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Auditing in Electronic Environments from an Actor-Network Theory Perspective: Case of Egypt

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By
Manal Nour El Din El Safty
BAcc, Helwan University, Egypt
MAcc, Helwan University, Egypt

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Abstract

This study seeks to explore how the network of auditing in an electronic environment, in the Egyptian context, is constituted. To understand how this network is constituted, the study explores the main actors that have an influence on auditing in electronic environments. It explores how, and why, these actors were enrolled, or found places for themselves, in this network. Moreover, the study discovers how these actors interact together to perform and shape the network.

Actor-Network Theory (ANT) was adopted to be the theoretical framework of this study as its main focus is on the process of constructing and maintaining networks; it asks how and for what purposes heterogeneous entities are brought together in a network. By adopting the ANT perspective, this study highlights the notion that auditing in an electronic environment is not only the process of auditing the outcomes (financial statements) of a technical system using technological methods. Rather, it is a network constituted from hybrid human and non-human, local and global actors, who interact with each other through circulating different intermediaries and who have an influence on the audit process.

In other words, this study looks beyond the fact that financial auditors are responsible for auditing the financial statements, which are the outputs of advanced electronic systems, to explore the process by which auditing in advanced electronic environments takes place. Thinking of the process of auditing in advanced electronic environments from an Actor-Network Theory perspective extends the list of actors involved in the process, and expands the issues that should be considered in their interaction.

1. Chapter One: General nature and Scope of the Study

1.1. Introduction

"Information technology is changing everything." (Elliott, 1992: 61).

Information technology has penetrated many areas of human activity, such as engineering, medicine, science, as well as business (Yang and Guan, 2004). It has dramatically changed the way that organisations initiate, process, store, retrieve and report business transactions (Bell et al., 1999; Rezaee et al., 2001; Rezaee et al., 2002). Most organisations are now using paperless systems (Bierstaker et al., 2001; Harkens & Green, 2004; Helms & Mancino, 1998; Kanter, 2001; Rezaee et al., 2000; Sutton, 2000). They employ new technologies such as electronic data interchange (Hansen & Hill, 1989; Pathak, 2001; Splettstoesser, 1997; Weiner & Carmichael, 1995), electronic fund transfer (Pathak, 2003b; Scott, 2002), electronic commerce via the Internet (Abu Musa, 2004; El-Beltagi, 2007; Harkens, 2004; Nearon, 2000; Pathak, 2004; Shaikh, 2005), and Enterprise Resource Planning systems (Arnold, 2007; Bae & Ashcroft, 2004; Brazel, 2005; Cagilo, 2003; Hunton et al., 2004;Spathis & constantinides, 2004; Wright & Wright, 2002). Although each of the previous systems has some special features, which are beyond the scope of this study, all of them are similar in being advanced electronic systems.

Electronic information, generated from these electronic systems, is more timely, flexible, accessible, transferable, transparent, and can be stored, retrieved, summarised, and organised more easily than paper-based information (Rezaee et al., 2002). Nevertheless, using these systems presents a multitude of challenges to accounting professionals and standard setters (Liang et al., 2001; Shaikh, 2005; Sutton, 2000). Moreover, it raises serious concerns from auditing practitioners and

professional bodies as it has a great impact on both financial auditors and information system auditors (known also in the literature as electronic data processing auditors, computer auditors and information technology auditors) (Abu-Musa, 2004; Hawker, 2000; Kanter, 2001; Munter, 2002; Pathak, 2003a).

The Information Technology Committee of the International Federation of Accountants (IFAC, 2002) emphasised the impact of electronic systems on the accounting and auditing professions by indicating that

> *"These fundamental changes will also have a significant impact on accounting systems, changing business processes and the evidence available to support business transactions, which, in turn, will lead to changes in the accounting records maintained and accounting procedures followed. Consequently, accountants and auditors will face new challenges and may need to apply new technologies, such as the development of accounting systems based on business processes, to ensure that transactions are appropriately recorded, are in compliance with local and international legislation and regulations, and meet current and evolving accounting standards and guidance." (IFAC, 2002: 1)*

As a result of the impact of information technology on the audit function most of the Western professional auditing bodies have promulgated standards and guidelines to help auditors to deal successfully with these advanced electronic systems (e.g. AICPA, 1996; AICPA, 1997; CICA, 2003). Moreover, many research projects have been conducted to study auditing in electronic environments from different perspectives. Some studies concentrated on explaining the standards and the guidelines that have been promulgated by the professional bodies relating to auditing in the electronic environment (e.g., Damianides, 2004; Moreland, 1997; Munter, 2002; Pathak, 2003a; Rezaee & Reinstein, 1998; Wallace, 2002; Williamson, 1997; Yang & Guan, 2004). Other studies paid attention to the auditors' need to deal with electronic audit evidence in conjunction with, or instead of, the paper audit evidence as traditional paper-based evidence available for verifying and reconciling transactions is either limited or in electronic form (e.g., Harkness & Green, 2004; Helms & Lilly, 2000; Nearon, 2005; Rezaee & Reinstein, 1998; Williamson, 1997).

Moreover, researchers paid attention to the security aspects that auditors should consider when planning financial statement audits in advanced electronic environments (e.g., Abu Musa, 2002a; Abu Musa, 2002b; Abu Musa, 2003; Hannaford, 1995; Henry, 1997; Martin, 2000a). Auditors are especially concerned about security of financial data because they understand that where there is a lack of data security, integrity is threatened. Techniques, such as continuous auditing and computer assisted audit techniques (CAATs) which auditors need to adopt when auditing in advanced electronic environments were also considered by different scholars (e.g., Braun & Davis, 2003; Chen, 2003; Debreceny et al., 2005a; Debreceny et al., 2005b; Helms & Lilly, 2000; Helms & Mancino, 1998; Kogan et al., 1999; Liang et al., 2001; Rezaee et al., 2001; Rezaee et al., 2002). Other researchers paid attention to the identification of the audit risks when dealing with legacy and advanced electronic systems (e.g., Al-Fehaid, 2003; Bell et al., 1998; Bell et al., 1999; Hunton et al., 2004; Martin, 2000b; Pathak, 2003a; Wright & Wright, 2002), while others considered the impact of information technology on the audit process (e.g., Bierstaker et al., 2001; Rezaee & Reinstein, 1998; Messier et al., 2004; Wallace, 2002). Moreover, some researchers discussed the expanding role of information system auditors when the audit is performed in an electronic environment (e.g., Baldwin & Kneer, 1986; Curtis & Viator, 2000; Gallegos, 2003; Henderson, 2002; Viator & Curtis, 1998).

1.2. Research Problems

Notwithstanding the previous considerable efforts that have been undertaken to help auditors to deal with the electronic environments, three essential points can be noticed:

Firstly, it can be recognised that all of the well known attempts that have been made to help auditors to deal with advanced electronic environments come from professional bodies and researchers in the Western developed world. In Egypt, as a developing country, no previous research has been conducted to help auditors deal with advanced electronic environments[1]. Although Egyptian auditors can learn from the western world, there are many differences between developed countries and developing countries in the application of technology, culture, and social relationships. Appendix 1 shows the main cultural differences between developed and developing countries based on Hofestede's perspective.

Secondly, previous review of the literature pointed out that these studies adopted a technological perspective as the technical aspects of auditing in electronic environments are the main aspects that should be considered. In other words, these studies assume that technology problems can be solved by technology solutions. Although this approach is a logical one, there are two other essential issues that should be taken into consideration:

- This approach treats auditors as rational objective decision makers although the audit process relies heavily on professional judgment and decision making including subjective processes (Trotman, 1998).

[1] A previous study was conducted in Saudi Arabia, also a developing country, to investigate the influence of information technology on audit risk (Al-Fehaid, 2003). The main difference between this study and the current study is that Al-Fehaid study concentrated on the effect of adopting IT-based accounting systems on audit risk while the current study seeks to explore the impact of adopting advanced electronic systems on the audit function from a holistic perspective.

- This approach can hide the fact that technology does not function in a vacuum, away from humans who operate and use it (Adebayo, 2004; Calhoun et al., 2002; El Sayed, 2004; Grint, 1998; Latour, 1999; Trewin, 1988; Williams & Wilson, 1997). Technology itself has no objective existence independent of the accounts given to it by individuals (El-Sayed, 2004). Clarke (2003:224) emphasised the importance of taking human beings into consideration when dealing with technology, arguing: *'Consider, for example, what might happen if the computers containing the so-called information had no human beings to use them.*' Technology has no impacts independent of the purposes of those who would use it and the responses of those who have to work with it.

As technology is only one part of the process that produces goods and services, and as it does not function independently of the humans who interact with it, it can be expected that social factors will also affect the audit process when conducted in an electronic environment (Adebayo, 2004).

Thirdly, notwithstanding the great effort exerted by the different scholars in studying different aspects of electronic auditing, no previous research has been conducted to explore all the actors that may have an influence on auditing advanced electronic environments and how these actors interact with each other. In other words, although previous studies covered different aspects that are related to auditing electronic systems, they treated some of these aspects in isolation from other aspects.

There are, thus, gaps in current knowledge, which need to be filled by research which adopts a different perspective and approach than has been the case so far. This research contributes in filling these gaps, in the following ways:

Firstly, this study took place in Egypt. Egypt was chosen to conduct this study for three reasons. The first one is that Egypt is classified as a developing country, and no previous research about electronic auditing has been conducted in Egypt. The second reason is the series of steps undertaken by the Egyptian government towards information technology development and pinpointing this development as a national priority (El-Sayed, 2003; MCIT, 2005; MCIT, 2007). The last reason for conducting this study in Egypt is that it is the home country of the researcher, so there are less barriers of language, or culture. In addition, gaining access to the audit firms in Egypt was attainable.

Secondly, this study was guided by a socio-technical approach, namely, Actor-Network Theory (ANT). ANT is an approach that has been developed by scholars including Latour (1986, 1987, 1993, 1999a, 1999b, 2005), Callon (1986a, 1986b, 1987, 1999), and Law (1992, 1999, 2002). ANT calls to consider both the social (humans) and the technical (non-humans) aspects, or actors, when analysing any situation and to adopt a symmetrical approach when dealing with them without differentiating or giving priority to any of the actors, as each actor has an important role to play.

Thirdly, adopting ANT to be the theoretical framework of this study allowed the researcher to fill the third gap in knowledge. ANT allows the researchers to see the world in different ways or from different perspectives (Lee & Hassard, 1999). Consequently, ANT helped the researcher to present auditing in electronic environments from a different perspective. This research shows that auditing in electronic environments is a combination of many socio-technical aspects that comes from the interaction between different actors. It is an association between the external auditor who has the responsibility to sign the external audit report which is the end

product of the audit examination; the information system auditors who are responsible for auditing the electronic systems and evaluating their automated controls; the automated tools used by both the financial auditors and the information system auditors to deal with electronic systems; the management of the auditor's client and its IT staff as they are responsible for the quality of the internal controls; the educational institutions as they provide financial auditors and information system auditors who can deal with the electronic environment, especially if it is a complicated environment; the standards, laws and regulations that auditors have to apply; the vendors of the electronic systems as they are indicators of the quality of the system; the training provided by the audit firms to their auditors as well as the training provided by the vendors of the electronic systems; and any other human or non-human actor that can affect the audit process when auditing in electronic environments. In other words, this study presents auditing in electronic environments as a network of these heterogeneous social and technical, local and global actors who are brought together into associations.

The research problems and how the researcher addresses them are summarised in Figure 1.1

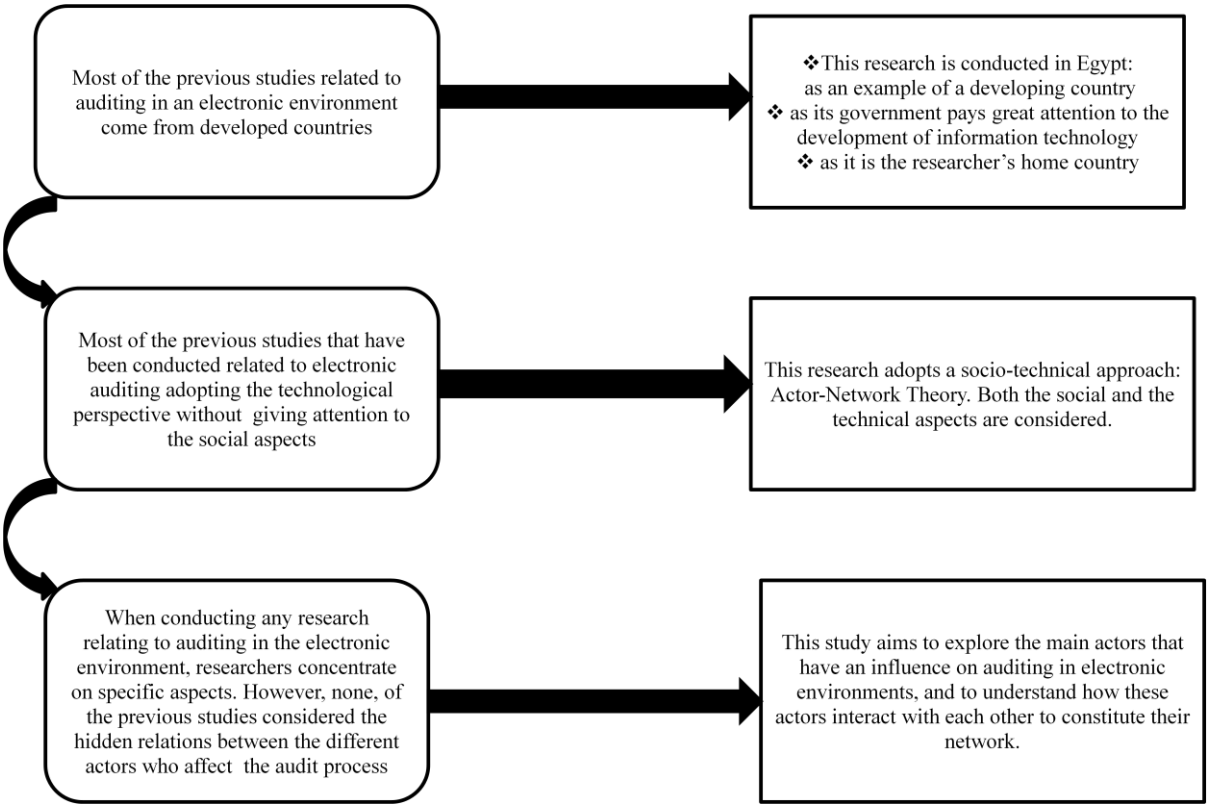

Figure 1.1: Summary of Research Problems

1.3 Research Objectives

This research aims at achieving four main objectives. Figure 1.2 summarises the objectives of this research and how they are to be achieved.

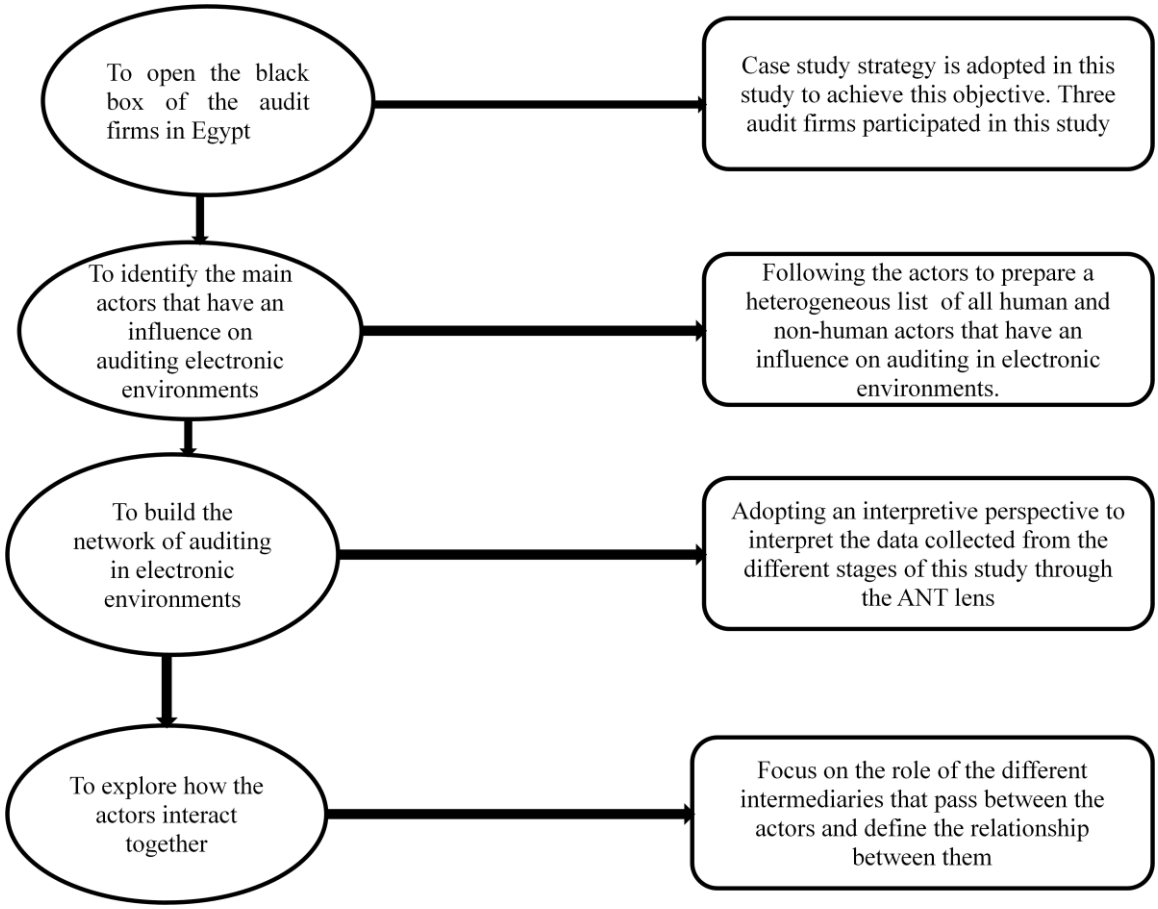

Figure 1.2: The Research Objectives

The first objective is to open the *black box* of audit firms in Egypt to understand how they consider auditing in advanced electronic environments. Case study strategy is adopted in this study to achieve this objective. The black boxes of three audit firms, participated in this study, are opened to understand how they consider auditing in advanced electronic environments.

The second objective is to identify the main actors that have an influence on auditing electronic environments. This objective is achieved by *following the actors* (Latour, 1987) that are identified by the participants in this study to prepare a heterogeneous list of all human and non-human actors that have influence in auditing in electronic environments.

The third objective is to explore how and why heterogeneous actors are enrolled to build the network of auditing in electronic environments. This objective is achieved by adopting an interpretive perspective to interpret the data collected from the different stages of this study through the ANT lens. The main focus of ANT is the process of constructing and maintaining the networks as it asks how and for what purposes heterogeneous entities are brought together (Lee & Hassard, 1999).

The fourth objective is to explore how the actors interact together to perform the final shape of the network of auditing in electronic environments. This objective is achieved by focusing on the role of the different intermediaries, identified by Callon (1991), that pass between the actors and define the relationship between them.

1.4 Significance of the Study

The significance of this study stems from two characteristics. The first one is that the study employs an interpretive qualitative paradigm. Such paradigm gives due recognition to the role of ideas, perceptions and beliefs of the participant people. In other words, it addresses the world from the point of view of the people studied. This point indicates that exploring the actors who have influence on auditing electronic environments and how these actors perform this influence takes place through the interpretation of the financial auditors and the information system auditors who are involved in it.

The second one is that this study is conducted through the lens of Actor-Network Theory (ANT). It guides the researcher's way of thinking while performing this research. ANT allows the researchers to see the world from different perspectives. When adopting this perspective, researchers embark on the research without a clear picture of what sort of actors they will discover during their research; they have to

follow the actors and make a list of those actors who constitute the network under analysis. From this perspective, I started the study without a clear identification of the actors that have an influence on auditing electronic systems. I followed the actors to prepare the list of these actors.

Moreover, ANT's main focus is on the process of constructing and maintaining the networks as it asks how and for what purposes heterogeneous entities are brought together (Lee & Hassard, 1999). Similarly, the main focus of this study is to understand the process of building the network of auditing in electronic environments. It aims to identify who are the actors, whether human or non-human, that can have an effect on the audit of electronic systems, why these actors are enrolled in the network, and how they interact with each other to form the final shape of the network.

It is important to indicate that none of the previous studies considered auditing in electronic environments has adopted such a holistic perspective. Table 1.1 shows the results of searching for relevant literature in different data bases. As can be seen there is a deficiency of previous studies adopting ANT theoretical approach.

Key word / Database	Actor-Network Theory	Electronic auditing	Auditing & electronic systems	Electronic auditing & Egypt	Auditing & electronic systems & Egypt	ANT & electronic auditing	ANT & auditing electronic systems	ANT & electronic systems & Egypt	ANT & auditing & electronic systems & Egypt	ANT & accounting
Academic Search Elite	162	1	14	0	0	0	0	0	0	0
Business Source Premier	216	10	54	0	0	0	0	0	0	26
Emerald Journals	211	126	111	12	12	0*	0**	0	0	6
Ingenta Connect	153	45	21	0	0	0	0	0	0	10
ProQuest	277	20	45	0	0	0	0	0	0	24

Table 1.1: Inadequacy of Previous Studies

Updated: **March 2009**

*When searching by these key words in all the fields, 11 results were given. 9 of them were irrelevant, and 2 of them were related to the search of accounting and ANT. When searching for the same key words using the abstract option, it gave 0 results.

**When searching for these key words in all the fields, 9 results were given. 8 of them were irrelevant. Only one was related to search of ANT and accounting. When searching for the same key words using the abstract option, it gave 0 results.

1.5 The Structure of the Thesis

This study is divided into nine chapters. Figure 1.3 presents the structure of the thesis.

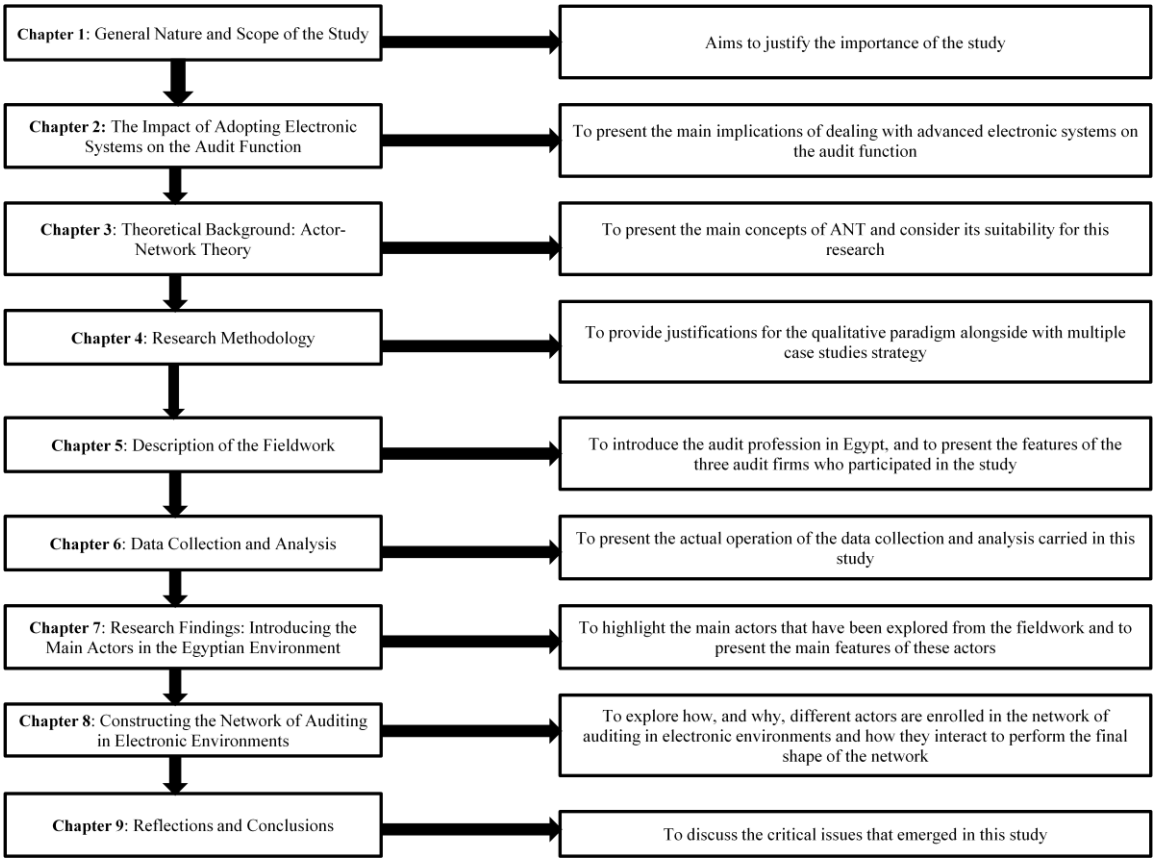

Figure 1.3: The Structure of the Thesis

Chapter two presents the main implications of adopting advanced electronic systems on the audit function. These implications are presented from the academic perspective as well as the pronouncements of the professional bodies. Chapter three presents the socio-technical perspective adopted to be the framework of this study, namely: Actor-Network Theory. Studies that have adopted this theoretical background in accounting and auditing are introduced, and justification of adopting ANT while conducting this study is also presented. Chapter four describes the research methods employed to achieve the objectives of the study. It explains the research process including the research philosophy, research strategy, research

approach, research design, and data collection method. Case study strategy will be discussed in detail, as it will be adopted to conduct this research.

Chapter five presents a detailed description of the fieldwork. It provides an overview of the audit profession in Egypt, and also presents the features of the three audit firms that are included as the main cases: A, B, & C. Chapter six presents the actual operation of the data collection and analysis carried in this study. Chapter seven aims to introduce the main actors that have an influence on auditing in electronic environments in the Egyptian context. In Chapter eight the network of auditing electronic environments is built. In addition, this chapter introduces how the actors enrolled in this network are interacting with each other to form the final shape of the network.

Chapter nine presents my reflections and conclusions about this study; it reassesses the suitability of adopting the ANT perspective in this study, then it considers the originality of this research, followed by assessing whether this study is able to achieve its main objectives, then it considers the implications of the research findings. It ends by presenting the main limitations of this study and suggesting further studies that can overcome these limitations.

2. Chapter Two: The Impact of Adopting Electronic Systems on the Audit function

2.1. Introduction

Information technology has penetrated many areas of human activity, such as engineering, medicine, science, as well as business (Yang and Guan, 2004). It has dramatically changed the way that organisations initiate, process, store, retrieve and report business transactions (Bell et al., 1999; Caster & Verardo, 2007; Rezaee et al., 2001; Rezaee et al., 2002). Most organisations are now using paperless systems (Bierstaker et al., 2001; Brazel & Agoglia, 2007; Emond & Lavigne, 2002; Harkness & Green, 2004; Kanter, 2001; Rezaee et al., 2000; Sutton, 2000). They employ new technologies such as electronic data interchange (Hansen & Hill, 1989; Pathak, 2001; Splettstoesser, 1997; Weiner & Carmichael, 1995), electronic fund transfer (Pathak, 2003b; Scott, 2002), electronic commerce via the Internet (Attaway,2000; Nearon, 2000; Harkness, 2004; Pathak, 2004; Shaikh, 2005), and some organisations are using internal integrated information systems such as enterprise resource planning systems (Arnold, 2007; Bae & Ashcroft, 2004; Brazel, 2005; Caglio, 2003; Hunton et al., 2004; Spathis & Constantinides, 2004; Wright & Wright, 2002). Although each of the previous systems has some special features, which are beyond the scope of this research, all of them are similar in being advanced electronic systems.

Electronic information, generated from these electronic systems, is more timely, flexible, accessible, transferable, transparent, and can be stored, retrieved, summarised, and organised more easily than paper-based information (Rezaee et al., 2002). Nevertheless, using these systems present a multitude of challenges to accounting professionals and standard setters (Liang et al., 2001; Shaikh, 2005; Sutton, 2000). Moreover, it raises serious concerns for auditing practitioners and

professional bodies, as it has a great impact on both financial auditors and information system auditors (known also in the literature as electronic data processing auditors, computer auditors and information technology auditors) (Abu Musa, 2004; Hawker, 2000; Kanter, 2001; Munter, 2002; Pathak, 2003); it is rare to find an entity whose information technology use does not affect its independent audit (Tucker, 2001).

The Information Technology Committee of the International Federation of Accountants (IFAC, 2002) emphasised the impact of electronic systems on the accounting and auditing professions by indicating that

> *"These fundamental changes will also have a significant impact on accounting systems, changing business processes and the evidence available to support business transactions, which, in turn, will lead to changes in the accounting records maintained and accounting procedures followed. Consequently, accountants and auditors will face new challenges and may need to apply new technologies, such as the development of accounting systems based on business processes, to ensure that transactions are appropriately recorded, are in compliance with local and international legislation and regulations, and meet current and evolving accounting standards and guidance." (IFAC, 2002: 1)*

In this chapter the implications of adopting electronic systems on the audit function will be identified in order to specify the main actors that can play an essential role when auditing in an electronic environment. These implications will be presented from the academic literature as well as from the professional pronouncements that considered the implications of dealing with the electronic systems on the audit function. At the beginning a brief overview regarding the well known electronic systems with which auditors may come into contact will be given, and after which the main implications of adopting electronic systems on the audit function will be identified. The appearance of the electronic audit evidence, instead of, or besides, traditional paper evidence will be discussed. The effect of the electronic evidence on internal controls and its components will be explained. The need for more financial

auditors experienced in dealing with electronic systems will be discussed and the need for the involvement of information system auditors will be debated.

2.2. Electronic Systems

Before identifying the main implications of adopting electronic systems on the audit function, it is useful to have an overview of the different systems that auditors may deal with. Gaining information about the system under audit is an essential task for auditors in general and especially when auditing in an electronic environment, as every electronic system may have special features that can affect the audit procedures (Strefeler & Thomas, 1994).

In some cases clients depend on computerised accounting systems, which may be integrated or stand-alone systems (Cosserat, 2000; Lanier, 1992). An integrated accounting system is a system in which two or more modules are used together and share information, while a stand-alone accounting system refers to the computerisation of one specific accounting function (e.g. payroll) (Lanier, 1992).

In other cases auditors may deal with more advanced and more integrated electronic systems. These systems can perform internal integration of all the internal enterprise functions, e.g. enterprise resource planning (ERP) systems, or can perform external integration between the enterprise and the outside world, e.g. electronic data interchange (EDI), electronic commerce, and electronic business systems (CICA, 2003).

Enterprise Resource Planning (ERP): is an example of integrating all the internal functions of an enterprise. Kumar and Hillegersberg (2000: 23) define ERP systems as *"information systems packages that integrate information and information-based processes within and across functional areas in an organization."* This means that all the functions in the organization (i.e. sales, human resources, finance and accounting,

production, distribution, stock control, and quality control) are integrated together (CICA, 2003; Spathis & Constantinides, 2004).

EDI enables computers to communicate with one another; however, it requires partners to agree to use specific standard data format to conduct their business transactions in an electronic fashion (Pathak, 2001; Rezaee & Reinstein, 1998). Since few or no paper documents exist, auditors should concentrate on the computer system itself. Some risks may occur when auditing in such an environment. For example, unauthorised intruders can interrupt and change information that is communicated over a public network. Moreover, disruption in communications can cause some transactions to be lost and finding these lost transactions is difficult in a paperless environment. Moreover, greater reliance placed on computer controls can impede the effectiveness of internal control systems (Rezaee & Reinstein, 1998).

E-commerce is a term used by different parties to mean different things (Abu-Musa, 2004). IFAC (2002) described e-commerce as the procurement and distribution of goods and services over the Internet using digital technology. The extent of e-commerce use affects the nature of the risks to be addressed by the entity. However, security issues may arise whenever the entity has a web site, as information-only pages can provide an access point to the entity's financial records (AARF, 2002; Attaway, 2000; Martin 2000b, Pathak 2003d).

E-business is a term which encompasses e-commerce; it encompasses a digital approach to the whole enterprise, including non-transactional activities such as recruiting employees via the Internet (IFAC, 2002; Nearon 2000; Price 2001). Different models have occurred as applications of electronic business, such as B2C (Business to Customer), B2B (Business to Business) and B2E (Business to Employee) (Abu-Musa, 2004; Pathak, 2003c).

Although each of these electronic systems has special characteristics and may have special risks, which are not the main focus of this research, all of the integrated systems create a paperless environment, which is a challenge for the auditors (Kanter, 2001; Munter, 2002; Pathak, 2003; Rezaee et al., 2000; Tucker, 2001) and have different implications for the audit function. The next section will discuss the main implications of auditing electronic systems.

2.3. The Implications of Auditing Electronic Systems

In the information age, traditional, paper based accounting systems that show the financial position and results of operations for time periods in the past are increasingly disappearing with current practices (Rezaee et al., 2000) and are being replaced by electronic systems. Different implications for the audit function arise as a result of the use of such electronic systems, such as handling electronic audit evidence, the need to pay great attention to the internal controls over the electronic systems, the need for more knowledgeable and experienced auditors to deal with these electronic systems and in some cases the need for IT audit specialists or information system auditors.

2.3.1. Electronic Audit Evidence

The increasing dependence on information technology and use of electronic systems may require auditors to obtain evidence electronically (Harhness & Green, 2004; Helms & Lilly, 2000; Nearon, 2005; Rezaee & Reinstein, 1998; Williamson, 1997). Generally speaking, audit evidence is all the information used by the auditor in arriving at the conclusions on which the audit opinion is based, and includes the information contained in the accounting records underlying the financial statements and other information. Audit evidence, which is cumulative in nature, includes audit evidence obtained from audit procedures (e.g., inquiry, external confirmation,

recalculation, reperformance, inspection, observation, and analytical procedures) performed during the course of the audit and may include audit evidence obtained from other sources such as previous audits; it affirms quality control procedures for client acceptance and continuance (IFAC, 2008).

It is important to indicate that in the electronic environment, traditional procedures for obtaining audit evidence may not be appropriate or sufficient, as evidence may only come in an electronic form.

2.3.1.1. Introducing Electronic Audit Evidence

Electronic audit evidence can be seen as any information created, transmitted, processed, maintained, or accessed electronically and used by the auditor to evaluate financial statement assertions and to support the content of the audit report (AICPA, 1997 as cited in Rezaee & Reinstein, 1998; CICA, 2003). It can take various forms such as text, data, video and voice (Rezaee et al., 2001).

When depending on electronic systems like Electronic Data Interchange or Image Processing systems, electronic messages may replace certain source documents, such as purchase orders, bills of lading, invoices and checks-in (Rezaee & Reinstein, 1998). To simplify, with EDI an entity and its customers or suppliers use communication links to conduct business electronically. Some of the electronic evidence that takes place as a result of these transactions may exist for only a short time and be irretrievable after a specified period of time if files are changed and backup files do not exist. Thus, auditors have to take into consideration the time during which information exists or is available, when determining the nature, timing and extent of their substantive tests and applicable tests of controls (Brazel & Agoglia, 2007; Carmichael, 1995; Helms, 1999; Porter et al., 2008; Rezaee & Reinstein, 1998). Limited access to electronic evidence may require auditors to select

samples several times during the audit period rather than only at the end of the year (Rezaee & Reinstein, 1998).

2.3.1.2. Electronic Audit Evidence and Professional Pronouncements

In order to enhance the auditors' ability to understand and deal with electronic evidence, professional bodies issued statements and guidelines to identify the issues that may face auditors when dealing with electronic evidence and how to get over these issues. For example, the AICPA's Auditing Standards Board (ASB) issued Statement on Auditing Standards (SAS) No. 80 which amends SAS No. 31 'Evidential Matter' to consider the impact of information technology on the audit evidence. Moreover, in 1997, the AICPA's ASB issued a study entitled '*The Information Technology Age: Evidential Matter in the Electronic Environment'*. The purpose of this study was to provide auditors with practical guidelines that would mitigate the challenges concerning audit evidence in the electronic environment. Table 3.1 summarises the main concerns of dealing with electronic evidence and the solutions for them, as discussed in that study

The Concerns	The Solutions
Reliance on electronic evidence as competent evidential matter: - The validity, completeness, credibility and integrity of electronic system are questionable. - Traditional approaches of inspection, observation, inquiry, or confirmation for obtaining quality evidence may not be appropriate in the electronic environment.	In order to provide sufficient competent evidential matter, electronic systems must contain strong internal controls to ensure security, validity, completeness, credibility, and integrity of the information been processed.
Different forms of electronic evidence presentation: - Electronic information presented may provide incomplete or partial evidence, auditors may be unable to determine the competence or consistency of the information received from clients. - Auditors may access electronic data that do not provide the full or true picture of the audit evidence.	Auditors must possess sophisticated technological knowledge, and be competent in the use of technology-assisted audit techniques used to test the consistency of data presentation.
Competence of tools used to access electronic evidence: - Data extraction technology used in producing evidence may be functionally faulty or incapable of extracting the appropriate information that may be considered competent. - If the data fields within the data extraction software are not appropriately defined, the auditor may draw inappropriate conclusions from the report generated.	Auditors must be technologically knowledgeable and competent in using the technology-assisted data extraction software being used.

Error detection: - Electronic evidence may contain errors, such as undetected changes, alterations, or inconsistencies, thereby increasing audit risk. - Errors may result from data transmission, or intentional manipulation of information	Error detection routines, such as check digit, hash total, etc., must be incorporated in the information technology to prevent the occurrence of errors, thereby strengthening the controls of the technology. Auditors may assess and test the controls by auditing through the information technology used by the entity.
Control performance: - Evidence of IT control performance is not obvious; in other words, there may be no evidence that the IT control functions as intended. - The reduced segregation of tasks ordinarily cause some control challenges, thereby rendering the effectiveness of processing controls questionable.	Auditors must possess IT skills to allow for appropriate level of control performance assessments; otherwise auditors must employ IT professionals to perform the audit task.
Access to evidence: - Information may be unavailable due to lack of retention of backup, or irretrievable due to integration of new technology and legacy technology. - Audit tools are incapable of accessing electronic evidence due to the lack of uniformity in data extraction processes as unique processes are often necessary for each entity	Auditors need to be technologically confident in using the audit tools to properly extract data, and/or to engage in continuous auditing.

Table 2.1: Summary of the Auditing Procedures Study: Information Technology Age: An Evidential Matter

Source: AICPA (1997)

SAS 106, Audit evidence, issued by the ASB in 2006 ranks the reliability of certain forms of electronic evidence. For example, electronic documents are more reliable than oral representations, but photocopies are less reliable than original documents. Another attempt to help auditors in dealing with electronic audit evidence was conducted by The Canadian Institute of Chartered Accountants (CICA) who released a research report entitled 'Electronic Audit Evidence' (CICA, 2003). This report aims to

- Give a definition of electronic audit evidence;
- Identify the special attributes of electronic audit evidence and determine the differences from the traditional audit evidence;
- Evaluate the impact of using electronic audit evidence to support the content of the audit report, especially regarding the audit approach, the risks

associated with electronic audit evidence and the controls that may help mitigate these risks;

- Identify the tools and audit procedures available to audit controls;
- Indicate the other implications for the performance of audit procedures;
- Examine the legal issues related to electronic audit evidence;
- Make recommendations to the Assurance Standards Board on electronic audit evidence issues.

It is important to indicate that both the Auditing Procedures Study (1997) and the report issued by the CICA (2003) have many similarities, for example, both aimed to define the electronic evidence, identify the attributes of the electronic evidence and its differences from the traditional evidence, identify the concerns involved in dealing with the electronic evidence and how to overcome these risks, and pay attention to the tools that can be used to deal with electronic evidence. However, the report issued by the CICA (2003) is more detailed, comprehensive, and covers some points that have not been discussed in the APS, such as the legal issues related to the electronic audit evidence. This may be because the former was conducted in the early stages, soon after the use of electronic evidence began to appear, while the later was conducted after a period of dealing with electronic evidence, so more information had been gained about it and the auditors faced more real problems, not only expected ones. Therefore the CICA presented them in the report and identified how to overcome them.

As for International standards, there is no specific standard that is totally on the subject of electronic audit evidence; ISA No. 500 “Audit Evidence” does not explicitly refer to electronic audit evidence, although some paragraphs contain

general guidance to help auditors in evaluating such evidence. The International Auditing Practice Statement (IAPS) No. 1013 "Electronic Commerce-Effect on the Audit of Financial Statements" published in 2002 provides guidance on the effect of electronic records on audit evidence but is still not totally about electronic audit evidence.

