. Given these changes and challenges, these changes created the need for a professional with a special combination of knowledge and skills. A professional understanding of the auditing concepts as well as IT concepts is required to perform an IS audit. As stated by McCombs (2004) "employers are demanding that their accounting and auditing professionals possess adequate backgrounds in Computer Science and Information Systems". Thus, as previously stated in Chapter 2, people coming from different backgrounds (IT and/or auditing) are forced to learn and develop the skills necessary to meet the demands of IS auditing. The following typical questions, as proposed in Chapter 2, arose from this problem of having people coming from different backgrounds:

- Is there a difference between the level of knowledge required from IT professionals, audit professionals and IS audit professionals?
- Who will be the best candidate to perform IS audit assignments: someone with an audit or an IT background?
- What is the level of IT knowledge required from these professionals?
- What is the level of audit knowledge required from these professionals?
- Is the field of IS auditing really as specialised as perceived?
- What are the typical daily roles and responsibilities of IS auditors?
- What IS audit tools and techniques are used in assisting IS auditors to perform IS audit evaluations and assessments?

From these questions the main research question was derived: What is the IT and audit knowledge and the soft skills required from an IS auditor given that specific auditing tools and techniques are available to assist the auditor in executing an IS audit assignment by evaluating these knowledge and skills according to his/her daily roles and responsibilities?

In response to the research question, an IS auditor's profile will be developed. A profile is defined for the purpose of this study as a set of data, often in graphical form, representing the extent or significant features and characteristics of something. The IS auditor's profile will be based on an IS auditor's daily roles and responsibilities. The roles and responsibilities will then be considered in terms of Knowledge, Skills and IS Auditing Tools and Techniques.

The primary data obtained through structured interviews will be interpreted and compared with the secondary data obtained by means of the literature review that was conducted. The aim of this chapter is to combine the primary and secondary data in order to define an IS auditor's profile.

This chapter will provide the interpretation, comparison and combination of the primary (interview response – Chapter 4) and secondary data (literature review – Chapter 2) according to the following main characteristics and / or features:

- Roles and Responsibilities of IS auditors;
- Knowledge;
- Soft Skills; and
- IS Audit Tools and Techniques.

These characteristics and features will aid in defining the IS auditor's profile.

5.2 ROLES AND RESPONSIBILITIES OF IS AUDITORS

The roles and responsibilities of an IS auditor for the purpose of this study is defined according to two basic principles:

1. Different types of IS audit assignments; and

2. The typical generalised steps required to perform the different types of IS audit assignments (therefore the tasks performed by IS auditors).

5.2.1 Secondary data

After taking the information as obtained through the literature review into account, the following summary was compiled which contains the most important roles and responsibilities which an individual in the profession of IS auditing should possess. The summary is based on the literature obtained from the following sources: Hinson (2004:10-12), the audit program by Burbage (2001), Weber (1999), Watne and Turney (2002), ISACA CISA Review Manual (2006), Warren, Edelson and Parker (2001:A2-5:7), Hall and Singleton (2005), Marx, van der Watt, Bourne and Hamel (2002) and Lucy (1999:44).

Table 24 contains the summary according to the data obtained from the literature review:

ROLES AND RESPONSIBILITIES	DESCRIPTION	MAIN STAGES
Understand Information System and the client's business	Identify the main focus areas regarding the audit. It is essential for an IS auditor to obtain a thorough understanding of the business processes, structure and Information Systems regarding the organisation to be audited. This understanding can be obtained through interviews, observation of operations and the collection of relevant documentation.	1. Scoping and pre-audit survey
Review control objectives	Review the control objectives to establish relevant control objectives according to the main focus areas as identified in stage 1. This includes an assessment of the risks.	2. Planning and preparation

ROLES AND RESPONSIBILITIES	DESCRIPTION	MAIN STAGES
Compile audit program	Compile an audit program to fit the specific needs and risks, as identified in stages 1 and 2. The audit program consists of all the control activities, which relate to the control objectives, as determined above. The audit program is also compiled specific to the different audit assignments. For example: input, processing and output controls audit. Assess the adequacy and completeness of the audit plan.	
Evaluate and observe established controls/ strategy and application information	Evaluate the physical, procedural, operational application and other general controls through interviews, observation and reviews. The types of tests and objectives will differ according to the types of audits which include: operational computer or network audits; IT installation audits; system development audits; IT process audits; change management audits; information security and control audits; IT legal compliance audits; disaster contingency / business contingency planning / disaster recovery audits; IT strategy audits; organisational audits; contract compliance and quality assurance audits; value-added support; personnel practice audits; hardware and software audits; special ad hoc assignments; financial audit assignments and emerging technology audits. Gather supporting documentation to support conclusions and findings.	3. Fieldwork
Identify risks	According to the evaluation in stage 3, all risks related to the computer environment are identified. The bigger the risk the more comprehensive substantive testing is required. Data analysis tools, such as ACL, IDEA, excel, access or in-house development scripts are used to assist IS auditors in identifying risks.	4. Analysis

ROLES AND RESPONSIBILITIES	DESCRIPTION	MAIN STAGES
Compile findings and recommendations on controls	An overall evaluation takes place and the audit findings are summarised and recommendations are made to the client.	5. Reporting
Advice on findings	Persuade management to commit to and adhere to recommendations within a sensible timeframe.	
Follow up on findings and recommendations	Preparing notes for future audits. Ensure that management adheres to recommendations through follow-ups.	6. Closure
Client's relationship management	It is essential to build good and stable client relationships to improve the effectiveness of audits and to build a trusting relationship. Providing value-added support to organisations through technical, control and security guidance, development and facilitating controls and training. The auditor is perceived to be a consultant, change agent, expert, advisor and advocate.	Stages 1 to 6
Quality assurance	Ensure that the business processes of clients adhere to standards, legislation and guidelines. Also ensure that minimal risks are present.	
Control assurance	Ensure that management establishes and enforces controls in the computerised environment.	

Table 24: Roles and responsibilities per main IS audit stage (from literature review)

5.2.2 Primary data

The following summary regarding the IS auditor's roles and responsibilities is presented based on the primary data gathered through the structured interviews as presented in Chapter 4, Section 4.4.3. The summary as presented in Table 25 incorporates the three concepts described in Chapter 4, namely: 1) the services provided by the IS audit function; 2) the steps involved in performing an IS audit; and 3) the roles and responsibilities of an IS auditor.