2.3.1.3. Comparing Electronic Audit Evidence with Traditional Audit Evidence

The emergence of electronic evidence added new dimensions for auditors to consider, such as the reliability of the system producing and controlling the evidence (Rezaee & Reistein, 1998; Rezaee et al., 2000). However, electronic evidence is similar to traditional evidence in raising issues regarding its validity, completeness and integrity. Moreover, it is important to indicate that electronic evidence does not always replace traditional evidence; in some cases both electronic evidence and a paper source of evidence occur for the same transaction (Rezaee & Reinstein, 1998).

The APS (1997), the CICA report (2003) and the literature (e.g. Munter, 2002; Rezaee & Reinstein, 1998) identified the main differences between electronic audit evidence and traditional audit evidence; the main differences are:

Source of audit evidence: the source of audit evidence is more difficult to establish in a paperless environment than in a paper-based one. The proof of the origin of the traditional audit evidence can be easily determined through the letterhead, the data in the document, the sent or received stamp and the signature. Proof of origin of electronic audit evidence is difficult to establish by examining electronic information only; it is determined using controls and security techniques that allow for authentication and non-repudiation.

Altering or modifying the audit evidence: paper audit evidence is difficult to alter, as any changes in the paper-based documents can be detected as they leave visible traces, while electronic evidence is much easier to alter and alterations are much harder to detect. As a result, effective internal controls and security techniques play an important role in detecting changes to electronic evidence.

Completeness of documents and information: paper evidence usually includes all essential terms of any transaction, such as the purpose of the transactions and its terms and conditions. In an electronic environment, information about transactions exists, but can be retained in different ways. It can be recorded in several electronic documents or messages, or it can be saved in several files and databases. This means that all the information relating to a specific transaction is not generally included in the same electronic document.

Evidence of approval: paper evidence approvals are prominent on the face of the original documents, by a signature, seal or other mark. Electronic approvals do not take these forms. The approval process can take other forms, for example it can restrict logical access to certain functions to authorised persons only. Moreover, acknowledgement messages and digital signatures can be used as evidence to support consent. This digital information is stored separately from transaction information.

Availability of audit evidence: access to paper evidence is usually not restricted to a short period of time. However, the audit of many controls, especially application controls, can only be performed in real time. Moreover, in some cases electronic evidence is available only for a short time. Even if the electronic historical data are archived, they are not easy to access as the electronic information needed to understand and verify a transaction may be stored in many files. In addition, to be

able to read the files, users must have access to the authoring systems and adequate equipment. This means that an extra effort is required when dealing with electronic systems.

Ease of use: paper evidence does not require any special techniques or tools to be used to understand and evaluate the evidence. However, electronic evidence may require knowledge of data extraction techniques to enable complete evidence to be found and evaluated.

Clarity and credibility: paper documents are usually clearer and have a high degree of credibility as they lead to the same conclusions by different auditors. Electronic evidence is not as clear and credible as paper evidence; it may lead to different conclusions by auditors depending on the procedures used and effectiveness of the controls implemented.

To sum up, dealing with electronic systems and electronic audit evidence requires auditors to pay more attention to the credibility of the systems and their controls and to adopt new audit techniques such as Computer Assisted Audit Techniques CAAT's and continuous auditing. Moreover, it confirms the need for financial auditors to improve their knowledge and skills in dealing with electronic systems and emphasises their need to use the work of an information system auditor, as a specialist, when dealing with advanced and complicated electronic systems.

2.3.2. Internal controls

The move towards electronic systems has increased the importance auditors, managers, and accountants give to internal controls (Pathak, 2003a; Rezaee & Reinstein, 1998; Rezaee et al., 2001; Sutton, 2000). The report issued by the

Committee of Sponsoring Organizations of the Treadway Commission (COSO) defined internal control as:

> "*A process, effected by an entity's board of directors, management and other personnel, designed to provide reasonable assurance regarding the achievement of objectives in the following categories:*
>
> - *Effectiveness and efficiency of operations.*
> - *Reliability of the financial reporting.*
> - *Compliance with applicable laws and regulations"* (COSO, 1994: 13).

Responsibility for designing adequate internal controls rests with management (Bell et al., 1999). However, external auditors must gain competent understanding of these internal controls in order to exercise due professional care (Nearon, 2000), as auditors are responsible for assessing the risks that a control system does not meet its objectives.

It is important to indicate that auditors have to evaluate internal controls in both manual and electronic systems in order to assess the risks associated with them (Cosserat, 2000; Munter, 2002). However, in electronic systems the importance of these internal controls increases as poor internal controls in an electronic environment may cause problems such as unauthorised access to data or computer fraud (Bae & Ashcroft, 2004; Bell et al., 1998).

2.3.2.1. The Effect of Adopting Electronic Systems on Internal Controls

To emphasise the significance of internal controls when auditing in an electronic environment, the (ASB), the senior technical body of the (AICPA), has issued (SAS) No. 80, *Amendment to SAS No. 31, Evidential Matter* in 1996, then issued SAS No. 94, *The Effect of Information Technology on the Auditor's Consideration of Internal Control in a Financial Statement Audit,* in 2001. These two standards indicated that when a significant amount of information supporting one or more financial statement

assertions is electronic, the auditor may decide that it is not practical, or possible, to limit detection risk, the third component of the audit risk[1], to an acceptable level by performing only substantive tests for one or more financial statement assertions as the audit evidence does not exist outside the IT environment. In such cases, the auditor should gather evidence concerning the effectiveness of both the design and operation of controls in order to reduce the assessed level of control risk (Helms & Lilly, 2000; Pathak, 2003; Rezaee et al., 2001; Tucker, 2001). In other words, in a complex electronic environment, auditors will not be able to reduce audit risk to an appropriate level via additional substantive procedures; they will need to perform more control testing. However, SAS No. 94 still requires the performance of substantive tests for significant account balances and transaction classes.

SAS No. 94, in a section titled *'The Effect of IT on Internal Control'*, indicates that IT provides effectiveness and efficiency benefits for an entity's internal control as it enables the entity to consistently apply predefined business rules and perform complex calculations in processing large volumes of transactions or data. Moreover, it enhances the timeliness, availability, and accuracy of information and facilitates additional analysis. In addition, it reduces the risk of controls being circumvented and enhances monitoring (Wallace, 2002).

[1] SAS No. 300: Accounting and Internal Control Systems and Audit Risk Assessment (APB, 1998: para. 3) defined audit risk as "the risk of the auditor giving an inappropriate audit opinion on financial statements". Audit risk can be broken down into three components; inherent risk, control risk and detection risk. According to SAS no. 300 (APB, 1998):
Inherent risk is defined as "the susceptibility of an account balance or class of transactions to material misstatements, either individually or when aggregated with misstatements in other balances or classes, irrespective of related controls".
Control risk is defined as "the risk that a misstatement could occur in an account or class of transactions and that could be material, either individually or when aggregated with misstatements in other balances or classes, would not be prevented, or detected and corrected on a timely basis, by the accounting and internal control systems".
Detection risk is defined as "the risk auditors' substantive procedures (tests of detailed transactions and balances or analytical procedures) do not detect a misstatement that exists in an account balance or class of transactions that could be material, either individually or when aggregated with misstatements in other balances or classes".

On the other hand, there are some risks that an entity's internal control may face as a result of using electronic systems. This may include:

Lack of segregation of duties: many control procedures that would ordinarily be performed by separate individuals in manual systems may become concentrated in an electronic information system. Thus, an individual who has access to computer programs, processing or data may be in a position to perform incompatible functions.

Potential for errors and irregularities: the potential for human error in the development, maintenance and execution of computer information systems may be greater than in manual systems, partially because of the level of detail inherent in these activities. Also, the potential for individuals to gain unauthorised access to data or to alter data without visible evidence, or recording unauthorized or non-existent transactions may be greater in an electronic information system than in manual systems.

Dependence of other controls over computer processing: computer processing may produce reports and other output that are used in performing manual control procedures. The effectiveness of these manual control procedures can be dependent on the effectiveness of controls over the completeness and accuracy of computer processing. In turn, the effectiveness and consistent operation of transaction processing controls in computer applications is often dependent on the effectiveness of general computer information systems control.

However, it is important to indicate that there are several techniques auditors can use to test the effectiveness of internal controls when dealing with electronic systems. These techniques will be discussed in Section 3.3.2.3.

2.3.2.2. IT and the Internal Control Components

According to the COSO report (1994), internal controls consist of five interrelated components which are control environment, risk assessment, control activities, information and communication, and monitoring.

Control Environment

The control environment provides an atmosphere in which people conduct their activities and serves as the foundation for all other internal control components. The main factors of the control environment are the integrity, ethical values and competence of the entity's people, management philosophy and operating style, the way management assigns authority and responsibility, and organises and develops its people, and the attention and direction provided by the board of directors (COSO, 1994: 23).

As a starting point, auditors need to obtain sufficient understanding of the control environment established by the management in order to determine their audit approach. Although a strong control environment does not ensure the effectiveness of the overall internal controls, it is equally true that without a strong control environment it is unlikely that the entire control system will be reliable (Gray & Manson, 2005). Evaluating the control environment is important whether auditors deal with manual systems or electronic systems. However, it is important to indicate that internal controls in most of the electronic systems are a combination of both manual and automated controls. Manual controls may be independent of the electronic system, use information from it or only monitor the system's effective function (Munter, 2002; Pathak, 2003a; Tucker, 2001).

Risk Assessment

The main aim of risk assessment is to identify, analyse and manage the risks the entity may face in a timely manner. Assessment of the control risk determines the degree of reliability of the internal control, which is the foundation for determining the nature, timing, and extent of substantive audit procedures performed in gathering sufficient and competent evidence (Bell et al., 1998; Rezaee et al., 2000; Rezaee et al., 2001). Some researchers (e.g., Gibbs & Keating, 1995; Hunton et al., 2004; Wah, 2000) indicate that implementing advanced electronic systems can increase the overall control risk although, from a technical perspective, most of the advanced electronic systems vendors (e.g. the ERP systems' vendors) design adequate controls into their integrated application suites (Hunton et al., 2004; Wright & Wright, 2002). For example, software platforms such as SAP R/3 come equipped with a variety of advanced control features including logging capabilities, security tools, the ability to compare actual performance in an area to present goals, and the capacity to trace individual transactions completely, from beginning to end (Bierstaker et al., 2001). However, such control mechanisms are effective only if they are properly established from the beginning and subsequently maintained, which is not always the real situation.

Under certain conditions, the technical potential of advanced electronic systems to reduce control risks can be compromised, especially if the integrated internal controls are partially adopted or bypassed (Hunton et al., 2004). During the implementation of new advanced electronic systems, managers sometimes neglect security controls surrounding the system access rights, especially if they mainly focus on bringing the system online quickly and cheaply. This can be especially problematic from a

security risk perspective due to the vulnerability of the system to mischief or malfeasance by unauthorised users (Hunton et al., 2004).

A study conducted by Wright & Wright (2002) indicated that 40% of IT audit specialists who participated in the study confirmed the ERP system (as an example of an advanced electronic system) lacked adequate controls because the clients and consultants focus mainly on getting the system operating (going live) by a particular date, thereby bypassing critical business process reengineering activities. This indicates that controls and security were of little concern (Wright & Wright, 2002).

Some electronic systems have been developed with security as a low priority. Information systems audit trails implemented for the recording of activity performed against electronic systems have been poorly designed and implemented, non-existent, turned off or overwritten within short time periods because of problems with space and storage. Removal of electronic records can be achieved with ease and without traceability. Where systems have poor to no information systems audit trails implemented, information can be removed without trace, which increases the control risk (Allinson, 2004).

Control Activities

Control activities refer to the policies and procedures that help to ensure that the actions identified by management as necessary to address risks to the achievement of the entity's objectives are effectively carried out. They include a range of activities such as approvals, authorisations, security of assets and segregation of duties (COSO, 1994: 49).

Generally speaking, two broad groupings of information systems control activities can be used; general controls and application controls (COSO, 1994).

General Controls: are controls over the environment in which the entity operates and therefore form an extension of the control environment (Gray & Manson, 2005). The widely known general controls are organisational controls, system development and maintenance controls, access controls, backup and recovery controls (Bell et al., 1999; COSO, 1994; Cosserat, 2000; Gray & Manson, 2005). It is important to indicate that if general controls are not operating as effectively as intended, it may not be worthwhile to test application controls (Pathak, 2003b). If auditors decide that general controls are adequate and effective, they can then assess the sufficiency and effectiveness of application controls related to material classes of transactions in various application subsystems (Rezaee et al., 2001).

Application Controls: are those controls over the input, processing and output of the accounting applications. The objective of the application controls is to improve the reliability of data processing by preventing and detecting fraud and correcting errors in individual transactions as they are processed within the system (Bell et al., 1999). Thus, these controls form a significant part of the control activities' component of the internal control systems.

If adequate control procedures exist, then the auditor should perform tests of controls to determine the effectiveness of internal control structure policies and procedures in preventing, detecting, and correcting material misstatements in financial statements. Tests of controls refer to the procedures directed toward either the effectiveness of the design or operation of a control. In designing tests of automated controls, the auditor may need to obtain supporting evidence that the operations of controls directly related to the assertions and other indirect controls on which these controls depend, is effective. The extent of testing of an automated control may be reduced

due to the inherent consistency of IT processing. After determining that an automated control is functioning as intended, the auditor should consider performing tests to ensure that the control continues to function effectively (SAS NO. 94 as cited in Yang & Guan, 2004).

Different techniques can be adopted to test the effectiveness of application controls, these techniques will be discussed in the next section.

Information and communication: surrounding these activities are information and communication systems. These enable the entity's people to capture and exchange the information needed to conduct, manage and control its operations (COSO, 1994).

Monitoring: in order to assess the quality of the performance of the system over time and perform any needed modifications. In this way the system can react dynamically as changing conditions warrant (COSO, 1994).

Sufficient understanding of the five components of the internal controls assists auditors in deciding whether or not adequate control activities are built into the electronic system (Rezaee et al., 2001; Tucker, 2001).

2.3.2.3. Techniques for Testing the Effectiveness of Internal Controls of Electronic Systems

Different techniques can be used to test the effectiveness of the design or the operation of internal controls, including Computer Assisted Audit Techniques (Braun & Davis, 2003; Helms & Lilly, 2000; Liang et al., 2001; Rezaee et al., 2001) and continuous auditing.

2.3.2.3.1. Computer Assisted Audit Techniques (CAATs)

A CAAT can be defined as any computer program or application that has been used to enhance the efficiency and effectiveness of an audit process through the automation of previously manual procedures, expansion of the scope of the audit coverage, or the creation of new audit procedures (Champlain, 2003). CAATs can be used to perform tests of general controls, test of application controls and for data extraction (Hall & Singleton, 2005). Internal and external auditors of many organisations and firms have developed and implemented CAATs that have greatly increased the efficiency and effectiveness of their audits (Curtis & Payne, 2008; Debreceny et al., 2005a). Through the use of CAATs the productivity and value of their audits and consulting services to their clients has also increased (Champlain, 2003). CAATs are often an efficient means of testing a large number of transactions or controls over a large population by analysing and selecting samples from a large volume of transactions, applying analytical procedures, and performing substantive procedures (ASOSAI, 2003; Porter et al., 2008).

CAAT's can be used in performing various auditing procedures such as (ASOSAI, 2003: 67, 68):

- Tests of details of transactions and balances, for example, the use of audit software for recalculating interest or the extraction of invoices over a certain value from computer records.
- Analytical review procedures, for example, to identify inconsistencies or significant fluctuations.
- Use of expert systems, for example, in the design of audit programs and in audit planning and risk assessment.

- Tests of general controls, for example, to test the set up of configuration of the operating system or access procedures to the program libraries.
- Sampling programs to extract data for audit testing.
- Tests of application controls, for example, to test the function of programmed control.
- Creation of electronic working papers, for example, by downloading the general ledger for audit testing.
- Recommitting calculations performed by the entity's accounting systems.

The most commonly used CAATs in testing the effectiveness of internal control structure among others are (Rezaee et al., 2001):

Test data: it facilitates determining whether the electronic system is correctly processing valid transactions and verifying correctness and completeness of processing. In this technique, auditors prepare dummy transactions and process them through the client's software at a time when the client is not processing the program. Then the auditors compare the output from processing the dummy data with their expected output to determine whether the controls are operating effectively. Any departure from the expected results could be an indicator of a logic or control problem (Braun & Davis, 2003; Cosserat, 2000; Porter et al., 2008; Rezaee et al., 2001).

Parallel simulation: in this type of CAATs the auditor develops software that is designed to replicate the results of the client's application using the client's real data. The results from the auditor's software and the client's system are compared. If the real system, the client system, and the auditor's software yield the same output, then

the auditor would have confidence that the client's system is accurate (Braun & Davis, 2003; Cosserat, 2000; Rezaee et al., 2001).

Generalized audit software (GAS): the most frequently used of all of the CAATs, as it enables auditors to access live account data stored in various file formats that are machine-readable only (Debreceny et al., 2005a; Shaikh, 2005). GAS also can disclose useful information on client master files that are not included in reports produced by the client.

The key reason for the widespread use of GAS is its simplicity, compared to other CAATs, as a result of which auditors require only little specialised information system knowledge. Moreover, GAS is capable of handling a wide variety of different systems and with different users. Although auditors often have some degree of difficulty in preparing the data for first use, the design of effective audit procedures after this initial set-up facilitates the achievement of greater coverage than could be possible with traditional types of procedures. This coverage is achieved through queries that allow the auditor to analyse data and extract information from the client database. (Braun & Davis, 2003).

Integrated test facility (ITF): this technique provides an in-built testing facility through the creation of a dummy department or branch within the normal accounting system. This means that the dummy or simulated data are being processed with the client's actual system instead of running dummy data on a static basis with the client system, as in the test data approach. Once established, test data can be placed in the normal transaction stream and the results can allow the auditor to evaluate application controls during normal operations (Braun & Davis, 2003).

2.3.2.3.2. Continuous Auditing

Another technique auditors can use when auditing in an electronic environment is adopting the continuous auditing approach. Auditors may consider applying continuous auditing when most of the accounting information is recorded and stored in electronic form (Helms & Mancino, 1998; Kogan et al., 1999; Rezaee et al., 2002). Continuous auditing has been defined differently in academic literature, in professional literature and in official reports issued by standard-setting bodies. For example, Rezaee et al., (2001: 151) define continuous auditing as *"a systematic process of gathering electronic audit evidence as a reasonable basis to render an opinion on fair presentation of financial statements prepared under paperless, real-time accounting system."*. Helms & Mancino (1999: 61) state that "*continuous auditing historically meant using software to detect auditor-specified exceptions from among all transactions that are processed either in a real-time or near real-time environment. These exceptions could be investigated immediately or written to an auditor's log for subsequent work".*

The joint study of the North American accounting bodies (CICA & AICPA) defines continuous auditing as "*a methodology that enables independent auditors to provide written assurance on a subject matter using a series of auditors reports issued simultaneously with, or a short period of time after, the occurrence of events underlying in the subject matter"* (Study Group, 1999: 5). The Global Technology Audit Guide No. 3 issued by the Institute of Internal Auditors (IIA) defines continuous auditing as "*a method used to automatically perform control and risk assessments on a more frequent basis, technology is the key to enabling such an approach. Continuous auditing changes the audit paradigm from periodic reviews of*

a sample of transactions to ongoing audit testing of 100 percent of transactions" (GTAG, 2005: 3).

From the definitions, it can be seen that applying the continuous auditing technique can help auditors to reduce the cost of the basic audit assignment by enabling them to test a larger sample (up to 100%) of clients' transactions and examine data faster and more efficiently than the manual testing required when auditing around the computer. Moreover, it helps the auditors to specify transaction selection criteria to choose transactions and perform both tests of controls and substantive tests throughout the year on an ongoing basis. Besides, it enables auditors to assess risk, evaluate internal controls and electronically perform a variety of audit procedures, including extracting data, downloading information for analytical review, selecting samples for tests of controls and substantive tests, identifying exceptions and unusual transactions and performing confirmations (GATAG, 2005; Kogan et al., 1999; Rezaee et al., 2002; Study Group, 1999).

The main difference between continuous auditing and other CAATs is that continuous auditing needs to be implemented on an online computer system; an online system refers to a system that is permanently connected through computer networking between the auditors and the clients, or the auditees. This can be applied by including an embedded audit module in the client's shipping software (Debreceny et al., 2003; Debreceny et al., 2005b; Helms & Lilly, 2000; Higson, 2003). The auditors set a number of pre-defined attributes that monitor and analyse the client's real time accounting system. In case of any problem, alarm systems warn the auditors to check it out (Kogan et al., 1999; Rezaee et al., 2000). This means that the continuous auditing technique functions more as a preventive and detective

procedure against the misstatements of financial statements than as a corrective method (Rezaee et al., 2000).

Although there are many benefits to be gained from applying a continuous auditing approach, in practice some challenges may face its application; the great variety of software systems used by clients makes it very difficult for auditors to develop integrated online auditing systems, at least for the meanwhile (Kogan et al., 1999). Moreover, it needs skilled auditors to be able to deal with such an approach.

2.3.3. Financial Auditors' Knowledge, Experience and Training

Another impact of the spread of using advanced electronic systems is the need for financial auditors to increase their knowledge and experience in dealing with such systems in order to assure the integrity and reliability of the accounting system (Abu-Musa, 2004; Bierstaker et al., 2001; Brazel, 2004; Brazel & Agoglia, 2007; Helms & Mancino, 1999; Kinney, 2001). The Public Oversight Board (POB) on Audit Effectiveness, in its executive summary report in August 2000, in chapter 2, *Improving the Conduct of Audits*, confirms that there is an increased need for auditors *'to have a higher level of technology skills and for more effective participation in audits by information technology specialists'* (POB, 2000:29). This means that although auditors need to improve their technology skills, they still need to determine whether any IT audit specialists (or information system auditors) are needed while performing their external audit. If specialised skills are needed, the auditor would seek the assistance of an expert possessing such skills, who may be either one of the auditor's staff or an outside professional.

To work with IT specialists, auditors need reasonable IT capabilities for conducting their detailed audit and in order to be able to direct, supervise, and review the work of the IT audit specialist and to be able to obtain reasonable assurance that the work performed by IT audit specialists is adequate (Helms and Mancino, 1998). This IT understanding becomes more crucial as auditors are faced with accounting transactions entirely in electronic form, without supporting paper documentation (Pathak, 2003a).

Nearon (2005) indicated that auditors know they have to be more skilled in dealing with electronic systems, as they cannot escape from the effect of the dramatic continuous changes in information technology on their work, however, with few exceptions, this knowledge has not been translated into significant changes in audit procedures (Nearon, 2005: 33). Even though almost all financial accounting records are in digital form, in general, auditors are not trained to collect and evaluate it. Nor, in most cases, do they learn how to do this in practice. This is contrary to the requirements of all the audit standards that require auditors to have adequate technical training and knowledge. Bell et al., (1999) explained this point by indicating that auditors have historically relied on special experts to assess the reliability of computerised accounting information systems and as a result of this dependency, many auditors feel they lack the expertise to evaluate and test automated systems adequately. Nearon (2005) explained it in another way; he indicated that auditors do not really feel the need to enhance their technical skills as many auditors do not realise, despite SAS 94, that hardcopy printouts and listings generated by computers and used for audit tests are only a physical view of digital evidence, which could have been easily altered to deceive them. Therefore, with regard to competence, auditors must have the skills to evaluate the reliability of digital

evidence used to support their audits. The first step in gaining technical competence is appreciating one's limitations and realising that there are some things one does not know. Once an auditor accepts his/her limitations, he/she is obliged to either acquire the necessary skills or hire someone who already has the requisite knowledge and skills, until he/she gains the needed skills (Nearon, 2005).

Technical competence can be gained through determined formal university education for entry into profession, practical training and experience in auditing and continuing professional education during the auditor's professional career (Boynton et al., 2001).

As for education, most of the undergraduate accounting programs do not offer curriculums that allow their graduates to deal with advanced electronic systems (Allinson, 2004; Nearon, 20000). Although most of the top business schools offer electronic-business courses, few accounting schools do. Moreover, IT auditing has not been considered a high priority or even part of the IT formal education process (Allinson, 2004). Brazel (2008: 41) emphasized this point by stating that there is:

> *"…an increasing need to improve the system-related educational experiences of accounting students who will be the IT and financial statement auditors of the future. Undergraduate and master's degree programs in accounting might want to partner with management information system departments, or develop faculty strengths in the field of AIS, in order to incorporate an IT concentration into their programs"*

If accounting schools placed greater emphasis on technical competence, clients and regulators would feel more confident that auditors have the requisite skills to deal with advanced electronic systems (Nearon, 2000).

Regarding the training programs, POB (2000) recommended that audit firms have to develop training programs to make auditors more knowledgeable about information technology, and information technology specialists more knowledgeable about auditing by stating that:

> *'Information technology specialists should be integrated more effectively and consistently into the audit process. There should be joint training of auditors and specialists, starting at the partner and the manager levels. Firms without such specialized capabilities should develop appropriate cooperative arrangements to ensure that information technology risks and controls are fully addressed in the audit'* (POB, 2000: 30).

The same idea was suggested by Helms (1999) as he indicated that there should be cross training programs between the IT specialists and external auditors.

However, breadth and depth of training to audit electronic systems should be appropriate to the situation (Brazel, 2008; Pathak, 2003c). It is important to identify whether information system auditors should be in-depth trained in financial auditing techniques, or whether they should be trained as systems professionals with limited knowledge of auditing (Pathak, 2003c). The same applies to the financial auditor; it is important to identify whether he/she needs an in-depth training in information systems or only the knowledge necessary to help him to deal with the IT specialist. However, it could be argued that financial auditors with in-depth IT training and high experience in dealing with electronic systems could be able to compensate the low level competence of an IT audit specialist, if such is the case, while auditors with limited training and experience may not have the knowledge to do so (Brazel, 2004). Moreover, auditors with IT knowledge will have a distinct advantage in the future market for financial statement audits (Nearon, 2000) but there will still be a need for IT audit specialists, or information system auditors.

2.3.4. The Role of Information System Auditors

Moving towards the information technology age caused the need for financial auditors to seek the help of information system auditors who possess the suitable knowledge and experience in dealing with advanced electronic systems. Information system auditors can improve both the efficiency and effectiveness of the financial

statement audits (Brazel, 2008). The next sub-sections will shed light on the need for information system auditors as a part of the external financial audit, their competence and the factors that can affect their competence, and the important role ISACA plays to enhance the competence of information system auditors.

2.3.4.1. The need for Information System Auditors

Another important impact of the widespread use of advanced electronic systems is the need for information system auditors (Gallegos, 2003). Collaboration between financial auditors and information system auditors ensures a controlled electronic environment (Abuo-Musa, 2004; POB, 2000; Price, 2001) as they have different expertise structures so they can assist each other (Curtis & Viator, 2000; Hunton et al., 2004). As electronic systems became more dominant and complex, auditors' ability to audit around the system (e.g., perform their audits without evaluating the reliability of the system) has become significantly reduced. Moreover, financial auditors cannot possess high levels of knowledge in all areas, which is why specialists are often consulted when needed (Champlain, 2003; Hunton et al., 2004).

Prior studies have found that auditors, who are industry specialists, are more effective when working in specialisation. They are more knowledgeable about their industry and this allows them to be more effective when working in specialisation and can make more accurate judgments than non-specialists (e.g. Hammersley, 2006; Knechel et al., 2007; Low, 2004; Owhoso et al., 2002; Wright & Wright, 1997). Solomon et al. (1999) confirmed that auditors who are industry specialists possess different knowledge to non-specialists, as the specialists possess more focused indirect experience, in the form of education and training, and direct experience, in the form of audits and consultations with clients in specific industries.

Hunton et al. (2004) confirmed that consulting IT audit specialists makes the audit more secure, especially when auditing in an advanced electronic system (they took an ERP system as a representative of advanced electronic systems). In their experimental study, which involved case studies of clients operating ERP or less advanced, legacy, electronic systems, they embedded in both ERP and non-ERP cases a security control weakness that causes greater security risks in ERP systems. The participants, who were 82 IT audit specialists and 83 financial auditors, were asked to read the cases and assess the risk in six categories, namely, business interruption[1], process interdependency[2], network security[3], database security, application security, and overall internal control. The identification of these categories for assessment was based on a literature review and from a focus group discussion with IT audit specialists both of which indicated that these risks can occur in an ERP environment. The outcome of the experiment showed differences between IT audit specialists and financial auditors. The former assessed risk in all six categories is significantly higher in the ERP than the non-ERP system, whereas the latter gave higher risk assessment to ERP for only three categories: business interruption, process interdependency and overall internal control risks. They assessed the level of risk for network security, database security, and application security as similar in the two systems. Moreover, the differences in levels of risk

[1] Business interruption risk refers to the likelihood that endogenous or exogenous factors, such as computer hardware or software failures, labour strikes, or normal disasters will disrupt a company's ability to accurately process and record economic transactions in a timely manner. An audit prospective classifies this risk as an inherent risk.

[2] Process interdependency risk represents the likelihood that disturbances in automated or manual workflow procedures will fail to transmit information from upstream (e.g., sales order) to related downstream (e.g., procurement, production, shipping, and billing).

[3] System security risk reflects the likelihood that a variety of possible undesirable actions committed by mischievous employees, dishonest employees, or outside hackers will compromise the integrity of a company's information system. An audit prospective classifies process interdependency risk and system security risk as control risks.

between the two system types were assessed as significantly greater by IT audit specialists than by financial auditors, in all risk categories. These findings demonstrate financial auditors' lack of awareness of the nature of the security risk in an advanced electronic environment. The researchers expected, in view of the ERP system and the limited experience of financial auditors in assessing risks and controls in such advanced electronic environment, that financial auditors would consult IT audit specialists in an ERP setting. However, it was found that some of the financial auditors who participated in the study were no more inclined to consult with IT audit specialists in the ERP as compared to the non-ERP environment, but were equally confident in their ability to assess risks in both computing environments.

Several explanations were offered for financial auditors' unwillingness to consult with IT audit specialists. One was overconfidence, consistent with psychological research which indicates that less experienced people in a specific field often show as much confidence as more experienced, despite recognising that their performance is inferior (e.g., Klayman et al., 1999; Mahajan, 1992; Arkes et al., 1987 as cited in Hunton et al., 2004). Unwillingness to consult IT audit specialists may be also attributable to economic pressures, as IT audit specialists are in short supply and their billing charges can be higher than those of non-specialists (Brazel, 2008; Hoffeman, 2004; Hunton et al., 2004; Marks, 2005), thereby causing additional audit costs which the audit firm may be unable to recoup through its fees, due to competition between audit firms. If financial auditors consider themselves capable of assessing ERP system risks, holding billing rates constant, then they can minimise audit costs by so doing, rather than absorbing the added costs of specialists. The last explanation for financial auditors' reluctance to consult IT audit specialists is that they were

unable to see the link between the ERP system risks and the possibility of material financial misstatement fraud (Hunton et al., 2004).

Although some auditors believe that there is no need to depend on information system auditors, others believe that these specialists are essential in conducting an audit in an advanced or complicated electronic environment, but the most important point is to depend on competent IT audit specialists.

2.3.4.2. Competence of Information System Auditors

Previous researchers have demonstrated the sensitivity of auditors to the perceived competence of their evidence sources and that auditors' judgment in relation to the audit evidence is influenced by this factor (Anderson et al., 1994; Bamber, 1983; Hirst, 1994). Bamber (1983), in an investigation of auditors' sensitivity to the competency of their own staff, specifically audit managers' evaluations of evidence provided by senior auditors, results indicate that auditors were sensitive to experimental manipulations of source competence, it showed participants' sensitivity to such manipulations with less reliance on evidence provided by a less competent senior. Similarly, Brawn (1983) in a study of source competence among internal auditors found a direct positive relationship between internal auditor competence and the extent to which auditors relied on the internal audit function.

Margheim (1986) was another researcher who investigated the impact of variation in the source competence of internal auditors specifically in terms of the scope of audit procedures. They found that auditors reduced planned audit hours when dealing with more competent internal auditors.

Competence has also been studied in relation to client management or accounting personnel to determine whether auditors can rely on their representations or their evidences. Studies by Rebele et al. (1988) and Andreson et al., (1994) found a

positive relationship between the competence level of management and auditors' reliance on their representations. In assessing the true value of a client's uncollectable receivables, auditors placed more reliance on evidence obtained from client personnel with greater expertise (Rebele et al., 1988). A similar influence of management competence has been found in the case of auditors obtaining explanations for unexpected account fluctuations (Andreson et al., 1994). Auditors attributed greater reliability to explanations received from a client manager possessing high competence.

The importance of specialist competence was also asserted by Hirst (1994) in his study of audit seniors' evaluation of evidence related to an inventory balance, provided by specialists of different degrees of competence with respect to the type of inventory in question. In line with previous source competence research, it was found that participants placed more reliance on evidence reported by a more competent than a less competent specialist.

In the case of IT audit specialists also, it is important to indicate that their competence determines the degree to which financial auditors, who believe in the IT auditors' role, will depend on their work. This is especially the case for financial auditors who have experience in auditing advanced electronic systems for whom IT audit specialists are a source of evidence (Brazel, 2004; Brazel & Agoglia, 2007). According to SAS No. 94 (AICPA, 2001) the utilisation of IT audit specialists as a source of audit evidence is necessary in audit engagements of advanced electronic systems, due to their potential value in both gaining an understanding of, and testing, the internal controls of audit clients who use such systems (Brazel, 2008; Curtis & Viator, 2000; Hunton et al., 2004; Wright & Wright, 2002).

The evidence from previous source competence studies suggests that auditors will be likely to place greater trust in tests of internal controls performed by IT audit specialists of higher competence, than those of less competent counterparts. Consequently in the face of a report from an IT audit specialist that system controls are reliable auditors' evaluation of the control risk should vary inversely with the perceived level of IT audit specialists' competence. In other words, when IT audit specialists with a high level of competence attest that system controls are strong, financial auditors are likely to place reliance on their evidence, to give a lower assessment of the control risk. Conversely, where such evidence originates from less competent IT audit specialists, auditors are likely to rely less on that evidence and, in turn, assess control risk as higher (Brazel, 2008; Brazel, 2004).

Brazel (2004) investigated the effect of IT audit specialists' competence and financial auditors' expertise on the auditor's judgment in an advanced electronic environment. The research was a quasi-experiment design, in which auditors were presented with case studies manipulating between high and low competence of IT audit specialists, and the expertise of the financial auditors in dealing with electronic systems was measured. Auditors were asked to evaluate evidence related to the audit of complex electronic system for a client to which an IT audit specialist had been assigned, to assess current year inherent and control risks, and to plan the nature, timing and extent of the substantive procedures for a transaction cycle. It was found that auditors with greater experience in dealing with advanced electronic systems perceived higher levels of both inherent and controls risks and designed more extensive substantive tests to mitigate those risks, accordingly, more experienced auditors produced more accurate risk assessments, and designed more effective tests than those of less experienced counterparts. Auditors also responded to the competence of the IT audit

specialist in assessing the reliability of evidence from that source, assessing control risk higher when control testing evidence emanated from an IT audit specialist with low competence. However, when planning substantive procedures, auditors' reaction to IT audit specialist competence was moderated by their expertise. Specifically, when confronted with less competent IT audit specialists, auditors who were more experienced in dealing with electronic systems expanded the scope of their audit testing beyond the scope designed by less experienced auditors. No such difference was found under conditions of high IT audit specialist competence. These findings demonstrate the importance of the IT audit specialists competence for auditors, as the quality of work performed by the IT audit specialists can affect the efficiency and the effectiveness of the audit. This means that if an auditor does not take sufficient account of source reliability, the efficiency and effectiveness of an engagement may be reduced. If unreliable evidence is over weighted, under-auditing may ensue (Brazel, 2004).

2.3.4.3. Factors Affecting the Competence of Information System Auditors

To identify the main factors that affect the IT audit specialist competence from the financial auditors' point of view, Brazel (2004) conducted a survey to ask the participants to identify the factors that influence their perceptions towards the IT audit specialist competence[1]. The factors included in the survey included those previously used in prior source competence studies, together with some additional factors that are unique to the IT audit context. The survey then asked the auditors to

[1] The study identified six factors as indicators of the IT audit specialist competence which are:

- The technical ability of the IT audit specialist.
- The number of years of experience of the IT audit specialist.
- How much training the IT audit specialist received.
- How well the IT audit specialist knows the client
- How quickly or late the IT audit specialist handles his internal control working papers.
- The audit manger opinion in the IT audit specialist

add any areas in which IT audit specialists' competence is evaluated in order to ensure that factors excluded from the survey were considered. The participants had experience in dealing with IT audit specialists and evaluating their audit evidence. The IT audit specialist's experience in auditing advanced electronic systems was the first indicator of their competence. Training on how to audit advanced electronic systems was another indicator of the IT audit specialist's performance.

It is important to indicate that education and work background can affect the IT audit specialist's performance (Curtis & Viator, 2000; Viator & Curtis, 1998). As for education, the academic degrees of IT audit specialists may vary across accounting, business administration, business-oriented management information systems (MIS), computer science (CS) and non-technical academic areas (Viator & Curtis, 1998: 20). The work backgrounds of IT audit specialists may include experience in information systems departments, accounting departments (such as accounts payable or payroll), and internal or external auditing (with or without financial audit experience) (Kneer et.al, 1994 as cited in Viator & Curtis, 1998: 20).

However, IT audit specialists have to continuously obtain the skills necessary to audit information systems effectively. Skills can be obtained through significant investment in ongoing technical training; active participation in audit and security related professional associations such as Information Systems Audit and Control Association (ISACA), effort to establish and maintain networks with peers and scholars in field pertaining to IT audit and relating technologies; facing the challenge of obtaining and maintaining professional certifications related to IS audit, control and security; a commitment to reading books, trade journals, internet sites, and other publications pertaining to IS audit, controls and security. Attending conferences and seminars is another good way of obtaining skills. A study conducted at California

State Polytechnic University indicated that the main venue used to train information system auditors is seminars (Gallegos, 2003). Conferences and seminars offer several benefits. First, they provide high to midlevel training sessions on a variety of technical subjects. These training sessions are grouped into different categories. The length of every session usually ranges from two to eight hours. The overall length of conference usually ranges from three to five days. Second, conferences and seminars offer the ability to network with peer reviews and experts in the IS field. The larger conferences attract from 500 to 1500 attendees. The experience level for the attendees ranges from beginning IS auditors to experts. Other attendees include managers, executives, audit committee members, vendors who sell audit related products and services, and public accounting firms that market auditing, assurance services and other consulting services (Champlain, 2003). This means that conferences are very effective means of contact with IS experts from different industries and different countries to share experience, so that everyone can benefit from others' collective knowledge. Moreover, conferences are a source of continuing professional education for attendees who possess one or more certifications that require continuing education (like CISA). Finally they can obtain the necessary skills through practical experience performing IS audits (Champlain, 2003). Standard 4 (competence) issued by ISACA confirmed that 'the information systems auditor is to be technically competent, having the skills and knowledge necessary to perform the auditor's work the information system auditor is to maintain technical competence through appropriate continuing professional education and training' (ISACA, 2007: 9).

2.3.4.4. ISACA's Role in Improving the Quality of the IS Audit

The Information System Audit and Control Association (ISACA), previously named the Electronic Data Process (EDP) Auditors Association, was established in 1967, when a small group of individuals with similar jobs—auditing controls in computer systems that were becoming increasingly critical to the operations of their organizations—discussed their need for a centralised source of information and guidance in the field. In 1969, the group was formally incorporated as the EDP Auditors Association. In 1976 the association formed an education foundation to undertake large-scale research efforts to expand the knowledge and value of the IT governance and control field (ISACA).

Today, ISACA's membership, which is more than 65,000 strong worldwide, is characterised by its diversity. Members live and work in more than 140 countries and cover a variety of professional IT-related positions, such as information system auditor, consultant, educator, IS security professional, regulator, chief information officer and internal auditor. Some are new to the field, others are at middle management levels and still others are in the most senior ranks. They work in nearly all industry categories, including financial and banking, public accounting, government and the public sector, utilities and manufacturing. This diversity enables members to learn from each other, and exchange widely divergent viewpoints on a variety of professional topics (ISACA).

Another of ISACA's strengths is its chapter network. ISACA has more than 170 chapters established in over 70 countries worldwide, and those chapters provide members with education, resource sharing, advocacy, professional networking and a

host of other benefits on a local level. However, Egypt does not have an ISACA chapter.

ISACA issues standards relating to IS auditing and IS control. The specialised information systems auditing and skills necessary to perform such audits require standards that apply specifically to IS auditing (ISACA, 2007: 6). ISACA's IS auditing and IS control standards are followed by practitioners worldwide and these standards are mandatory requirements for certificate holders (ISACA, 2007).

Moreover, ISACA has issued two worldwide certifications, Certified Information System Auditor (CISA) and Certified Information Security Manager (CISM) certifications. These professional certifications aim to evaluate individual competence in the field, to provide a mechanism for maintaining such competence and to provide management with objective criteria for personnel selection and promotion (Champlain, 2003). Since 1978 CISA has been globally accepted and has been earned by more than 50,000 professionals. Although CISA is not a mandatory certificate, a growing number of organisations are recommending that employees become certified. It is important, however, to recognise that having the CISA certification is not the end of the road, as CISA holders have to maintain their certificate through continuing professional education to ensure that all CISAs maintain an adequate level of current knowledge and proficiency in the field of information systems audit, control and security, as the field of IT changes very quickly (ISACA). CISM is another certification that can be earned from ISACA. It uniquely targets the information security management audience and has been earned by more than 7,000 professionals.

Moreover, ISACA publishes a leading technical journal in the information control field, the *Information Systems Control Journal*. It hosts a series of international conferences focusing on both technical and managerial topics related to the IS assurance, control, security and IT governance professions. Together, ISACA and its affiliated IT Governance Institute lead the information technology control community and serve its practitioners by providing the elements needed by IT professionals in an ever-changing worldwide environment.

ISACA, however, is not the only institution that provides certifications related to the IS audit. There are other certifications, such as the Certified Internal Auditor (CIA) which is sponsored by the Institute of Internal Auditors (IIA). Earning CIA certification requires candidates to pass a four part examination; part of which is about management control and information technology (Champlain, 2003). The Certified Public Accountant (CPA) certification, which is sponsored by AICPA, is another certification that relates to IS audit as part of the examination relates to Information Technology (Champlain, 2003). Nevertheless, CISA, which is sponsored by ISACA, is the most accepted and well known certificate in the field of information systems.

2.4. Summary

This chapter presented the main implications of adopting electronic systems on the audit function by determining its effect on internal controls, audit evidence, skills needed for financial auditors and the important role played by information system auditors in auditing electronic systems. These factors will be taken with the other actors raised during data collection to build the network of auditing in advanced electronic environments.

3. Chapter Three: Theoretical Background: Actor-Network Theory

3.1. Introduction

This chapter aims to provide a thorough understanding of Actor-Network Theory (ANT) as it is the theoretical approach that will form the backbone of this research. This chapter will start by introducing the conventional approaches of dealing with the social and the technical aspects, and then it will move to introduce the main features of ANT. The ANT ideas that will be adopted in this research will be introduced and the criticisms of the ANT perspective will be discussed. Moreover, this chapter will review accounting and auditing studies that have adopted ANT perspective in order to gain in-depth understanding on how to use the ANT perspective in this research. The chapter ends by justifying the suitability of adopting the ANT perspective in this study.

3.2. Before Actor-Network Theory

Actor-Network Theory, ANT, is an approach that has been developed by scholars including Latour (1986, 1987, 1993, 1999a, 1999b, 2005), Callon (1986a, 1986b, 1987, 1999), and Law (1992, 1999, 2002) with the aim of explaining complex networks in scientific research strategy.

Before the emergence of ANT, there were two opposite positions of thinking regarding the relation between technology and society. At one extreme there is the *"materialist view"* (Latour, 1999a: 177). According to this view, technology is seen as *'impacting'* on society (Prout, 1996: 201) by causing changes in it. In other words, technology was seen as a force coming from outside the society and then impacted upon it. Or as Markus & Robey (1988: 585) indicated *'... this perspective views technology as an exogenous force which determines or strongly constrains the*

behaviour of individuals and organisations'. This perspective deals as if there could be a technology which was not already social or a society that did not have technology.

At the other extreme there is the *"sociological view"* (Latour, 1999a: 177), the advocates of the social approach responded to the technical way of thinking by reversing the putative order of causality; they asked what it is that gives birth to and shapes technology (Grint, 1998; Hill, 1988). Hill (1988: 6) criticised the materialistic approach by stating that:

> *"To attribute intrusive power to technology per se is inherently wrong. Social, economic and political negotiations are involved in bringing particular technological systems into existence. Equally the impact of technological change varies according to the social and the cultural context into which new technologies are implanted".*

In other words, advocates of the sociological approach contend that technology does nothing by itself or by its material components, it is a tool or a medium that carries the human wills.

Although these two approaches are two extremes, they both agree that technical aspects and social aspects can be divided into two separate heaps where one of them drives the other. Actor-Network Theory combined these two approaches, it is neither a social approach nor a technical one; it is a socio-technical approach.

3.3. Introducing ANT

At its beginning, the main focus of Actor-Network Theory was in the laboratory setting, but more recent ANT analyses include investigations of science and technology development outside the laboratory, and in the public and private sectors (Williams-Jones & Graham, 2003). ANT has proved its flexibility to move from its origins in science and technology studies into social science fields as diverse as sociology (Law, 1991; Law, 1994), psychology (Michael, 1996), anthropology

(Strathern, 1996), politics (Mol, 1999), geography (Comber et al., 2003; Murdoch, 1998), and economics (Callon, 1998), and accounting (e.g., Alcouffee et al., 2008; Briers & Chua, 2001; Chua, 1995; El-Sayed, 2004; Ezzamel, 1994; Gendron & Barrett, 2004; Lowe, 2001b; Miller, 1991; Preston et al., 1992; Robson, 1991; Robson, 1992; Robson, 1994). Latour (1999b) indicated that ANT may also bring something to theology.

ANT can be seen placed between the social and the technical perspectives. It is neither purely social nor purely technical; it denies that purely social or purely technical relations are possible (Law, 1991). What seems, on the surface, to be social is partly technical, and what may appear to be only technical is partly social.

ANT argues that the world is full of hybrid entities, these entities can be humans or non-humans (e.g., technologies, institutions, standards) and any entity with the ability to act and to be acted upon is known as an actor. The ability to act is not a function for humans only, according to ANT non-humans can act and be acted upon also. For example, a telephone may appear to be an ordinary, passive technology, but this impression changes when the telephone rings. Even if one decides to ignore the call, the telephone has still provoked a decision making process and elicited a response (Callon & Law, 1995). In other words, an actor is accepted to be the source of action regardless of its status as a human or non-human.

Some actors interact together to constitute a network which aims at achieving a goal or some common goals. Latour (1987) observed that scientists and engineers are constructing networks by enrolling hybrid entities of the material world, money, established knowledge, people, laboratory equipment, inscriptions, and all other actors that can support the network. Law (1986) also emphasised that technologists build successful artefacts through their effort in enrolling heterogeneous entities like

raw materials, skills, scientific and social knowledge, and capital in a stable network that will hold these diverse elements together to perform as one. This indicates that the success of any network depends on linking as many heterogeneous entities as possible that can perform in harmony.

To perform in harmony, the enrolled actors have to *"translate"* their interests to be in accordance with the requirements of the network (Callon, 1986a; Latour, 1987; Latour 1999a). Each actor enrolled in a network has its own diverse set of interests that encourages it to join; however, actors have to negotiate in order to redefine their roles and interests to be aligned with the main goal of the network. The stability of a network will result from the continual translation of the interests of the actors (Williams-Jones & Graham, 2003). However, some actors may resist redefining their roles, such actors will become a weak node in the network and this may lead to the modification or even the disintegration of the network (Callon, 1986a; Callon 1986b).

The main focus of the ANT is the process of constructing and maintaining the networks as it asks how and for what purposes heterogeneous entities are brought together (Lee & Hassard, 1999). Similarly, the main focus of this research is to understand the process of building the network of auditing in electronic environments. It aims to identify who are the actors, whether human or non-human, that can have an effect on the audit of electronic systems, why these actors are enrolled in the network, and how they interact with each other to form the final shape of the network.

Actor-network theory claims that every actor in the network, whether a social or technical actor, has an important role to play. This means that all the actors, humans or non-humans are important, without differentiating or giving priority to the social

or the technical aspects. Callon (1999: 183) stated that ANT was mainly developed to analyse situations in which it is difficult to separate humans and non-humans, and in which the actors have variable forms and competencies. In other words, ANT calls to adopt a symmetrical approach to humans and non-humans and the analytic divisions between the social and the technical are explicitly prohibited. Law (1994: 9) emphasised the importance of this symmetrical approach by stating that:

> *'To insist on symmetry is to assert that everything deserves explanation and, more particularly, that everything that you seek to explain or describe should be approached in the same way'.*

For example, ANT does not refer to a computer network and software system as a technical system, a collection of hardware and software, data-flows and business processes. Rather, it refers to it as a socio-technical network that places machines, people, software, institutions, protocols, bureaucracies and all manner of other things in relation to each other, without differentiating analytically between people and machines, or between social and technical, in terms of superiority. All of these elements are actors that interact together to perform the network and work cooperatively with it (Arnold, 2003).

Arnold (2003) gives another example to understand the equivalence of the social and the technical aspects. He explains, from the ANT perspective, that Thomas Edison was not someone who dealt with purely technical problems to invent a light bulb:

> *'He was a heterogeneous engineer who worked to assemble copper, glass, wire-filaments, generators, meters, transformers, electricians, laws of nature, mathematical formula, engineers, politicians, investors, bankers, labourers, local councils, regulatory authorities, and others into a network (or assemblage) that produce light for house-holders, profits for investors, work for coal mines, pollution for the air, unemployment for gas light-filters and so forth. Edison recruited these actors to his network' (Arnold, 2003:243).*

From the ANT perspective, all the actors Edison used to invent the bulb are important, without differentiating between humans and non-humans. The absence of

any of the actors may cause the whole network to break down (Callon, 1986a), all of them are actors that interact together in a network to achieve Edison's goal; inventing the bulb (Law 1994).

The difficulty of separating between humans and non-humans, or giving priority to any of them was explained by Latour (1999a) when he presented the mutual constitution notion.

3.4. Mutual Constitution

This notion indicates that both social and technical aspects should be studied as propositions, where neither technical nor social, subject nor object is seen as fixed (Latour, 1999a). Latour (1999a) explained that when the propositions (the social and the technical, or in other words the human and the non-human) are articulated, they become a new proposition, and become '*someone something else*' (Latour, 1999a: 180).

Latour (1999a:176) explained how to become *someone something else* by giving an example of the relation between a gun and a man. A slogan was adopted by those who try to control the unrestricted sales of guns: '*Guns kill people*'. The National Rifle Association replied with another slogan: *'Guns don't kill people; people kill people'.* The first slogan can be seen as a technological approach; it deals with the gun according to its material components without paying attention to the social qualities of the man who holds the gun. The other slogan concentrated on the sociological approach; it indicates that the gun can do nothing by itself or by its material components; it is only a tool or a medium for the gunman to express his intentions. '*If the gunman is a good guy, the gun will be used wisely and will kill only when appropriate'.*

The question here is about the one or the thing that is responsible for killing people, the guns (non-humans) or the humans. Latour (1999a:179) explained that neither guns alone nor people alone kill people, but when the two are combined together they become *'someone else (a citizen-gun, a gun-citizen)'*. They both are mutually constituted in relation to each other, (Latour, 1999a:179-180) explained that:

> '*You are different with a gun in your hand; the gun is different when you are holding it. You are another subject because you hold the gun; the gun is another object because it has entered into a relationship with you. The gun is no longer the gun-in-the-armoury or the gun-in-the-drawer or the gun in the pocket, but the gun-in-your-hand, aimed at someone who is screaming. What is true of the subject, of the gunman, is as true of the object, of the gun that is held'*.

It is not simply the gun added to the man, but a new link is created that did not exist before and that modifies the original entities, or the original actors. As human-nonhuman interactions perform *'someone something else'*, so it is difficult to determine what is more important, the social or the technical; humans and non-humans should be dealt with in the same way without distinguishing or defining priority for any kind of elements (Latour, 1999a).

This notion of mutual constitution is essential in conducting this research. By adopting this notion it can be clear that the actors' attributes have to change when they transfer from dealing with traditional paper-based auditing to dealing with advanced electronic systems. For example the external financial auditors, when dealing with advanced electronic environments, will be different from auditors when dealing with papers. Auditors who deal with electronic systems need more technical skills to be able to deal with the electronic system, they use different techniques to conduct the audits, they pay attention to new points they have not considered before (e.g. in electronic environments they have to consider the automated controls, not only the manual ones), they need to enrol information system auditors as they are

specialised in auditing electronic systems. By using Latour's words (1999a: 180), auditors in electronic environment will become *'someone something else'.*

3.5. Actors' Power

Although all the actors are playing an important role to achieve the goal of their network, differences between the actors in their roles and size cannot be denied. Fox (2000: 862) focused on this idea by questioning '*they are all actors; the key question is how do they grow?'* Callon & Latour (1981) as cited in Fox (2000) indicated that these differences are the result of some processes of negotiation between the different actors; this negotiation determines the power relations that may cause the differences in level, size and scope of the actors. However, from the ANT perspective, to take power as a starting point to explain the relations between the actors is unacceptable. Power by itself cannot be used to explain anything, it is not something that is provided by the prior existence of society, or a fact that does not need to be explained (Callon, 1986b), rather it is a consequence of the actors' action towards each other. Law (1991: 18) explained this point by stating that:

> *"No one, no thing, no class, no gender, can have power unless a set of relations is constituted and held in place: a set of relations that distinguishes between this and that (distribution), and then goes on to regulate the relations between this and that...power, whatever form it may take, is recursively woven into the intricate dance that unites the social and the technical"*

In other words, we cannot translate the relation between the actors depending on their powers but we have to translate it depending upon the negotiations that identified the role and position of everyone in the network and that cause this power as a product of negotiation (Law, 1996). Therefore, power relations should be explained rather than using "power" to explain the existence of the relations (Callon, 1986b, Latour, 1986). Latour (1986: 265) summed up this point by stating that:

> *'when you simply have power… in potentia…nothing happens and you are powerless; when you exert power…in actu… others are performing the action and not you …power is not something you may process and hoard…power is, on the contrary, what has to be explained by the action of the others who obey the dictator'*

Law (1996) showed how power should be seen as the action of all the actors involved in any situation, not only the action of the actor who seems to possess power. He gave an example by telling a story of Andrew, a manager who has many responsibilities, makes decisions, exercises discretion, and whose commands are respected, a manager who seems to have power. To understand the *"powers of the powerful manager"* (Law, 1996: 3), Law (1996) wondered how he would perform in any particular situation if his materials (e.g. computers, furniture, telephones, fax machines, archives, calculators), and assistants (e.g. secretary, postman, driver, engineers, fellow managers) were not available. Law (1996) argued that in such a case this manager would not be able to calculate, decide, command, exercise discretion, or even remember. In other words, he would not be seen as a powerful manager as *"Andrew is nothing by himself"* (Law, 1996: 6). He is as powerful a manager as the negotiation between him and all his surroundings allowed him to be, but if he is away from all the things and the people who help him, he will be different as the powers of this manager is distributed:

> *"They are distributed through the arrangements of the organisation. They arise from those arrangements. The people who do the work of subordinating themselves. Secretaries. The tiers of under-managers. The clerks. The technicians. All those people. But not just people. For the powers of the powerful manager lie also in the papers. The texts that fix the commands. That map the organisations, its financial health, its credibility...And in the technologies which remember. Which calculate. Which write. Which talk to the other end of the world. Technologies which act at a distance"* (Law, 1996: 3).

This means that ANT proponents do not deny that there are differences in power between the actors; however we cannot translate the relation between them depending on their powers. We have to translate it depending upon the negotiations

that identified the role and position of everyone in the network and that cause this power as a product of negotiation.

3.6. Actor–Network and Black Boxing

From the ANT perspective, networks are constituted through the enrolment of heterogeneous, human and non-human, actors in the network. However, by looking to each actor individually, we will find that each actor, by itself, is a network. Law (1994:33) explained how an actor is also a network by itself at the same time by stating that:

> *"People are networks. We are all artful arrangements of bits and pieces. If we count as organisms at all this is because we are networks of skin, bones, enzymes, cells- a lot of bits and pieces that we don't have much direct control over and we don't know about at all".*

Each actor, as a network, consists of heterogeneous elements which interact together to form the final shape of the actor. Looking for human actors, they are shaped by their social, political, psychological and economic levels; they have various degrees of commitment, skills, prejudice and constraints associated with them. They are often hybrid of social, technical and personal aspects (Latour, 1993). In other words, the actors are not just points, or nodes, in the network; they are both: points and networks (Law, 1992; Tatnall, 2003), 'they *are individuals and collectives'* (Callon & Law, 1997: 174). This means that actor and network are two faces of the same coin (Latour, 1999b).

Notwithstanding that, every actor is not just a point but is a full network; however analysing the details of the network inside each actor is a very difficult and complicated task and will drive researchers to deal with endless networks. To prevent this complexity, researchers deal with the actors as *"black boxes"* (Callon, 1986a; Latour, 1987; Law, 1992) without considering the network that lies inside these

boxes. Law (1992: 385) explained that in the flow of everyday life we tend to treat other entities as if they are single points in order that the flow of life can continue. Social life would be impossible unless *'network packages'* were to be treated as single entities that have, relatively, stability and durability (Prout, 1996: 202). In other words, we consider the output of any black box without considering how the network which is inside this box shaped its output. However, on some occasions, we may need to open the black box of the actor to look at the network inside it to make it visible (Callon, 1987, Callon, 1991). Prout (1996: 201-202) gave an example of a case that may need to open the black box of an actor to look in the network that lies behind it by indicating that:

> '*For example, normally I treat the computer on which I am writing this paper as a single block. When, however, it recently broke down and I had to call on the supplier's guarantee, part of the network (made up of people, things and their organisation) that stands invisibly behind the machine was revealed.'*

To clarify the actor-network idea, we can look at the Business School as an actor in a University (assuming that a university is the network under analysis). At the same time, the Business School itself is a network that includes many departments (as actors). Each department (which is an actor in the Business School) is also a network which includes the staff, the courses, the students, the equipment, etc. Moreover, every actor in every department, for example every member of the staff, can be seen as a network in themselves. This means that every actor is an actor and a network at the same time (actor-network). Identifying the networks or the actors under analysis depends upon the aim of the analysis.

Dealing with the actor-network as a black box helps in conducting this research. The main network this research looks at is the network of auditing in an electronic environment. This network is constituted by the enrolment of different human and non-human actors (who are networks at the same time). However, for simplification,

and in order not to deal with endless networks, each actor in this network will be seen as only a black box. This black box will not be opened unless it is useful to understand how the network is constituted. For example, the financial auditor is a black-boxed actor; this black box will be opened only to pick up what can serve the research (e.g. his skills in dealing with electronic systems, his educational background, his experience with electronic systems), not to look at all the networks inside him.

It is important to indicate that individual actors are not static or fixed; they will change over time, across social, technical and political contexts, and in their relations with other social or technical actors (Williams-Jones & Graham, 2003). Relationality is an important notion in ANT.

3.7. Relationality

The relationality concept is concerned with how all sorts of actors are associated and drawn together in an attempt to build a network where none of these actors are privileged (Law, 2000). It assumes the *'radical indeterminacy'* (Callon, 1999:181) or as Law (2000: 4) calls *'radical relationality'* of both the social and the technical. They are not seen as fixed entities, but as flows or as circulating objects that are collected together to perform a network of relations. Instead of a purified world of categories relationality emphasises the connections, interdependence, mutuality and flux (Latour, 1999a; Latour, 1999b; Callon, 2002; Law, 1999; Law & Mol, 2000; Law & Urry, 2002). Law (1999: 4) notes that:

> *'…actor-network theory may be understood as a semiotics of materiality. It takes the semiotic insight, that of the relationality of entities, the notion that they are produced in relations, and applies this ruthlessly to all materials-and not simply to those that are linguistic'.*

ANT argues that any entity, or actor, is not fixed and does not have significance or attributes in and of itself, the attributes of any particular element in the network are entirely defined in relation with other actors (Law, 2000). It achieves significance through relation with other entities (Arnold, 2003; Callon, 1986a; Doolin & Lowe, 2002; Williams-Jones & Graham, 2003; Latour, 1999a). No entity can be seen in isolation (Briers & Chua, 2001) as it affects and is affected by other entities (actors). For example, the actor's size, its psychological make-up, and the motivations behind any of its actions, none of these are predetermined; they are redefined as a result of the interaction with other actors in their networks (Callon, 1999: 181). This means that every actor is performed in, by, and through its relation to other actors. That is why actor network theory is also known in the literature as the 'performativity approach' (Latour, 1999b; Law, 1999).

Callon (1999) used the relationality notion to offer an understanding of an economic market. The market is regarded as a considerable challenge for ANT and the relationality idea as it introduces a clear separation between what is circulated in it (goods which are passive and classified as non-human) and human agents (like producers, distributors, and consumers) who are active and able to make complicated decisions. Moreover, the agents involved in the market have the ability to calculate, know and pursue their own interest and take decisions, and that is why Callon called them *"calculative agents"* (Callon, 1999:184). However, Callon indicated that in order for these calculative agents to write and conclude calculated contracts and to be able to take decisions they must also have "*information on all the possible states of the world, on the nature of the actions which can be undertaken and on the consequences of these different actions, once they have been undertaken"* (Callon,

1999: 184). In other words, if agents can calculate their decisions, it is because they are entangled in a web of relations and connections with other agents, or other actors.

Callon (1999) used the Garcia study on the transformation of the table strawberry market in the Sologne region in France to discuss the constitution of the strawberry market (a calculative agent). He indicated that the construction of the strawberry market is not only a relation between buyers and sellers around a product (strawberry), but it can be seen as a result of the interaction between different human and non-human actors: "*the technique of degressive bidding, the display of transactions on the electronic board, the relative qualification of batches of strawberries on their data slips, and knowledge of the national market all made the transactions calculable"* (Callon, 1999: 191). Moreover, the counsellor of the Regional Chamber of Agriculture played an important role in the construction of the market and his action towards the market was inspired by his personal skills and the training in economics he received at university. The, direct and indirect, interaction between all of these actors shapes how all sorts of actors are associated and drawn together to produce the final shape of the network.

Miller (1998) gave another example of using the relationality concept to understand accounting practices which were formed and re-formed through *"specific ensemble of relations formed between a complex of actors and agencies, arguments and ideals, calculative devices and mechanisms"* (Miller, 1998: 189). He indicated that accounting practices are not the preserve of the accountants only, or any other single group. Instead, the transformation of accounting as a body of expertise takes place within and through ensembles of relations between different groups, or different actors.

To understand this idea, Miller (1998) explained that in some cases, changes that may take place in other disciplines, like economics, business strategy, engineering and marketing, may show deficiency of the existing practices of accounting; which means that accounting is lacking in specific respects and it needs to be supplemented or modified in particular areas, or that it needs something wholly new. Discovering any problem in the existing practices of accounting and taking steps to modify these practices can be done by regulatory bodies, government agencies, and other related actors. It is important to indicate that the approach Miller adopted to look for the formation and re-formation of the accounting practices can be adopted in any other discipline.

Law (2000) indicated that the analyst's job (or the researcher's role) is to explore how relations between actors in the network are brought together into being. Since '*agency is a product or an effect. Thus, since agents are not given by nature, we should be investigating how they got to be the way they are'* (Law, 1994: 11). In other words, my role, as a researcher, is to explore how the enrolled actors in the network of auditing in electronic environments are related to each other, and how they identified their roles and attributes according to their relations. Relations between the actors who are enrolled in the network of auditing in electronic environment will be discussed in Chapter 8.

As the attributes and the significance of each actor are entirely defined in relation to other actors, so there should be a link that can connect the different actors in the network. Callon (1991: 140) stated that "*actors define one another by means of the intermediaries which they put into circulation".* This means that the *intermediaries* act to bind the actors together and cement the links between them. Because of the

importance of the intermediary notion in this research, it will be discussed in more details in the following section.

3.8. Intermediaries

Callon (1991: 134) defines an intermediary as *'anything passing between actors which defines the relationship between them.'* For simplification, Callon (1991: 135) identified four main types of intermediaries. The first intermediary is texts which include books, reports, articles or notes. The second intermediary is the technical artefacts which include scientific instruments, machines, robots and consumer goods. This intermediary (in the form of machine or any technology) can be seen as structured groups of non-human entities which together perform certain tasks. The third one is human beings which includes skills and knowledge and the know-how that they incorporate. This intermediary identifies the different relationships between human beings that are derived from position, job, responsibility, and peer evaluation (Comber et al., 2003). This includes the control and power relationships that shape the actors interactions and the key individuals in any network. Finally, there is money in all its different forms and how it is translated into actions.

It is important to indicate that texts, or as Latour (1986) called them literacy inscriptions, have a specific power as it enables action at a distance. Latour (1987) indicated that inscriptions enable action at a distance as they help others to take decisions and to take different actions depending upon these inscriptions although they are far from the place related to this action. There are three major qualities that allow inscriptions to assist action at a distance: mobility, stability and combinability Latour (1987: 219-232).

For mobility, inscriptions are required to be able to move from the setting to the actor and back. **Stability** means that inscriptions must be recognisable to their users,

also it implies the stability of relation between inscriptions and the context to which it refers. **Combinability,** allows actors to accumulate inscriptions, aggregate them, tabulate them, recombine them in order to establish new useful relationships.

To understand how inscriptions enable action at a distance, Lowe (2001a) indicated that accounting information can be seen as inscriptions as it can represent and translate aspects of the organisation's environment into financial numbers which provide the key to the widespread use of accounting information. Moreover, different decision makers can take their decision, regarding a special organisation, depending upon the accounting numbers (or financial statements) although they may be far away from this organisation.

Callon (1991) argued that the different intermediaries are the language of the network. They provide the missing link which connects actors into a network and at the same time defines the network itself. Actors form networks by circulating intermediaries among themselves, thus defining the respective position of the actors within the networks and in doing so constituting the actors and the networks themselves. "*Intermediaries thus both order and form the medium of the network they describes"* (Callon, 1991: 135).

To understand this idea, Callon (1991: 135) discusses how a text can order and form a network. He indicated that scientific texts can be seen as an object which makes connections with other texts and literacy inscriptions. The choice of the journal that the text will be published in, the language used to write it, and its title are the methods by which any article seeks to define and build an interested reader. The list of authors can be seen as the beginning of the network; however this network extends to references and citations. The rework of the cited texts inserts them into new relationships, identifies and links new actors together. The words, ideas and phrases

that organise them describe a whole collection of human and non-human actors, some of them may be well established and others could be novel. However, taken together they "*define, explore, stabilise, and test their identities against one another"* (Callon, 1991: 135). This means that the text (as an intermediary) linked the references (as actors) together and at the same time of doing this the network was performed.

In spite of Callon's (1991) identification for the four types of intermediaries, he stated that this pure classification is difficult in reality by indicating that *'impurity is the rule'* (Callon, 1991: 139). He explained that each intermediary is a network by itself, the same as the actors, which include hybrid social and technical intermediaries. Callon (1991: 137) gave an example to show how the technical artefact intermediary is a network which is constituted of hybrid entities by stating that:

> "*When designing any technical object many questions arise, what will it look like? What will it do? What will it be used for? What skills will its users need? What maintenance will it require? ... Answers to these questions- questions about design- are both technical and social".*

Moreover, Callon (1991) added that in some cases it can be difficult to separate actors from intermediaries as intermediaries can act. Callon (1991: 140) states that *'... a scientific text seeks to create a reader with the skills needed to mobilise, consolidate, or transform the network described in the paper. Thus it acts: it is an actor.'* In other words, intermediaries can be seen as actors if they are able to associate other intermediaries (i.e. texts, human beings, technical artefacts and money) into circulation.

Callon (1991: 141) summed up this point by stating that "*an actor is an intermediary that puts other intermediaries into circulation"*. He indicated that the division between the actors and the intermediaries is purely a practical matter that can be

identified while conducting any study and the researcher has to see who acts and who links the actors.

3.9. ANT Criticism

Although actor-network theory has been adopted by many scholars in different disciplines, there are some concerns regarding its application. These concerns include: the symmetrical assumption; the inclusion/exclusion debate; and the micro/macro issue.

3.9.1. The Symmetrical Assumption

Dealing with both the social and the technical actors without differentiating between them or between their importance has been criticised by some researchers (Amesterdamska, 1990; Collins and Yearley, 1992; Whitlle & Spicer, 2008). Whittle & Spicer (2008: 620) indicated that this symmetrical assumption degrades one of the main characteristics of human beings which is their capacity for particular types of meaningful, purposeful, self-aware and non-repetitive action. Moreover, Amesterdamska (1990) questioned the benefits of denying the traditional differences between humans and non-humans, and treating both people and things as important actors. She argued that the reasons, the methods and the results of enrolling humans are different from the reasons, methods and results of enrolling non-humans and the elimination of difference among them leads to confusion. Moreover, Amesterdamska (1990) criticised the adoption of the symmetrical treatment for all the actors by indicating that it will not help to know how any one of them contributed to the success or failure of the network. She emphasised her argument by stating that:

> *"In what way is enrolling the microbe the same as enrolling a group of interested farmers or enrolling someone to finance a given project equivalent to the enrolment of a group of colleagues? Does each actant contribute to success or failure in the same way? Do scientists enrol electrons for the same reasons they enrol industrialists?...Does enrolment mean the same thing in all these cases?"* (Amsterdamska, 1990: 501)

For Collins & Yearely (1992), the major problem with ANT studies is the way in which humans (frequently in the form of researchers) have to represent non-humans as the analysis of any study appears to rely heavily on the human subject being centred, with little room for non-humans. They questioned whether, in practice, researchers can treat both human and non-human actors in the same way; They indicated that while the scallops in Callon's (1986b) study of St Brieuc Bay are to be treated as actors, the creation of symmetry between the fisherman and the scallops still appear to be in the hands of the analyst by stating that:

> *"The analysts remain in control the whole time, which makes their imposition of symmetry on the world seem something of a conceit. Would not complete symmetry require an account from the point of view of the scallops? Would it be sensible to think of scallops enrolling the scallop researchers so as to give themselves a better home and to protect their species from the ravages of the fishermen?"* (Collins & Yearley, 1992: 313).

On the other hand, while Callon & Latour (1992: 359) emphasised the importance of the symmetrical treatment of humans and non-humans, they also stated that *"it is not our intention to say that scallops have voting power and exercise it... but that a common vocabulary and a common ontology should be created".*

Thus, the proponents of ANT pointed out that the symmetrical assumption does not suggest that there are no fundamental differences between people and things. For example, Law (1992) indicated that symmetrical treatment *"does not mean that we have to treat the people in our lives as machines. We don't have to deny them the rights, duties, or responsibilities that we usually accord to people'* (Law, 1992: 386). However, when people and things interact together in a network we cannot differentiate between their importance, as the disappearance of one will affect the

network as a whole. This means that actor-network theory does not deny the difference between humans and non humans; rather it denies *a priori* status as there is no order of the importance of the things.

3.9.2. Inclusion/Exclusion Issues

One of the main concerns of ANT is that of the so-called inclusion/exclusion debate (McLean & Hassard, 2004) about the decision of who to include and who to exclude in ANT studies. Adopting Latour's (1987: 258) rule that: *"we have to be undecided as the various actors we follow as to what technoscience is made of...and make a list, no matter how long and heterogeneous of those who do the work"*, or looking from the Lee and Brown (1994: 778) point of view that *"ANT has broadened the franchise to grant the right of representation to anything-anything at all"*, this will lead to an important question about where to cut the network (Starthen. 1996: 523).

Miller (1997) indicated that following the actors, like Latour (1987) suggests, will result in a wide range of associations and actors without clear vision about choosing the actors. He expressed this point by stating that:

> *"Who decides who the actors are? It's fine to tell us that we should believe them when they speak to us, that we should refrain judging them, but we have to know who to speak to in the first instance, which meeting to attend, who to call on the telephone, who to email, and who to ask for an interview!"* (Miller, 1997: 363).

Even if the researcher focuses in the project itself, this remains problematic as it assumes that the boundaries of the project are given and knowable and the linkages are clear, however this clear vision is not always available (Miller, 1997). He indicated that the linkages usually do not end at a certain point, but just get flimsier and become more difficult to detect, even though their influence may become significant. Thus, for Miller (1997: 363) "*the trick is to select the paths you wish to*

follow, and those which you wish to ignore, and do so according to the assemblage you wish to chart".

McLean & Hassard (2004: 500) added that academic researchers cannot follow all the actors everywhere and they will have to engage in a process of ordering, sorting and selecting the actors they will follow, and as a result, they will need to mention the guidelines that specify which actors should be included and which actors should be excluded. In other words, the researcher needs to depend on his/her human skills and judgement to identify where to cut the network (Lowe, 2001a).

Choosing a starting point to follow a network can also be a problem when applying this approach (Collins & Yearley, 1992; Grint & Woolgar, 1997; Miller, 1997). Hull (1999: 414) questioned '*Why choose one object of study rather than another?; Why choose to start at one point and not another?; Why choose to follow some network-tracing activities and not others?'.* In other words, the boundaries of the network are not always clear.

However, Law (1991) noted that, in practice, researchers do not ignore any actor according to their subjectivity. He indicated that some links between some actors may become invisible; however those links are *"those that are of no concern to the actor who is being followed tend to melt from view"* (Law, 1991: 11). In other words, the researcher can cut the network at the point when the followed actors stop identifying any linkages with other new actors related to the research topic as *"We take on their categories. We see the world through their eyes. We take on the point of view of those whom we are studying"* (Law, 1991: 11).

Moreover, El-Sayed (2004: 35-36) argued that researchers are not totally free handed in deciding which actors should be taken into account and which actors should be

excluded, as researchers are restricted by the research objectives, the restrictions of time and cost and by the access issues also.

3.9.3. The Micro/Macro Issue

McLean & Hassard (2004) indicated that ANT was criticised as it addresses the local contingencies, but it pays little attention to the broader social structures that influence the local. In other words, *"...it concentrates on the micro at the exclusion of the macro"* (McLean & Hassard, 2004: 508). However, Latour (1991: 118) argued that the macro structure of society is made of the same stuff of the micro structure, and thus can be examined in the same way. Latour (1999b: 18) added that *"Big does not mean 'really' big or 'overall', or 'overarching', but connected, blind, local, mediated, related"*, and that the same innovation can lead us from a laboratory to a world and from a world to a laboratory (Latour, 1991), in other words, it can lead from the micro to the macro and vice versa. Latour (1993:117) gave an example of the railroad and ask:

> *"Is it local or global? The answer was neither, it is local at all points, since you always find sleepers and railroad workers and you have stations and automatic ticket machines scattered along the way. Yet it is global since, it takes you from Madrid to Berlin or from Brest to Vladivostok. The main point that there are continuous paths that lead from the local to the global, from the circumstantial to the universal"*

In other words, ANT does not avoid the shift from the micro to the macro; it mainly concentrates on following the actors wherever they may lead.

Although ANT has been criticised, such criticisms did not prohibit many scholars from different disciplines to adopt it, including accounting scholars.

3.10. Adopting ANT Perspective in Accounting Research

Different accounting scholars (e.g., Alcouffee et al., 2008; Briers & Chua, 2001; Chua, 1995; El-Sayed, 2004; Ezzamel, 1994; Gendron & Barrett, 2004; Lowe, 2001b; Miller, 1991; Preston et al., 1992; Robson, 1991; Robson, 1992; Robson, 1994) have adopted ideas from actor-network theory in a variety of areas. Some have been more concerned with the explanation of social systems within organisations (Ezzamel, 1994; Chua, 1995) while others have given attention to the explanation of systems of accounting at a broader historical and societal level (Robson, 1992; Robson, 1994). Some writers applied specific concepts of the theory in their research (e.g., inscriptions and action at distance), while others took the theory as a guide to shape their way of thinking to determine the actors who build the networks of the topic under research, which is the same technique that will be adopted in this research. Following is a review for the accounting studies that have adopted the ANT perspective. The aim of reviewing these studies is to gain more in-depth understanding of why and how the ANT can be applied in the accounting context.

Miller (1991)

In his paper Miller adopted two concepts from Actor-Network Theory namely, 'translation' and 'action at a distance' (Latour, 1987; Law, 1986). He explained that accounting innovation is not only a process that takes place inside the enterprise through the efforts of practitioners; it also can take place beyond the enterprise through the collection of different claims and processes, which is known as the 'translation process'. He explained his idea by following the actors who were the main reason for adopting discount cash flow (DCF) techniques for investment decisions by managers in the UK during the 1960s (as an accounting innovation) as the most known reliable technique for assessing investment decisions.

Although innovation in management accounting usually is from inside the firms as an attempt to solve actual problems that face the managers, the introduction of DCF techniques was different as it was developed by academic scholars in business schools in the UK starting from the 1930s gaining significance during the 1960s. These scholars were not the only actors who played an important role in promoting the use of this technique for investment decisions by managers; Miller indicated that there were various actors who played an important role in this promotion like professional magazines, experts in economics, and the media, as in 1965:

> ‘*an editorial advised that many accountants would probably learn something from a current television series entitled Fothergale Co. Ltd.– a programme which showed modern accounting and statistical techniques, such as DCF and network analysis, in action’* (Miller, 1991:743).

Moreover, governmental bodies exerted great effort to promote the use of DCF techniques for investment decisions in order to help the UK to achieve higher economic growth, which was a main concern in the 1960s. Investment decisions were given significance beyond their direct impact within firms as investment became a key factor in influencing economic growth. Moreover, great attention was paid to the quality of the investment as well as its amount. Linking investment decisions to economic growth caused the governmental bodies to try to intervene in the investment decisions of enterprises. However, in order to avoid direct intervention, they promoted the use of DCF techniques, as they were seen as the most accurate and objective means of evaluating and differentiating investment opportunities. In other words, the governmental bodies saw the DCF techniques as a method which could be used to find a connection between macro-economic objectives and the actual investment decisions of managers within firms. Firms should be persuaded to use DCF techniques for investment decisions as a result of their superiority to other techniques, the performance of the individual firms would be improved and, as a

result, economic growth would be stimulated without any direct intervention of the government.

Miller indicated that ‘translation’ is the term that can be given when different thoughts and actions of diverse actors and agencies come in a similar direction (the promotion of using DCF techniques for investment decisions), and when particular issues (the capital investment decision) were linked to much larger and more general issues (which is the economic growth).

Moreover, he indicated that the concept ‘action at a distance’ (Latour, 1987; Law, 1986) could be used to understand and express the indirect intervention of the government in individual investment decisions. Generally speaking, ‘action at a distance’ refers to the possibility of a particular point becoming a centre with the capacity to influence other points that are distant, yet without resorting to direct intervention. The government was able to intervene indirectly in the individual investment decisions, regardless of the geographic or administrative distance that separates governmental agencies and managers in enterprises as decision makers. The governmental agencies’ publications, as well as the issue of taxation and free depreciation, were used by the government as key mechanisms through which attempts were made to persuade managers of the relevance of using DCF techniques for making investment decisions. DCF techniques appeared to provide an ideal mechanism by which macroeconomic concerns could be addressed at the level of the firm, but in such a way as to avoid direct intervention within the private domain of managerial decisions.

In other words, the government acted at a distance on the investment decisions of the firm by recommending DCF techniques and gave facilities that would encourage the decision makers to use these techniques. It could indirectly seek to influence the

actual investment choices made within firms while keeping the privacy of the individual firms respected.

Robson (1991)

In his paper, Robson studied the relationship between accounting change and social context. In other words, he tried to discover the process of the accounting change relating to its environment in order to understand how the social passes through accounting. To achieve this, the researcher used one of the actor-network theory ideas: 'translation'. The paper suggested that the interpretation of the relationship between accounting and its social context can be understood as a process of 'translation'. The concept of translation has been suggested as a construct for understanding the specific associations, connections or relations that are made between accounting and its social context. The process of translation is discussed through a study of the birth of the standard setting programme in the UK.

Translation, as a general term, points toward the operation of language in creating equivalences between entities which are otherwise different. Through the operation of discussion, the concept of 'translation' refers to the way in which different claims, substances or processes are connected with one another to perform something which has meaning.