Some of the isolated concepts, as described in Chapter 4, were also included in the summary if the isolated concept was found in the literature review or if it is deemed important from the researcher's own experience and observations.

Table 25 will use the characteristics of Table 24 (as presented above) to simplify the summary of the primary and secondary data.

ROLES AND RESPONSIBILITIES PER RESPONSIBILITY LEVEL	DESCRIPTION	MAIN STAGES
Consultants ▪ Client's business ▪ Responsibility / objective	Understand client's business and own responsibility within team as well as team role.	1. Pre-planning
Manager ▪ Selling and marketing ▪ Client's business.	Selling and market services, identification of opportunities and sales. Also needs to understand the client's business.	
Director ▪ Identify client needs ▪ Engagement setup ▪ Ensure independence	Identification of client needs, assisting in setting up of engagement and ensure independence of engagement team.	
Consultant ▪ Identify risks and controls	Assessment of the risks and controls to mitigate identified risks. Audit approach needs to focus on key risk areas.	2. Planning
Manager ▪ Engagement Planning	Audit objectives, audit activities, risk assessment, scope of work, budgeting, resource allocation, client and team meetings.	
Director ▪ Engagement setup	Assist manager in engagement planning and set-up.	

ROLES AND RESPONSIBILITIES PER RESPONSIBILITY LEVEL	DESCRIPTION	MAIN STAGES
Consultant ▪ Perform fieldwork ▪ Gathering of evidence ▪ Testing of controls	Perform fieldwork according to type of audit assignment: 1) General computer controls; 2) Application control review; 3) Data analysis audits; 4) Technical reviews; 5) SDLC reviews; 6) Process / project audits; 7) IT governance reviews; 8) Special ad hoc/ outsourcing assignments; 9) Financial audit assignments; 10) Compliance audits; and 11) Risk assessments. Perform fieldwork by execution of audit plan, gathering of evidence to support conclusions and findings and testing of controls to meet control objectives.	3. Fieldwork
Manager ▪ Review of audit programs and working papers	Reviewing of audit programs and working papers to ensure completeness, accuracy and validity of information presented and tests performed to meet control objectives.	
Director ▪ Assessment of risk ▪ Management of risk ▪ Monitoring of findings, conclusions and engagement quality	Ensure adequacy of assessment and management of risk, monitoring of adequacy and quality of work completed.	
Consultant ▪ Reporting of control weaknesses	Identify and report on control weaknesses. Issue draft report.	4. Audit report and follow-up
Manager ▪ Report on risk areas ▪ Reporting to management	Compile final report to general management and issue report.	
Director ▪ Monitoring of findings, conclusions and engagement quality	Reviewing of final report to general management and issuing of report.	

ROLES AND RESPONSIBILITIES PER RESPONSIBILITY LEVEL	DESCRIPTION	MAIN STAGES
<u>Consultant</u> ▪ Enhancement of skills ▪ Broadening of technical skills ▪ Understanding of methodologies	Assessment of the enhancement of skills, identify areas for improvements, training in identified areas.	5. Closure
<u>Manager</u> ▪ Evaluations ▪ Client satisfaction survey ▪ Exit interview	Perform evaluations of audit and staff performance, complete client satisfaction surveys and make notes for future audits, exit interviews with client management and staff.	
<u>Director</u> ▪ Final assurance	Final assurance on engagement quality and closure.	
<u>Manager</u> ▪ Management of client, audit team, resources, time and budget	On-time service delivery, encouragement of audit team, training and development of staff, adherence to company policies and standards, client meetings and management, audit team management, budgeting.	Stages 1 - 5
<u>Director</u> ▪ Practise management ▪ Building relationships with clients ▪ Development of staff ▪ Enhancement of brand ▪ Organisation strategic objective	Continuous building and refinement of relationships with clients, development of staff, enhancement of the brand (marketing), compliance with organisational strategic objectives and ensure adequate practise management.	

Table 25: Roles and responsibilities per main IS audit stage (from interview responses)

5.2.3 Summary on Roles and Responsibilities

To contribute to the information gathered through the structured interviews, to ensure the validity of the data obtained and to enhance the secondary data obtained through the literature review, a roles and responsibilities framework was developed.

The framework contains an abstract from both the primary and secondary data obtained. In developing the framework, the primary and secondary data were compared, generalised and the most relevant, essential and appropriate concepts were chosen as representative of all presented data. The framework is presented in Figure 10.

The data from the secondary and primary data sources corresponded closely to the same principles. Phase 4, "analysis" from the secondary data source, was combined with Phase 3, "fieldwork", since during the fieldwork phase, analysis of conclusions and findings is also performed. The result of the analysis is captured in Phase 5, "reporting". The secondary data table (literature review, Section 2.4) was also amended to include the different responsibility levels as described in the primary data section.
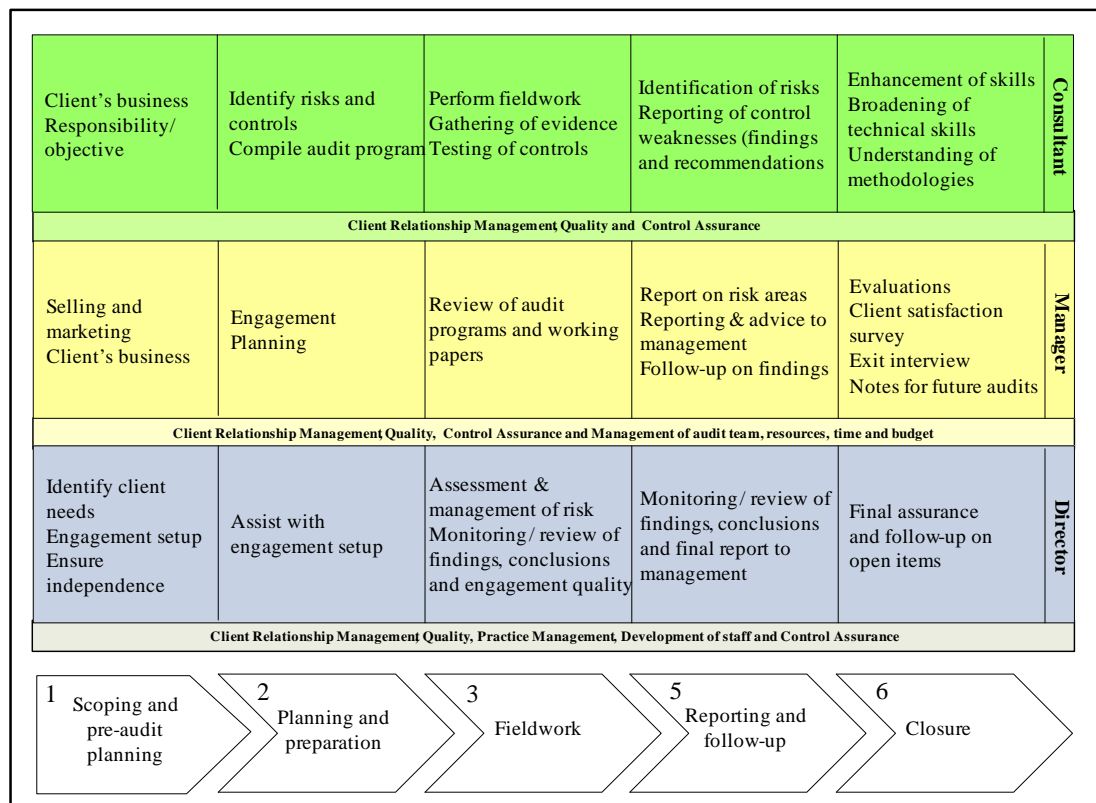

Figure 10: An IS auditor's roles and responsibilities

It is important to take all these roles and responsibilities into account to determine the IT and auditing knowledge, the soft skills required and the IS audit tools and techniques used to assist IS auditors.

The IT and auditing knowledge, soft skills required by an IS auditor and the IS audit tools and techniques used to assist the IS auditor in executing IS audit assignments will be considered in Sections 5.3, 5.4 and 5.5 respectively.

5.3 KNOWLEDGE

Knowledge was defined in Chapter 2 as the combined result of formal education, experience and training; something gained by listening, reading, learning and/or observation. Since IS auditors come from different backgrounds, the knowledge which they possess when entering the IS audit profession is very diverse. It is therefore even more important to establish a minimum level of knowledge expected from IS auditors. To be able to identify the different backgrounds and education paths chosen by IS auditors and expected by IS audit employers, the secondary data, as obtained from the literature review and the primary data, obtained through the structured interviews, were assessed and compared. The following list of preferred backgrounds and/or qualifications were drafted, based on recurrence:

- General IT / IS related background (BSc or BCom Information Systems or any other related IT degree or diploma);
- Accountancy background (BCom degree or any other related field, e.g. financial management, quality assurance and/or general management);
- Information Systems qualification (e.g. CISA, CISM); and
- Accountancy qualifications (e.g. CA, ACCA, CPA ,CIMA or CIA).

From the list presented above, it is clear that there are mainly two routes into IS auditing: 1) from an IT / IS background; and/or 2) from an auditing / accounting background. This statement is supported by the interview responses when it was found that both IT and auditing/accounting backgrounds obtained a response rate of 90 % (9/10 employers expected one or the other of these backgrounds), all other areas were scored 40% or less (refer to Section 4.4.1.4, Table 13).

Since it can therefore be concluded that the two main routes into IS auditing are IT or auditing, the knowledge requirements of an IS auditor will be assessed based on the two different types of knowledge.

5.3.1 Secondary data

After taking into account the described and defined knowledge criteria and by reviewing the available literature from various sources, the following summary is presented as based on the differentiation between IT knowledge and audit knowledge as presented in Chapter 2. The summary is illustrated in Chapter 2, Figure 7.

IT and audit knowledge and skills consist of knowledge which is obtained through formal education and training. This represents "What to do". This knowledge is transformed into skills through experience. This represents "How to do it". Knowledge has therefore a direct influence on skills, as skills cannot exist without knowledge. The skills referred to exclude the soft skills that will be described in the next section. For the detailed descriptions of IT and Audit knowledge concepts, refer to Chapter 2, Section 2.5.

5.3.2 Primary data

Based on the interview responses described in Chapter 4, Section 4.4.1, the following represents the IT knowledge required by an IS auditor:

- Application programs / ERP systems;
- Basic Information Systems and Information Technology general concepts;
- Programming languages and procedures;
- Networks (including routers, switches and internet);
- Data structures and database;
- Information security (logical access);
- Information Systems Management;
- Operating Systems / domain controllers; and
- System analysis, design, development, testing, implementation and maintenance (SDLC).

The auditing knowledge required from IS auditors according to the interview responses, as detailed in Section 4.4.1.2, are as follows:

- Understanding of the concept of risk;
- Knowledge of applicable standards and best practices;
- Audit planning (Understanding the objectives of the audit, the scope of the audit and the areas of significance);
- Audit testing methods (including compliance testing, substantive testing and analytical review procedures);
- Understanding of the concept of control;
- Understand basic accounting principles;
- Business understanding;
- Obtaining and interpreting relevant audit evidence; and
- Independence.

5.3.3 Summary of IT and auditing knowledge

To be able to define an IS auditor's profile, the basic IT and auditing knowledge required from IS auditors is of utmost importance. Very rarely one individual will have all the required knowledge, but through education, formal and on the job training, the gap between expected and current levels of knowledge can be bridged. Individuals usually come from either an IT or audit background, and will therefore, most of the time, only possess either one of the required areas of knowledge. It is therefore essential for employers to employ professionals from different backgrounds. It is even more essential for the professionals to transfer their knowledge within the IS audit domain to learn and obtain the knowledge sets of both areas. In summary, the IT and audit knowledge required from IS auditors can be defined as presented in Table 26. The summary is derived from the secondary and primary data as presented above.