To introduce the connection between translation and accounting, Robson indicated that preparing financial statements is a method of translation; accounting takes into consideration countable financial activities. In order to represent uncountable items in the balance sheet, they should be translated into money or numbers. In other words, the balance sheet can be seen as the outcome of a process of translation of different, countable and non-countable, objects using different accounting techniques.

Robson (1991) identified that the alliance of heterogeneous actors, where different claims and processes are collected together, was the main focus encouraging the decision to form the Accounting Standards Steering Committee (ASSC) in the UK in order to form and codify the professional regulations of accounting practices. Failures that had taken place as a result of using some accounting techniques, like profit forecasts and discounted cash flow, the consequences of the rise of investment calculations, and the failure of accounting and auditing practices to meet the investment-decision roles of accounting statements, were translated into a problem of accounting regulations. The response to overcome this problem was the formation of the ASSC.

Robson explained that the main reason for using some specific accounting techniques was the political and economic circumstances that prevailed in the UK during the 1960s, as great alteration was made to economic growth. Mergers amongst important exporting companies were one of the important governmental policies that had been used to achieve this growth. Moreover, the emergence of investment decision making as a body of knowledge to help investors take informed decisions highlighted the importance of employing methods of investment calculation.

Robson's 'translation' of the circumstances that were surrounded by the formation of the ASSC indicates that the solution was loosely coupled to the circumstances which provided its conditions of possibility. In other words, the outcome, the formation of the ASSC, could not be expected from its specific origins (which were the economic and political circumstances in this case). A final outcome can be 'worlds apart' from its initial causes or origins.

Robson (1992 & 1994)

In his theoretical paper, Robson (1992) proposed that the study of accounting developments attends to the nature and role of inscriptions (Latour, 987). The term inscription refers to the material and graphical representations that constitute the accounting report: writing, numbers, lists, and tables. He indicated that the quantitative orientation of accounting can be understood in relation to the utilisation of inscriptions that assist in enabling action at a distance (Latour, 1987) rather than attributing any general epistemological privilege to quantification. Latour (1987) indicated that there are three important and interrelated features of the inscriptions that allow them to assist action at a distance: mobility, stability and combinability.

For mobility, inscriptions are required to be able to move from the setting to the actor and back. **Stability** means that inscriptions must be recognisable to their users, besides it implies the stability of relation between inscriptions and the context to which it refers. **Combinability,** allows actors to accumulate inscriptions, aggregate them, tabulate them, recombine them in order to establish new useful relationships. Robson argued that accounting numbers as inscription have these three features and as a result accounting numbers allow for action at a distance.

Robson (1994) used the same idea, of dealing with the accounting information as inscriptions that can act at a distance, to answer a question about why accounting for inflation was a problem in the 1970s by presenting the case of the Sandilands report in the UK. He analysed the shifts in method of accounting for inflation proposed by the Sandilands Committee (the Current Cost Accounting Method to value company assets) and related this to the concept of how government, through accounting techniques, can *act at a distance* (Latour, 1987) upon management, economic organisations and other institutions.

From his analysis, Robson (1994) concluded that by altering the representations that accounting reports offer and the adjustments that these alterations can make to certain calculations and decisions within the organisation, accounting can offer a means of exercising long-distance control upon the processes of many organisations to re-orient the activities of the managers and the employees, who adjust their operations according to the representations created by the accounting numbers and associated calculations.

Preston et al. (1992)

Preston et al. (1992) adopted the ANT perspective to study *"accounting in action"* (Preston et al., 1992: 561). They used ANT ideas to explain the process which accompany the implementation of budgeting systems in National Health Services (NHS) hospitals, within a particular organisational setting: Osgood District, in the UK. They used qualitative data based on interviews and observations plus six specific public documents.

In this study, they not only focused on the production of specific accounting and budgeting packages, but also concentrated on the process by which people attempt to entangle accounting innovations within the functioning of organisations. They indicated that it is not acceptable to assume that assembling the components of a system will produce the desired outcome as the design of the system only represents part of the process. The process also includes individuals' interpretations of, and their responses to, the implemented system.

In other words, they argued that accounting systems are not fixed technologies which are designed, with well-defined purposes reflecting the patterns of responsibility, and then implemented. Budgeting systems emerge through a process of '*fabrication'* (Latour, 1987). After Latour (1987), they indicated that in order to understand the

nature of a technology (i.e. budgeting system), the processes of its fabrication should be examined.

The researchers indicated that the debates about conditions facing the NHS, about levels of funding, modes of management, responsibilities of doctors and administrators, during the period of the study can be regarded as part of the process of fabricating the budgeting system. The fabrication process was supported by other actions like conducting four pilot studies in selected sites in the NHS to develop management budget and the release of supported reports (i.e. Griffiths report). They added that, resistance and scepticism of the users from the beginning of creating the system were also regarded as central elements in the fabrication process as resistance is not just a negative force, but it offers the proponents of the initiative opportunities for redefinition and new fabrications. Moreover, machination, texts, and appeals to other legitimate activities (e.g. science and experimentation, managerial practices in the private sector of the economy) are also significant elements of the fabrication process.

In other words, they explained that the construction of technologies (budgeting system) is a collective process which involves not only the designers, but also the potential users of this technology as the fate of this technology depends on others' behaviour (Latour, 1987).

Chua (1995)

Being an ethnographer, Chua aimed to understand how and why new accounting systems are under experiment in three Australian hospitals. She argued that accounting changes emerged not because there was certain knowledge of positive economic outcomes, but because uncertain faith, fostered by expert-generated

inscriptions and rhetorical strategies was able to tie together shifting interests in an actor network.

She was looking at the *"doing of accounting"* process (Chua, 1995: 113) by getting involved in the making up of accounting numbers in organisational settings. She stated that preparers of accounts had not been followed in action, and she tried to contribute to this area by focusing on the role of the experts, actor networks, computerised software, and visual inscriptions in the accounting fabrication. Moreover, she tried to investigate the diverse relations that empower accounting numbers and give them authority: how does accounting persuade?

Chua mentioned three reasons for adopting ANT *"to write a piece of critical ethnography about the fabrication of accounting knowledge"* (Chua, 1995: 115). The first reason is that the making up of new accounting numbers and struggling to keep their legitimacy can be seen as important as a scientific controversy because applying the new accounting techniques can change the map of organisational reality and challenge the traditions of the existing work. The second reason is that ANT does not begin with the positivistic assumption that a particular science or technology has been accepted because it is more rational, accurate and represents reality, but ANT tries to answer how, why and who are the actors that lie behind the acceptance of this technology. Similarly, in her research she tried to identify who are the main actors that are enrolled in the process of fabricating accounting images and how they participate. The last reason is that ANT pays attention to the power of the non-human resources like visual inscriptions, academic texts and all forms of paperwork (e.g., formulae, charts, and graphs). Such inscriptions *"possess many rhetorical advantages: they are mobile, immutable, recombinable, and are perceived to be built on many facts"* (Chua, 1995: 116). Moreover, inscriptions permit *"action at a*

distance" (Latour, 1987) which enables people far away from the scene of activity to have a window on those activities and intervene in the name of better management.

In her study, Chua showed the constitutive capability of accounting systems (DRGs) to reconfigure resource use and relationships in the hospitals studied and that accounting numbers became facts, not because of their representational reliability, but because of their ability to connect diverse interests in the health care sector (Federal Government, State Government, Hospital Administration, Clinicians and Academicians) about resource management.

Briers & Chua (2001)

Briers & Chua (2001) conducted research to understand how accounting change occurs and to identify the preconditions and processes of this change. They conducted a field study in an Australian organisation that had implemented an Activity-Based Costing system (ABC). In their paper, they investigated the impact of both extra organisational and organisational factors on accounting change and gave great attention to the interaction between both local and global aspects that caused this implementation. To achieve this objective they adopted ANT in order to follow networks of actors who affected the implementation of the ABC system.

The researchers discovered heterogeneous actors who had affected this implementation. The starting point, to follow these actors, was a problem in one of the machines the company used. This problem led the organisation's management to discover points of weakness in their applied product cost system. Moreover, the management discovered that their organisation faced increased competition from both local and overseas competitors and they needed to take a new step to be more competitive.

Trying to find out what was new in cost systems, the accounting general manager and other representatives from the organisation attended a seminar which was co-sponsored by a large accounting firm and a major university; the participants included both accounting practitioners and academics. An American academic presenter introduced innovative approaches to the design of strategic cost management systems that had helped some US firms in gaining strategic advantage in a competitive global economy. ABC was one of these systems.

For the accounting general manager of the organisation, this seminar represented a heterogeneous mix of human and non-human, local and global elements as the seminar

> '*included influential American academics and consultants, the technologies they spoke about, the local university and the accounting profession (as joint sponsor of the seminar), the organisation's new competitive and operating environment, the perceived inadequacies of the existing cost system and the undeniable logic of the ABC alternative.'* (Briers & Chua, 2001: 250).

After being convinced of the importance of implementing ABC, the accounting general manger tried to persuade his peers and subordinates of the need to develop an ABC system. He read books about management accounting, attended workshops and sent some of his accountants to attend relevant seminars. Moreover he conducted training sessions to update his staff in various aspects relating to the organisation's business operation. It was important to persuade the staff of the importance of implementing the ABC system because, as Latour (1987) indicated, the success or failure of a machine or technology lies in the hands of those who come after the inventor, which means that it lies in the hands of those who use it. The management also depended on external consultants to help in implementing the ABC system. When they needed a piece of customised ABC software that would help to

successfully implement the ABC system, it was easy and cheap to transfer it from the United States to an Australian context.

To sum up, implementing the ABC system in this organisation was a result of heterogeneous local and global, human and non-human actors; it was the interaction between the weakness of the previous cost system, the support of the top management, the innovation of the American ABC system, the contribution of the academic institutions and the practitioners in conducting seminars to introduce advanced American systems in Australia, the training sessions for the accountants in the organisation, the experts who helped in implementing the ABC system, and the software itself. All the actors played an important role in successfully implementing the ABC system in the organisation.

Lowe (2001b)

Lowe represented a story of the use of Diagnosis Related Group (DRG) coding technology as a part of a casemix accounting system from an ANT perspective. He argued that medical coding and the DRG methodology are black boxes that should be opened to understand their importance in the process of change in the research setting which is a large hospital in New Zealand. From an ANT perspective, the concern of this research is to examine how technologies are fabricated, or in other words, it seeks to address the making-up of accounting numbers and the role of accounting systems in mediating the social networks in modern organisations.

El-Sayed (2004)

The researcher used Actor-Network Theory to form the backbone of her research which aimed at understanding the effect of applying enterprise resource planning (ERP) systems (as one of the advanced electronic systems) to Egyptian accountants' expertise and practices. The researcher argued that the impact of advanced

information and communication technologies, particularly ERP, on accountants' expertise and practices was performed through chains of associations or networks where various entities were drawn and linked together and if one or more of the entities broke away or failed to cooperate, the whole would come under threat or even fall apart.

The researcher tried to follow the main actors who have an impact on the practices and expertise of Egyptian accountants who are dealing with enterprise resource planning systems and understand the relation between them. This relation was discussed as a series of associations among various agents to whom enterprise resource planning systems act as a common point of interest. The main actors identified were the Egyptian government, Oracle Egypt as the main vendor of ERP systems in Egypt, two businessmen who are the owners of two big manufacturing companies in Egypt and the accountants in these two companies.

The Egyptian government attempted to redefine its role in the provision of services and restructure its legislation to meet international trade frameworks such as, The World Trade Organisation (WTO) and help in attracting foreign capital and technological expertise like Oracle which was the main ERP vendor in the two companies studied. The researcher explained how Oracle tried to adapt to the local market conditions in Egypt by taking into consideration some aspects related to the Egyptian environment, like the need to address the cost of Internet access, the absence of qualified staff able to apply their systems, and the methods that would be adopted to secure the property rights of software producers to reduce the likelihood of fraud (El-Sayed, 2004: 77).

Moreover, the researcher shed light on how Egyptian businessmen became interested in ERP systems as a method to modernise their companies through bringing best

practices embedded in ERP systems into their companies as well as aligning themselves with the Egyptian government initiatives for developing information and communication technology. To enable them to operate and deal with ERP systems, some changes were found to have taken place in the market demands of the accountants' skills and qualifications, and the accountants had redefined their expertise through their usage of the systems. To sum up, the researcher explained that change expertise of Egyptian accountants was not a simple process resulting from applying new technology; technology was just one actor in a network that included heterogeneous actors.

Gendron & Barrett (2004)

Like "Science in Action" (Latour, 1987), Gendron & Barrett (2004: 563) tried to spot the light on *"Professionalization in Action"* through examining the attempts of the North American accounting institutions (CICA & AICPA) to develop a new market in e-commerce assurance based on their claims to professional expertise through the WebTrust project.

In an in-depth longitudinal field study, they adopted ANT to capture the dynamic nature of constructing a market for the WebTrust service. They used ANT as it provides a set of concepts that can be used to better understand how networks of support develop (or do not develop) around claims to expertise. They indicated that one of the key advantages of ANT lies in its emphasis on the construction of networks of support that account for the spread in time and space of knowledge claims.

Gendron & Barrett argued that the development of markets for professional services depends on the successful construction of stable and solid networks of support around claims to expertise. They indicated that WebTrust was originally developed

and promoted as a seal of business-to-consumer (B2C) assurance, however, the initial network of support for this project was fragile, and the WebTrust of B2C largely failed to generate support in the market place. When proponents of WebTrust of B2C found that the actual performance is much different from what was initially expected, and that the targeted audiences (e.g. managers of the online organisations, and the online consumers) did not show their interest in the project, they attempted to develop WebTrust in a more viable concept by modifying its essential features, the promotional strategies, and by redefining its target market; they reshaped the WebTrust concept and learned to translate it in ways that aroused the interest of corporate managers to be around the B2B. In other words, they followed the ANT suggestion that the form and substance of knowledge claims continuously change as proponents reflect on the outcomes of their prior efforts to develop a suitable fit between their claim and the interests of the targeted audience.

The study implies that professionalisation should be recognised as a translation process (Latour, 1987) by which claims to expertise are transformed and adapted in trying to enrol audiences and construct extended and durable networks of support. Because of the translation process, the outcome achieved, which is establishing a network of support for the WebTrust as a B2B seal of assurance, is far from the vision that motivated the institutes into undertaking the project in the first place, which was establishing a network of support for WebTrust as B2C seal of assurance.

Alcouffe et al. (2008)

In their paper, Alcouffe et al. presented two stories of failure and success of two management accounting innovations, GPM and ABC in France, using ANT concepts. They used secondary data and in-depth interviews as data collection methods. They indicated that GPM failed not because of the unsuitability of the invention, but

because the inventor, Georges Perrin, did not pay enough attention to interest the suitable actors who could have been powerful allies in supporting his invention. Moreover, Perrin wished to protect his method and that is why he did not diffuse the technical aspects of his method and he refused to perform any transformation to the method. As a result there was no chance for any adaptation and translation for his method and this caused its limited success in France.

On the other hand, the ABC method found its way as there were heterogeneous actors who contributed, directly or indirectly, to build a strong network that supports the method including academic professors, books, conferences, published articles, the publishers of ABC software in Paris. All the actors in the network had their own interests that pushed them to support the method. As the ABC network includes strong allies, it was able to face the competition coming from other methods, or other networks. Moreover, when there was a debate about the method, actors in the ABC network considered all the others' points of view and used the debates they faced to translate this innovation into something acceptable to its opponents.

They found that the fate of an innovation depends upon unpredictable interactions between actors who participate in the networks.

Reviewing the previous studies show that there is a trend to move from applying specific ideas of ANT when conducting the research (e.g. Miller, 1991; Robson, 1991; Robson, 1994) towards adopting it as a way of thinking to understand how networks, related to the topic of research, are built (e.g. Briers & Chua, 2001; El-Sayed, 2004; Gendron & Barrett, 2004; Alcouffee et al., 2008). Table 2.1 summarises the accounting and auditing studies that have adopted ANT

Author & year	Country	Main objective	Research methods	Historical/ current research	Unit of analysis	Area of interest
Miller (1991)	UK	To show how concerns about investment decisions within firms came to be posed in terms of a general problematisation of economic growth.	Not mentioned	Historical	Holistic perspective	Management accounting
Robson (1991)	UK	To study the relationship between accounting change and social context	Not mentioned	Historical	The Accounting Standard Steering Committee (ASSC)	Financial accounting
Robson (1992)		The focus of the paper is to propose that the study of accounting developments attends to the role and nature of inscriptions	Not applicable	Theoretical	Not applicable	Not applicable
Preston et al. (1992)	UK	To explain how accounting and budget systems are produced (defined, redefined, developed & implemented) in an organizational context	Not mentioned	Historical	Hospitals of NHS	Accounting & budgeting systems
Ezzamel (1994)	UK	To examine the extent to which the budgeting system is implicated in a process of organisational change	Longitudinal case study	Current	University	Budgeting systems
Robson (1994)	UK	To explain why inflation accounting was a problem in the 1970s in the UK, and how government can act at a distance upon management, economic organisations and other institutions to solve the problem.	Not mentioned	Historical	Sandilands Committee	Accounting for inflation
Chua (1995)	Australia	Seeks to understand how and why new accounting systems are experimented within organisations	Ethnography	Current	Hospitals	Accounting information systems
Briers & Chua (2001)	Australia	To illustrate how an organisation's accounting system can be changed by a heterogeneous actor-network of local and global actors and actants.	Case study	Current	Company-Alroll	Management accounting

Lowe (2001b)	New Zealand	To examine how technologies are fabricated	Qualitative case study, using unstructured interviews and documentary analysis	Current	Hospital	Accounting information systems
El-Sayed (2004)	Egypt	To understand the effect of applying ERP systems on Egyptian accountants' expertise and practices.	Longitudinal case study using semi-structured interviews and documentary data analysis	Current	Two Egyptian companies	Accountants' expertise when dealing with ERP systems.
Gendron & Barrett (2004)	Canada	To understand the process of professionalisation by which accountants sought to develop a new market for their expertise by means of web trust.	Longitudinal field study using semi-structured interviews and documentary data analysis	Current	North American accounting institutes	Web trust assurance services
Alcouffe et al. (2008)	France	To understand the nature of accounting change.	Interviewing & used secondary data	Historical	Two innovations : GPM & ABC	Management accounting

Table 3.1: Summary of Accounting and Auditing Studies Adopted ANT

3.11. Why Adopt the ANT Perspective in This Research?

One of the main features of ANT is that it is *"ontologically relativist"* (Lee & Hassard, 1999: 393) in that it allows the world to be organised differentially. Because of its ontological relativism, ANT does not produce its own decision about what phenomena are to be studied or create its own discriminations and boundaries; *"ANT removes from itself any terms and conditions that might serve to exclude others"* (Lee & Hassard, 1999: 392). In other words, ANT allows researchers to see the world in different ways or from different perspectives as they embark on the research without a clear picture of what sort of actors they will discover during their research; they have to follow the actors that constitute the network under analysis. This

different perspective is adopted in this research; I followed the actors to build the network of auditing in an electronic environment from a different holistic perspective. This research argues that auditing in an electronic environment is not only the process of auditing the outcomes (financial statements) of a technical system using technological methods. It can be seen as a network that is constituted from hybrid human and non-human actors, inside and outside the audit firm, who interact together through different intermediaries and have an impact on the audit process. In other words, this research argues that auditing in an electronic environment is not just a technical process; it is a combination of many socio-technical aspects that come from the interaction between different actors. It is seen as an association between the external auditor who has the responsibility to sign the external audit report; the information system auditors who are responsible for auditing the electronic systems and evaluating their automated controls; the automated tools used by the auditors to deal with electronic systems; the management of the auditor's client as they are responsible for the quality of internal controls; the educational institutions as they provide financial auditors and information system auditors who can deal with the electronic environment, especially if it is a complicated environment; the standards, laws and regulations that auditors have to apply; the vendors of the electronic systems as they could be indicators about the quality of the system; and any other human or non-human actor that can affect the audit process when auditing in an electronic environment. In other words, the network of auditing in an electronic environment is constituted from heterogeneous human and non-human actors where every actor has an important role to play.

'Radical relationality' (Law, 2000: 4) which is assumed by the ANT was an important concept that helped to understand how actors in the network identify their

roles and gain their significance and attributes and why these actors are enrolled in the network. Every actor in the network cannot be seen in isolation as it affects and is affected by the other actors who are enrolled in the network of auditing in the electronic environment. For example, the skills of the financial auditors in dealing with electronic systems cannot be seen in isolation of the audit standards that determine the required skills for the auditors; cannot be seen in isolation of the degree of complexity of the electronic system they will deal with; and cannot be seen without considering whether an information system auditor is involved in the audit process. All the human and non-human actors are mutually constituted in relation to each other to become, as Latour (1999a: 180) mentioned, *'someone something else'.*

ANT focuses on understanding how reality becomes reality through opening the *'black boxes'* and understanding the relations inside these boxes (Callon, 1986a; Callon, 1986b; Callon, 1999; Latour, 1987; Latour, 1999a; Latour, 1999b; Law1992; Law, 1999). Opening the black box of the audit firms when auditing in an electronic environment and understanding the relations inside it is one of the aims of this research. Latour (1987: 258) contends that we cannot take any reality as a given but we have to understand how this reality has been built. He indicated that:

> *'we study science in action and not ready made science or technology; to do so, we either arrive before the facts and machines are black boxed or we follow the controversies that reopen them'.*

However, as dealing with electronic systems became a fact, I will open the black box of the audit firms when auditing in an electronic environment and follow the actors that build the network of auditing in electronic environment.

It is important to indicate that starting to follow the actors by opening the black box of the audit firms does not mean that the other actors outside the audit firms (e.g. auditing standards, educational system, vendors of the electronic system, etc.) do not

have an important role in the network. However, following the actors by starting from the audit firms has two reasons; using electronic systems became a fact, and electronic information generated from these systems is more timely, flexible, accessible, transferable, transparent, and can be retrieved, summarised and organised more easily than paper-based information (Rezaee, 2002). However, from ANT perspective, the ability of these systems to achieve what it is designed for depends upon the users' perspectives towards it. In other words, the success or failure of any electronic system does not depend only on the good invention of the system but, as Latour (1987: 143) indicated *'the fate of technology lies in the hand of those who come after the inventor'*. Auditors are essential groups of those who deal with these electronic systems and their outputs.

The second reason is that the external auditor can be seen as the spokesperson (Latour, 1987), or the representative, of the other actors in the network. Latour (1987) indicates that non-human actors cannot speak because of their lack of both voice and intentionality so they must have representatives. Although human actors have the ability to speak to express their points of view, they are prevented from speaking for other causes, they may not have the right to speak, or they cannot all speak at once. The external auditor can be seen as the spokesperson of the network as he is the only one who has the responsibility to sign the external audit report which is the end product of the audit examination and the one who has the legal responsibility for the audit process. In other words, auditors can speak through the audit report which includes their opinion about the financial statements which are the final outcomes of the electronic systems.

To sum up, Lee & Hassard (1999) indicated that the main focus of ANT is the process of constructing and maintaining the networks as it asks how and for what

purposes heterogeneous entities are brought together (Lee & Hassard, 1999). Similarly, the main focus of this research is to understand the process of building the network of auditing in an electronic environment. It aims to identify who are the actors, whether human or non-human, that can have an effect on the audit of electronic systems, why these actors are enrolled in the network, what intermediaries pass between them to connect them together, and how they interact with each other to form the final shape of the network.

3.12. Summary

This chapter shed light on the ANT perspective as it will be the theoretical perspective of this study. It started by introducing the conventional approach of dealing with the social and the technical, then it showed how ANT introduced another way of thinking about social and technical relationships. The chapter introduced the main ideas of ANT that will be adopted in this research; it explained how the actors are mutually constituted in relation to each other, and how they gain their significance and attributes through their interaction with each other using different kinds of intermediaries. The source of the actors' power has been explained and the rationale behind dealing with actors as black boxes has been discussed. The chapter presented the main debates around ANT which are the symmetrical assumption, the inclusion/exclusion issue, and the micro/macro issue, after which the accounting and auditing studies that have adopted the ANT perspective were reviewed. Finally, the rationale behind adopting the ANT perspective in this research study has been explained.

4. Chapter Four: Research Methodology

4.1. Introduction

The purpose of this chapter is to present and justify the research methodology adopted to carry out this study. Methodology *"refers to the procedural framework within which the research is conducted"* (Remenyi et al., 1998: 30). This chapter aims to answer the major philosophical questions in research suggested by Remenyi et al. (1998) why research, what to research and how to conduct research.

The chapter outlines the main dimensions of the research process including the philosophical assumptions underpinning the research, the research strategies, the research approaches, and justifications for the choices made. Subsequently, the research designs are discussed with a detailed discussion about the case study design which covers the debate of sampling techniques and the selection of multiple cases. Following, the chapter discusses the data collection process, emphasising two main data collection methods in qualitative inquiry and the case study approach, namely, interviews and documentary data. Finally, the criteria of evaluating the quality of qualitative research are debated. Figure 4.1 presents the main dimensions of the research process.

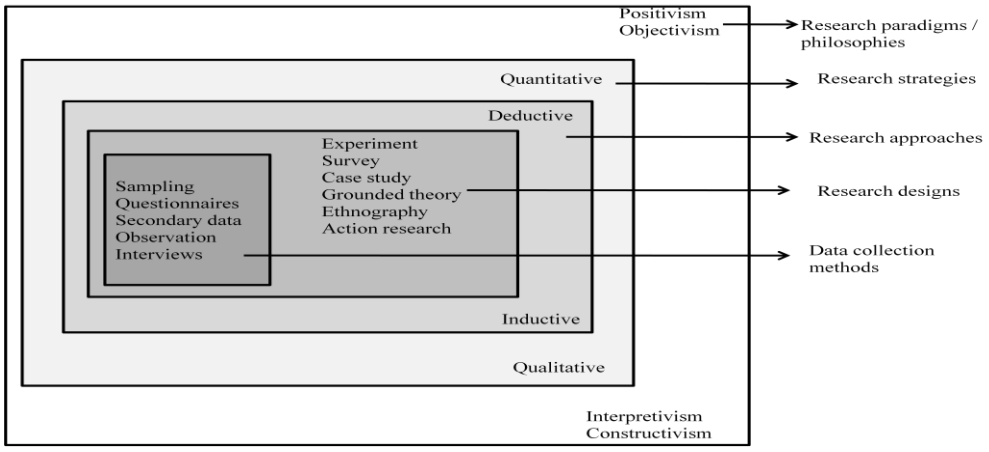

Figure 4.1: Dimensions of the Research Process

Adapted from: Bryman & Bell (2007); Collis & Hussey (2003); Denzin & Lincoln (2000); Patton (2002); Saunders et al. (2007)

4.2. The Research Paradigm

Research paradigm is a whole system of thinking (Neuman, 2006: 81). It is a set of beliefs, propositions or a worldview that defines the nature of the world (Guba & Lincoln, 1994: 107), and explores what constitutes proper techniques for inquiring into that world (Punch, 2005: 35). It refers to the progress of scientific practice based on people's philosophies and assumptions about the world and the nature of knowledge in this context, about how research should be conducted (Collis & Hussey, 2003: 46). In other words, paradigm *"refers to a set of very general philosophical assumptions about the nature of the world (ontology) and how we can understand it (epistemology)"* (Maxwell, 2005:37). Hence, research paradigm is comprised by the epistemology and ontology which explain how the researcher sees the subject of the study and how s/he intends to study it. The philosophical assumptions underpinning any research should be *"clearly spelt out"* (Remenyi et al., 1998: 30) to prove that *"the approach to the research has been sound"* (Remenyi et al., 1998: 27). In other words, the research paradigm shapes the entire research process and identifies its direction.

4.2.1. Epistemological Considerations

Epistemology is the branch of philosophy which addresses the nature of knowledge and how it is created. It is concerned about knowing the relationship between the inquirer and the known (Denzin & Lincoln, 2000: 9). In other words, epistemological considerations are concerned with the question *"how do we know what we know?"* (Crotty, 1998: 8). Research epistemology can be classified within a continuum of beliefs which goes from positivism on one extreme to interpretivism on the other.

Positivism

The roots of the positivistic epistemological position lie in the natural science. Positivists believe that reality is real, it exists *'out there'* and is waiting to be discovered (Neuman, 2006: 82). This reality can be discovered through experimental reasoning or scientific observation and tested in terms of its cause-effect relationship among identified variables (Creswell, 2003; Collis & Hussey, 2003; Saunders et al., 2007). According to the positivistic paradigm the research is undertaken, as far as possible, in a value-free way (Saunders et al., 2007); researchers who follow this paradigm try to keep an independent and objective attitude, as they believe that their interaction with the research problem will not affect the parties connected with it. Moreover, keeping distance between the researcher and the research issue would allow an objective evaluation of the research problem (Creswell, 1994). In other words, the assumption is that *"the researcher is independent of and neither affects nor is affected by the subject of the research"* (Remenyi et al., 1998: 33). In short, positivistic researchers focus their efforts on testing hypotheses deduced from certain theories, or developing new hypotheses based on relationships discovered through the analysis of data. Such theories tend to be aggregated, not specific to the cases.

Interpretivism

Interpretivism is taken to denote an alternative to the positivist epistemology. It is predicated upon the view that a strategy is required that respects the difference between people and the objects of the natural sciences and therefore requires the social scientist to grasp the subjective meaning of social action (Bryman & Bell, 2007: 19). Its emphasis is to understand the social world through an examination of the interpretation of that world by its participants (Bryman & Bell, 2007; Gummesson, 2000). Interpretive researchers believe that human beings are dynamic

and they continuously construct their own social world, they do not behave according to causal relationships but socially constructed values. They believe that *"each situation is seen as unique and its meaning is a function of the circumstances and the individuals involved"* (Remenyi et al., 1998: 33).

4.2.2. Ontological Considerations

Ontology is concerned with the nature of existence (Denzin & Lincoln, 2000). It is concerned with whether the social world is regarded as something external to social actors or as something with which people are in close engagement (Bryman & Bell, 2007).

Roughly, there are two opposite perspectives within ontology. The first one is objectivism, or realism, which states that *"things in the world have a real existence independent of our thoughts about it"* (Williams & May, 1996: 42). In other words, objectivism is an ontological position that implies that social phenomena confront us as external facts that are beyond our research or influence (Bryman & Bell, 2007). Positivistic researchers adopt the objectivist ontological position.

The other perspective is constructivism, or idealism which views the external world as *"a product of the mind"* (Williams & May, 1996: 42). It asserts that social phenomena and their meanings are accomplished by social actors. These social actors are dynamic and, as a result, they continuously construct their own social world. Consequently, efforts to understand social phenomena necessitate an unveiling of the understandings and beliefs of the people who shape such phenomena (Silverman, 2000). Interpretive researchers adopt the constructivism ontological position.

4.2.3. Philosophical Standing of this Study

The selection of the most appropriate research methodology depends on the nature of the phenomenon being researched. In particular, the assumptions which the researcher holds regarding the nature of the phenomenon's reality (ontology), will affect the way in which knowledge can be gained (epistemology), and these two in turn affect the process through which research can be conducted (methodology). Consequently, the selection of an appropriate research methodology cannot be done in isolation from a consideration of the ontological and epistemological assumptions which underpin the research objective.

The ontology of this study is constructivist with interpretive epistemology. I believe that reality is subjective in nature and that it is created by the interpretations of people. In addition, I believe that phenomena can be known through the interpretations of the people involved with those phenomena.

The interpretive epistemology addresses the world from *"the point of view of the people studied"* (Hammersley, 1992: 165). Consequently, I believe that auditing in electronic environments has to be seen through the eyes of those who perform it. Exploring the main actors that have an influence of auditing electronic environments, and how these actors can perform this influence, has to take place through the interpretation of the financial auditors and the information system auditors who are involved in it.

Beliefs about the external world being a *"product of the mind"* (Williams & May, 1996: 42) play an important role. According to this constructivist ontology, the world is constructed in peoples' consciousness, including my mind as a researcher as *researchers are not objective, but part of what they observe. They bring their own*

interests and values to the research" (Hussey & Hussey, 1997:48). The interests and values of the researchers cannot be eliminated (May, 1997).

In other words, as an interpretive researcher, I did not draw a line between me and the research as reflexivity of the researcher cannot be denied in qualitative studies (Horsburgh, 2003: 308). By means of reflexivity I believe that I am an integral part of the world that I study and that neutrality and detachment in relation to data collection, analysis and interpretation are impossible (Bryman & Cassell, 2006).

Consequently, the outcome of this research will be the result of my interpretations (as an interpretive researcher) of the interpretations, or the points of view, of the participants in the study.

4.3. Research Strategies

A research strategy is regarded as a general orientation of the conduct of a research process (Ryan et al., 2002). Many research writers on methodological issues find it helpful to categorise different research strategies into two distinctive camps, namely quantitative and qualitative (e.g. Bryman & Bell, 2007; Ghauri & Gronhaug, 2002; Saunders et al., 2007).

4.3.1. Quantitative and Qualitative Strategies

On the surface it seems that the only difference between qualitative and quantitative strategies is that quantitative researchers employ measurement while qualitative researchers do not. But many writers suggested that the differences are deeper than the presence or absence of quantification. The fundamental difference between qualitative and quantitative research is established in their individual epistemological and ontological foundations and their connections to theory and practices (Bryman & Bell, 2007: 28; Onwuegbuzie & Leech, 2005: 376).

Quantitative research strategy emphasises quantification in the collection and analysis of data with positivist objectivist foundations and is often linked with the deductive approach where emphasis is placed on the testing of theories. On the other hand, qualitative research strategy usually emphasises words rather than quantification in the collection and analysis of data with interpretivist constructivist foundations and is often linked to the inductive approach where emphasis is placed on the generation of theories. Merriam (1988: 17) introduced a clear differentiation between the quantitative and the qualitative strategies by stating that:

> *'Traditional research* [the quantitative research] *is based on the assumption that there is a single, objective reality-the world out there-that we can observe, know, and measure. Facts have been amassed by scientists to describe the world, and in some instances laws have been advanced to explain certain aspects of this reality. From a research perspective, this worldview holds the nature of reality to be constant. Confirmation of what is out there is desired; research is focused outcomes; reliability of measurement is stressed. In contrast, qualitative research assumes that there are multiple realities-that the world is not an objective thing out there but a function of personal interaction and perception. It is a highly subjective phenomenon in need of interpreting rather than measuring. Beliefs rather than facts form the basis of perception. Research is exploratory, inductive, and emphasizes processes rather than ends. In this paradigm, there are no predetermined hypotheses, no treatments, and no restrictions on the end product.'* (Merriam, 1988: 17)

4.3.2. The Strategy of This Study

In line with interpretive epistemology and idealist ontology, this research adopts the qualitative research strategy. Many reasons lie behind adopting the qualitative strategy:

Firstly, selection of the qualitative strategy was guided by the research objectives which are related to a specific context: audit firms in Egypt. Qualitative strategy, compared to quantitative strategy, offers more support for dealing with contextual data while quantitative studies do not try to look at any issues which are outside the domain of the predetermined research and thus tend to make the research *'context'* free (Creswell, 1994:7).

Secondly, this research aims at identifying the main actors that have an influence on auditing electronic environments. These actors could be outside the audit firms. This means that the researcher has to adopt a holistic perspective to be able to identify these actors and follow them. This holistic perspective can be achieved through qualitative research.

Thirdly, another objective of this research is to open the *'black box'* of the audit firms when auditing in an advanced electronic environment to explore how auditors are dealing with this phenomenon. This means that the researcher will interact very closely with people connected to the research issue, which is one of the features of qualitative research.

Fourthly, qualitative research can be used to discover and understand what lies behind any phenomenon about which little is yet known (Strauss & Corbin, 1998). This research aims to explore auditing in electronic environments in the Egyptian context, where little is currently known as no previous study was conducted in Egypt to explore the main actors that have an influence on auditing in electronic environments. The exploratory nature of this research is another reason for the adoption of the qualitative strategy. Patton (1990: 44) emphasised this point by stating that 'Qualitative *methods are particularly oriented towards exploration, discovery and inductive logic'*

4.4. Research Approach

Two different approaches can be adopted when conducting any research; the deductive or the inductive approach. These two approaches are two different perspectives in presenting the relationship between theory and research.

The deductive theory represents the most common view of the nature of the relationship between theory and research (Bryman & Bell, 200). In deductive

research, particular instances are deduced from general inferences (Ghauri & Gronhaug, 2005). The researcher, on the basis of what is known about a particular domain and of theoretical consideration in relation to that domain, deduces a hypothesis that must be subjected to empirical scrutiny. The deductive process appears to be very linear where one step follows the other in a clear, logical sequence. It represents the positivistic paradigm (Easterby-Smith et al., 1991)

The inductive theory moves from the specific to the general (Collis & Hussey, 2003) as it moves from individual observation to statements of general patterns or laws. This means that theories are developed from the observation of empirical realities (Collis & Hussey 2003) as theory is the outcome of research. The researcher who uses an inductive approach would be particularly concerned with the context in which the events were taking place where the researcher can understand how humans interpret their social world as theory would follow data rather than vice versa as in the deductive approach (Saunders et al., 2007). The inductive approach represents the interpretive paradigm (Easterby-Smith et al., 1991). The main differences between the deductive and inductive approaches are summarised in table 4.1.

Deduction emphasises
1. Scientific principles
2. Moving from theory to data
3. The need to explain causal relationships between variables
4. The collection of quantitative data
5. The application of controls to ensure validity of data
6. The operationalisation of concepts to ensure clarity of definition
7. A highly structured approach
8. A researcher independence of what is being researched
9. The necessity to select samples of sufficient size in order to generalise conclusions
Induction emphasises
1. Gaining an understanding of the meanings humans attach to events
2. A close understanding of the research context
3. The collection of qualitative data
4. A more flexible structure to permit changes of research emphasis as the research progresses
5. A realisation that the researcher is part of the research process
6. Less concern with the need to generalise.

Table 4.1: Major Differences between Deductive and Inductive Approaches to Research

Source: Adapted from: Saunders et al. (2007:89).

In line with the interpretive qualitative paradigm, the research approach of this study will be inductive so that the researcher can make sense of situations without imposing pre-existing expectations on the phenomenon under study (Patton, 1990). This research will not adopt the deductive approach as it does not aim to prove or disprove a particular theory via hypothesis testing. Although actor-network theory will be the framework of this research, it will not be tested. Saunders et al., (2007:13) explained that qualitative inductive research often makes use of theory by stating that '*not only does much qualitative research not generate theory, but also theory is often used at the very least as a background to qualitative investigators'.* In other words, the theory will be used to guide the researcher's way of thinking and as a lens to see the world.

4.5. Research Design

A research design provides a framework for the collection and analysis of data (Bryman & Bell, 2007: 40). Case study is considered as the most appropriate research design to conduct this research. Before discussing the case study design and its justification, excluding other research designs will be justified.

4.5.1. Excluding Other Research Designs

Research designs that are commonly used in qualitative research are action research, ethnography, grounded theory and case study (Collis & Hussey, 2003; Creswell, 1994; Denzin & Lincoln, 2000; Morse, 1994).

Action research

Action research assumes that *'the social world is changing and the researcher and the research itself are parts of this change'* (Collis & Hussey, 2003:66-7). Action research is similar to the case study strategy as both of them are carried out in a

particular organisation. However, action research aims to bring change into the organisation and monitor the results of this change (Collis & Hussey, 2003). This means that close cooperation should take place between the researcher and the staff of the organisation where the research is conducted, they should learn from each other and develop their competency.

The researcher will not adopt action research in this study as this research does not aim to bring specific changes to the audit firms participated in the study; it aims to understand the recent practice when auditing in advanced audit environments Moreover, the researcher cannot gain the in-depth access which is essential to conduct action research.

Ethnography

Ethnography refers to a social scientific description of people and their cultural basis (Vidich & Lyman, 1994). Grbich (2004) indicates that any study based upon ethnography looks at the role of culture and how it is interrelated to the research problem. Ethnography is not related to the production of new information; it aims to transfer information into written or visual form (Tedlock, 1994). The main method of collecting data is participant observation (Bryman & Bell, 2007). Interviews and collection of documents can also be used. Ethnographers become full working members of the group being studied and spend a long time in the workplace. The researcher is not a part of any of the audit firms in Egypt so is not able to carry out an ethnographic research. Moreover, the researcher cannot spend the long time understanding the field work, because of time constraints in order to conduct ethnographic research. In summary, ethnography was not adopted as the data collection method because of the time and the level of access required conducting observation.