IT knowledge	Audit knowledge
Application programs / ERP systems	Understanding of the concept of risk
Basic Information Systems and Information Technology general concepts	Know about applicable standards and best practices
Programming languages and procedures	Audit planning (understanding the objectives of the audit, the scope of the audit and the areas of significance)
Computer communications and Networks (including routers, switches and internet)	Audit testing methods (including compliance testing, substantive testing and analytical review procedures)
Data structures and database	Understanding of the concept of control
Information security (physical and logical access)	Understand basic accounting principles
Information Systems Management / IT Governance	Business understanding
Operating Systems	Obtaining and interpreting relevant audit evidence
System analysis, design, development, testing, implementation and maintenance (SDLC)	Independence
Business Continuity and Disaster Recovery planning	
Information Systems Operations	
Specialised areas	

Table 26: IT and audit knowledge

The three concepts of "Business Continuity and Disaster Recovery Planning", "Information Systems Operations" and "Specialised areas" were not part of the IT knowledge summary as provided by the primary data although it was referred to in the secondary data. These concepts were, however, part of the isolated IT knowledge table, Chapter 4, Table 9:

Area	Interview response (Chapter 4, table 9)
Business Continuity and Disaster Recovery planning	J
Information Systems Operations	A & H
Specialised areas	D

Table 27: Isolated concept rationale

"Hardware Support" and "Understanding the social, economical and legal implications of computer technology" was only raised in the secondary literature data and was omitted from the summary table. "Hardware support" can also be regarded as part of "Computer communications and network" as well as "software" since most network communication centres mainly consist of tangible hardware like routers, switches, hubs, and servers (software). "Understanding the social, economical and legal implication of computer technology" can also be included in the "Information System Management / IT Governance" section.

There were no exceptions to the auditing knowledge concepts and the data from both the secondary and primary sources were used.

It is important to take into account that the overall knowledge and skills base of an IS auditor is much more comprehensive and more complex than presented above. This study only focuses on the basic IT and audit knowledge and skills for the purpose of defining an IS auditor's profile.

5.4 SOFT SKILLS

Having the required IT and audit knowledge is not enough to enable an IS auditor to successfully execute an IS audit assignment. Most of the information obtained during the fieldwork phase needs the interaction of the client and audit team, especially in obtaining supporting evidence, in observing processes and in interviewing staff. The IS auditor needs to adapt to different circumstances and client personnel to effectively and efficiently perform the IS audit. Since the scope for soft skills is tremendous and not only applicable to IS auditing but to almost all professions, all data presented in both the interview responses and literature review will be illustrated as part of the basic soft skills set required by an IS auditor. The purpose of defining soft skills is to provide the IS auditor with guidelines for the basic level of soft skills required for performing IS audits, thereafter new skills and knowledge can be aquired through on-the-job training, observation and experience.

5.4.1 Secondary data

As described in the literature review, soft skills are learned through experience or are inherent in personality and are not learned through a medium such as education or training. As stated in Chapter 2, skills are the "How to do it" and are only obtained through experience and observation (observing others). A soft skills base was developed as a means of illustrating the soft skills as obtained from the literature. For the soft skills base refer to Chapter 2, Figure 8.

For the detailed descriptions of the soft skills' concepts, illustrated in Figure 8, refer to Chapter 2, Section 2.5.

5.4.2 Primary data

The following soft skills were derived from the interview responses as described in Section 4.4.2:

- Analytical or systematic;
- People's person or people knowledge;
- Communication skills (both written and verbal, including interviewing techniques, persuading, presentation, managerial communication and negotiation);
- Initiative;
- Managing people, resources, time and budgets (leadership);
- Resilience;
- Good listener;
- Passion for auditing;
- Understand client environment / business;
- Team player; and
- Conflict resolution.

5.4.3 Summary of soft skills

An IS audit cannot be successfully completed without the auditor applying soft skills, therefore the soft skills believed to be of most value to the IS auditor are included in the concepts in Table 28. Table 28 contains the summary of information obtained through the interview responses and literature review. These soft skill concepts are not a complete representation of the entire skills set which an IS auditor should possess, since soft skills are perceived as "who or what" someone is and are not primarily taught or obtained through training although some of these skills can be enhanced upon through training. The soft skills provided in this study are only a guideline and are only focused at the basic levels of skills required by IS auditors.

Soft Skills
Analytical / systematic
People's person / people knowledge
Communication skills (both written and verbal, including interviewing techniques, persuading, presentation, managerial communication and negotiating)
Initiative
Managing people, resources, time and budgets (leadership)
Resilience
Good listener
Passion for auditing
Understand client environment / business
Team player
Conflict resolution
Constant learning / seeking new knowledge
Decisive / Judgement
Diligence and detail
Establish rapport
Inquisitiveness
Punctual
See the "bigger picture"
Strength of character
Tact
Tenacity

Table 28: Soft skills needed by an IS auditor

5.5 IS AUDITING TOOLS AND TECHNIQUES

With the rapid increase in the complexity of application systems, operating systems, databases and networking structures, the auditor is not always capable of obtaining the appropriate evidence or audit trails of transactions to ensure that specified control objectives are met. Furthermore, the IS auditor (especially if in experienced) needs to evaluate controls, policies and standards against pre-defined criteria which are accepted as reasonable. For this purpose audit methodologies, standards, guidelines and best practices are available against which one can compare company data and settings. For the purpose of this study, IS auditing tools and techniques collectively are defined as a supporting function, with the focus belong to assist the IS auditor in selecting, gathering, analysing and reporting information to help add credibility to the findings, conclusions and recommendations. IS audit tools and techniques are therefore essential features which enable the IS auditor to successfully perform an IS audit and are therefore an essential part of the IS auditor's profile.

5.5.1 Secondary data

IS audit tools and techniques are described in the literature review, Chapter 2, Section 2.7, according to the following main categories:

- Generalised audit software (e.g. ACL, IDEA, Microsoft Excel or SQL queries);
- Security analysis tools (used to assist the auditor in analysing the security settings at the domain level of the operating systems and networking software);
- Application analysis tools (used to ensure that proper validation, data integrity, completeness and other controls are implemented at application or database level);
- Audit methodologies and programs (assisting the auditor in all areas of the audit by means of evaluating organisational controls against control objectives, audit guidelines and best practices); and
- General applications (enabling the auditor to create work papers, reports, document management and planning management, e.g. Microsoft Word, Microsoft Projects).

For the detailed descriptions of each of the main categories of IS audit tools and techniques, refer to Chapter 2, Section 2.7.

5.5.2 Primary data

The IS audit tools and techniques used to assist IS auditors in executing IS audit assignments, obtained through the structured interviews (described in Chapter 4, Section 4.4.4.2), are as follows:

- In-house developed software specific to a particular methodology and planning methods or technical reviews;
- Specialised information security analysis tools;
- CAATs (e.g. ACL, IDEA, SQL queries);
- Microsoft Office (Word, Excel, Visio, Power Point, Projects and Outlook);
- AuditPro;
- Myclient (Teammate); and
- Peoplesoft (billing and project management).