Grounded Theory

Grounded theory is concerned with *'the discovery of theory from data'* (Glaser & Strauss, 1967:1). It allows researchers to derive constructs and build theories directly from the immediate data they have collected rather than from existing theories. Researchers use the empirical research to establish directly the variables, concepts and relationships which will be combined in the theory (Remenyi et al., 1998). Strauss & Corbin (1998:12) claim that *'theory derived from data is more likely to resemble the reality than is theory derived by putting together a series of concepts based on experience or solely through speculation'.*

Grounded theory is not employed as the researcher will not depend only on the data that will be collected to build the network of auditing in electronic environments, as the researcher will combine the literature review with the findings from the collected data to build this network.

4.5.2. Case Study

Yin (2003:13) defines a case study as '*an empirical inquiry that investigates a contemporary phenomenon within its real life context, especially when the boundaries between phenomenon and context are not clearly evident'*. Eisenhardt (1989:534) refers to the case study strategy as a strategy that focuses *'on understanding the dynamics present within single setting'* where the importance of the context in the case study is essential. Case study has been widely used as a common research design in different disciplines as it can make contributions to our knowledge of individual, organisational, social and political phenomena (Yin, 1994). In addition, it has the ability to retain the holistic and meaningful characteristics of real life events. Case studies are often described as exploratory research, used in areas where there are few theories or a deficient body of knowledge (Collis &

Hussey, 2003:68). Moreover, case studies can also be descriptive, illustrative, experimental or explanatory. Case study design is adopted for this research.

4.5.2.1 Rationales behind Adopting Case Study Design

Three main rationales are behind adopting case study design for conducting this research which are the nature of the research objectives and questions, theory building, and contemporary research.

4.5.2.1.1. Nature of the Research Objectives and Questions

An important consideration in the selection of a specific research design is its ability to answer the research questions and to achieve its objectives.

As for the research questions: Yin (2003:5) proposed a framework, presented in Table 4.2, to assist researchers in selecting the appropriate research strategy when conducting social science researches. He identified three indicators researchers can use to choose the best strategy for their research. These indicators are the type of research question posed, the extent of control the investigator has over actual events, and the degree of focus on contemporary as opposed to historical events (Yin, 2003:5)

Strategy	Form of research question	Requires control over behavioural events	Focus on contemporary events?
Experiment	How, why?	Yes	Yes
Survey	Who, what, where, how many, how much?	No	Yes
Archival analysis	Who, what, where, how many, how much	No	Yes/No
History	How, why?	No	No
Case study	How, why?	No	Yes

Table 4.2: Relevant Situation for Different Research Designs

Source: Yin (2003: 5)

This research aims to understand how audit firms in Egypt are dealing with audits when conducted in advanced electronic systems. According to Yin's framework (Table 4.2) 'how' questions can be answered by conducting experiments, case studies or historical research. To choose among them, the researcher depended upon the other two indicators. As this research is focusing on a contemporary event, which is auditing in advanced electronic environments in the Egyptian context, and as the researcher has no control over the behavioural events, experiments and historical research were excluded. Case study is more desirable and has a distinct advantage over other research strategies when the researcher desires little or no control over the investigation process of contemporary events (Yin, 2003).

As for the research objectives: this research aims to explore the actors that have an influence on auditing in advanced electronic environments and how they interact to build their network.

To achieve these objectives the researcher needs to adopt a holistic perspective to be able to follow the actors that constitute the network of auditing electronic environments and explore their interaction.

This holistic perspective can be adopted when applying the case study design. Gummesson (2000) explained that the main strength of the case study is to provide a greater opportunity to obtain a holistic view of a specific research project. Remenyi et al., (1998:162) emphasised the same idea by stating that '*case studies allow the student or the researcher to retain a more holistic perspective than can be easily achieved through other approaches'* (Remenyi et al., 1998:162).

4.5.2.1.2 Theory Building

One of the objectives of this research is to build the network of auditing in electronic environments in Egypt and to explore how the actors enrolled in this network are interacting to form its final shape. Case study is recommended for theory building (Eisenhardt, 1989; Perry, 1998; Voss et al., 2002; Woodside & Wilson, 2003). For example, Eisenhardt (1989: 548) recommends the adoption of the case study for research areas which require development of new theories or fresh perspectives on existing theories by stating that case studies are *'well-suited to new research areas or research areas for which existing theory seems inadequate'*.

It is important to indicate that building theory from case studies does not mean building theory from the data collected during conducting the cases only. Eisenhardt (1989:548) indicates that any theory building process requires a mixture of existing literature and empirical observation or experience, as well as the insight of the theorist to incrementally build more powerful theories. According to Voss et al. (2002), when building theory from case studies, researchers need to have a prior view of the general constructs or categories they intend to study and their relationships. Perry (1998) indicates that these general categories can be identified through the literature and through pilot studies by stating that:

> *'The prior theory is developed from the literature and from pilot studies and/or convergent interviews to be the first step in the theory-building process of case study research'* (Perry 1998:790)

To follow this guideline the researcher conducted two pilot studies in two international audit firms that have experience in dealing with advanced electronic systems; two interviews were conducted in each audit firm with two knowledgeable key persons. The outcomes of these two pilot cases combined with the literature review provide the researcher with a prior view of the general categories to be

studied in the main cases. The details of the pilot cases and their outcomes are discussed in Chapter 6.

4.5.2.1.3 Contemporary Research

Case study research is the most appropriate design for the study of complex and multi-faceted contemporary phenomena within some real-life context (Eisenhardt, 1989; Yin, 2003) which is the case of this research. Many researchers have discussed many points related to the auditing of electronic systems. Some researchers discussed the techniques auditors have to adopt such as continuous auditing and computer assisted audit techniques (Braun & Davis, 2003; Chen, 2003; Helms & Lilly, 2000; Helms & Mancino, 1998; Kogan et al., 1999; Liang et al., 2001; Rezaee et al., 2001; Rezaee et al., 2002). Other researchers discussed the expanding role of information system auditors when the audit is performed in an electronic environment (Baldwin & Kneer, 1986; Curtis & Viator, 2000; Gallegos, 2003; Viator & Curtis, 1998). Others concentrated on explaining the standards and guidelines that have been pronounced by the professional bodies relating to auditing in the electronic environment (Damianides, 2004; Moreland, 1997; Munter, 2002; Pathak, 2003a; Rezaee & Reinstein, 1998; Wallace, 2002; Williamson, 1997; Yang & Guan, 2004). Moreover, some researchers discussed the electronic systems themselves and their expected technical impacts on the audit function.

Notwithstanding the great effort of these researchers, it can be seen that none of the studies have been conducted, in the Egyptian context, to explore the main actors that have an influence on auditing electronic environments from a holistic perspective and to understand how they are enrolled to build their network and how they interact with each other. In other words, this research can be seen as a complex and multi-faceted

contemporary research and, as a result, the case study is the most appropriate research strategy to be adopted.

4.5.2.2 Criteria Regarding Adequate Number of Cases

After determining the case study as the main research design that will be adopted, it is important to decide whether the researcher will depend on a single case study or multiple cases. Before discussing the two options, it is important to indicate that the choice of a case study design alone cannot be the basis of generating good theories. The quality of case or cases that should be conducted is more important than the quantity. Patton (1990:185) emphasises this idea by stating that:

> *'The validity, meaningfulness and insights generated from qualitative inquiry have more to do with the information-richness of the cases selected and the observational/analytical capabilities of the researcher than with sample size'.*

4.5.2.2.1 Single Case versus Multiple Cases

Eisenhardt (1989:545) recommends that cases should be added till *'theoretical saturation'* is reached. Theoretical saturation is the point where incremental learning is minimal because the researchers are observing phenomena seen before. She indicates that multiple cases are a powerful means to create theory because they permit replication and extension among individual cases. Lincoln & Guba (1985:204) as cited in Perry (1998:793) adopt the same idea as they indicate that cases should be added *'to the point of redundancy'*. Both of them indicate that multiple cases are essential for replication and generalisation purposes. However, Dyer & Wilkons (1991) criticised Eisenhardt's (1989) perspective. They advocate researchers adopt single case study design, as most of the pioneering studies in social science involving case study research design have been carried out using one single case. Eisenhardt (1991:622) argued that this critique is not well founded as the

pioneering studies that Dyer & Wilkons (1991) presented as examples of single case are actually multiple cases. Eisenhardt (1991:622) stated that:

> *'This is a critical misreading of these studies. Although these studies may focus on a single setting such as a corporation they are not single cases. Rather, many are multiple-case studies, relying on the comparative multiple-case logic of replication and extension for their theoretical insights'*

Voss et al., (2002) indicate that single, in-depth, case studies offer researchers the opportunity to carry out an in-depth observation that can lead to very significant research findings. On the other hand, Voss et al., (2002:201) state that an important limitation of a single case study design is that the theory developed would have to overcome perceptions concerning its applicability due to limitations in relation to the generalisability of the conclusions. However, they indicate that researchers can overcome this risk by incorporating 'events and data' from multiple cases when designing the case study.

Although Yin (2003) indicates that enhancing external validity, generalisability, is one of the advantages of using multiple-case studies, he also argues that there are no issues in generalisation of the results obtained from the adoption of the case study, whether it is a single or multiple case design, in comparison to other approaches that aim to verify hypotheses (scientific experiments). However, Yin (2003) accepts the adoption of a single case study design if justifications are provided for this adoption. The rationales behind accepting a single case study are:

- A single case may be sufficient when a well-formulated theory is to be tested. If the theory identifies a clear set of propositions, as well as circumstances in which it is believed that these propositions will be true, then a single case can be used to confirm the theory or to extend it (Remenyi et al., 1998). This rationale is not accepted in this research as it does not aim to test any well-

formulated theory but it aims to build the network of auditing in electronic environments.

- Another rationale for depending on a single case is when the case represents a unique case that deserves to be documented and analysed separately (Yin, 2003:41). This reason is not applicable in this research; although auditing in advanced electronic environments is not a common process for all audit firms in Egypt, it can still be found in many audit firms.
- Additionally, it is acceptable to conduct a single case study if the researcher conducts a *'revelatory case'* (Yin, 2003:42) which exists when an investigator has an opportunity to observe and analyse a phenomenon previously inaccessible to scientific investigation. In this study, issues of confidentiality prevented access to real time work in an electronic audit context.
- Longitudinal case; where the same case is studied at two or more different points in time to specify how certain conditions change over time is another acceptable reason to conduct a single case study research (Yin, 2003). This research will be a cross-sectional research. A longitudinal case will not be used as this research is less concerned with analysing trends or how situations develop over time. Studying the changes from one point of time to another is not the aim of this research. Moreover, it could not be feasible, given the time and funding constraints that the researcher faces.

This research will adopt the multiple case study design; more than one Egyptian audit firm will be included in this research in order to be able to determine all the main actors that can influence auditing in electronic environments. Conclusions arising from multiple cases will be more powerful than those coming from a single case

alone (Remenyi et al., 1998). Amaratunga & Baldry (2001:100) emphasise this idea by stating that:

> *'Case studies can be single or multiple-case designs but add that multiple cases strengthen the results by replicating the pattern matching, thus increasing confidence in the robustness of the theory. The use of multiple cases in this study underlines the complexity of the topic under investigation and develops the empirical evidence to support and sharpen the theory. The approach to the case studies involves theory building and verification rather than testing'.*

Yin (2003) emphasises that the evidence from multiple cases is often considered more compelling, and the overall study is therefore regarded as more robust.

4.5.2.2.2 Number of the Multiple Case Studies

As the researcher will conduct multiple cases, the question emerges concerning what constitutes a sufficient number of cases, or the number of audit firms that will be included in a study. Most researchers indicate that there is no ideal number of cases to be included in a study. However, some researchers use their experience to recommend a range within which the number of cases for any research should fall. For example, Eisenhardt (1989:545) indicates that to build theory from the cases, a number between four and ten cases usually works well. With fewer than four cases, it will be difficult to generate theory with much complexity, and its empirical grounding is likely to be unconvincing. If the cases are more than ten, it quickly becomes difficult to cope with the complexity and volume of the data. Perry (1998:794), depending on the work of Eisenhardt (1989), Miles & Huberman (1994) and Yin (1994), states that '*the widest accepted range seems to fall between two to four as the minimum and ten, twelve or fifteen as the maximum'.*

Because of the time constraints for the researcher, and in order to deal with the quantity of data, three audit firms participated in this study. Great attention was paid to the choice of these audit firms and to ensure that they are suitable source for the

needed information. Rationales behind choosing these audit firms are discussed in Chapter 5

4.5.2.3. Sampling

Scholars in qualitative research indicate that non-probability sampling techniques are appropriate for selecting the population for the study (e.g. Denzin & Lincoln, 2000; Eisenhardt, 1989; Patton, 2002; Perry, 1998). There are different types of non-probability techniques, summarised in Table 4.3. However, scholars indicate that the selection for case studies should be undertaken based on purposive sampling as the most appropriate non-probability sampling technique.

Type of Technique	Definition
Quota Sampling	It is based on the premise that sample will represent the population as the variability in your sample for various quota variables is the same as that in the population.
Purposive Sampling	Enables the researcher to use judgement to select cases that will best enable to answer research question and meet objectives.
Snowball Sampling	Used when it is difficult to identify members of the desired population. Initial members are asked to identify similar possible members, and they in turn are asked, and so the process continues.
Self-Selecting Sample	The researcher allows a case, usually an individual, to identify their desire to take part in the research.
Convenience sampling	Involves selecting haphazardly those cases easier to obtain for sampling.

Table 4.3: Non-Probability Techniques

Summarised from: Saunders et al (2007)

Denzin & Lincoln (2000: 370) defended the use of the purposive sampling by indicating that

> *"...many qualitative researchers employ purposive, and not random sampling methods. They seek out group, settings and individuals where the processes being studied are most likely to occur"*

Purposive sampling involves selecting a sample or people who are most readily available to participate in the study, and who can provide information that answers the research questions. The logic and power of purposive sampling lie in selecting information-rich cases for an extensive and in-depth study (Patton, 2000). It is also

known as judgmental sampling as it enables researchers to use their judgment in choosing the sample that are believed to be reliable in revealing detailed information required in the exploration and understanding of the central themes of the research.

These techniques allowed me, as a researcher, to depend on my judgment to select the three audit firms that participated in the study, and to select the financial auditors and information system auditors who are knowledgeable and have experience in dealing with advanced electronic systems so that they can provide relevant in-depth information that can help to achieve the research objectives.

4.6. Data Collection Methods

A research method is a technique for collecting data. The research design usually provides the guidance to the execution of a research method and analysis of the subsequent data. For example, cross sectional survey normally relies on questionnaires and ethnography normally relies on participant observation. As for case study, Yin (2003) asserts that evidence for case studies may come from six sources, namely: documents; archival records; interviews; direct observation; participant observation; and physical artefacts. The use of multiple sources of evidence is recommended when conducting case studies. Yin (2003: 97) stated that a major strength of case study data collection is the opportunity to use different sources of evidence.

Patton (2002: 247) used the term *"triangulation"* to refer to a combination of different sources in the study of the same phenomena. He identified two types of triangulation in qualitative studies: methods triangulation; and triangulation of qualitative data sources. Method triangulation involves comparing some kind of data collected through qualitative methods with some kind of data collected by

quantitative methods. On the other hand, triangulation of qualitative data sources refers to use data collected by different means within qualitative methods.

As for this study, interview was the main data collection method. The interview is one of the data collection tools in qualitative research (Bryman & Bell, 2007; Bryman & Cassell, 2006; Patton, 2002; Punch, 2005). Interview is a powerful way to access people's perceptions, meanings, experiences and beliefs (Dilley, 2004; Punch, 2005). In other words, it is one of the most powerful ways researchers have to understand human beings and how they interact with their world (Denzin & Lincoln, 2000; Patton, 2002; Perry, 1998; Punch, 2005). Interview is a flexible process, and because of its flexibility it is probably the most widely employed method in qualitative research (Bryman & Bell, 2007: 472)

Interviews vary according to the degree of structure of the interviews and how deep the interview tries to go. On one hand, it can be very tightly structured and standardised; on the other hand it can be unstructured and open-ended. In between lays the semi-structured interview.

In the structured interviews: the interview questions are planned and standardised in advance with pre-set response categories. Also, the interview itself does not attempt to go to any great depth (Bryman & Bell, 2007; Fielding, 1993; May, 1997; Punch, 2005). In this sort of interview the researcher attempts to engage a neutral style and is to be encouraged in executing that role. This means that flexibility, which is an essential feature of interviews as a powerful tool, is minimised while standardisation is maximised. For these reasons, structured interviews are associated with survey research which depends on using questionnaires as an instrument to collect data (May, 1997).

This type of interview was not used while conducting the interviews of this research. Through interviews I was looking to understand the experience of the auditors when dealing with advanced electronic systems. To understand such experience, I needed to immerse myself into the auditors' beliefs, stances, preferences, and judgments that shape their actions and practices. Such immersion indicates that I will not be able to play the neutral role recommended by this type of interview. In addition, this research did not start with clear defined categories specified for the respondents to be adhered to, on the contrary, most of the categories emerged from the interviewee respondents. The unstructured and the semi-structured interviews were more appropriate for this research.

Unstructured interviews: are open-ended in-depth interviews with no pre-planned questions, instead there are general questions that cover the topic under discussion (Fielding, 1993; May, 1997; Punch, 2005). It is a way of understanding the complex behaviour of people without imposing any a priori categorisation which might limit the field of inquiry. This type of interview can produce rich and valuable data that help the researcher to have a better understanding of the whole context in which the phenomena takes place (Kumar, 1999).

Unstructured interviews were conducted in the first stage of this research (explained in Chapter 6). Unstructured preliminary interviews were conducted to understand the audit market in the Egyptian context, and to collect preliminary data concerning the actors that have an influence on auditing in electronic environments. These unstructured interviews gave the interviewees enough time and space to express their thoughts freely and deeply which helped me to immerse myself, as a researcher, in their beliefs.

Semi-structured interviews: lie between structured and unstructured interviews as the researcher has a list of questions on fairly specific topics to be covered (interview guide), but the interviewee has a great deal of leeway in how to reply. Semi-structured interview is recommended for researchers if they are beginning the investigation with a fairly clear focus rather than a general notion of wanting to do research on a topic (Bryman & Bell, 2007: 479). Semi-structured interviews were used while conducting the pilot case studies, and whilst conducting the interviews in the main cases. Using these types of interviews in this research gave me the freedom to vary the questions to include issues not originally planned as I was picking up on things mentioned during the interviews by the interviewees. In addition, it gave me the chance to amend the order of the questions, or even to omit some questions in some interviews if needed either because the answers of these omitted questions were explicitly answered in former questions, or because these omitted questions were irrelevant as some questions were relevant to the financial auditors only while others were relevant to the information system auditors only.

Beside the interviews, the researcher engaged, to a limited extent, in a number of observations during the data collection process as three informal meetings were observed. The first took place during the pilot study in Audit Firm A in a meeting between a partner in the financial audit division and a partner in the computer audit division. The second took place while conducting the main case in Audit Firm B between two financial auditors and an information system auditor. The third was in Audit Firm C between two information system auditors. Notes about observing these meetings were taken and were considered during data analysis.

In addition, collecting relevant documents was undertaken to supplement primary data obtained from interviews. Documents about the audit firms were an important source to be able to provide a description concerning the three audit firms (discussed in Chapter 5). Laws and standards that are related to the audit profession in Egypt were also important documents that support primary data collected from the interviews. Books including the Egyptian auditing curriculum were also an important secondary data that considered supporting, or not, the primary data collected from the interviews.

The researcher requested the auditors in the three audit firms to have a look at their working papers related to any of their clients who adopt an advanced electronic system to gain more understanding on how they perform their audits when dealing with such systems. However, for confidentiality purposes, none of the auditors responded to the researcher's request.

4.7. Criteria for Evaluating the Quality of Qualitative Research

One criticism levelled at qualitative approaches to research is that they lack sufficient rigour and credibility associated with traditionally accepted quantitative methods, in which inquiry is assumed to occur within a value-free framework and which relies on the measurement and analysis of causal relationships between variables. Although reliability and validity are important criteria in establishing and assessing the quality of research for quantitative researchers, debate among qualitative methodologists continues to take place about their suitability to evaluate the quality of qualitative research (Bryman & Bell, 2007; Horsburgh, 2003; Punch, 2005; Silverman, 2000).

Some qualitative researchers indicate that validity and reliability are relevant criteria to evaluate qualitative studies but the meanings of the terms should be altered.

Mason, for example, in her book on qualitative research, argues that reliability, validity, and generalisability (which is the main component of external validity) *"are different kinds of measures of the quality, rigour, and wider potential of research, which are achieved according to certain methodological and disciplinary conventions and principles"* (1996: 21)

Mason (1996: 146) added that judgments of validity are judgments about whether the researcher is measuring or explaining what he/she claims to be measuring or explaining.

As for validity, Remenyi et al., (1998: 115) indicate that validity of research is concerned with *"whether the researcher has gained full access to knowledge and meanings of respondents"*

The same idea is presented by Silverman (2000: 175) and Collis & Hussey (2003) who indicated that validity in qualitative research is concerned with the truth in research findings as it considers whether the research findings accurately represent what is really happening in the situation. In other words, qualitative researchers adhere to the core principle of validity to be truthful (i.e. avoid false or distorted accounts). They try to create a tight fit between their understanding, ideas, and statements about the social world and what is actually occurring in it (Neuman, 2006: 196).

As for **reliability**, Collis & Hussey (2003: 58) indicate that reliability in the phenomenological qualitative paradigm seeks to determine whether a similar observation or interpretation can be made on different occasions and/or by different observers. However, one difficulty is that qualitative researchers often study processes that are not stable over time (Neuman, 2006). Moreover, most of the qualitative methodologists accept that different researchers or researchers using

alternative methods will get distinctive results because data collection is an interactive process in which particular researchers operate in an evolving setting and the setting's context dictates using a unique mix of measures that cannot be repeated (Neuman, 2006: 196). Because of this, some qualitative methodologists indicate that researchers can achieve reliability by providing an *audit trail that* presents how the researcher was able to reach what he has reached (Koch, 1994; Guba & Lincoln, 1994). This audit trail should be a complete record for all the phases of the research process including the problem formulation (discussed in Chapter 1), selection of participants (discussed in Chapter 6), fieldwork notes (available with the researcher), interview transcripts (available with the researcher), data analysis decision (discussed in chapter 6), etc., and this audit trail should be in an accessible manner.

On the other hand, other qualitative methodologists introduce alternative criteria for evaluating qualitative research as they believe that qualitative studies should be judged or evaluated according to different criteria from those used by quantitative researchers. For example, Guba & Lincoln (1994) propose that it is necessary to specify terms and ways of establishing and assessing the quality of qualitative research that provide an alternative to reliability and validity. They propose two primary criteria for assessing qualitative study: trustworthiness and authenticity. Trustworthiness is made up of four criteria, each of which has an equivalent criterion in quantitative research: credibility is parallel to the internal validity, transferability is parallel to the external validity (or generalisability), dependability is parallel to reliability, and confirmability is parallel to objectivity[1].

[1] For more information about this point refer to Guba & Lincoln (1994)

As for case studies, Yin (1994: 33) indicated that in order for a case study to be considered valid and reliable, the research process has to pass four design tests which are summarised in Table 4.4

Test	Case study tactic	Phase of research in which tactic occurs
Construct validity	Use multiple sources of evidence. Establish chain of evidence. Have key informants review draft case study report.	Data collection Data collection Composition
Internal validity	Do pattern matching or explanation building or time-series analysis	Data analysis
External validity	Use replication logic in multiple case studies	Research design
Reliability	Use case study protocol Develop case study database	Data collection Data collection

Table 4.4: Case Study Tactics for Four Design Test

Source: Yin, 1994: 33

Ensuring validity and reliability for this Study

Different tactics were adopted to achieve validity and reliability for this research. Multiple sources of evidence were used in this study as it employed a triangulation of qualitative data sources in its data collection methods. This triangulation mainly involved interviews and document analysis. Observation was also used, to a limited extent. In addition, the interviews conducted were unstructured and semi-structured interviews allowing the researcher to gain full access to knowledge and meanings of respondents (Remenyi, 1998). The respondents were chosen carefully to ensure they had the knowledge, and the intention, to provide the researcher with the needed information concerning auditing in electronic environments in Egypt. The features of the participants in this study are discussed in Section 6.4.

Moreover, two pilot case studies were conducted to ensure that the researcher has the right understanding about the settings, to ensure that she is able to gain access to the

audit firms and she will be able to collect rich data from reliable sources, and to ensure the suitability and clarity of the interview guide. The pilot case studies are discussed in Section 6.2.2.

An audit trail (or case study database) is available for the research process. The recorded interviews are available with their Arabic transcripts. The translated interviews are also available. However, due to space limitations of this document these interviews are not included completely. Instead, segments of relevant parts (quotations) are included while presenting the findings in Chapter 7. The analysis of the interviews took place using NVivo, all the inputs to NVivo, the process of the data using NVivo, and all the outputs are available. As for generalisability (or the external validity), the researcher adopted logical replication when choosing the case studies. All the audit firms included in the study are international audit firms that are used to dealing with clients who adopt advanced electronic systems. The three audit firms have a separate computer audit division and perform computer audit as a part of the financial audit; it is their approach when the client adopts advanced electronic systems. Logical replication assumes that results can be generalised to the other settings that have, to some extent, similar features.

4.8. Summary

This chapter presented and justified the research methodology adopted to carry out this study. The chapter outlined the main dimensions of the research process including the philosophical assumptions underpinning the research, the research strategies, the research approaches, and justifications for the choices made. Subsequently, the research designs were discussed with a detailed discussion about the case study design which covered the debate of sampling techniques and the selection of multiple cases. Following, the chapter discussed the data collection

process, emphasising two main data collection methods in qualitative inquiry and the case study approach, namely, interviews and documentary data. Finally, the criteria of evaluating the quality of qualitative research were debated. The research methodology of this study is summarised in figure 4.2.

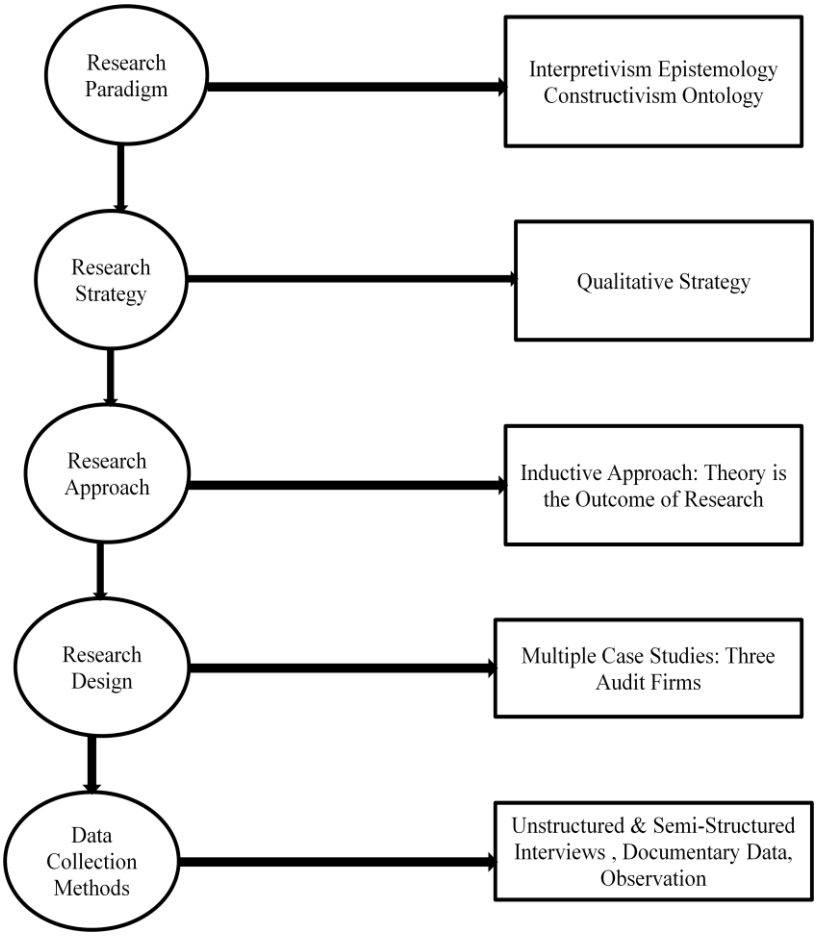

Figure 4.2: The Research Methodology

5. Chapter Five: Description of the Fieldwork

5.1. Introduction

The purpose of this chapter is to provide a description of the setting where the fieldwork took place. The fieldwork was conducted in Egypt in three audit firms: A, B, & C[1].

The chapter starts with an overview of the audit profession in Egypt by presenting the laws that shape the legal framework of auditing in Egypt, and introducing the professional bodies that play an effective role in shaping the profession. The audit education and auditing standards in Egypt are also discussed.

Then the rationales that lie in choosing audit firms A, B, & C is presented, followed by providing an overview of these three audit firms. This overview is considered as the first step of achieving the first objective of the study, opening the black box of the audit firms in Egypt. Information about the audit firms, the services they provide and the type of their clients is essential information that can help in opening their black box to understand how they consider auditing in advanced electronic environments.

5.2. An Overview of the Audit Profession in Egypt

This section will introduce an overview of the audit profession in Egypt. It will start by introducing the laws that shape the legal framework of auditing Egypt. Then it will present the professional bodies that play an effective role in shaping the profession. The audit education and auditing standards in Egypt will be discussed.

5.2.1. The Legal Framework of Auditing in Egypt

In 2002, a review of accounting and auditing standards and practices in Egypt was conducted jointly by the World Bank and the International Monetary Fund (IMF) as

[1] For confidentiality purposes the three audit firms renamed as A, B, & C.

a part of their joint initiative on Reports on Observance of Standards and Codes (ROSC). According to this report (World Bank, 2002), a combined set of laws represent the legal framework for the auditing profession in Egypt: External financial audit is required by the Company Law 159/1981, the Capital Market Law 95/1992, and the Banking Law. The main law that governs professional accountants and auditors in Egypt, particularly in the private sector, is The Accounting Practice Law 133/1951 and its amendments. A draft for a new Accounting Practice Law has been under discussion, however it has not yet been authorised. Audit of state-owned enterprises is governed by the Central Audit Organisation Law 144/1988. The next sub-sections will shed the light on these laws.

5.2.1.1. The Companies Law 159/1981

All companies registered under the Company Law are required to maintain proper accounting records and prepare annual audited financial statements that are attested by a certified accountant. The law indicates that the annual meeting of the shareholders should evaluate the external auditor's performance. The appointment of a new auditor or renewing the engagement of the existing one should be decided in this annual meeting. During this annual general meeting, the auditor is required to report on whether: the company keeps proper accounting records; the legal requirements have been applied to the accounts; enough evidence for the accomplishment of duties has been collected; and the financial statements fairly present the entity's financial condition and results of operations.

The Company Law requires the external audits to be conducted in accordance with the Accounting Practice Law 133/1951. However, it does not point to compliance with the accounting and auditing standards. The Law states that the external auditor must not have other contracts with his client (e.g. as a founder, director, permanent

consultant, or employee). However, it does not include any restriction on shareholders being appointed as external auditor for the company.

5.2.1.2. The Capital Market Law 95/1992

According to this law, all the companies listed in the Egyptian Stock Exchange are required to prepare their financial statements in compliance with the Egyptian Accounting Standards. Initially, the Capital Market Law required all listed companies to prepare their financial statements in compliance with the International Accounting Standards (ISA). Then, the Ministerial Decree 505/1997 obliged the use of the Egyptian Accounting Standards by all companies regulated by the Capital Market Authority. However, in the absence of Egyptian Accounting Standards regarding any accounting treatment, the requirements set by the ISA have to be applied. The Law requires all listed companies to file annual and semi-annual audited financial statements and quarterly financial statements with the Capital Market Authority and the Cairo & Alexandria Stock Exchange. The quarterly financial statements require limited review by auditors.

In addition, The Capital Market Authority (CMA) approved new listing rules which have been effective since August 2002. These rules aim to ensure timely preparation and presentation of financial statements and full compliance by the issuers with accounting, auditing, and other legal requirements. Moreover, in 2006 the Capital Market Authority (CMA) created an auditors' registry (CMA, 2006). The auditors who join this registry are the only ones who are allowed to audit companies that are listed on the stock exchange. Appendix 2 shows the requirements of this registry. In 2007, CMA issued a new code of ethics for auditors who are registered in the CMA auditors' registry (CMA, 2007). The code discusses and explains the rules and regulations for important issues such as independence of auditors, objectivity,

competence, confidentiality and professional conduct. In addition, it presents conditions and rules for important topics, including hiring auditors, conflict of interest, fees, marketing of services, and gifts.

5.2.1.3. The Accounting Practice Law 133/1951

The main law that governs the professional accountants and auditors, in the private sector, is the Accounting Practice Law 133/1951 and its amendments. According to the Law a graduate of a faculty of commerce with a major in accounting needs to spend a training period before being qualified to register with the General Register for Accountants and Auditors in the Ministry of Finance as a Chartered Accountant. Registration rules state that the registered trainee accountant should be a graduate with a bachelor's degree and a major in accounting. Trainees qualify for first level registration as accountants after three years of professional work in a practising accountant's office or equivalent, which authorises them to practice as auditors of sole proprietorships and partnership enterprises. After an additional five years of employment experience, accountants apply to the registry for a final registration certificate, which is a licence to act as auditor of joint stock companies. Members of the Egyptian Society of Accountants and Auditors are also qualified for a licence to audit joint stock companies.

Three main points can be considered as deficiencies in the current Law. The first one relates to the training required for auditors to be qualified for registration with the General Register for Accountants and Auditors as the requirements do not ensure proper or adequate practical knowledge to the auditor-trainee. The registration requirements is considered met if the trainee produces a letter from an employer stating that he/she has worked for a practicing licensed accountant or equivalent throughout the stipulated apprenticeship period. The application and the

employer's letter are not subject to verification. Moreover, there is no evidence that the trainee has participated in any actual audit assignment during the training period. The World Bank group (2002) suggested that the requirements for licensing registration should be upgraded so that the trainee auditors receive practical training through authorised audit firms who can verify the work experience.

The second point of deficiency in this Law is that it does not require auditors who apply for final registration certificates to take qualifying or competency examinations before their names are listed in Accountants Registry. Moreover, it does not require licensed auditors to undertake regular training or continue their professional education. As a result, many practicing auditors lack the necessary professional competence for providing high-quality auditing services (World Bank, 2002: 5).

The third point is that this law is considered out-of-date by most practitioners (World Bank, 2002). This point caused the need to draft a new accounting practice law to replace the Law 133 of 1951.

5.2.1.4. The Proposed Accounting Practice Law

The Proposed Law of Accounting and Auditing Profession was drafted to overcome some of the shortfalls of the current law 133/1951. It was drafted under the sponsorship of the Ministry of Finance, the Syndicate of Accountants, and the Egyptian Society of Accountants and Auditors (World Bank, 2004; UNCTAD, 2008). Although it aims to enhance the quality of the audit profession in Egypt, this law is still under discussion by the People Assembly (FSF, 2009).

The most important points that would be introduced in the new proposed Law include (World Bank, 2004; UNCTAD, 2008):

- Auditors will not be licensed to audit corporate financial statements unless they pass two exams. The exams are designed to test their competence in understanding and applying accounting and auditing standards. The first exam is held after three years of practicing the profession as a trainee. Passing this exam will allow the auditors to audit partnerships and sole proprietorships. After practicing for other five years, a certified accountant may sit for another exam to test his/her ability to audit joint stock companies (corporations). The previous law did not require testing the capabilities of auditors.
- Audit firms can be appointed as auditors. The current law allows only licensed individuals to act as auditors. Accounting companies are not allowed to perform this function. In practice, companies appoint individual partners of audit firms. In case of bad audit, the audit firm cannot be held liable.
- The proposed law suggests establishing a Supreme Council for Accounting and Auditing to be responsible for enhancing professional capabilities, performance and competence of the auditors.
- The proposed law suggests establishing an Accounting Oversight Board. It will be responsible for monitoring, inspecting and reviewing the auditors' work. In addition, it will assess auditors' independence and compliance with auditing standards. The Oversight Board is entitled to impose penalties on non-complying auditors. The majority of the Board's members will be non-auditors, with two members representing each of following entities: the Capital Market Authority (CMA), the Central Auditing Bureau (CAB), and the Supreme Council for Accounting and Auditing (SCAR). Membership on

this Committee will be for three years and could be renewed for other similar periods.

- Under the proposed law, auditors are not allowed to provide consultation services to companies they audit unless they receive approval from the Oversight Board to ensure auditors' independence and integrity. This duplication is not banned in the current law 133/1951.

5.2.1.5. The Banking Law

This Law requires all banks to follow the accounting and auditing guidelines set by the Central Bank of Egypt. According to these guidelines, banks are required to follow the Egyptian Accounting Standards and they have to file annual, semi-annual, and quarterly reports including financial statements. Two licensed auditors must audit the bank's financial statements. The two auditors can be partners in the same audit firm. However, the individual auditor cannot sign reports for more than two banks per year.

5.2.1.6. The Central Audit Organisation Law 144/1988

The central audit organisation is an independent public organisation that reports directly to the People's Assembly. It is responsible for the audit of state-owned enterprises. It governs the audit of government departments and agencies, public sector enterprises, and companies in which ownership interest of public investment is not less than 25%. The Central auditing organisation has implemented important steps toward coordination of the public-sector accounting and auditing standards with the international accepted standards.

5.2.2. Professional Bodies (Auditing Profession)

The Egyptian Society of Accountants and Auditors (ESAA), established in 1946, is regarded as the first professional body attempting to organise and supervise the education and training of accountants in Egypt, and develop an accounting and auditing profession. It is an association of chartered accountants that develops educational and professional standards. The society is a member of the International Federation of Accountants (IFAC). Members of ESAA have to satisfy one, or more of the following requirements:

- Membership in the Institute of Chartered Accountants in England and Wales, or another acceptable foreign professional body (provided they pass the society's examinations on Egyptian tax law and Egyptian company law).
- Doctoral degree in accounting with three years of experience in practice.
- At least three years of full-time work experience in the office of a practicing Society member, and successful completion of the Society's two part examination (the first part, an intermediate examination, is taken after one-and-a-half years; and the second final part is taken at the end of three years).

To improve the qualifications of Society members, the Society Chairman indicated that training programs would be organised for candidates of Society examinations. Moreover, the Society curriculum and textbooks will be developed in line with the learning materials developed by the ACCA in the UK and the AICPA in the USA (ESAA, 2002). The American University of Cairo will offer training programs covering the Society's examination curriculum.

Two main points are considered in the role of the ESAA: the first one is that the intended high quality training will be provided only to the elite who can afford to

pay the cost of the courses in the American University (known as relatively expensive in Egypt). The other point is that the ESAA, until January 2009, did not require any continuing education for its members although international best practice stipulates that every practicing auditor should complete at least 30 hours of continuing professional education per year to be aware of the new developments in accounting and auditing (World Bank, 2002: 6). To enhance this point, the ESAA has established a project to develop general rules of continuous professional development, in accordance with IFAC. These rules aim at improving the educational and professional level of the society members to face the advancements in the field of accounting and auditing (ESAA, 2008).

5.2.3. Auditing Education

As discussed previously, Law 133/1951 restricted accountants' registration in the Accountants Registry to only those who graduate from a faculty of commerce with a major in accounting. In Egypt, there are eighteen government-funded universities[1], all of them with a faculty of commerce, including an accounting department providing courses leading to the bachelor's degree in accounting. The entry requirements for the different faculties are specified centrally by the Supreme Council of Universities at the Ministry of Higher Education. The allocation of candidates to different faculties is dealt with centrally based on candidates' grades attained in secondary school education. High entry requirements are normally set for the medicine and engineering faculties, while lower requirements are specified for faculties of commerce. This can be seen as an important reason for the large number of students who graduate from faculties of commerce each year.

[1] According to the Egyptian Universities network: http://www.frcu.eun.eg/docs-n/uni1.php, accessed 2008.