5.5.3 Summary of IS audit tools and techniques

To define an IS auditor's profile, it is essential to list the features which enables the IS auditor to perform an IS audit. IS audit tools and techniques are essential in assisting the IS auditor to evaluate and assess complex detailed transactions in the fraction of the time of normal manual evaluations. The data obtained through the interview responses as well as through the literature review can be generalised and grouped under the following main categories of IS audit tools and techniques:

1. Generalised audit software: includes CAATs used for data analysis purposes, the most popular applications are: ACL, IDEA, Microsoft Excel and in-house developed SQL queries and scripts;

2. Specialised analysis tools: these include security analysis tools (e.g. Sekchek and ESM) and application analysis tools (e.g. analysis tools interrogating SAP and Oracle applications);

3. Audit methodologies, standards, guidelines and audit programs: assisting the auditor in executing IS audit assignments.

According to the interview responses, the following standards and guidelines are mainly used by IS audit organisations and professionals:

- COBIT (100% response);
- In-house developed methodology (70% response);
- COSO framework (60% response);
- Internal auditing standards (60% response);
- International auditing standards (50% response);
- Itil (40% response); and
- ISACA guidelines and frameworks (40% response).

The other standards and guidelines listed had a response rate equal to or less than 20% and are therefore not included.

4. General Applications: these applications include document management, planning and audit software and enable the auditor to create work papers, write reports and create any other related documents. According to the interview responses, the types of applications most often used by IS audit organisations and IS audit professionals are:

- Microsoft office (Word, Excel, Visio, Power Point, Projects and Outlook);
- AuditPro (auditing software);
- MyClient (Teammate – auditing software); and
- Peoplesoft (billing and project management).

5.6 CONCLUSION

The objective of the chapter was too interpret, compare, combine and summarise the primary data, obtained through structured interviews, and the secondary data, obtained though a literature review. The summaries presented at the end of each section will form part of the IS auditor's profile which will be defined in the next chapter.

This chapter was divided into sections based on the main features or characteristics of the IS auditor's profile, namely: 1) Roles and Responsibilities of an IS auditor; 2) Knowledge; 3) Soft Skills; and 4) IS audit tool and techniques.

The secondary data was first presented per section based on a summary derived from the detailed literature review. Secondly, the primary data was presented based on response rates greater than 20% per section. Finally a summary per section was provided detailing the conclusions reached regarding the interpretation, comparison and combination of the primary and secondary data.

CHAPTER 6

AN IS AUDITOR'S PROFILE

6.1 INTRODUCTION

This chapter will provide an overview and conclusion to the research. The aim of the research was to define an IS audit's profile. With the aim of defining an IS auditor's profile the research questions were used to derive the 4 main characteristics or features of the IS auditor's profile, namely:

1. Roles and responsibilities of an IS auditor;
2. Knowledge;
3. Soft skills; and
4. IS audit tools and techniques.

The structure of the research was also based on these main characteristics as presented in Chapters 2, 4 and 5. After defining the IS auditor's profile the research will be concluded with the suggested use of the profile.

6.2 OVERVIEW OF THE RESEARCH

Chapter 1 introduced the research problem and related research questions. The objectives of the research were derived from the research questions and main research problem. The objectives of the study are:

- Define the roles and responsibilities expected from IS auditors, based on the different types of audit assignments and the steps involved in performing an IS audit assignment;
- Describe the basic IT and audit knowledge required from IS auditors based on the roles and responsibilities identified;
- Describe the soft skills required by IS auditors to successfully perform an IS audit assignment;
- Define the main types of IS audit tools and techniques used most often to assist IS auditors in executing IS audit roles and responsibilities; and
- Establish an IS auditor's profile based on the 4 characteristics defined above.

The following structure was used to describe and illustrate the research objectives:

- The literature review conducted was described and detailed in **Chapter 2.** Firstly the evolution of the IS auditing profession was illustrated to understand the influence of Information Technology on traditional auditing and to understand the establishment of a new profession, namely IS auditing. All concepts influencing the IS auditing profession were defined. These concepts included: Information Systems; Information Technology; Skills; Knowledge; Training; Experience; Education; CAATs; and Audit. The impact of these concepts on IS auditing were represented in a model (Figure 5) that was developed according to the IDEF$_0$ modelling technique.

  The roles and responsibilities of IS auditors were discussed according to the value engineering approach. The roles and responsibilities were derived from the types of audit assignments and the steps involved in performing an IS audit assignment. The main roles and responsibilities, as obtained from various research sources, were presented in a framework (Figure 6) in accordance with the main stages in the audit approach.

  The IT knowledge and skills which an IS auditor must possess were presented in a knowledge and skills base. Knowledge, which includes formal education (background) and training was divided into the two main entry routes into the IS auditing profession, namely IT and Auditing and was defined accordingly. Knowledge represents "What to do" whereas skills are defined as "How to do it".

  The IS auditing tools and techniques used to assist IS auditors in executing their roles and responsibilities and enabling them to assess and evaluate complex detailed transaction were described and categorised into 5 main categories, namely:
  - Generalised Audit Software;
  - Security analysis tools;
  - Application analysis tools;
  - Audit methodologies and programs; and
  - General applications.

- **Chapter 3** has defined the research design and methodology employed to enable the researcher to answer the proposed research questions and achieve the research goal, namely to define an IS auditor's profile.

- **Chapter 4** aimed at presenting the primary data obtained through structured interviews. The interview population selection and criteria, the layout of the structured questionnaires and the interview responses were described.

- The primary data, obtained through structured interviews, and the secondary data, obtained through literature reviews were interpreted, compared, combined and summarised in **Chapter 5**. This chapter was divided into sections based on the main features or characteristics of the IS auditor's profile.

This chapter will provide an overview and conclusion to the research and will conclude by defining the IS audit's profile and the suggested application of the profile in both business and education.

6.3 AN IS AUDITOR'S PROFILE

The definition of a profile, as defined in the previous chapters, is as follows: "A profile is a set of data, often in graphical form, representing the extent or significant features and / or characteristics of something".

The IS auditor's profile will be discussed based on the 4 main characteristics derived from the research questions in the following section:

6.3.1 Roles and responsibilities of an IS auditor

The roles and responsibilities set the direction for the tasks and types of audits to be performed. The roles and responsibilities may vary according to the level of responsibility.