According to the World Bank report (2002), the educational quality suffers from lack of modern curricula as in the undergraduate level accounting and auditing courses focus mainly on elementary topics, and the accounting curriculum taught in most faculties does not meet the demands of the changes in the global business environment (El- Sayed, 2004: 125).

Moreover, the lecturer/student squeeze is another problem. The lecturer/student ratio in accounting departments of large public universities is about 1:1000 (World Bank, 2002). These large number of students studying in faculties of commerce affects the way in which those candidates are taught, as there is no space for discussion or creative thinking. Moreover, students are accustomed to work individually as there is no scope for teamwork (El-Sayed, 2004).

Accounting education is not only provided through government-funded universities, the American university in Cairo offers an accounting major within its business administration department. In addition, private universities (established during the 1990s) are now offering English-language accounting programmes using internationally comparable curriculum and English-language textbooks. High tuition fees for private universities are restrictive, giving access mostly to the wealthiest students (World Bank, 2002; UNCTAD, 2008).

5.2.4. Auditing Standards in Egypt

In 1997, the Ministry of foreign trade issued Ministerial Decree 478/1997 to establish the Permanent Committee for Accounting and Auditing Standards. This committee is officially responsible for setting accounting and auditing standards. However, in practice the Egyptian Society of Accountants and Auditors has the responsibility to select the international accounting and auditing standards that are applicable to the Egyptian situation and translate it into Arabic, considering any

specific requirements of Egyptian laws and regulations, to be the draft Egyptian standard. This draft standard is submitted to the Permanent Committee for discussion, finalisation and adoption. The final version of the standard is submitted to the Ministry of Foreign Trade for issuance by a ministerial decree. Six Egyptian auditing standards were issued by the year 2002. These standards are mainly related to reporting issues ignoring all other aspects included in the International Standards on Auditing. However, the International Standards on Auditing (ISA) should be applied in the absence of the Egyptian Standard as stated in the introduction of the ESA.

In 2008, Ministerial Decree 166/2008 was issued to approve the release of 38 Egyptian audit and limited inspection standards. The 38 new standards will replace the current standards, and will be effective by January 2009. These standards are in harmony with the International Standards on Auditing as they are considered the Arabic version of the ISA.

5.3. The Rationale behind Choosing Audit Firms A, B, & C

Different reasons lie behind choosing Audit Firms A, B, & C to be the cases included in the main study.

These three audit firms are international audit firms (two of them are among the International Big 4). They perform external audits for large Egyptian and multinational companies that are using advanced electronic systems (e.g. ERP systems). Auditors working in these audit firms are expected to have good information that will help the researcher to explore the actors that have an effect on auditing in electronic environments as they have experience in dealing with such systems extensively. Saunders et al., (2007) indicate that researchers can use their

judgment to select cases that will best enable them to answer the research question set and meet objectives.

Moreover, the three audit firms have the facilities that help them to deal with advanced electronic environments. Each of them has a separate computer audit department with highly qualified staff. The approach of the three audit firms requires the computer audit as an essential part of the external audit if the client is using advanced electronic systems. In addition, the three audit firms have their advanced automated tools (CAATs) that help them to conduct effective audits when dealing with advanced electronic systems.

The ability of gaining access to these audit firms is another reason to be included in the study. Gaining access is a difficult task in Egypt. Hofstede (1991) reported that Egypt represents a culture with high uncertainty-avoidance where people are more conservative and which has a more elaborate legal system. To overcome this point the researcher, as a staff member in a faculty of commerce, depended on personal contacts and professional relationships with the auditors to be able to gain access. Some auditors did not show their interest in joining the study, or provide assistance to the researcher to gain access to their audit firms. However, three partners in the three Audit Firms A, B, & C showed interest in the study. One of the main points that encouraged these audit firms to accept their involvement in the study is its objective. The objective of this study is to gain a holistic perspective of the actors that can affect auditing electronic systems, and to follow these actors to build the network of auditing in advanced electronic environments. In other words, the participants understood that the researcher did not aim to find specific confidential information about their audit firms that could be used against them in the market.

Finally, the objective of building a framework of auditing in electronic environments was another reason for choosing these three audit firms. Voss et al. (2002: 203) state that *"when building theory case studies, case selection using replication logic rather than sampling logic should be used. Each case should be selected so that it either: predicts similar results (a literal replication); or produces contrary results but for predictable reasons (a theoretical replication)".* The three audit firms are international audit firms and they have common features, as will be shown when introducing the cases. In other words, these cases are expected to provide literal replication that can help in building the network of auditing electronic environments.

As stated previously, the main case studies took place in three international audit firms A, B, & C. The following sections will introduce these firms.

5.4. Introducing Case A[1]

This organisation is an international, integrated and independent organisation specialising in audit, accounting and advisory services. It is an integrated organisation in 40 countries with 7500 professionals. It is also a member of the Praxity alliance which brings together 23000 professionals in 65 countries. Praxity is a global alliance of independent firms committed to the high standards required in international business (Fisher, 2007).

5.4.1. Overview of the Egyptian Member

This firm is identified as one of the oldest accounting and audit firms in Egypt and the Middle East region as it was founded in the 1940s.

This firm has a staff of 600, providing different services to multinational, international, and national business entities working in Egypt. The members of this

[1] Information about the cases have been collected from the interviews with the informants, the unstructured interviews collected before the pilot studies, and the websites of these audit firms available online.

firm have played an important role in the standardisation of Egypt's accounting and auditing profession. Moreover, the firm publishes a periodical every quarter which is considered a specialised reference publication; it includes major professional and academic research in the fields of audit, accountancy and taxation. Also, the firm has organised a number of conferences and symposia with the National Bank of Egypt and other organisations.

5.4.2. Professional Services

Audit firm A is rendering different services to their clients including:

Tax services: involving anticipating, answering and resolving tax queries promptly as well as tax planning. The Audit firm introduces the tax services staff as having a professional relationship with the Tax Authority in Egypt.

Social insurance services: for the permanent employee system and the casual, or temporary, system which are the main components of social insurance system in Egypt.

Financial and management consulting services are other services that are provided by Audit Firm A. The Financial and Management Consulting Division provides its services in many fields such as market research and marketing studies, economic and financial feasibility studies, financial system development, organisation and management development, valuation, privatisation and restructuring, strategic planning, financial monitoring and internal control systems.

Corporate services: including company formation as the corporate service team undertakes the completion of the legal procedures associated with the establishment of joint stock companies, partnerships, wholly-owned foreign subsidiaries, foreign representative and branch offices. The corporate service division claims that its staff can deal with handling registration of company stocks and shares at the Egyptian

Capital Market Authority, and provide services related to mergers and acquisitions of a business enterprise. In addition, the corporate services team provides outsourcing services for several business enterprises such as: accounting, book keeping, payroll, and internal audit.

Special services: are rendered by this audit firm in case of legal administration (sequestration) or in cases of voluntary or obligatory bankruptcy, or in cases of liquidations.

Specialised training programs: the audit firm indicates that they can design training programs that covers their clients' needs. The audit firm has previously conducted training courses to financial and manufacturing institutions to cover different areas including management, finance, marketing and taxation. The computer consulting division in this audit firm is conducting computer software user training programs.

Executive recruitment: another service rendered by Audit Firm A in Egypt and the Gulf countries. The firm assists its clients in placing candidates in different fields such as finance, management information systems, human resources, sales and marketing, engineering, project management, and administration.

The two services that are rendered by Firm A and are related to this research are **the auditing and business advisory services**, and **the computer consulting service**.

Auditing and Business Advisory services: the primary goal in performing audit engagements is to render an opinion on the financial statements in accordance with International and Egyptian Auditing Standards; it also seeks to add value to audit services by effectively communicating the business implications of the audit findings. This division indicated that their audit approach can be classified into five phases:

Client service planning: by working with the client management to reach a common point about the objectives of the audit, the scope of work and client service expectations.

Assessment of the risk factor: by understanding the company's control environment and identifying specific risk factors and their relationship to accounts and potential errors.

Develop an audit plan: based upon the risk assessment. An individual plan for each audit location is created by involving the appropriate personnel in each planning phase, reaching an up-front agreement on scope, timing, and responsibilities.

Performance of audit work: in accordance with the Egyptian Auditing Standards. This division pays attention to the internal control structure which involves the control environment, the accounting systems being used, and a review of the control procedures implemented by management.

Conclude the audit report and report to management: which involves performing a subsequent review of events, obtaining management representations, and preparing an audit summary memorandum. They issue the report on financial statements and communicate to management any business recommendations or information on deficiencies detected while performing the audit.

Moreover, the auditing and business advisory services division indicates that it can provide other services such as accounting consultation. They can provide advice on the appropriateness and application of accounting principles and policies for any particular business situation. They claim that they and can provide advice on specific industry practices and procedures as well as developing accounting procedures and management reports. In addition, the staff of this division indicate that they can provide services related to the internal control development as it can help companies

to develop workable internal control systems and work with the clients to setup the system and enhance it over time to ensure that controls are sufficient to meet future needs as they grow. It is important to indicate that the audit services department depends heavily on computer specialists from their computer consulting division.

Computer Consulting Services: this service is provided by the computer consulting division. The Firm introduces the team of this division as a highly qualified and trained team who have been performing IT audit services since the mid 1980s. Moreover, the leader of this team is a CISA holder with approximately 30 years of experience in IT audit. This firm introduces itself as a business partner with some of the international accounting software vendors that are reputed to be amongst the best in the IT industry. Different services are rendered by this division including:

Strategic Automation Planning: helping clients to define their information requirements, from hardware and software to organisation and training requirements, to deliver the right information to the right person. The division have developed and documented specific methodologies to guide this effort.

ERP Systems Implementation and Training: this service starts by performing functional reviews to identify the user requirements in different business areas of the organisation. It includes software installation, implementation, and training for users and system administrators to help them in using the system.

Applications Systems Development: when the client needs a custom-made software-system the work is designed to be in four phases: systems analysis, preliminary systems design, technical design and system implementation. As soon as the customer accepts the software, system support starts in order to monitor its operational performance and suggest necessary change and upgrades throughout the life of the system.

Computer Outsourcing Services: the main areas to provide this service in are payroll and accounting. This happens through using specialised resources (such as professional experts, hi-tech equipment and supplies) to process the information received in the shortest time possible. Then they present the pre-agreed output reports to the clients on a timely basis.

Computer Training: the division provides computer training for their clients in different areas of computer technologies including basic and advanced skills. The computer consulting service division indicate that they can provide their clients with computer training programs that are designed according to their needs.

Computer Audit and Risk Management: this service covers different aspects relating to the organisation's computerised information like:

Information systems security evaluation: the division indicates that it has developed a methodology for identifying sensitive data resources and evaluating the controls over access to these resources. This methodology is specially suited to computer installations which process highly confidential, proprietary or sensitive financial data.

Information technology controls review: which aims to review the scope of the overall general IT controls environment in the company. The objectives of this review are to assess the overall quality of security in key functional areas and to identify specific security and control risks, and then submit recommendations for improvement.

Contingency planning and disaster recovery: the division claims that they can assist clients in the evaluation and development of plans, which define the risks relating to interruption of data processing services and methods to mitigate those risks through rapid recovery. The development of contingency plans considers those aspects of

data processing and the company's business operations that are most critical to the survival of the company.

Information security management: the division claims that it provides consultation about the establishment and maintenance of a system to manage the information security. It encompasses logical and physical access security consideration. The management of information security involves the systematic integration of techniques that ensure the security of information systems and the integrity of the data processed. This security management system is designed to be on-going and provide senior management and users with feedback that the system is operating effectively. The division indicates that this security management system is beneficial to companies which rely heavily on the integrity and continuity of processing.

Application systems control evaluation: the division indicates that it can provide assistance to their clients in the system specification and design phases of application development to ensure the presence of adequate control features. This involves the definition of user and business needs and their translation into the overall system specifications so that the user/system interface and overall application controls, both manual and automated, are properly integrated.

5.4.3. Clients and Expertise

The audit firm indicates that it has clients from different industries, so the creation of Industry Groups was a good solution, from the firm's point of view, to provide specialised advice to clients. A specialised partner, with a qualified team, heads each Industry Group. Clients and industry groups can be classified into:

Banking and financial institutions*:* this is headed by a senior partner who divided this group into sub-groups which are banks, financial institutions, mutual funds,

investment banking, asset management, portfolio management, insurance, brokerage, and investments.

Manufacturing*:* includes different sectors such as textile and apparel, food, processing, pharmaceutical, commodities, cement, automotive, and other manufacturing.

Oil and gas: this specialised group classified their clients into three categories which are oil exploration and development, oil distribution, and gas transmission.

Hotels, hospitals and real estate: the firm indicates that it supports numerous hotels and real estate development entities.

5.5. Introducing Case B

This organisation is one of the Big Four international firms specialising in audit, tax, consulting and financial advisory services. It focuses on providing clients with high quality services through a global strategy executed locally in nearly 140 countries with the help of approximately 165000 people worldwide.

5.5.1. Overview of the Egyptian Member

Audit Firm B was established in Egypt in 1950s. It is considered to be one of the leading firms in Egypt and the Middle East. In Egypt, the firm provides its services to multinational companies, large national corporations and prominent private businesses as well as public sector companies and banks. It employs about 350 staff members. The firm claims that its staff possess specialised knowledge, strengthened by the global resources and expertise of their international organisation, allowing them to provide high quality services to their clients.

5.5.2. Professional Services

This firm claims that it renders different services to their clients including:

Tax services: the team who renders this service aims to keep their clients aware of any developments of tax laws that may affect their business. In addition, the team indicates that they can help clients to interpret the significance of these laws and consider their effects on business strategy.

Consulting: the consulting division indicates that it provides customers with the help needed to perform any required changes in different areas. These areas include enterprise applications, human capital, strategy and operations, technology integration and outsourcing. The consulting division tries to help their clients to run their business more effectively and efficiently, improve the cash flow and cut costs, gain a competitive edge, and expand their financial management capability.

Financial advisory service: this service provides strategic and financial advisory services to clients throughout the phase of the economic cycle. It comprises five distinct but related global service lines whose shared principal objective is the creation and enhancement of shareholder and stakeholder value. The main service lines are corporate finance, forensic and dispute services, transaction services, reorganisation services, merger integration, acquisition and due diligence services, and valuation services.

Enterprise risk services: the ERS group claims that they offer their customers services that help them to understand business risks, determine the acceptable level of exposure, implement controls, and provide ongoing measurement and monitoring of the risk environment. They try to help their clients to overcome the risks they could face through each stage of the business risk cycle. This group indicates that ERS encompass a variety of services offered to their client which are:

Corporate governance: through this service**,** the team aims to assist the boards of directors of clients and their audit committees in fulfilling their oversight responsibilities and respond to any new regulatory and stock market requirements for corporate governance reform.

Internal audit: the ERS group adopts a risk-based approach to internal audit to help clients to improve performance and operating efficiency. The team indicates that they can provide full range of services such as helping to design a strategic plan for internal audit, reengineering existing departments, providing specialised resources, or completely outsourcing the entire internal audit function.

Risk management: the team claims that they can provide different services such as identifying and prioritising strategic and business risks, assessment of risk mitigation strategies and action plans, development of audit and business risk models, review and design of risk management frameworks, and monitoring and reporting systems.

Two other services, which are related to this study, are rendered by the ERS group which are control assurance and IT security.

Control assurance: through this service, the team helps clients to identify, develop and test internal control policies and procedures within business process and information technology environments. They provide this service as part of an internal audit or financial statements audit or individual projects resulting from major organisational changes, implementation of new technologies or reliance on third-party service providers. The services include: control reviews over applications and/or computer environments, information quality, and systems project assurance.

IT security: The team indicates that they can help their clients to improve their systems' reliability, information protection and availability, Internet security, and

electronic commerce reliability. The firm indicates that the services rendered by the IT security group can be classified into:

Application integrity: the group claims that they can assist clients in the design and implementation of the appropriate infrastructure for their applications. They work with clients to integrate their security dependent web application from the Internet to their back-end systems and the underlying technology infrastructure. In addition, they indicate that they provide control assurance and services in connection with custom system development projects and applications requiring the testing of data quality and integrity.

Attack and penetration: the team assists their clients in this area by operating as ethical hackers to identify threats/vulnerabilities related to their environment and systems by utilising the latest software products used by the hacker community. Their approach is to evaluate the security of the clients' environment as well as their ability to prevent, detect, and ward off unauthorised intruders.

Infrastructure security: the team indicates that this service helps clients to manage information security risks associated with technological infrastructure. The team assists their clients in the design, implementation, and assessment of the environment necessary to support the requirements of their enterprise. The team claims that they have previous experience with environment hardening, cryptography, firewalls, virtual private networks, intrusion detection systems and other services.

Security strategy development: the team helps clients in securing information and corporate resources through the use of proactive policies, guidance, and communication. They assist their clients in the development of information Security strategies, and Information Security policies and procedures.

Audit services

The primary goal in performing audit engagements is to render an opinion on financial statements in accordance with the Egyptian Auditing Standards. The firm indicates that its audit approach aims to add value to their clients by enhancing quality and productivity.

To improve the quality of statutory audits, attention is paid to gain a thorough understanding of each client, the business and its environment. Then, the controls needed to guard against the risks of material misstatement of a company's financial position including fraud, are assessed. After the assessment of the business essentials, audit procedures that are designed to avoid risks of material misstatements are carried out. To leverage their professionals' skills and time, their practice uses their proprietary audit support software, AuditSystem/2, which supports all phases of the audit process, from planning to execution to reporting.

5.5.3. Clients and Expertise

The firm indicates that its staff has a broad knowledge of serving a variety of industries including:

Banking and financial services: these services are provided by staff who have experience and industry knowledge to provide financial services. Services offered to the financial services industry include: governance, design and realisation (corporate, finance and risk), people transformation (advisory and development), executive information (business and customer intelligence), technology and client alliances (advisory, project management and implementation), mergers and acquisition (targeting, evaluation and execution), transformation improvement and post-merger integration (organisation, cost and process), business risk control (mitigation and

forensics), tax structures (compliance and advisory), actuarial and insurance consulting services.

Manufacturing: the team helps in looking to new technologies and processes to maintain a lean operation, efficient supply chain and good internal controls.

In addition, the firm has specialised groups who provide their services to other industries such as real estate, gas, oil, and petrochemicals, investments, and construction.

5.6. Introducing Case C

Audit Firm C is a global network of professional services firms providing Audit, Tax and Advisory services. The Firm has 137,000 staff members who are working in 144 countries all over the world.

5.6.1. Overview of the Egyptian Member

Audit Firm C was established in Egypt in 1940s. It is considered to be one of the leading firms in Egypt as well as the Middle East. The firm currently has about 1000 staff serving clients from two offices: one in Cairo, the capital of Egypt; and the second in Alexandria.

Audit Firm C is a member of one of the Big Four international audit firms. The Egyptian member indicates that this membership provides it the ability to combine both the global experience with the detailed knowledge of local Egyptian laws, regulations, markets and competition.

5.6.2. Professional Services

The firm indicates that its staff can render different services including:

Tax services: the complexity of fiscal legislation and the great emphasis placed upon tax planning have increased the need for tax advisory services. The firm

indicates that the staff provides the tax services in two phases. The first is tax planning and advice to help clients in evaluating the most effective tax accounting methods and periods, evaluate the effects of the tax law structure, increase the tax benefits or savings, and provide consultation on tax aspects of proposed transaction. The second phase is tax compliance. According to Egyptian Tax Law, companies are required to present a yearly tax return to the Tax Authorities that shows the taxable profit computed in accordance with the provisions of the law and calculating the tax liability. Towards this, the tax services staff indicates that they can assist in the preparation of the annual tax return in a way that helps clients to minimise their tax liabilities within the limits permissible by the law. Further, the firm can certify to the Tax Authorities that the tax return has been prepared in accordance with the provisions of the Tax Law. If any disagreements arise with the Tax Authorities, the firm can act on behalf of its clients in negotiating tax liabilities. Tax service is an important source of income for the audit firm.

Social insurance services: the firm indicates that its staff can render this service depending on a thorough understanding of the Egyptian Social Security Law and its applications combined with a good working relationship with the Social Insurance Authority in Egypt. This combination allows the firm to provide the social insurance service effectively.

Company formation and advice on Investment Laws: the Investment and Company Formation team assists, or acts on behalf of: the investors; businessmen; and foreign companies in all matters related to establishing new businesses in Egypt under the companies law or under the investment law.

Financial advisory services: the financial systems department claims that its staff can perform different activities including the design of financial systems and

financial regulation as well as the review of established financial systems and internal controls. Moreover, they can help clients to develop and implement policies, procedures, and internal audit manuals to help mangers understand and manage risk. The department indicates that they conduct training courses on financial accounting, cost accounting, and reporting techniques. In addition, it offers long term financial management assistance.

Corporate finance services: the corporate finance team states that they have an extensive background in banking, economic consulting, law, tax planning and accounting. This team can provide advisory services regarding business valuations, privatisation, financial restructuring, corporate transactions, issuance of bonds and research.

Transaction services: most of the major transactions in the Egyptian market are awarded to this firm. Transaction services include transaction evaluation, vendor initiated, pre-deal evaluation, bid services, vendor assistance, transaction structuring, stock exchange reporting, and contract assistance.

Market research and feasibility studies: the firm states that the aims of this service are to conduct customer satisfaction surveys to quantify customer satisfaction with the clients' products or services, perform market penetration studies, perform packaging and brand name testing, perform market positioning studies and provide product testing prior to market launch.

Human resources development: the firm indicates that this service aims to help employees focus on job requirements and develop the behaviour to perform their jobs successfully and to redefine the organisational structure and establish core competencies and functions of each business unit. Moreover, it aims to detail management philosophy and establish policies and practices that reflect this

philosophy and to assist with the management change process. It conducts salary and benefits surveys also.

The two services that are rendered by the Firm C that are related to this research are the auditing and accounting services and the enabling technologies services.

Auditing and Accounting Services

Auditing is the fundamental activity of the firm. Most of the firm's clients are joint stock companies, or branches of foreign companies whose audit requirements are prescribed by the Companies Act. Also, the client base of the audit firm includes multinationals, international and local government agencies, non-governmental organisations, and financial institutions.

The firm indicates that its audit approach is based on a consistent methodology developed to comply with the Egyptian Standards on Auditing. It is built on the basis of core principles relating to professional integrity, independence and ethical behaviour with which all partners and staff must comply. The firm claims that this service is enhanced by technologies and tools that assist teams to access knowledge, including the firm's computer-assisted audit techniques (CAATs) and Accounting Research Online, all designed to help teams focus on the issues that impact on audit judgments and improve the effectiveness and efficiency of the audit.

Moreover, the firm states that its approach is based on gaining a thorough understanding of the clients' business and financial issues in order to perform an effective audit. To achieve this understanding, the firm form specialised audit groups for different industries. Such specialised groups indicate that qualified partners and auditors are involved in conducting the audit. The audit service provided by the firm is considered a dynamic one as it is designed to meet any new requirements and regulations.

Audit and accounting services provided by the firm include: statutory and non-statutory audits, agreed upon procedures, limited review, compilation services, internal audit engagements, internal control systems reviews and bookkeeping services.

Enabling Technologies Services

The firm states that these services are rendered by eighteen consultants in four inter-dependent divisions who have access to use each other's resources and experience. The main services rendered by these divisions are:

ERP implementation: the firm claims that a team of nine functional and four technical advisors provides services around ERP solutions in different industries. These services include the selection of the system, its installation and configuration, and provide the training needed to use the system. In addition, the team provides services related to data conversion and the documentation of the system.

IT Strategy and Business Intelligence: this service includes different activities such as software assessment, hardware assessment, setting IT strategy, software selection, and the activities related to security procedures.

Business Processes service: include management change, mapping the client's current business process, setting the manual procedures around the ERP's, setting the coding structure for master database tables for ERPs and setting the audit/ control during the ERP system implementation.

Technical division: includes database support, optimisation and administration (Oracle/Sybase) for ERPs, customisation and modification of ERPs, data warehousing and data mining. It also includes the LAN/WAN design and hardware procurement.

5.6.3. Clients and Expertise

The firm indicates that it has clients who perform in different industries. For that reason the firm is structured into specialised industry groups. The industry focus has enabled it to develop in-depth knowledge of clients' businesses and to provide them with an informed perspective on the issues they face. In other words, such groups indicate that qualified staff is involved in conducting the audit. The specialised industry groups are classified into banking and finance, energy and natural resources, building and construction, industrial products, insurance, consumer products, and information, communication and entertainment.

The detailed overview of the three firms A, B, & C ensure their suitability to be chosen as the main cases for this research. This overview shows that these firms deal with different industries and, as a result, they deal with different electronic systems. In other words, the staff in these audit firms is expected to have the necessary experience to provide the researcher with suitable information for this research. Further, the three firms have computer divisions that render different services to different clients which indicate that the information system auditors working in these firms will be a reliable source of information.

5.7. Summary

This chapter provided a detailed description of the setting where the fieldwork took place. It started by providing an overview of the audit profession in Egypt by presenting the laws that shape the legal framework of auditing in Egypt, and introducing the professional bodies that play an effective role in shaping the profession. The audit education and the auditing standards in Egypt were also discussed.

The rationales behind choosing audit firms A, B, & C as the main cases were discussed. Then the chapter presented detailed description of the three audit firms A, B, & C. This description is considered as the first step of achieving the first objective of the study, opening the black box of the audit firms in Egypt. Information about the audit firms, the services they provide and the type of their clients is essential information that can help in opening their black box to understand how they consider auditing in advanced electronic environments. Achieving this objective will be elaborated in Chapter 7.

6. Chapter Six: Data Collection and Analysis Approach

6.1. Introduction

The aim of this chapter is to present the actual operation of data collection and data analysis carried out in this study. This chapter starts by providing an explanation of the data collection process through its three stages: the preliminary interviews, the pilot case studies, and the main case studies. It then provides a discussion of the design of the interview questions followed by presentation of the main features of the respondents who participated in the three stages of the study. The steps undertaken for preparing the interviews for analysis are discussed. NVivo software was used to help in the analysis of the data. Using NVivo for qualitative data analysis and its use in this research is discussed. The chapter ends by presenting how Miles & Huberman's approach, with the use of NVivo, is adopted for the analysis of this study.

6.2. Data Collection Process

As illustrated in figure 6.1, the data collection process for this study involved three different stages, namely the undertaking of preliminary interviews; carrying out the pilot case studies and finally conducting the main case studies.

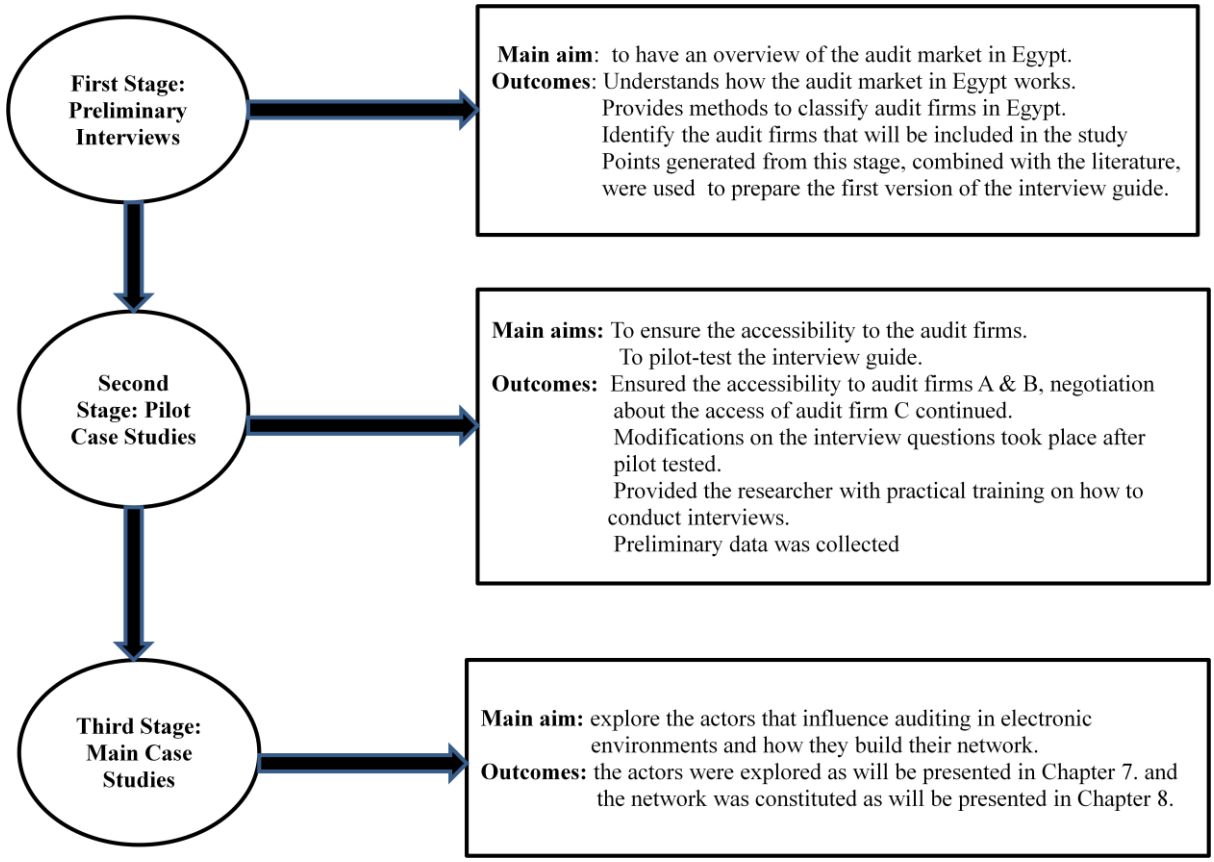

Figure 6.1: Data Collection Process

6.2.1. The Preliminary Interviews

The main aim of the preliminary interviews was to have an overview of the audit market in Egypt as no literature covers this area in Egypt. The researcher contacted twelve auditors to join this stage. Purposive sampling technique (discussed in section 4.5.2.3) was used to select these auditors. However, five of them did not show interest in joining the study and they indicated that they may not be able to help the researcher in gaining access to their audit firms. Seven interviews were conducted in this stage with participants who can provide the required information (information about the participants are provided in section 6.4). Many benefits were achieved from the preliminary interviews.

The main benefits of the preliminary interviews are:

Firstly, it provided the researcher with an understanding of how the audit market in Egypt works. For example, it helped the researcher to identify who are the big audit firms in Egypt, as there is no formal, or standard, ranking for audit firms in Egypt. It also helped the researcher to understand the competition especially between the international audit firms to have the highest market share and how some of them use audit fees as a main method to compete (as will be discussed in Chapter Six).

Secondly, these interviewees in the exploratory study implied that audit firms in Egypt can be classified according to three different perspectives:

The first perspective based upon the nationality of the audit firms. Audit firms can be classified into three categories. The first category includes the Big Four international audit firms. The Big Four audit firms have an Egyptian member: Hazem Hassan Public Accountants and Consultants is a member of KPMG International; Mansour & Co. is a member firm of PricewaterhouseCoopers; Saleh, Barsoum & Abdel Aziz is a member of Deloitte; and Ernst & Young Egypt is a member of Ernst & Young Global. The second category includes the audit firms which are members in international audit firms (excluding the Big Four) like Mostafa Shawki & Co. which is a member of Mazars International; Grant Thornton Mohamed Hilal which is a member of Grant Thornton; and Wahid Abdel Ghaffar & Co. which is a member of Baker & Tilly International. The third category includes audit firms who do not have a foreign partner which can be introduced as 100% Egyptian audit firms.

The second perspective is based upon the type of electronic systems the auditors' clients use. The electronic systems used by clients vary between very advanced electronic systems, or legacy, traditional, computerised accounting systems, or manual systems. The interviewees stated that most of the clients who use advanced

electronic systems mainly consider the adoption of internal fully integrated information systems such as the enterprise resource planning systems (ERP). The external integrated systems like electronic data interchange (EDI), e-commerce and e-business systems are not used widely by their clients.

The third perspective is based upon the attitude of audit firms towards dealing with electronic systems. Some audit firms have strong IT audit departments that can support them in external audit and can offer separated services to clients. Other audit firms depend on outsourcing IT specialists when needed. Other audit firms do not believe in the importance of the computer audit and the need to involve IT audit specialists. Their financial auditors are dealing with the electronic systems the same way as dealing with the manual systems, they take print outs of financial reports and work with them as if they are dealing with a paper environment. A partner in a 100% Egyptian audit firm expressed this point by stating that:

> *for a financial auditor, if he takes the printouts of the journal entries, and checks whether it has been posted to the sub-ledgers correctly and then to the general ledger and the trial balance, then this will be enough for him....The story for me starts and ends with some of the outputs: trial balance, journal entries and ledger. If the entries are posted correctly, then things will be correct, but if for example I found that the total of the sub-ledgers are not the same of the general ledger this indicates that there is a problem.*

Thirdly, these preliminary interviews were useful to shed light on some of the points that should be considered during the study. For example, the interviewees mentioned that there are many financial problems (discussed in Chapter 7) that can hinder the quality of auditing in advanced electronic environments. The points generated from the exploratory interviews, combined with the points picked out from reviewing the literature were used to design the first version of the interview guide as shown in Appendix 3.

Fourthly, during the preliminary interviews the researcher was able to identify the audit firms that can be included in the study. Audit Firms A, B, & C were the audit firms chosen for conducting the main case studies. The rationale behind choosing these audit firms were discussed in Chapter 5 Section 5.3.

6.2.2. The Pilot Case Studies

The second stage in the fieldwork was to conduct a pilot study. The literature in qualitative research generally agrees on the importance of a pilot study as a final check before the journey of data collection takes off. Yin (2003) argues that the initial interview instrument and case study design should be kept flexible and open for further improvement. In this respect, a pilot case study would help researchers to refine the interview instrument and improve data collection procedures (Teijlingen & Hundley, 2001; Sampson, 2004; Yin, 2003).

The pilot studies for this research were undertaken in Audit Firms A & B with four participants. Two key persons in each audit firm were interviewed. The first is a partner in the Audit Division, and the second is a partner who is responsible for the Computer Audit Division.

<u>The pilot studies were able to achieve different goals:</u>

The first goal achieved through the pilot studies was to ensure accessibility to the site. As indicated previously, gaining access in Egypt is not an easy task. That is why I preferred to ensure that I would be able to collect the necessary data and conduct the needed interviews with qualified participants. This goal was achieved in Audit Firms A & B. The researcher was not able to conduct a pilot study in Audit Firm C because of the researcher's time constraints. However, negotiations around access

took place during this stage with a key person in Audit Firm C (an audit division partner).

The second goal achieved was to pilot-test the interview questions in order to assess their suitability and appropriateness. Maxwell (2005) indicated that the researcher should pilot-test the interview guide with people as much like the planned interviewees as possible to determine if the questions work as intended and what revisions the researcher may need to make. The interviews conducted in the pilot studies showed that some modifications had to take place on the interview questions prepared depending on the literature and the preliminary study (shown in Appendix 3), some questions were cancelled and others were added to produce the final version of the interview questions (shown in Appendix 4).

The third goal achieved from the pilot studies was to provide the researcher with practical training on how to conduct interviews. For example, during an interview with the audit partner in Audit Firm A, I noticed that I had to consider the wording of my probes to keep the interviewee's interest to complete the interview. During the interview, I probed about the relation between the financial auditors and the information system auditors in the audit firm by stating that "*so we can say that financial auditors depend totally on information system auditors to audit the electronic systems".* The interviewee showed, using his body language, that he did not accept my comment. He expressed his refusal by stating that:

> *"…we cannot say we totally depend on them, it is a close collaboration. We have to explain to them what we need to know, and then we give them a free reign to do their jobs sufficiently. But at the end of the day they know that they have to come back to us with their findings. After that we do the entire job, so depending on them in an initial stage does not mean that we totally depend on them"*

I realised that I had to pay attention to my probes and to consider how I would word the ideas that came into my mind during the interviews before starting the main case studies in the third stage in order not to lose the attention of my interviewees.

The fourth goal achieved from the pilot studies was the collection of preliminary data concerning the actors that can have an influence on auditing in electronic environments, and how these actors interact with each other. The data collected during this stage was considered when the actors are identified (in Chapter 7) and when the network of auditing electronic environments was constituted (in Chapter 8).

6.3. Designing the Interview Questions

Designing the interview questions is a crucial process in interviews (Collis & Hussey, 2003: 168). Moreover, the way in which questions are asked during the interview has a major bearing on how the responses are likely to be (King, 2004: 17). King (2004: 15) indicated that there are three sources for topics to be included in an interview guide: the research literature, the interviewer's own personal knowledge and experience of the area, and informal preliminary work such as discussions with people who have personal experience of the research area. These three sources were used when preparing the interview guide.

The interview questions, for this study, were designed in two stages. The first version of the interview guide (Appendix 3) was designed according to the topics that have been mentioned in the literature review (Chapter 2) combined with the issues that arose in the preliminary interviews (explained in section 6.2.1). The interview questions were pilot-tested in two pilot studies conducted in two audit firms with four participants. One of the main purposes of the pilot study was to assess the suitability and the appropriateness of the interview questions. Maxwell (2005) indicated that the

researcher should pilot-test the interview guide with people as much like the planned interviewees as possible to determine if the questions work as intended and what revisions the researcher should consider. The interviews conducted in the pilot cases showed that some modifications had to take place on the interview questions, where some questions were cancelled and others were added, to produce the final version of the interview questions (shown in Appendix 4).

The general topics and themes covered in the interviews are summarised as follows:

1. The type of the electronic systems used by the auditors' clients.
2. The problems the financial auditors and the information system auditors face when dealing with advanced electronic systems.
3. Issues of the internal controls
4. The influence of the electronic audit evidence on the audit process.
5. The influence of the IT client staff on the audit.
6. The influence of the electronic system's vendor on the audit process.
7. Using CAATs in auditing electronic systems.
8. The quality of the Egyptian educational system to provide qualified auditors.
9. The relationship between the financial auditors and the information system auditors in the audit firms.
10. The audit fees and any financial concerns when auditing in advanced electronic environments.
11. The suitability of the International auditing standards and the need for an Egyptian auditing standard[1].

[1] In June 2008, Ministerial Decree 166/2008 was issued to approve the release of thirty eight Egyptian audit and limited inspection standards. The new 38 standards will replace the current standards, and will be effective by January 2009. The interviews were conducted from June-October 2007 before issuing this ministerial decree.

A semi-structured interview approach was employed (as discussed in chapter 4) to address the questions. This approach was viewed as the most appropriate way to obtain the in-depth views and experiences of the financial auditors and the information system auditors, in the three audit firms, who deal with advanced electronic environments.

The questions were designed as open-ended questions using phrases that can help in exploring the participants' points of view such as: what do you think about this issue? Can you discuss further this point? Such design gives the chance for participants to explain their point of view in detail, and allows the interviewer to ask follow up questions, when needed, to encourage the interviewees to provide more information about the issue under discussion.

Most of the questions (21 in total) were asked to all the interviewees (financial auditors and information system auditors) in the main case studies including the three audit firms. However, in some interviews the researcher did not ask all the questions because either the responses of the interviewees for former questions included the answers of later questions, or because the interviewees did not show their interest in specific issues. In this case I preferred to lose their answers to some questions rather than lose their interest in the whole interview. Moreover, one question (about hiring information system auditors) was asked to the partner of the computer audit department in the three audit firms as they are responsible for choosing their staff. Another question (about judging the competence of the information system auditors) was asked only to the financial auditors to understand how they can rely on the work of the information system auditors.

6.4. The Participants

As discussed previously in Section 6.2, the study was conducted in three stages: the exploratory stage, the pilot study stage and the main study stage. The interviewees were chosen so that they could provide the needed information in each stage. Table 6.1 shows the features of the participants included in the three stages of the study.