For the purpose of this study, the roles and responsibilities were divided into three responsibility levels, namely:

- Consultant;
- Manager; and
- Director.

The roles and responsibilities of an IS auditor are perceived as very important attributes of the IS auditor's profile. The roles and responsibilities and the audit process set the direction for performing IS audits based on the type of audit assignment. In order to perform an IS audit through the defined roles and responsibilities, IT and audit knowledge are required; IS audit tools and techniques are required to enable and assist the IS auditor to perform these responsibilities and a certain set of soft skills are needed to drive the successful completion of the audit. The roles and responsibilities defined for the IS auditor's profile are presented in Chapter 5, Figure 10.

It can therefore be concluded that the roles and responsibilities section consists of the IS audit process and roles and responsibilities according to responsibility levels (consultant, manager or director). For example: during the "planning and preparation phase" (step 2) (refer to Figure 11), a manager's responsibilities will include engagement planning. Engagement planning includes, for example (according to the interview responses in Chapter 4):

- Establish and agree on purpose and objective of audit and clearly communicate to audit team;
- Prepare client requirements;
- Manage timing of the audit (scoping, available time, people and budget);
- Selection of audit procedures applicable and adequate to audit; and
- Prepare audit plans and questions according to the methodology.

6.3.2 Knowledge

Knowledge is defined as the combined result of formal education, experience and training, something gained through listening, reading, learning and/or observation. The basic knowledge required from an IS auditor to ensure the successful execution of the assigned roles and responsibilities were defined based on the most common entry routes into the IS auditing profession and employment requirements. These most common entry routes / employment requirements were found to be from either the IT/IS or auditing / accounting backgrounds. The knowledge required from IS auditors was therefore divided into IT knowledge requirements and audit knowledge requirements. The IT and audit knowledge requirements are presented in Chapter 5, Table 26.

Audit knowledge includes:
- Understanding of the concept of risk;
- Knowledge about applicable standards and best practices;
- Audit planning;
- Audit testing methods;
- Understanding of the concept of control;
- Understand basic accounting principles;
- Business understanding;
- Obtaining and interpreting relevant audit evidence; and
- Independence.

The audit knowledge should be applied to the IT knowledge in order to execute an audit of a specific IT knowledge area. IT knowledge includes:
- Application programs / ERP systems;
- Basic Information Systems and information;
- Technology general concepts;
- Programming languages and procedures;
- Computer communications and networks;
- Data structures and databases;
- Information security;
- Information System Management / IT Governance;

- Operating Systems;
- System analysis, design, development, testing, implementation and maintenance (SDLC);
- Business Continuity and Disaster Recovery planning;
- Information Systems Operations; and
- Specialised areas.

The following example will aid in clarifying the statement that audit knowledge should be applied to IT knowledge: The audit knowledge concept, "understanding of the concept of risk" should be applied to a specific area of IT knowledge depending on the type of audit assignment and the scope and objectives of the audit. Therefore, the auditing concepts of "understanding the concept of risk" may be applied in the IT knowledge area, "information security" which will entail the risk associated with information security being defined, for example:

- Unauthorised access to application data and physical assets and resources (e.g. servers);
- Unlicensed versions of software loaded on the entity's machines; and
- Resources and data are unprotected against virus attacks.

Another example is the auditing concept of "relevant audit evidence". To be able to ensure that IT strategies and policies and procedures are aligned to business objectives (IT knowledge area: "Information Systems Management / IT Governance), the ICT strategy, policies and procedure document should be obtained from IT management. The document should be evaluated and compared with the company's mission, vision and objectives statements (usually stated in minutes of a steering committee meeting or power point presentation).

Given the reasoning of audit knowledge being applied to IT knowledge, individuals coming from an auditing background have an advantage, since these individual understand the auditing concepts and are able to identify the impact of risks on the financial statements. Individuals coming from an IT background however have the advantage of understanding the more technical and complex IT concepts and can therefore easily identify risks and controls within the IT knowledge areas.

The challenge of people coming from different backgrounds presents the gap between the IT and auditing professions. Individuals are forced to interact with each other within the working environment to transfer some knowledge and skills especially if the employees are from different professional backgrounds. Extensive additional training is also recommended to bridge the gap.

The IT and audit knowledge required by IS auditors is considered to be the enabler for the process of performing an IS audit, since an individual who does not understand the auditing or IT concepts will not be able to perform the required audit steps, especially steps 3 and 4 (refer to Figure 12).

6.3.3 Soft skills

IS auditors need to adapt to the different circumstances and client personnel or environments to effectively and efficiently perform IS audit functions. Having the required IT and audit knowledge and IS audit tools and techniques is not enough for an IS auditor to successfully execute an IS audit assignment. In order to define the IS auditor's profile, the soft skills needed by IS auditors should be defined as well.

Most information obtained during the fieldwork phase (step 3) (refer to Figure 12) needs the interaction of the client and the audit team. Soft skills are imperative, especially to obtain supporting evidence, to observe processes, to document conclusions and finding and to interview staff.

For example: to be able to successfully complete step 5 ("reporting and follow-up") in the audit process, it is essential that the IS auditor utilises the following soft skills:

- Conflict resolution: client management usually does not accept that certain business processes are not operating as intended and therefore disagree with the findings and / or ratings of findings. Unresolved findings are usually also a trigger point for conflict;
- Communication skills: both verbal for client meetings and written for report writing;

- Understanding the client business / environment: clients are quickly annoyed by auditors when recommendations are not practical to their business environment; and

- Strength of character: it sometimes takes strength of character to stand up to the pressure from a client to remove audit findings from reports for example or to be tenacious in completing the audit despite distractions such as a high reliance on the client to provide information and audit evidence.

The relevant soft skills necessary in defining the IS auditor's profile is illustrated in Chapter 5, Table 28. The soft skills provided in this study is only a guideline and is only focused on the basic levels of skills required by IS auditors. It can therefore be concluded that an IS auditor's soft skills are the drivers towards successfully completing an IS audit assignment.
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6.3.4 IS audit tools and techniques

IS audit tools and techniques are enablers assisting the IS auditor to select, gather, analyse, and report information and help add credibility to the findings, conclusions and recommendations. IS audit tools and techniques are part of the solution to the increasing complexity of applications, software and networks. IS audit tools and techniques also enable the auditor to audit through the computer rather than auditing around the computer (as in traditional methods).