No.	Position	Group	Years of experience	International certification	Audit firm	Stage
1	Partner	Audit division	19	CPA	International big four audit firm	Exploratory
2	Managing partner	Audit division	20	CPA	International audit firm	Exploratory
3	Partner	Audit division	23	None	100% Egyptian audit firm	Exploratory
4	Partner	Audit division	21	None	100% Egyptian audit firm	Exploratory
5	Partner	Computer audit division	18	CISA	International audit firm	Exploratory
6	Audit manager	Audit division	13	None	International audit firm	Exploratory
7	Audit manager	Audit division	14	None	100% Egyptian audit firm	Exploratory
8	Partner	Audit division	18	CPA	Audit Firm A	Pilot study
9	Partner	Computer audit division	25	CISA	Audit Firm A	Pilot study
10	Partner	Computer audit division	16	CISA, CISM, ISO	Audit Firm B	Pilot study
11	Supervisor	Audit division	10	CPA	Audit Firm B	Pilot study
12	Partner	Audit division	20	CPA	Audit Firm A	Main study
13	Partner	Audit division	17	CPA	Audit Firm A	Main study
14	Partner	Computer audit division	25	CISA	Audit Firm A	Main study
15	Audit manager	Audit division	15	None	Audit Firm A	Main study
16	Audit manager	Audit division	12	None	Audit Firm A	Main study
17	Partner	Computer audit division	16	CISA, CISM	Audit Firm B	Main study
18	Partner	Audit division	18	CPA	Audit Firm B	Main study
19	Audit manager	Audit division	15	CPA	Audit Firm B	Main study
20	Partner	Audit division	18	CPA	Audit Firm C	Main study
21	Partner	Computer audit division	30	None	Audit Firm C	Main study
22	Supervisor	Audit division	12	CPA	Audit Firm C	Main study
23	Deputy manager	Computer audit division	9	CISA	Audit Firm C	Main study
24	Senior audit manager	Audit division	13	CPA	Audit Firm C	Main study

Table 6.1: Information about the Participants in the Three Stages

In the exploratory stage, I aimed to have an overview of the audit market in Egypt as no literature covers this area. Seven interviews were conducted with auditors who have experience ranged between 13-23 years in auditing which is an indicator that they have good information about the Egyptian audit market. Moreover, the interviewees are working in different audit firms: international big four audit firms, international audit firms (but not from the big four), and 100% Egyptian audit firms where they do not have a foreign partner. Such diversity provides a holistic perspective about the situation in the Egyptian audit market and how auditors in different audit firms deal with advanced electronic environments.

In the pilot study stage, four interviews were conducted in two audit firms. The participants were chosen to be key persons who could provide the researcher with good feedback concerning the questions, detailed information concerning the topic under discussion, and also who could facilitate access to other auditors in the audit firm. In each audit firm two key persons were interviewed, the first was a partner in the Audit Division, and the second was a partner who is responsible for the Computer Audit Division. All the participants are certified with experience ranged between 10 and 25 years. This indicates that they are a suitable source of the information needed in this stage.

In the final stage, the interviewees varied between financial auditors and information system auditors in three audit firms (A, B, & C) who could provide good information about dealing with electronic systems. The findings of the data collection and analysis are presented in Chapter 7.

6.5. Preparing the Interviews for Analysis

Preparing the interviews for analysis is an important step that cannot be ignored. Creswell (2003: 191) indicated that organising and preparing the data is the first step of analysis. The sequence of conducting the interviews and preparing them for analysis is shown in figure 6.2.

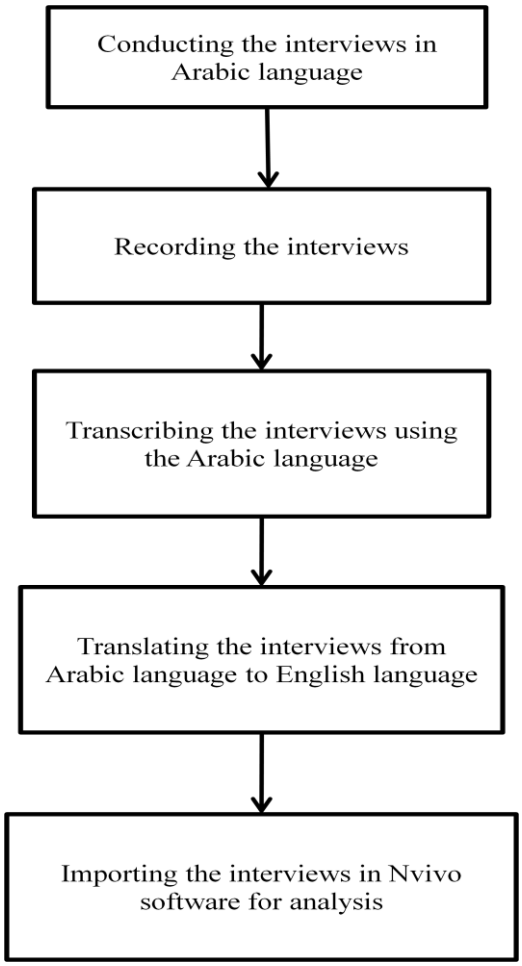

Figure 6.2: The Sequence of Preparing the Interviews for Analysis

18 interviews (out of 24 interviews) were tape-recorded to avoid the loss of data and to be able to retrieve when needed. Kvale (1996: 160) explained the significance of recording the interviews by stating that:

> "*The interviewer can then concentrate on the topic and the dynamics of the interview. The words and their tone, pauses, and the like, are recorded in a permanent form that can be returned to again and again for re listening*".

Listening to interview tapes prior to transcription can be seen as a first step of analysis (Maxwell, 2005: 96). Six interviewees did not to accept to record the interviews; however they gave the researcher enough time to write down the needed notes.

The interviews were conducted in Arabic, as it is the mother tongue of the interviewees and the interviewer. It is better to conduct the interviews in the respondents' primary language so that their ability to communicate effectively is not impaired by having to speak in a language with which they are less familiar (Bryman & Bell, 2007: 496) and to maximise the quality of data (Twinn, 1998). The transcripts were prepared in the Arabic language at the first stage. The transcription process is very time consuming; Bryman and Bell (2007:491) stated that researchers should allow five to six hours to prepare a transcription of a one hour interview. The researcher preferred to transcribe the interviews by herself to be more familiar with the data which could help her to speed the analysis process (Arkesy & Knight, 1999). In addition, the entire interviews were transcribed to ensure that the details and richness of information emerging during the interviews are fully captured in their actual sequence. However, transcriptions are considered an inadequate record of non-verbal actions as it does not include the visual aspects of the situation, neither the setting nor the facial and the body language of the interviewees (Kvale, 1996:161; Mason, 1996: 53). To overcome this problem, the researcher recorded her observations during the interviews as much as possible; these observations were considered during the analysis.

After preparing transcripts, translating the interviews from Arabic to English took place. Researchers are advised to translate the transcripts into English so that they

can analyse the data in the language that they will use to write their report (Bryman & Bell, 2007). Data translation is a crucial issue; however it is rarely discussed (Xian, 2008). Frequently, this process is summarised by indicating that data are translated from language A to language B by the researcher or by a translator. Translation from one language to another can have implications of the quality of the data (Twinn, 1998), and as a result this process should not be ignored.

Temple & young (2004) indicate that translating data can be undertaken by the researcher as a translator, or by professional translators. In this study, I translated the interviews by myself. Researchers who translate their data could be in a better position to analyse the data, because *"the researcher can use the experience of translating to discuss points in the text where she has had to stop and think about the meaning"* (Temple & Young, 2004: 168). Moreover, the translator does not simply just translate. Translation is first a sense-making exercise. The translator must understand and make sense of the material she/he is dealing with, before translating it into another language. This sense-making process brings the translator's knowledge; social background; and personal experience into play (Xian, 2008). In other words, translating qualitative data involves a degree of data analysis the researcher should not miss.

The literature indicates that translating qualitative data can face different issues such as linguistic, socio-cultural and methodological problems (Twinn, 1998; Temple & Young, 2004; Xian, 2008). I faced the first two problems while translating the data.

The first problem concerns the linguistic differences between languages. For instance, there are some Arabic words for which there is no true equivalent in English. Finding the appropriate English words to capture or represent the meaning of Arabic data was a continuing problem throughout the translation process. Mason

(1996: 35) indicated that the decision of the verbal utterances to be turned into text and the process of doing it depends on the person who is doing the translation. This issue raises questions about the extent to which translated data accurately reflects the feelings and experiences of the participants (Twinn, 1998). The second problem in relation to data translation is socio-cultural. This issue is associated with the translation of Arabic words originated from old stories and traditions. Translating such words according to its literal meaning will become meaningless to readers who do not understand the cultural background. To overcome these problems, I used the approach suggested by Xian (2008) while translating data. I used a contextualised approach of translation in which I focused on contextual consistency rather than verbal consistency between the Arabic language and the English language. In other words, I considered such words according to their meanings embedded in the interviews so as to reflect and feelings and experiences of the interviewees. After finalising translation, I consulted a native English speaker to ensure the translated data are understandable.

The last point of preparing the data for analysis was to import it into NVivo 8 software[1]. NVivo 8 provides different tools (as will be discussed) that encourage analysts to think about each document in detail whilst also making links, making comparisons and identifying commonalities. These tools can be used concurrently (Bazeley & Richards, 2000:62).

The next section will shed light on the usage of NVivo for qualitative data analysis and how it was used for the analysis of this study.

[1] The researcher prepared the interview transcripts using word processor, and then imported it into NVivo. Another option was to create the files directly using NVivo. The researcher preferred using the word processor as it has some functionality which are not presented in the NVivo like spelling checking, word count, and thesaurus.

6.6. Using NVivo for Data Analysis

One of the most notable developments in qualitative data research in recent years has been the arrival of computer software that facilitates the analysis of qualitative data. Computer-assisted qualitative data analysis software (CAQDAS) has been a growth area in terms of both the proliferation of programmes that perform such analysis and the numbers of people using them (Bryman & Bell, 2007: 603). One of the best software packages is NVivo which can increase speed and efficiency of the analysis process (Gummesson, 2003: 485).

Scholars from different disciplines used NVivo for qualitative data analysis. Some of them used it as a helpful programme for coding while others used it to perform different tasks such as performing comparisons and generating themes. Using NVivo in previous studies from different disciplines is presented in appendix 5.This is not a comprehensive list of all studies used NVivo for analysis, as this is not the aim of this research. However, reviewing part of this literature was important for the researcher to understand how scholars used NVivo for the analyses of their studies.

As for this study, two steps were undertaken to start using NVivo as a helpful tool for analysis. The first step was to create a project in the software for this research. This project acted as a container to all the data files used during the project. It became an organised storage file system that helped the researcher locate material and store it in one place (Creswell, 1998). Opening the project files enables immediate access to all of its components. Such live contact to source data increases the researcher's closeness to data (Lewis & Silver, 2004).

The second step undertaken was to arrange the transcripts in a meaningful way. Four folders were created in the internal sources as shown in the screenshot in figure (6.3).

The first folder includes the interviews conducted in Audit Firm A, the second folder includes the interviews conducted in Audit Firm B, the third one includes the interviews conducted in Audit Firm C, and the last one includes the transcribed exploratory interviews.

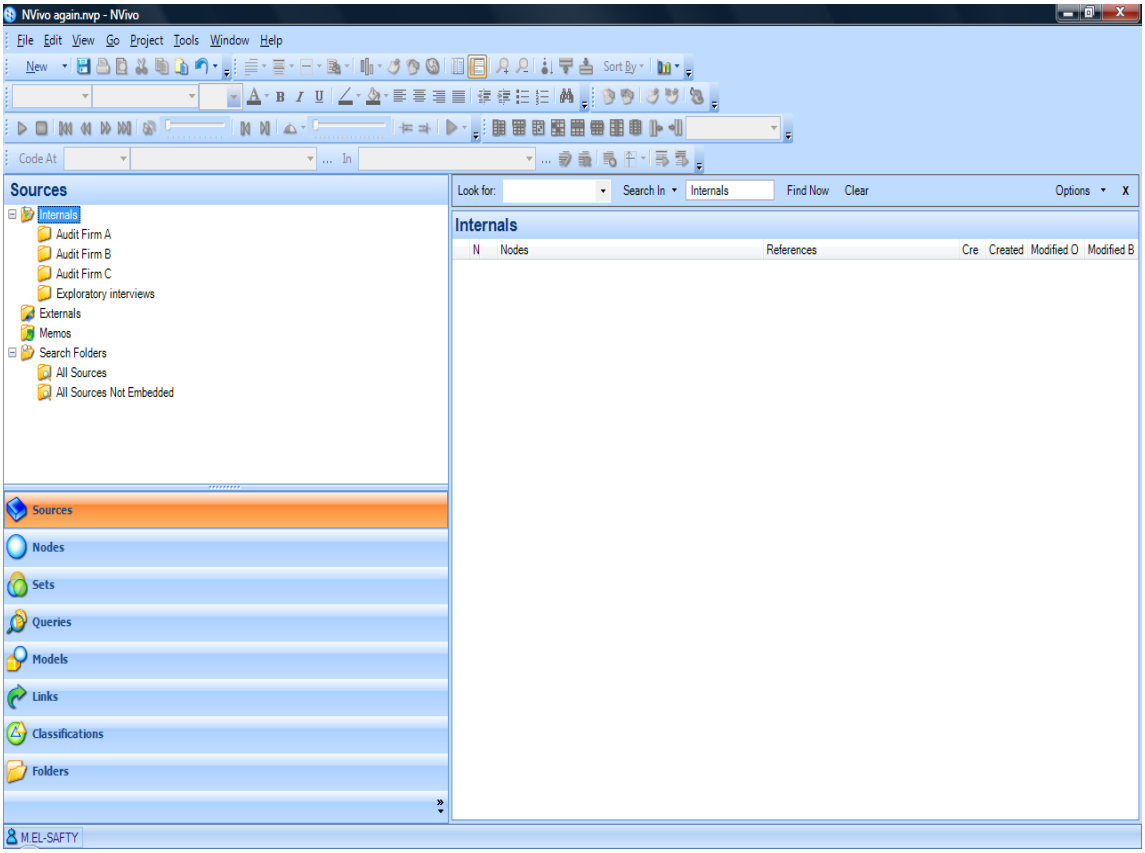

Figure 6.3: Creating Folders Using NVivo

Moreover, each of the interviews was considered as a case and the attributes of each case was identified. Using the attributes tool helped the researcher to classify the interviewees according to their type (financial auditors or information system auditors), the type of the audit firm they are working in (big four international audit firms, international audit firms but not from the big four, or 100% Egyptian audit firms), or according to their gender (male or female) Figure 6.4 shows the attributes assigned to the cases.

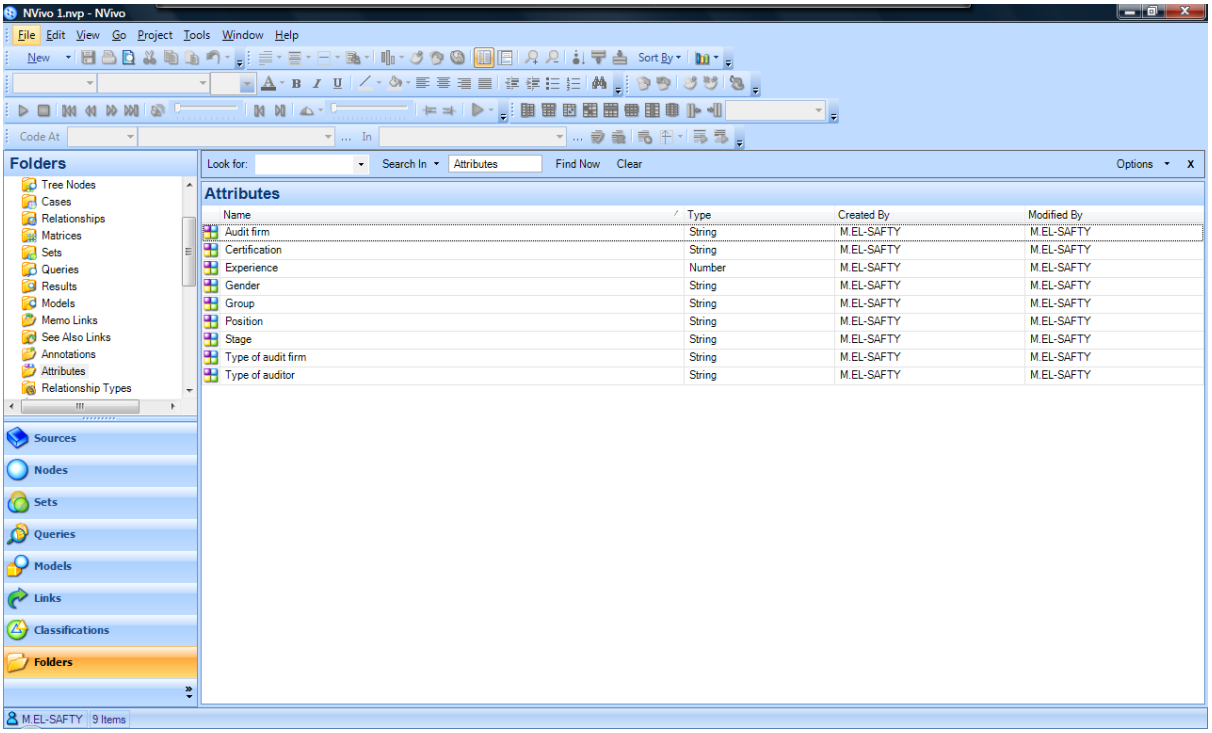

Figure 6.4: Creating Attributes Using NVivo

Attributes can be used to search in the data and conduct comparisons (Bazeley & Richards, 2000: 40). For example, the researcher can inquire (using queries option in NVivo) about the point of view of the information system auditors working in a big four audit firm concerning a specific topic, or the point of view of the financial auditors on the same topic, etc. Figure 6.5 shows the results of some queries used in the study.

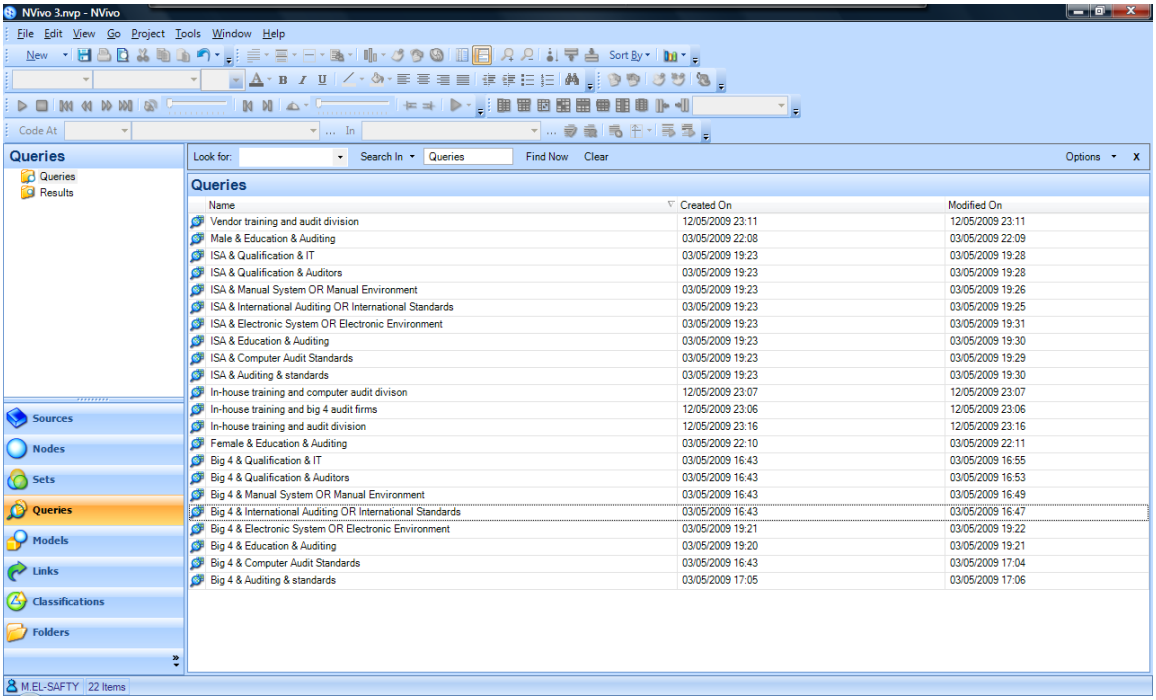

Figure 6.5: Creating Queries Using NVivo

In this research, using NVivo allowed for in-depth exploration of data including comparisons between the transcripts to explore the main categories and sub-categories. It also allowed for a more flexible, iterative approach to data analysis. The particular value of this capability is that it supported direct engagement with the data, allowing for iteration analysis of the emerged categories to be merged or split as appropriate. Using NVivo for coding and categorising is discussed in relation to the Miles and Huberman analysis approach in the next section.

Using NVivo in this study encouraged the researcher to look at the transcripts line by line and think about the meaning of each sentence and idea. In other words, it helped to "micro analyse" the interview transcripts (Strauss & Corbin, 1998: 57). Creswell (1998: 156) indicated that researchers who do not use computer software for qualitative data analysis are likely "*to casually read through the text files or transcripts and not analyze each idea carefully*"

Moreover, the researcher gained many advantages by using NVivo software as a tool to help in analysing the data such as (Beck, 2003; Creswell, 1998; Silverman, 2000):

- Decreasing the time required to perform tedious manual tasks
- Enabling the researcher to handle large amounts of qualitative data
- Enhancing the flexibility and comprehensiveness of data handling
- Allowing for more a visible audit trail

It is important to indicate that NVivo assists the qualitative data analysis but it does not undertake the thinking for of the researcher (Bryman & Bell, 2007). Unlike quantitative data analysis, which can be automated, qualitative data analysis requires the intervention of the human mind as qualitative data needs to be uncovered, inferred and interpreted within a context. Such tasks cannot be performed by computer software. In other words, NVivo is a tool to assist the qualitative data analysis as an iterative process; however, it is not a substitute for the core role of the analyst searching for meanings behind any given data. Gummesson (2003: 485) summarised this point by stating that *"the software can store data in an orderly way, provide structures and hierarchies of data, perform certain analytical tasks and respond to questions that the researcher puts to the data. Software assists, but does not take over interpretation"*

6.7. Miles and Huberman Approach for Qualitative Data Analysis Using NVivo

There are different approaches that can be adopted for analysing qualitative data (e.g. analytic induction, grounded theory approach, discourse analysis, etc.). However, the Miles & Huberman approach (1994) was adopted in the analysis of the interviews. The main reason for adopting this approach is its harmony with ANT, the theoretical backbone of this study. One of the main concepts of ANT is relationality, where all the actors are connected in relation to each other. Miles & Huberman's approach does not consider the analysis as a process which is separated from the other steps of

doing research; they defined the analysis in relation to the other processes of the research as shown in figure 6.6.

Miles & Huberman's analysis has three main components which are data reduction, data display and drawing and verifying conclusions. These three components are interwoven and concurrent throughout the data analysis.

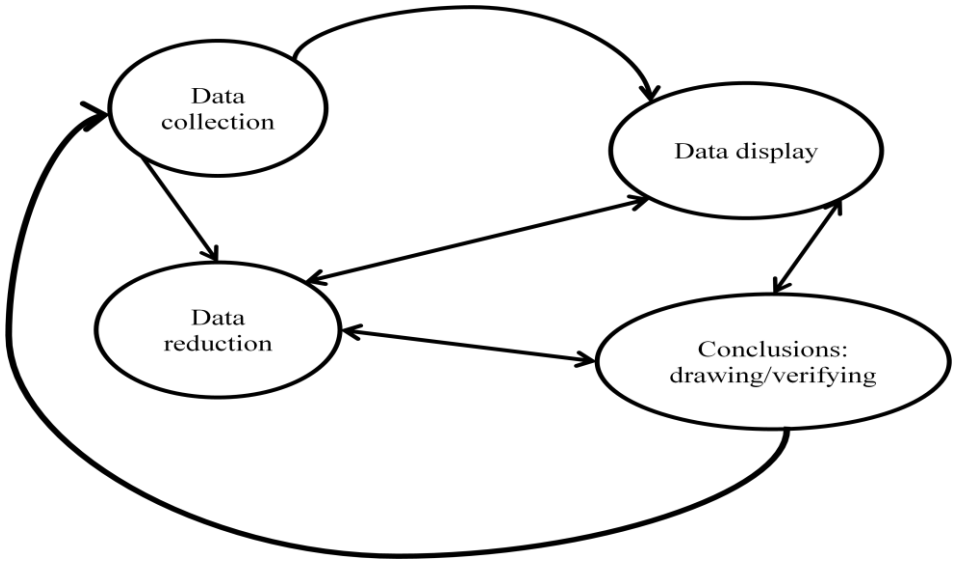

Figure 6.6: Components of Data Analysis: Interactive Approach

Source: Miles & Huberman, 1994: 12

Data reduction: is a process that occurs continuously throughout any qualitative research. It starts when the researcher identifies the research questions, the cases that will be included in the research and the data collection approaches that will be chosen. Then it takes place when dealing with the written fieldnotes or the transcriptions of the interviews where the researcher decides which data will be coded and which to pull out and which codes will be grouped in one category. In other words, data reduction is not something separate from the analysis; it is a part of analysis. It is *"a form of analysis that sharpens, sorts, focuses, discards, and organizes data in such a way that "final" conclusions can be drawn and verified"*

(Miles & Huberman, 1994: 11). Data reduction continues after the fieldwork until a final report is completed**.** Coding and memoing are essential strategies for data reduction. These strategies will be discussed in the next sub-sections.

Data display: is an *"organized, compressed assembly of information that permits conclusion drawing and action"* (Miles & Huberman, 1994: 11). The main form used for displaying qualitative data was the *extended text*. However, because of the volume of qualitative data dealing with extended texts as one bulk during the analysis it was a difficult task for the researcher. Displays help the analysis process at all stages of the research. There are different ways for displaying data such as matrices, graphs, charts, networks, diagrams and any other way that moves the analysis forward, any of which is appropriate. Different forms were used in the study to display data in all the stages of this study like matrices (e.g. Table 7.1 that presents the main similarities and differences in the findings between the three audit firms, and Table 7.2 that presents a checklist of these differences and similarities), and diagrams (e.g. Figures 8.1, 8.2, 8.3, and 8.4 used to define the relationships of the actors through intermediaries).

Drawing conclusion and verification: the reasons for reducing and displaying data are to assist in drawing conclusions. While drawing conclusions logically follows reduction and display of data, in fact it takes place more concurrently with them. Possible, early, conclusions may be drawn during the data collection but they could be vague and ill-formed at this early stage. Researchers should hold these conclusions tentatively at first pending further work that can produce its final shape. However, conclusions are not finalised until all the data are collected and have been analysed. Conclusions are also verified during the analysis process.

Miles & Huberman (1994) indicated, analysing data is not separate from the other research processes. Researchers need to explain how this process takes place in order to provide meaning to what they are doing.

6.7.1. Reading through the Interviews

The first point considered, after organising and preparing the interview for analysis is to read through it in order to obtain a general sense of the information and reflect on its overall meaning (Bryman & Bell, 2007: 594). Notes taken during reading the interviews is a valuable source that helps in generating the initial codes.

Whilst reading the interviews I used the *annotations*[1] tool of NVivo 8. Annotations are fast to prepare and fast to access (Bazeley & Richards, 2000: 50). They allow the researcher to add any notes or ideas on the transcript. In addition, it allows the researcher to add more than one note, or idea, for each point if needed. Appendix 6 shows an example of an interview transcript with annotation.

Reading through the interviews helps the researcher to understand *"What general ideas are participants saying? What is the tone of the ideas? What is the general impression of the overall depth, credibility, and use of the information?"* (Creswell, 2003: 191).

After getting the initial sense of the interviews, I started the coding process using NVivo. Coding is an essential method for data reduction (Miles & Huberman, 1994).

6.7.2. Coding

The literature presented two meanings of coding. On the one hand, coding is the starting process of data analysis and the foundation for what comes later in this analysis (Bryman & Bell. 2007: 593; Punch, 2005: 199). On the other hand *"coding is analysis"* (Miles & Huberman, 1994: 56) as it is the core of the data analysis. Both

[1] Like scribed notes in a margin, annotations enable the researcher to comment on selected content.

of these meanings are correct as coding begins the analysis and it also continues on different levels during the analysis (Punch, 2005: 199) as will be discussed when introducing the types of coding. Miles & Huberman (1994: 56) provided a comprehensive definition for coding by stating that:

> *"Coding are tags or labels for assigning units of meaning to the descriptive or inferential information compiled during a study. Codes usually are attached to "chunks" of varying size-words, phases, sentences or whole paragraphs, connected or unconnected to a specific setting"*

Neuman (2006: 460) indicated that coding involves two simultaneous activities: mechanical data reduction; and analytic categorisation of data. Data reduction requires hard work from researchers to reduce large amounts of raw data into small, manageable heaps. Categorisation of data takes place when qualitative researchers analyse data by organising it into categories on the basis of themes, concepts, or topics of similar features.

Codes are used to organise and retrieve the pieces of data. Organisation entail some system for categorisation of the various pieces so the researcher can quickly find, pull out and cluster the segments related to a specific question or topic (Miles & Huberman, 1994: 57). NVivo was used to facilitate the coding process. In NVivo, the containers for coding are *nodes*, where a node is made for each topic or concept to be stored (Bazeley & Richards, 2000: 24). The program permits multiple codes for the same data. In addition, it helps to overcome the manual labour of coding, to rearrange the codes, and to retrieve them when needed as coding using NVivo allows immediate retrieval of the text that was coded (Bazeley & Richards, 2000:23). However it does not automatically make the codes as the researcher is the one who has to interpret the data, to create the codes, to reorganise and to retrieve them when

needed. In other words, *"CAQDAS does not and cannot help with decisions about how to code qualitative data or how to interpret findings"* (Bryman, 2007: 621).

6.7.2.1. Creating codes

Miles & Huberman (1994: 57) suggest three approaches for creating codes:

- *"Creating a provisional "start list" of codes prior to fieldwork. That list comes from the conceptual framework, list of research questions, hypotheses, problem areas, and/or key variables that the researcher brings to the study.*
- *A more inductive researcher may not want to precode any datum until he or she has collected it, seen how it functions or nests in its context, and determined how many varieties of it there are.*
- *Partway between a priori and inductive approaches, is that of creating a general accounting scheme for codes that is not content-specific but that points to the general domains in which codes can be developed inductively."*

The third approach was adopted when creating codes in this study; some codes have been determined according to relevant categories that emerged in the literature review while other categories were created inductively from data. Corbin & Strauss (2007) introduced the same idea. Although they emphasised that researchers bring to inquiry a considerable background from the literature, still *"there is always something new to discover. If everything about a topic is known beforehand, there is no need for qualitative study"* (Strauss & Corbin, 2007: 36).

Reflecting on this study, the literature pointed out to the importance of using computer assisted audit techniques (CAATs) when dealing with advanced electronic environments, so CAATs (will be discussed in Chapter 7, section 7.8) as a category, was in my mind when creating codes. Types of electronic systems (will be discussed in section 7.2.1) are also introduced in the literature, so it was another identified category in my mind. However, the problems that face auditors when dealing with electronic systems were created inductively from the data. The financial considerations (will be discussed in section 7.11) of dealing with an advanced

electronic system was not clear in the literature, this category, and its sub-categories, was created inductively from the data.

It is important to indicate that it is difficult to create fixed codes, when starting the analysis, and keep them without changes. Codes change and develop during the analysis as:

> *"Some codes do not work; others decay, no field material fits them. Other codes flourish, sometimes too much so. Too many segments get the same code, thus creating the familiar problem of bulk. This problem calls for breaking down into subcodes"* (Miles & Huberman, 1994: 61)

This was the case while coding in this study. For example, the literature suggested adoption of the continuous online auditing approach when dealing with advanced electronic systems, so a code was created for it. However, during data collection and during analysis I found that this approach is not adopted by the audit firms in Egypt. So, this code was omitted.

Other codes *flourish.* The interviewees pointed to the financial considerations that may have an influence on dealing with electronic systems. Many segments had this code, so I split this into sub-categories: financial concerns relate to the audit firms, financial concerns relate to the clients, financial concerns relate to the audit fees.

6.7.2.2. Types of Codes

Types of codes vary according to the analysis approach. For example the grounded theory analysis approach introduced three types[1] of coding which are open coding, axial coding and selective coding (Strauss & Corbin, 1998). The Miles & Huberman approach (1994: 57) introduced two levels of coding: first level coding and pattern coding.

The first level coding aims to produce a working set of codes. At this level codes might be descriptive as they entail little interpretation. It involves a process of

[1] For more details about coding in the grounded theory approach, refer to Strauss & Corbin, 1998.

naming and classifying what is in the data where the researcher is only *"attributing a class of phenomena to a segment of text"* (Miles & Huberman, 1994: 57). The researcher may go far in this level by handling the data more interpretatively. First level codes are valuable in getting the analysis started, and in enabling the researcher to get the sense of the data (Punch, 2005: 200). Further, they are very useful in summarising segments of data and provide the basis for the pattern codes (Fielding & Lee, 1998). I created the first level code using NVivo. The first level code matches with using the *free nodes*[1] in NVivo. Free nodes do not assume relationships with other concepts, so they are useful at the beginning of coding (Bazeley & Richards, 2000: 25). At this stage, it could be useful to make generous use of free nodes in order not to structure the data too early. When the structure is more obvious, tree nodes are used (Bazeley & Richards, 2000). Appendix 7 shows a list of the free nodes created. These free nodes include both the codes that were identified from the literature, as well as the codes created inductively during the analysis.

The pattern codes are explanatory or inferential codes as they identify an emergent theme, configuration or explanation (Fielding & Lee, 1998; Miles & Huberman, 1994: 69). They pull together material into smaller and more meaningful units. According to Miles & Huberman (1994: 70) pattern codes *"usually turn around four often interrelated, summarizers: themes, causes/explanations, relationships among people and more theoretical construct".*

[1] What is a node? NVivo's help system in earlier releases defined coding as 'the process of marking passages of text in a project's documents with nodes'. Nodes are, therefore, the route by which coding is undertaken. In turn, a node is defined in the latest releases as 'a collection of references about a specific theme, place, person or other area of interest'. When a document has been coded, the node will incorporate references to those portions of documents in which the codes appears. Once established, nodes can be changed or deleted. Nodes can take different forms. Tree nodes and free nodes are two of these forms. In tree nodes, the nodes are held in a treelike structure, implying connections between them. In free nodes, the nodes stand-alone with no clear logical connection with other nodes.

The pattern codes match with the tree nodes created using NVivo 8. Tree nodes are used when the analyst finds that there is a need to create a node as a subcategory of another node (Bazeley & Richards, 2000: 70). In other words, tree nodes are used when the analysts move from descriptive coding towards interpretive coding.

NVivo 8 allows the creation of tree nodes which can be hierarchically structured with categories, subcategories and any number of sub- subcategories (Bazeley & Richards, 2000). The arrangement of the nodes is flexible so that the trees can be rearranged to reflect the analyst's perceptions towards the data in the different stages of analysis (Bazeley & Richards, 2000: 72). Appendix 8 shows a list of the tree nodes created.

The categories, and the sub-categories, created during the analysis are discussed in chapter 7. Table 6.2 summarises these categories and sub-categories.

Category	**Sub-categories**
Electronic systems in Egypt	• Types of the electronic systems. • Problems of dealing with the electronic systems. ▪ The conversion period. ▪ The unsuitability of the electronic system. ▪ Hosted electronic systems. ▪ Lack of awareness.
Electronic audit evidence	
Competence of financial auditors	• Formal university education • Practical training ▪ In-house training ▪ Vendor training • Experience
Competence of information system auditors	• Formal university education • Practical training ▪ In-house training ▪ Vendor training • Experience • Criteria of hiring information system auditors
The relation between financial auditors and information system auditors.	
Automated internal controls	• The responsibility of evaluating automated controls. • Problems of automated controls.

Computer assisted audit techniques (CAATs)	• Usage of CAATs.
	  ▪ Using audit software
	  ▪ Using CAATs to extract data.
	  ▪ Using CAATs to test the effectiveness of the automated controls.
	• Problems of using CAATs.

Vendors of the electronic system	• Well known vendors • Local less known vendors
IT client staff	• Different interests between the auditors and the IT client staff. • Lack of awareness • Lack of co-operation. • Resistance of using automated tools. • Ignorance of security controls
Financial considerations	• Financial considerations relate to the audit firms • Financial considerations relate to the auditors' clients • Financial considerations relate to the audit fees
Standards and guidelines	• Auditing standards. • Computer audit standards.

Table 6.2: Summary of Categories and Sub-categories of the Study

6.7.3. Memoing

Memos are the second fundamental tools for data reduction in qualitative analysis (Bryman & Bell, 2007; Miles & Huberman, 1994). Memoing is a continuous process in qualitative data analysis. It starts at the beginning of analysis, like coding, and it continues till its end (Punch, 2005: 201).

According to the widely used definition of Glaser (1978:83-84; cited in Miles & Huberman, 1994: 72)

> *"A memo is the theorizing write-up of ideas about codes and their relationships as they strike the analyst while coding... it can be a sentence, a paragraph or few pages...it exhausts the analyst's momentary ideation based on data with perhaps a little conceptual elaboration"*

However, Miles & Huberman (1994: 72) added that memos do not stand only for the codes and their relationships as they can cover any aspect of the study. They can be substantive, theoretical, methodological or even personal. Neuman (2006: 464)

pointed out that researchers can use analytic memos to discuss their thoughts and ideas about the coding process. Researchers have to regularly write memos while analysing data; memos not only capture the researcher's analytic thinking about the data, but also facilitate such thinking, stimulating analytic insights (Maxwell, 2005). In other words, memos are potentially very helpful for researchers to focus their attention and to crystallise their ideas and not to lose track of their thinking on various topics (Bryman & Bell, 2007: 589; Bazeley & Richards, 2000:45).

In this study, memos were mainly used to find the relation between the data collected and the theoretical background used in this study, Actor-Network Theory. These memos were helpful in the process of building the network of auditing in electronic environments that will be discussed in Chapter 8. Memos developed during the analysis were imported into NVivo as it allows the researcher to *"keep memos sortable"* (Miles & Huberman, 1994: 74). Besides, it can show links between memos and the source or the node that cause the emergence of this memo (Bazeley & Richards, 2000: 45). However, NVivo does not allow linkage of one document with more than one memo which is, in my point of view, a weak point in the program as some sources may give the researcher more than one idea to be added in the memos, but it cannot be linked to its source.

6.8. Summary

This chapter presented the actual operation of data collection and data analysis carried out in this study. After introduction, it started by explaining the three stages of the data collection process including the preliminary interviews, the pilot case studies and the main cases. The Chapter then moved to discuss the process of designing the interview questions followed by reviewing the main features of the respondents who participated in the three stages. The steps undertaken for preparing

the interviews for analysis were presented, followed by an explanation of how NVivo can be used in qualitative data analysis and its usage in this study. Finally, the chapter presented how Miles & Huberman's approach, with the use of NVivo, was adopted for the analysis of this study.

7. Chapter Seven: Research Findings: Introducing the Main Actors in the Egyptian Environment

7.1. Introduction

The purpose of this chapter is to introduce the main actors that have an influence on auditing in electronic environments in the Egyptian context. These actors are introduced from the analysis of the data collected in the three stages (exploratory, pilot and main studies) introduced in Chapter 6. This Chapter achieves two objectives of this research (the research objectives are discussed in Chapter 1, Section 1.3), the first is that it opens the *black box* of the three audit firms A, B, & C who participated in the study to understand how they consider auditing in advanced electronic environments. The second objective achieved in this chapter is the introduction of the actors that constitute the network of auditing electronic environments in Egypt. Building the network of auditing electronic environment is discussed in Chapter 8.

It is important to understand that the order of the actors in this chapter does not indicate their level of importance. ANT claims that every actor in the network, whether a human or non-human actor, has an important role to play. All these actors are important without differentiating or giving priority to any of them as ANT calls to adopt a symmetrical approach to all human and non-human actors. Besides, it is important to indicate that each actor presented can be seen as a network in itself (as discussed previously in Chapter 3). However, analysing the details of the network which is inside each actor is a very complicated and difficult task. To prevent undue complexity and to prevent dealing with endless networks, the researcher will adopt one of the notions of ANT which is dealing with each actor as a "*black box*"[1]. I will look inside these black boxes to discover what can serve this study only, without

[1] For more details about actors and black box, refer to Chapter Three section 3.6

trying to find all the details inside each box as such details in each box will reveal unlimited networks.