To define an IS auditor's profile, it is essential to list the features which enable the IS auditor to perform an IS audit assignment. IS audit tools and techniques are essential in assisting the IS auditor to evaluate and assess complex detailed transactions in the fraction of the time of normal manual evaluations. The following main categories of IS audit tools and techniques were presented based on the interpretation of the data:

- Generalised audit software;
- Specialised analysis tools;
- Audit methodologies, standards, guidelines and audit programs; and
- General applications.

For example: Generalised audit software (e.g. ACL) (as defined under IS audit tools and technologies) can be used during a data analysis audit (as defined under IT and audit knowledge) looking at journals processed in a specific application (e.g. Oracle financials). The audit software will enable the IS auditor to identify, for example, duplicated journals or unapproved journals.

6.3.5 An IS auditor's profile

In conclusion, taking the above defined main characteristics into account and the reasons for their importance to the IS audit profile, a framework was developed, illustrating an IS auditor's profile. The IS auditor's profile is presented in Figure 11.

Audit knowledge needs to be applied to IT knowledge. Knowledge is regarded as the enabler for the execution of an IS audit, since an IS audit assignment cannot be completed without the individual having adequate knowledge. The roles and responsibilities of an IS auditor are presented based on the main steps performed in an IS audit per responsibility level. Soft skills are regarded the drivers of the audit to ensure successful completion and are applicable to all responsibility levels. Soft skills though, are usually more mature at director level than, for instance, at consultant level. The audit tools and techniques are regarded as the supporting functions available to assist the IS auditor in performing IS audits (per the defined audit process). For examples per main category refer to the above Section, 6.3.4.

It is important to note that the IS auditor's profile as presented in this study, is not the only or optimum IS auditor's profile, since the characteristics may differ according to person and business or educational institution. The profile provided is only a guideline and has focused on the basic level of IT and auditing skills, soft skills, audit tools and techniques and roles and responsibilities.
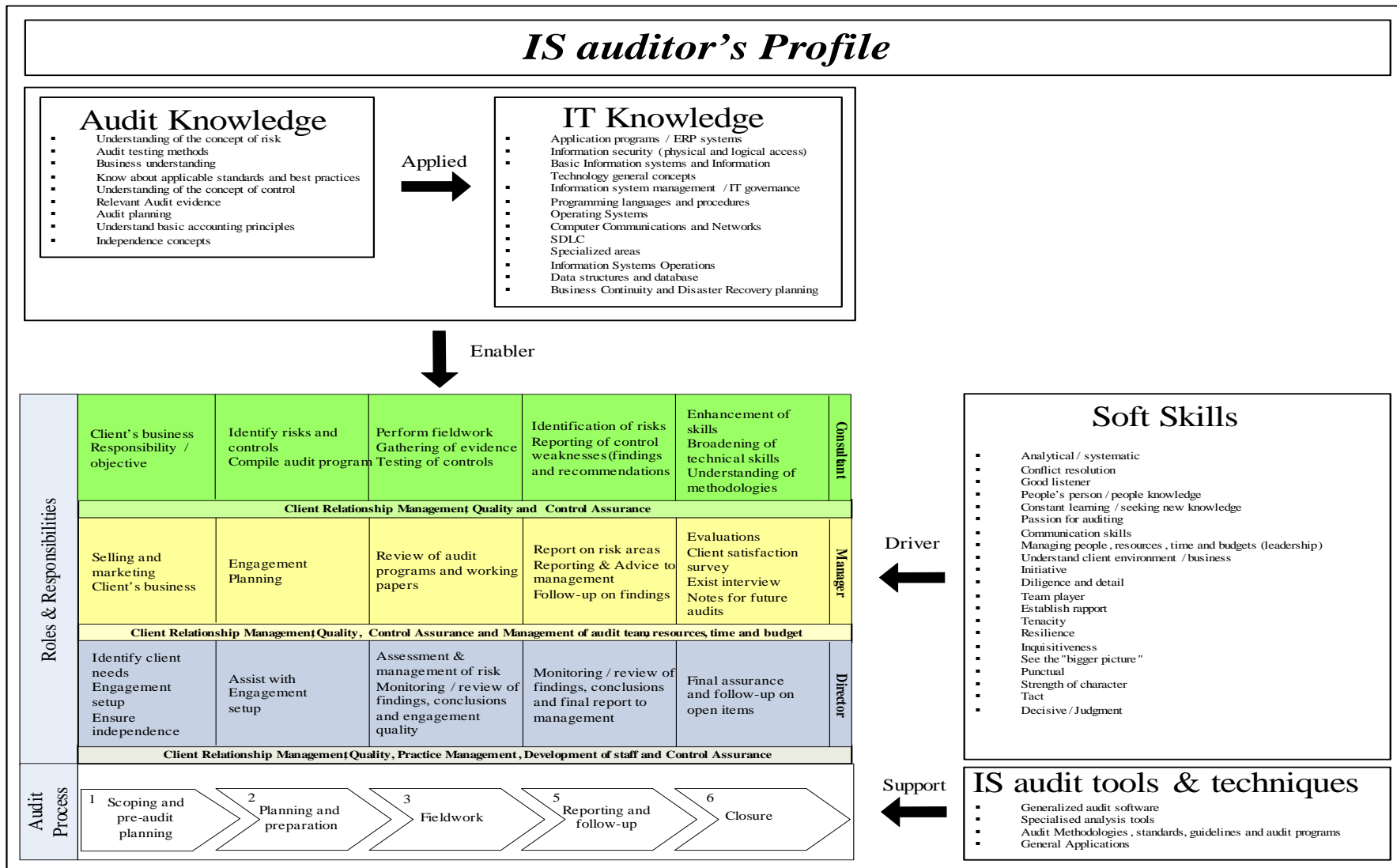
Figure 11: An IS auditor's profile

An IS auditor's profile

Future studies can focus on defining the IS auditor's profile in more detail, or establishing more than one / optimum profiles. Consideration could also be given to the following questions:

- Could people with different profiles be successful IS auditors?
- Is it realistic to expect all these characteristics from one person (depending on the level)?
- Given the global shortage of IS auditors, where do we usually compromise on the ideal profile?

6.4 RECOMMENDED USE OF THE IS AUDITOR'S PROFILE

By determining the roles and responsibilities and the concepts applicable to IS auditing, the knowledge and skills required and the IS audit tools and techniques used in supporting the IS auditor, the following institutions and individuals can benefit by the established IS auditor's profile:

1. Educational institutions can incorporate the concepts presented in the IS audit profile in the curricula of students, especially the concepts related to IT knowledge, audit knowledge and the IS audit tools and techniques. Therefore the terms and concepts as listed in Figure 11 can be used to incorporate these terms or concepts in the curricula for auditing students to ensure that they meet the minimum level of IT and audit knowledge requirements. The IS audit tools and techniques, especially the generalised audit software (e.g. ACL or IDEA) could also be used as a guideline as to what types of IS audit tools are available and mostly utilised by organisations (according to the interview responses).

2. The auditing profession will be able to utilise the profile to assess employees and benchmark them against their progress according to the defined concepts.

    For example: according to the responsibility matrix, it is required that an IS audit manager reviews audit programs and working papers during the fieldwork phase (step 3) (refer to Figure 11).

To enable the manager to perform a review, the necessary audit knowledge (e.g. "Understanding of the concept of risk"; "Audit testing methods used"; "Business understanding"; "Know about application standards and best practise"; "Understand the concept of control"; and "Relevant audit evidence") should be applied to the relevant IT knowledge area (as per the scope and objective of the audit defined in the planning phase (steps 1 & 2) (e.g. "Application programs / ERP systems"). The following IS audit tools and techniques are applicable for step 3 (review of work papers by manager): 1) generalised audit software (since it is an application review, ACL, IDEA or SQL queries can be used to perform data analysis which the manager should review); 2) Audit methodologies, standards, guidelines and best practise (the manager should ensure that the work performed adheres to audit methodologies and meets all audit objectives. Findings can also be compared to best practise to identify weaknesses (e.g. Password settings should be 6 characters or more); and 3) General application (document management applications (ensure version control of working papers) and Microsoft office (Word and Excel) for work paper documentation). The soft skills (e.g. "Communication skills" (verbal communication with consultants and written communication in review notes and the report); "Managing people" (audit team); "Diligence and detail" (to ensure accuracy, completeness, validity and timeliness of work papers); "See the bigger picture" (see audit as a whole and not as isolated parts per working papers); and "Decisive / Judgment" (decide and make judgment calls on weaknesses or risks identified and reporting to management) drive the manager to successfully complete step 3 in the audit process.

Professional institutions will also be able to use the IS auditor's profile to recruit employees based on the required level of knowledge and skills. They can also use the roles and responsibilities illustrated to define the job descriptions of employees at the different responsibility levels.

3. Individuals in the IS auditing profession can define their roles and responsibilities to successfully execute audit assignments and benchmark themselves in the IS auditing profession (refer to the example above). They can use the knowledge and skills base to evaluate their current knowledge and skills, identify gaps and work towards the desired level.

6.5 CONCLUSION

This research study has defined the IS auditor's profile according to the following main characteristics: 1) roles and responsibilities; 2) knowledge; 3) skills; and 4) IS audit tools and techniques.

This study will contribute to the existing body of knowledge by means of enhancing the definitions related to the roles and responsibilities, knowledge, skills and IS audit tools and techniques available and to provide insight to the relationship between these concepts as illustrated by the IS auditor's profile.

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APPENDIX A

INFORMATION SYSTEMS AUDITING

DEFINITIONS

1. **Information Systems Auditing Definition**

   Systems Auditing is defined as the examination of an Information System and surrounding procedures to express an opinion as to whether or not the data involved in processing, from the initiation of the transaction to its inclusion in the financial statements, is fairly represented at a specific date, to ensure completeness, accuracy, validity and timeliness of data and transactions and to scrutinise the controls implemented to mitigate identified risks as well as to provide assurance on the safeguarding of organisational assets and resources.

2. **Information Technology**

   The combination of Hardware, Software (operating system), Application software, Data, Networking and the procedures and people involved in programming, processing, maintenance and utilization.

3. **Knowledge**

   Knowledge is defined as the combined result of formal education, experience and training, something a person gains by listening, reading, learning and/or observation.

4. **Skill**

   Skill is defined as "what one can do" but cannot exist without knowledge ("what one knows"). Thus skill is the utilisation of one's knowledge in day-to-day operations.

5. **IS Audit Tools**

   Help auditors to select, gather, analyze and report information and help add credibility to the findings, conclusions and recommendations.

6. **Profile**
   A set of data, often in graphical form, representing the extent or significant features and/or characteristics of something or someone.

OBJECTIVE OF INTERVIEW

1. To establish an IS auditor's profile by means of an exploratory and descriptive study, as provided by the ability of the interviewee to identify and describe concepts and/or features of relevance to the research topic.

2. To confirm the accuracy and completeness of existing theory and their relevance.

STATEMENT OF PARTICIPATION

Research Topic: An IS Auditor's Profile

I ………………………………………….. hereby voluntarily grant my permission for participation in the project as explained to me by Mariana Carroll.

The nature and objectives have been explained to me and I understand them. I also understand my right to choose whether to participate in the project and that the information furnished will be handled confidentially. I am aware that the results of the investigation may be used for the purpose of publication.

Signed:_____   Date:_____

Researcher:_____   Date: _____

INTERVIEW QUESTIONS

Interviewee Information and Background

1. Name and Surname:

2. Company:

3. Job Title:

4. Job Description:

5. Qualifications:

6. Years experience in IS Auditing:

Knowledge

1. In your opinion, what knowledge is expected from an IS auditor with regards to **IT** concepts (e.g. Networks, Databases, Applications, Software, Security).

2. What knowledge with regards to **auditing** is expected from an IS auditor from your experience?

3. In your opinion, what is the most relevant **education** or **background** for an IS auditor to ease the execution of a successful IS audit assignment?

4. What level of education does your employer expect from you?

Skills

1. Over which **soft skills** should an IS auditor possess in your experience?

Roles and Responsibilities

1.　　What services are provided by your company's IS audit function?

2.　　What is the typical roles and responsibilities of an IS auditor in your opinion?

3.　　Name the steps involved in performing an IS audit.

IS Audit Tools

1.　　Does your company comply with any auditing standards, guidelines or frameworks? Elaborate on these.

2.　　What Information Technology tools and techniques (CAATs) does your company use to help meet audit objectives?