7.2. Electronic Systems in Egypt

The type of electronic system is one of the actors that should be considered by auditors as the requirements for auditing a simple electronic system differ from the requirements of auditing an advanced electronic one. The interviewees in Audit Firms A, B, & C indicated that most of their clients use electronic systems; the minority of them use simple accounting systems while the majority use internal fully integrated electronic systems akin to enterprise resource planning (ERP) systems that have become commonly used in Egyptian companies. However, the interviewees stated that they do not have clients who use external fully integrated electronic systems such as e-commerce systems. There are some challenges that obstruct the adoption of e-commerce in Egypt; such as a relatively weak telecommunications infrastructure with a low bandwidth capacity that leads to long waiting time for access and downloading (Kamel & Hussein, 2002). Lack of trust is another challenge with respect to electronic payment systems as there are no banks in Egypt that offer the secure electronic transaction (SET) system which decreases the chance of the adoption of e-commerce as it needs electronic payment systems to be available, efficient and secured (Elbeltagi, 2007; Kamel & Hussein, 2002). The payment problem was mentioned by the Computer Audit Partner in Audit Firm A who stated that *"when I was going to pay the fees of the CISA exam, I was not able to use my credit card, we are not allowed to pay online except by using internet credit cards which have a small limit and can be used only by the elite."*

7.2.1. Types of the Electronic Systems

The interviewees in Audit Firms (A, B, & C) classified the electronic environment they deal with into three main types; dominant, significant and minor environment. The classification of the IT environment depends upon the complexity of the system and its importance to the client. In the dominant IT environment, there is a heavy reliance on the electronic systems. Banks, insurance companies, and communication companies are examples of dominant IT environment. The computer audit department partner in Audit Firm B introduced the dominant environment by stating that:

> *Dominant means heavy reliance on computer systems and they are complex, there could be more than one system, interface between the systems, data warehouse reading from different applications and a network that exists all over the country…in such environment if the clients lost their network they would lose their business*.

In significant IT environments, the electronic system is still very important, but if it fails for a while the client can still perform their work. The computer audit department partner in Audit Firm B gave an example for significant environments

> *In a significant environment, like hotels, computers are very important, but if they do not exist they can still do manual reservation. The hotel will not stop working if the system is not working but in a bank or communication company, if they lost their network they would lose their business.*

In a minor IT environment computers are rarely used, or the clients are using simple applications like Word or Excel, or they are using simple accounting application and the majority of the work is done manually.

7.2.2. Problems of Dealing with the Electronic Systems

The interviewees in Audit Firms A, B, & C presented four main problems they faced when dealing with advanced electronic systems.

1. The conversion period from a manual or simple electronic system to an advanced one is the first problem. An audit partner in Audit Firm A and a

senior audit manager in Audit Firm C indicated that the period of converting from a manual or a simple electronic system to an advanced electronic one is a critical period where different problems may take place. They presented two reasons for the occurrence of problems in this period. The first reason is the users' resistance to accepting a new system. Sometimes users do not accept such transfer and as a result they do not exert much effort to understand how to use the system and they do not try to overcome any problems in it. A supervisor in Audit Firm C stated that *"if you have the best system in the world and the users are reluctant, it is useless".*

The second reason is the quality of training provided to the users of the electronic system as suitable training may not be provided to all users and as a result the system cannot be used efficiently so the client may stop using that system. One of the interviewees, during the exploratory study, gave an example of one of his clients who bought an expensive fully integrated system but he stopped using it after nine months. Training was provided to all the accountants and the engineers on how to use the system, but other workers who performed small jobs did not have enough training. As the system was a fully integrated one, small jobs may cause huge problems in the system. The interviewee emphasised this point by stating:

> *But the point is that the system is fully integrated, you trained the accountants and the engineers but you did not train the other workers, so the man who is looking after the storehouse does not know how to deal with the system, the worker in front of the machine was not able to make it work; although the program was good, he was not able to manage to work the system as a whole. So he stopped using this program because the staff was not ready*

2. The unsuitability of the chosen electronic system is another problem auditors face. An audit manager in Audit Firm A indicated that some clients choose

the electronic system without enough understanding of its suitability for their needs as this choice is governed by the cost of the system and so they may look mainly for a low price. On the other hand, an audit partner in Audit Firm A indicated that some of her clients buy very advanced systems although they do not use all the features available for such a system. In addition, some clients do not hire qualified IT staff who can deal with such an advanced system and so do not reap the advantages of all its features. Acquiring and keeping qualified IT staff is accompanied with offering them high salaries.

3. Hosted electronic systems: Another problem mentioned by both an audit partner and a computer audit partner in Audit Firm B relates to central computerised systems where some of the systems are hosted outside Egypt. This means that the Egyptian client does not have control over the system and the main function of the IT client's staff is data entry. In this case the IT client's staff in Egypt does not have the rights to make any modifications to the system except through a written request to the IT department where the system is hosted. As a result the information system auditors in the audit firm do not have anything to audit in the Egyptian branch and they have to contact their audit firm member abroad to ask its information system auditors (who have audited the system abroad) to send them reports regarding the general automated controls and the business cycles controls to ensure that things are working adequately. This problem was mentioned only by the auditors in Audit Firm B.
4. Lack of awareness of how to deal with the electronic system is the fourth challenge mentioned by the information system auditors in the three audit

firms. An information system auditor in Audit Firm C stated that one of his clients adopted a new release of an advanced electronic system but he was insufficiently aware about this release. He had not received an invitation from the client to attend the training course provided to his IT staff by the vendor of the system. To overcome such a problem, the information system auditor spent more time and effort, using the manual of the electronic system, to understand how the system works.

7.3. Electronic Audit Evidence

The type of audit evidence produced from electronic systems is another important actor that affects auditing in an electronic environment as using electronic systems often requires auditors to obtain evidence electronically as discussed in Chapter 2 Section 2.3.1 (Helms & Lilly, 2000; Nearon, 2005; Rezaee& Reinstein, 1998; Williamson, 1997).

The information system auditors in Audit Firms A, B, & C indicated that in advanced electronic systems there are many internal integrated transactions, which cause the disappearance of the audit trail[1]. The computer audit division partner in Audit Firm A explained this point by stating that there are two kinds of electronic evidence; one that stays for a long time and another one that stays for a short time and then disappears. For transactions where their audit trail stays for some time, the interviewee stated that:

[1] The audit trail is a chronological record of system activities that shows all additions, deletions, and changes to both data and software. It can be used to trace and verify the source documents and other data supporting the financial statement assertions, from their input into the system to their output, or vice versa. In other words, it enables the reconstruction, review and examination of a transaction from its inception to output and final results (CICA, 2003)

> *If we understand the application well, we can determine which output will give us the needed information. The output does not mean the printout; we may ask for a copy of the electronic file and add it to our database then use our analytical tools to conduct the needed audit tests that determine whether the information which is presented without a clear audit trail is correct.*

For transactions where the audit trail is retained only for a short period of time after which it cannot be accessible or is not available to perform the relevant audit tests, for example, in the case of sending an order via the Internet to buy a product or a service where the audit trail disappears after the implementation of the order, computer auditors depend on observation by seeing how the order is implemented from its beginning to the end before the disappearance of the audit trail. However, the interviewee indicated that they are not faced with this problem frequently, as customers can place their orders online but they do not pay online because of the payment problem in Egypt which was discussed previously.

Audit Firms B & C use the same method as Audit Firm A to overcome the loss of the audit trail as they use a backup copy of the data file to reprocess the data using their automated tools to ensure that their results are the same as produced from the client's system.

The interviewees in the three audit firms indicated that they do not always deal with electronic audit evidence as some of their clients do not use fully integrated electronic systems and as a result the paper audit evidence is still available. As an audit partner in Audit Firm A stated *"the processing of the data is computerised but the documentation is not."*

7.4. Competence of Financial Auditors in Dealing with Advanced Electronic Systems

The literature indicates that financial auditors need a higher level of technology skills to be able to deal with electronic systems and to be able to supervise and review the work of computer auditors to ensure the accuracy of their work (Helms & Mancino, 1998; Pathak, 2003a; POB, 2000). Different sources can help financial auditors to enhance their IT skills such as formal university education for entry into the accounting profession, practical training and experience in auditing advanced electronic systems (Boynton et al., 2001).

7.4.1. Formal University Education

With regard to education, all the interviewees in the three audit firms indicated that the educational background of financial auditors does not allow them to be competent enough in dealing with advanced electronic systems without the help of IT specialists. An audit partner in Audit Firm A explained this point by indicating that the accounting and auditing curriculum in Egyptian universities include the very basics of accounting and auditing without paying attention to auditing electronic systems. A supervisor in Audit Firm B explained the reason of the weakness of the educational system by stating that:

> *"If you look at the number of the students in year one in the faculty of commerce, Cairo University, you will find there are more than seven thousand students. By any method, how can I enhance their skills in a few lectures? Moreover the curriculum in faculties of commerce in the Egyptian universities is not designed to enhance such skills. Most of the auditing books that are taught include only the basics about auditing, without discussing any new topics, and as a result there is a huge gap between what students study in the universities and the practical reality."*

An audit manager in Audit Firm B criticised the educational system in Egypt, generally, by indicating that it does not help the students to be creative or to use their

skills, so even if they learn any useful topic in the university, they will not be able to use it in their work.

7.4.2. Practical Training

With regard to training provided to financial auditors to enhance their skills in dealing with electronic systems, it can be classified into in-house training provided to the auditors by their audit firms and the training provided by the client's electronic system vendor.

7.4.2.1. In-House Training

The computer audit departments in the three Audit Firms A, B, & C provide IT training courses to the financial auditors to teach them the basics of general computer controls and to teach them how to use the audit software used by the audit firm. In addition, they conduct training courses for financial auditors to teach them how to use CAATs in extracting the needed information from the electronic systems and give them case studies to understand it in-depth. After attending these courses, the auditors have to go for on the job training with others who have good experience in dealing with advanced electronic systems to enhance their skills in dealing with electronic systems. All the financial auditors in the three audit firms stated that they are satisfied with the training courses they attend in their audit firms and they believe that these courses cover their needs as financial auditors. An audit partner in Audit Firm B expressed this point by stating:

> *The computer audit department here organises training courses that provide us with suitable knowledge on how to deal with electronic systems, and there is a course entitled "Introduction to General Computer Controls" which provides us with general knowledge about the work of IT auditors and what they are doing when they audit the systems and the impact of their work on our audit [external financial audit].*

7.4.2.2. Vendor Training

Concerning vendor training, the financial auditors in the three audit firms indicate that it can be a good source for understanding the electronic systems of their clients and enhance their abilities to deal with such systems. However all of them indicate that they do not attend the training courses provided by the vendor regularly except an audit manager in Audit Firm A who stated that he is specialised in auditing hotels and he gets used to dealing with their systems as there are three well known software packages used in hotels and he is up to date with the vendor of these systems. If the vendor produces any version of a system he attends the training course provided to the client. An audit partner in Audit Firm A explained the reason for not attending these courses by stating that:

> *"…such course takes about two weeks, eight hours daily. Such a long time is not available for me or for my team; I cannot stop doing everything for all the other clients to attend this course…sometimes I go by myself for some sessions, sometimes I may send one of the team, it depends upon the pressure of the work"*

Other financial auditors stated that they do not attend such training courses because they can depend on the computer audit division in their audit firms to help them to understand how to deal with the advanced electronic systems. An audit partner in Audit Firm A explained that:

> *I can ask our computer audit team to help us in understanding the system and dealing with our needs from it.*

7.4.3. Experience

With regard to experience, all the financial auditors in the three audit firms indicate that experience is an essential source of enhancing their competence in dealing with advanced electronic systems as mentioned by an audit partner in Audit Firm B

"…and the most important source is experience in dealing with the clients and their electronic systems".

An interviewee (supervisor) in Audit Firm B indicated that he can depend on his experience to judge the reliability of the electronic system by stating that:

> *"experience of dealing with electronic systems is another point, I mean for example if I am looking to know the detailed cost of the production unit, and I find that the system only provides me with the total cost of the unit, without any details of its components, from my experience I can recognise that there is a deficiency in the system, and I have to consider whether that deficiency affects the financial statements".*

Finally, it is important to indicate that, the three Audit Firms A, B, & C do not hire any financial auditor without computer skills, at least the skills that help them to learn what they are taught in the training courses quickly. The minimum requirements for anyone to join these audit firms is to have some computer skills, accounting and auditing skills and English language skills. The combination between these three skills has become a minimum requirement. An interviewee in Audit Firm B (computer audit division partner) explained such needs by stating that:

> *"Generally speaking, auditors have to know at least the basics of how to use technology to be able to work in our audit firm as we have our audit software and they have at least to be able to use it. Besides, they are dealing now with electronic systems, the financial statements they have to audit is an output of an electronic environment, so how can I audit something produced from a system I do not know how to deal with? So they should have the basics like English language, basics of dealing with computers and technology and of course knowledge about accounting and auditing. After that we improve such skills by providing training courses."*

7.5. Competence of Information System Auditors

The approach of the three Audit Firms included in the study requires the involvement of the computer auditors when dealing with dominant or significant IT environments. As a result there is a separate computer audit division in the three audit firms. All the financial auditors in the three audit firms consider their computer audit team as competent. The main sources to enhance competence are formal university education, practical training and experience (Boynton et al., 2001).

7.5.1. Formal University Education

With regard to formal university education, the literature indicates that academic degrees of IT audit specialists may vary across accounting, business administration, business-oriented management information systems (MIS), computer science and non-technical areas (Viator & Curtis, 1998). However, the educational background of information system auditors in the three Audit Firms is accounting and auditing or computer science or engineering. Those who have an accounting and auditing background took courses in computers, depending on self-study, to enhance their skills and they then attend training courses provided by their audit firms to enhance their qualifications. Those who have computer science and engineering background have to learn more about audit concepts and computer auditing. They gain such knowledge from the training courses provided by their audit firms before starting their work. Moreover, some of them enhanced their competence by being CISA holders (Certified Information System Auditors).

7.5.2. Practical Training

The information system auditors indicated that practical training is gained through two main sources: in-house training and vendor training.

7.5.2.1. In-house training

The information system auditors in the three Audit Firms indicated that in-house training was an essential source to enhance their competence; the computer audit partner in Audit Firm A (CISA holder) stated that her educational background was computer science. When she joined the audit firm, more than 20 years ago, she was enrolled in three courses in the audit firm; the first was about the basics of accounting, the second was about the financial audit concepts and the last was about computer audit. She explained the importance of these courses by stating that:

> *"Before the audit concepts course, I did not understand what do they* [the financial auditors] *mean by audit risk or the audit tests that are related to the audit risk, this was hard for me to understand, and that is why I really believe in the importance of training courses and always try to enhance the training programmes for all our candidates in computer audit."*

The computer audit division partner in Audit Firm C emphasised the importance of the in-house training by stating that he spent two years as a trainee in the computer audit department of the audit firm in the UK, and after returning to Egypt he was responsible for establishing the computer audit division in the Egyptian branch of the audit firm. The main reason for establishing it was cost effectiveness; previously, in the 1980s, if the audit firm in Egypt had to audit a client with a computerised system, the computer auditors in the UK branch used to go to Egypt to audit the general computer controls of the client. After establishing the computer audit division in Egypt, its staff became responsible for conducting the computer audit. The interviewee indicated that since that time he updates his knowledge through reading, practical experience and attending seminars in the field.

The computer audit division partner in Audit Firm B is a CISA holder. She stated that the courses provided online through the learning system designed by the audit firm abroad are very important in enhancing her competence.

7.5.2.2. Vendor Training

Concerning courses provided by the vendor, the computer auditors indicate that they are keen to attend these courses if they are dealing with a new system, or a new application, as such courses enhance their ability to understand the system. However, if they have enough awareness about the system they do not attend.

7.5.3. Experience

With regard to experience, the interviewees stated that experience in dealing with electronic systems is an important source for their competence. The computer audit

division partner in Audit Firm B emphasised the importance of experience by stating that:

> *Moreover, previous experience in dealing with electronic systems is considered. I have seen some inexperienced information system auditors in other audit firms. When they audit they insist that the IT client staff has to implement a specific automated control and the problem is that implementing a control in an IT environment may affect the production environment, so the information system auditor must be very knowledgeable about this, and such knowledge will come mainly through experience*

7.5.4. Criteria of Hiring Information System Auditors in the Three Audit Firms

As the computer auditors play an important role when dealing with electronic systems, the three audit firms set high standard criteria to hire such auditors. The computer audit division partners identified the criteria they set to choose the candidates who will join the computer audit division.

In Audit Firm A, the computer audit division partner (CISA holder) stated that the most suitable employee is the one who has accounting and auditing educational background and has studied computers extensively as such people can best learn computer audit. She added that certified people (i.e. CISA holders) are preferable. However, she stated that some of the employees in the department have a computer science background. Such employees are provided with training courses in relation to audit concepts and audit risks. She added that auditors with technical educational backgrounds are preferred if they will provide the client with a separate IT service, or if the client's electronic system has a problem with a technical dimension. However, if the computer audit is conducted only as part of the financial audit, those who have an accounting and auditing educational background are preferable.

The interviewee added that the personality of the employee is considered before being accepted in the audit firm. She stated that:

> *"Moreover we cannot ignore the person himself he has to be mature and responsible and I can feel that. If I look in his CV and find that he is jumping from one place to another quickly…like in one or two years he worked in two or three places with small differences in salaries or position, it is a bad indicator, he will come, stay with us for a while, take our experience and then fly to another place."*

The interviewee indicated that although the computer auditors in the audit firm are highly qualified, they still face the problem of limited skilled information system auditors especially when they have many jobs, requiring skilled computer auditors, to be done at the same time. To overcome this problem, she suggested conducting more extensive computer audit training for financial auditors in the different audit groups to develop a cadre of people with the appropriate skills of both financial auditing and computer audits to face the problem of limited skilled IT auditors in the audit firm, but this suggestion is still under discussion.

It is important to indicate that the computer audit partner is the only CISA holder in Audit Firm A, and the audit firm does not fund the auditors to attend the preparation courses or to pay for the exam.

In Audit Firm B**,** the computer audit division partner (CISA & CISM holder) believes that the employee who has a computer science educational background with previous experience in auditing electronic systems and suitable knowledge of accounting and auditing concepts is a suitable one to be hired in her team. She explained her preference to the computer science background by stating that:

> *"For IT auditors who will go to deal with IT people they have to have enough information about IT, they should speak the same language as the people whom they will deal with. They should have the same knowledge more or less"*

She added that she considers whether the candidate is mature enough, and she can discover this through the CV, and whether he/she has an intention to enhance his/her qualifications and what the intended plans for such enhancement are. Moreover, there

is an ongoing evaluation system for those who are accepted to work to ensure their suitability to keep working in her team.

There are three CISA holders in Audit Firm B, and there is a rule in the audit firm that no one will reach supervisor level in the computer audit division without being a CISA holder. However, the interviewee stated that the audit firm does not fund employees to be Certified. She pointed out that CISA is a primary qualification and employees should come with it; if they do not come with it, it is their responsibility to fund themselves.

The interviewee pointed out that finding qualified information system auditors is a difficult task, and retaining them in the audit firm, after attendance at the training courses to learn how to use the audit firm's automated tools, is another difficult task which is why all employees have to sign a 'secrecy declaration'. In this 'secrecy declaration' they agree that they are not allowed to use any of the knowledge they learned or any of the tools they used in the audit firm with another employee. Otherwise, they expose themselves to an ethical issue which may affect any future position.

In Audit Firm C**,** the computer audit division partner stated that the division performs two main tasks. The first one relates to computer audit and the other one relates to IT advisory services. He indicated that the IT advisory tasks are, preferably, conducted by specialists who have a computer science educational background or engineering. But for the computer audit which aims mainly to support financial audits, the interviewee stated that this audit should be performed by computer auditors who mainly have an accounting and auditing educational background with some studies in IT. This means that they should have a combination between auditing and IT. He stated that:

> *"He should be graduated from a faculty of commerce to be able to understand me when I am speaking about fixed assets or depreciation. If he is an engineer and found that the inventory is negative, this may not be a problem for him but for an accountant he will understand that there is a mistake. Besides, he has to have knowledge about IT, like having an IT diploma or any other IT qualifications. I cannot take someone with zero knowledge about IT".*

The interviewee added that computer auditors should have an accounting and auditing educational background in order to be able to understand the audit concepts and the audit risks and in order to be able to produce a meaningful report that can support the financial audits.

It is important to indicate that the computer audit division partner encourages his computer audit team to be certified by buying them the needed material. The audit firm does not pay the cost of attending the preparation CISA courses and does not pay for the cost of registering for the exam. However, if any auditor passes the CISA exam the audit firm refunds the cost of registering to the exam. Besides such a computer auditor is given a reward and is promoted in the audit firm.

7.6. The Relation between the Financial Auditors and the Information System Auditors

All the financial auditors in the three audit firms believe that they are not competent enough to deal with advanced electronic systems without the involvement of the computer audit division in their audit firms. They indicated that the information system auditors are more qualified in auditing the electronic system and evaluating its automated controls. An audit partner in Audit Firm B emphasised the importance of the involvement of the information system auditors by stating that:

> *…when we investigate about a big and complicated system, we must depend on someone behind us understanding how to use the system, we need someone more qualified to go through it, we need the information system auditors.*

An audit partner in Audit Firm A added that financial auditors cannot have enough knowledge about both financial audit and computer audit. He stated that:

> *"…I don't think one person can do everything, I mean auditors are not going to keep up with all the accounting rules that they would need in financial auditing as well as all the changes in technology"*

The financial auditors, in the three audit firms, mentioned different tasks that are performed by information system auditors in their audit firms. An essential task performed by the computer audit team in the three audit firms is auditing the electronic system and evaluating the automated controls built into it. The approach of the three audit firms requires the involvement of the computer auditors when auditing a client with a dominant or significant IT environment. Then the computer audit team submits a report to the financial auditors presenting their findings about the system. Such a report states whether the electronic system is reliable and whether the financial auditors can depend on the output of the system. The report should identify any weakness in the internal controls and explain its direct or indirect impact on the financial statements. The computer audit division partner in Audit Firm B emphasised the importance of explaining the impact of the weakness in internal controls to the financial auditors by stating that:

> *If we say to the financial auditors that there is a weakness in the password controls as the users do not change their passwords frequently it has no meaning for the financial auditor. So we have to explain the expected impact of lacking such a control and how this may affect the financial statements.*

The report of the computer auditors is the first step for the financial auditors to plan their audit including all the requirements for a sufficient audit which is why the computer audit team needs to do most of their work before the financial auditors start their planning, after which some tests can be conducted upon the request of the financial auditors. However, in Audit Firm B, the computer audit division partner stated that it rarely happens that they cannot finalise their work in the budgeted time.

If such a situation occurs, there should be an intensive communication between the computer audit team and the financial auditors.

The financial auditors stated that they trust the work of their computer audit divisions and they can totally depend on their report. An audit partner in Audit Firm A expressed this point by stating that:

> *The computer division is responsible for auditing such controls and giving us the results of their audit in a written report. And according to their findings we can determine whether the system is reliable or not and whether we can trust the outputs of this system. I need to make a risk assessment and see if the problems discovered by the computer auditors affect the financial statements.*

The financial auditors pointed out that they trust the work of their computer audit team as they know that their staff is highly qualified because of the restricted rules of hiring information system auditors in their audit firms. One of the financial auditors (partner) in Audit Firm A expressed this idea by stating that:

> *"We have an excellent IT audit division; we can say that it is one of the best in the Egyptian audit firms, so why should I not depend on them if they are specialists?"*

Another financial auditor in Audit Firm C (supervisor) indicated that there are *"three lines"* that provide him with confidence when depending on the report of the computer audit division. The first line is the hiring system that requires good qualifications to join the audit firm and to be supervisors (at least local qualification is required) or managers (foreign qualification is required). The second line is the way the IT auditors are assigned to the job. For example, if the client has a complicated system the computer auditors who will be in charge of the task will be at least supervisors in the computer audit division. And the third is that the report sent from the computer auditors to the financial auditor should be signed from their partner, and this signature indicates that he accepted what has been included in the report and so "*after these three lines I can rely on their report"*

In addition to evaluating and reporting on the automated controls, the computer audit divisions in the three Audit Firms provide newly employed financial auditors with two main training courses. The first is to teach them how to use the audit software of the audit firm. The second is to teach them the importance of conducting computer audit and how the findings of this audit can affect the financial auditors' work. In addition, this course teaches them the basics of the general computer controls. All the financial auditors, in the three audit firms, stated that they found such courses useful and cover what they need to know about computer audit. An audit partner in Audit Firm B presented this idea by stating that:

> *The computer audit department here organises training courses that provide us with suitable knowledge on how to deal with electronic systems, and there is a course entitled "Introduction to General Computer Controls" which provides us with general knowledge about the work of IT auditors and what they are doing when they audit the systems and the impact of their work on our audit.*

The financial auditors added that the computer audit team usually help them if they experience problems in understanding the electronic system or in dealing with it in order to extract the necessary information and the required reports.

Although all the financial auditors in the three audit firms mentioned the important roles of the computer audit team in their audit firms, they did not accept the description that their relation with the financial auditors as a dependency relationship. An audit partner in Audit Firm A explained that:

> *We cannot say we totally depend on them, it is a close collaboration. We have to explain to them what we need to know, and then we give them free hand to do their jobs sufficiently. But at the end of the day they know that they have to come back to us with their findings. After that we do the entire job, so depending on them in an initial stage does not mean that we totally depend on them.*

The financial auditors preferred to describe the relationship between them and the information system auditors as a "*close collaboration"*, or as "*integration"*, or as *"organising the responsibilities"*. They stated that the external financial auditor is the one who has the responsibility to issue and sign the audit report, and when they seek

the involvement of the information system auditors it is to ensure that qualified people have performed the needed tasks.

7.7. Automated Internal controls

Although the responsibility of designing adequate internal controls rests with the client's management, external auditors must still gain competent understanding of these internal controls to exercise due professional care (Nearon, 2000). The literature and the professional pronouncements indicate that in a complex electronic environment, auditors will not be able to reduce audit risk to an appropriate level via additional substantive procedures and they will need to perform more control testing (AICPA, 1996; AICPA, 2001; Helms & Lilly, 2000; Pathak, 2003; Rezaee et al., 2001; Tucker, 2001). All the interviewees in the three Audit Firms A, B, & C emphasised this point by indicating that in a dominant electronic environment, like in banks and insurance companies, all the business transactions are processed and documented by electronic means, and as a result, there is an essential need for testing the controls built into the system. However, paying attention to the automated controls does not mean that auditors do not consider the manual internal controls. In electronic environments both of the controls are important. An audit partner in Audit Firm A emphasised this point by stating that:

> *Actually dealing with electronic systems needs us to pay more attention to internal controls. Internal control is an important matter whether you are auditing in a paper environment or in an electronic environment. If you are dealing with paper systems, or simple computerised systems, the manual controls are the only controls you are looking for, but if you are dealing with advanced and complicated systems, you need to pay attention to the computerised controls as well. We cannot ignore the controls built in the systems; evaluating these controls is really important.*

7.7.1. The Responsibility of Evaluating Automated Controls

The financial auditors in the three Audit Firms indicated that evaluating the automated controls is the responsibility of the computer audit division in the audit firms as the information system auditors are more qualified to perform this task than the financial auditors. An audit partner in Audit Firm B emphasised the need for evaluating the automated controls by the IT auditors by stating that:

> *If I did not depend on computer specialists in my audit team this means that I would build my entire audit on substantive tests, which is not sufficient in itself to render an opinion on the financial statements produced from advanced electronic systems especially in banks. Even if we increased the sample size I cannot reach a suitable assurance and you know that in banks there are hundreds of transactions daily, so I need a combination between control assurance and substantive assurance. If the system is complicated and I do not have computer assurance specialists, any method I will apply to the audit will not be sufficient.*

The computer audit team issues a report to the financial auditors including the weaknesses they discovered in the automated controls and their expected direct and indirect impact on the financial statements. Moreover, they submit these points to the clients' management with their suggestions to surmount these points, and the client then has to prepare an action plan to overcome these problems.

In case of weaknesses of automated controls, financial auditors should not rely on these controls totally. They have to increase the sample size and pay more attention to the manual controls. The computer audit division partner in Audit Firm C pointed out that sometimes the computer controls or the IT environment controls are not effective but this is compensated by manual controls. She gave an example for this situation by stating that:

> "*You may find one person doing the transaction from its beginning to its end; however there is an auditing department that audits effectively. Of course this is a form of detective control, not a preventive one, I mean this will not prevent the fraud but it will discover it."*

7.7.2. Problems of Automated Controls

The interviewees defined some problems they face when assessing automated controls. The computer audit division partner in Audit Firm A and a deputy manager in Audit Firm C mentioned that weakness in security control is an important problem they face as some employees are using weak passwords while others are retaining the same password for long periods of time. Moreover, some ex-employees continue to have access to the system as their ID has not been cancelled which means that they have unauthorised access to the system. The deputy manager in Audit Firm C added that he has to consider whether the programmer has access to the production environment as such access will increase the possibility of fraud as he may modify the code of the program. He added that:

> *"This situation happened before, not in Egypt, when the programmer had the access to the production environment in one of the banks and he converted money from other accounts to his account illegally and it took two years to be discovered"*

Another problem was mentioned by the computer audit division partner in Audit Firm B which is the lack of segregation of duties. She expressed this point by stating that:

> *You may find someone in the accounting department is over privilege; he may do a transaction from its start to its end. It is better especially in banks, to segregate duties so that people can check on each other, to have the ability to check the transaction, to minimise the possibility of fraud. If we find such over privilege we have to tell the financial auditor to consider this point as it may have a direct impact, as this person may be a source of fraud which has a direct impact on the financial statements.*

7.8. Computer Assisted Audit Techniques (CAATs)

CAATs are considered as important tools that help both financial auditors and information system auditors in conducting their audits. CAATs are used by financial auditors and information system auditors to perform different tasks.

7.8.1. Usage of CAATs

The interviewees, in the three audit firms, indicated that using CAATs can be classified into three categories:

- Using audit software is the first category of using CAATs. The three audit firms have their own audit software, used by audit firms' members all over the world. All financial auditors know how to use audit software after the training they receive from the computer audit department in their audit firms. Audit software helps them in conducting their financial audit. An audit partner in Audit Firm C pointed out to their use for the audit software stating that:

  > *We have our audit software and all the staff has an excellent training on how to use it. This software is downloaded on the laptops of each auditor as they use laptops during their audit. It belongs to our audit firm and it is used for auditing by our auditors worldwide. We all use the same software and the same methodology all over the world and this facilitates the audit.*

- Using CAATs to extract data from electronic systems is the second category. All computer auditors and some financial auditors can use CAATs for data extraction. However, the financial auditors indicate that if the electronic system is complicated and there are many internal integrated transactions that may cause the loss of audit trail then they cannot depend on themselves to extract the needed data from the system and they seek help from the computer auditors who can reprocess the available data using CAATs. The computer audit partner in Audit Firm B gave an example of such case by stating that:

  > *In some cases the financial auditors determine their needs and then we use our tools to fulfil their requirements. I mean if the financial auditors are auditing a communication company and they want to have enough assurance about their revenue, we are the ones who can provide them with this assurance. We can take a sample for a week; take the calls that took place in this company for the whole week. Of course it is a huge amount of data, lot of gigs, so we need to use software. We have software called ATL, so we take the generated data from the client's system and process it in our software to extract the information they need. They may look for the exceptions, like to*

find out if there are calls rated mistakenly, or calls that were not accepted, things like this.

- Using CAATs to test the effectiveness of the general controls and the application controls of the electronic system is the last category of using CAATs. Computer auditors, in the three audit firms, are the ones who use CAATs for this task. Financial auditors depend totally on information system auditors in this matter. The financial auditors believe that they do not have enough experience in using CAATs for such a purpose and they do not have to seek such experience as they have a qualified computer audit team. However, an information system auditor in Audit Firm C gave another explanation for not using CAATs heavily, except as audit software, by financial auditors. He stated that:

  "I think that the financial auditors are scared of using them, they look at it as a new area and the terms of the program are new as well, so he gave up trying. They prefer to avoid headache and believe that it is enough for them to know financial audit and we know computer audit and that is it."

7.8.2. Problems of Using CAATs

The information system auditors defined two problems they face with their clients when using CAATs. The computer audit division partner in Audit Firm B mentioned that some clients do not allow them to use their automated tools. They are concerned running such tools may affect their production system and cause a crash in the production environment. The interviewee stated that sometimes she can have the approval from the top management, however sometimes they insist on not using such advanced tools which cause more time and effort for the computer auditors.

The computer audit division in Audit Firm A mentioned another problem they face when using CAATs. She stated that some clients do not allow them to use their

automated tools for confidentiality reasons. She gave an example of a client who refused to use the automated tools to conduct the computer audit as the company was providing IT services and the managers refused to let the computer auditors know about their technology. However, she stated that most of their clients accept the computer audit.

All the interviewees in the three audit firms stated that they do not adopt the continuous online auditing approach and they expect that it will not be adopted in the Egyptian audit firms in the near future. The computer audit division partner in Audit Firm A stated that: "*...I read about it in books, it is a very advanced, complicated and expensive method, it is impossible to be adopted in any audit firm working in Egypt…I think it is not a well known approach even in the most developed countries".*

7.9. Vendors of the Electronic Systems

The interviewees in the three audit firms indicated that the vendor of the system is an indicator of the quality of the electronic system and its performance. They mentioned that vendors in Egypt can be classified into well known vendors, like Oracle or SAP, and local lesser known vendors. The interviewees explained the main differences between these two vendors.

7.9.1. The Well Known Vendors

The interviewees stated that if the system is provided by a well known vendor, they expect that more controls will be built into the system. Also, the vendor will provide the clients with the necessary maintenance and the required technical support if there is any problem in the system. An audit partner in Audit Firm A gave an example of the services provided by the well known vendors by stating that:

If we are dealing with systems like Oracle or SAP or PeopleSoft we expect that more controls will be built on the systems and they will provide suitable training courses for the users and the needed maintenance of the system. I mean Oracle, for example, has opened a branch here in Egypt including an Arabisation centre to provide Arabisation services for Oracle applications and products. In this case it will be easy for them to provide their customers with any support they need."

The interviewees added that reputable vendors provide their clients with the required training courses that allow them to understand how to use the system successfully. They indicated that the training courses must be held before implementing the system and when any updates take place in the system.

7.9.2. The Local Individual Vendors

On the other hand, interviewees indicated that sometimes the individual less known vendors design programmes, then they are more likely to "*disappear"*, leaving the system without any maintenance and without the necessary upgrade and technical support. As a result after a while the programme will become difficult to operate.

All the interviewees indicated that if the systems provided by a well known vendor are implemented successfully, then they are expected to be more reliable than the systems provided by individual less well known vendors. One of the interviewees in Audit Firm B added that:

"Even if there are some problems in a system provided by a well known vendor, we expect that the problem will come from the implementation or the need for more training for the users, not from the product itself."

7.10. IT Client Staff

Both financial auditors and information system auditors, in the three audit firms, indicated that the IT client staff can be an important source for them to collect information about the electronic system, how it operates, and how to extract the needed information from it. A computer audit partner in audit Firm A stated that:

The first thing I have to do is to gather enough information about the electronic system, its modifications and its work flow. I need to gather such information from a technician who understands how the system works.

However, the interviewees stated that there are five problems they face when dealing with the IT client staff.

1. Different interests between the auditors and the IT client staff: A financial auditor in Audit Firm A and another one in Audit Firm B indicated that the auditors and the IT client staff may not have the same set of objectives. The auditor is looking for the controls of the system and seeks to understand such controls while the IT specialists pay all their attention to the maintenance of the system. An audit partner in Audit Firm A stated that:

   > *sometimes I feel that we are speaking different languages, I am asking him about specific controls I need to know and I need him to explain to me, but he does not understand, or does not pay attention to what I am saying. What he is thinking of is the maintenance of the system, how he can bring it back to life if it fails and that is it.*

2. Lack of awareness about the electronic system is another problem mentioned by both the financial auditors and the information system auditors. The financial auditors stated that sometimes the IT client staff cannot help them to deal with the system and to extract the needed information because they do not have enough awareness about the system. For example, in some cases when financial auditors ask for a detailed report, the staff cannot get it from the system which means that the auditors have to spend more time and effort to obtain the needed information and may seek help from the computer auditors of their audit firm.

   The information system auditors face the same problem. A computer auditor in Audit Firm A stated that she needs to gather enough information about the electronic system to be able to start her work; such information should be

gathered from a technician who understands how the whole system works. However, the interviewee stated that:

> *sometimes you cannot find such a person in the client's staff; everyone understands and knows how the part he is responsible for works but does not know about the system as a whole, which means that we need to exert more effort to understand the system especially the big ERP systems as it can operate in a different way from one client to another.*

3. Lack of co-operation: the auditors in the three audit firms indicated that they face another problem when dealing with IT client staff. They indicated that sometimes the staff refuse to co-operate with the auditors as they consider all information about the system and how it operates as confidential. An audit partner in Audit Firm B stated that:

> *Another point is that the IT client department is not helpful, they think that all the information is confidential and that the auditors are not allowed to know that much about their work and their system, ignoring that all of us are in one boat. So sometimes we ask top management to solve such problems.*

The computer audit division partner in Audit Firm A added that she always tries to convince the IT client staff that the computer audit does not aim to criticise them or to shed light on their mistakes, it aims to ensure the quality of the work. She explains to them that the report that will be submitted to the management will include the IT staff achievements as well as the requirements that may enhance the performance of the system or its security. However they sometimes still do not co-operate. One of the interviewees in Audit Firm B explained the non-cooperation of the IT client staff by stating that: *"the IT client staff thinks that the computer auditors are just showing off by writing these points in their report and do not understand how this can affect their work"*

To overcome this problem, the interviewees stated that they seek assistance from the client's top management. However, the top management has to be interested in the IT audit, at least as a part of the external audit, to force their IT staff to co-operate with the IT auditors of the audit firm. A computer audit partner in Audit firm A expressed this point by stating that:

> *If the management supports the IT audit, then the IT client staff will be co-operative even if they do not like so, but if the management is not supportive so it will be difficult to gain the co-operation of the IT staff as they will feel that there is no need to waste their time with us.*

4. Resistance to using the automated tools: The computer audit division in Audit Firm B introduced the resistance problem she faced with some of the IT clients' staff. She indicated that some of them resist using the automated tools of the audit firm as they think that such tools may affect their production system and may cause a crash in the production environment. The computer audit division partner in Audit Firm B exemplified such problem by stating that:

> *"To save time and to be more efficient during the audit we prefer to use our tools …advanced tools that are used in our audit firm abroad. For example, if we need to audit an oracle database, instead of sitting with the administrator asking him to read us a selected statement or to have a copy of a specific file on our USB to understand the configuration of the database. We can use our tools that can run the files we need in less than one minute… and give me the output so I can audit it at any time or any place which is more efficient, but sometimes the clients refuse."*

   The interviewee stated that in such cases she tries to have the approval from the top management, however sometimes they insist on not using such advanced tools although its use will save time and effort for the computer auditors.

5. Ignorance of security controls: The computer auditors in the three audit firms pointed out that some of the IT specialists do not pay enough attention to security controls (discussed previously in the internal control actor in section 7.7) and such weaknesses in the automated controls can increase the audit

risk. The information system audit partner in Audit Firm B explained the ignorance of some of the IT client staff to such controls from her personal experience by stating that:

> *"Being qualified in IT means that he/she is administering the system or the application accurately and all the users feel happy and do not face problems with the system. I used to work before as an IT specialist and I know that being qualified does not mean paying that much attention to controls and security. It is good to have, but it is not my priority."*

She gave an example to prove her explanation by stating that if the administrator has a request authorised from the manager to give an employee access to different conflicting functions that may cause non-segregation of duties, the administrator will concede to the request although he knows that this will affect controls. Although such explanation can be acceptable in some cases, like in the case of her example, it is not acceptable in all cases like approving a blank password or a weak one.

7.11. Financial considerations

Financial consideration is an actor that was introduced by the interviewees. Financial considerations can be classified into three sub-actors: financial considerations relate to the audit firm, financial considerations relate to the auditors' clients and financial considerations relate to the audit fees.

7.11.1. Financial Considerations Related to the Audit Firms

The interviewees mentioned four problems the audit firms face as a result of financial considerations.

1. Training problem: The interviewees in the three audit firms indicated that some of the auditors spend a period of time in the audit firm abroad to receive training courses. However, the number of auditors who receive such training is

governed by cost. An audit partner in Audit Firm B explained this point by stating that:

> *The point with the training abroad, I mean when the audit firm sends someone to the main audit firm abroad, they send only one partner from the Egyptian member, then he will be responsible to provide training for all the auditors in the audit firm to decrease the cost of training.*

He added that audit firm members from other countries do not adopt the same approach as they send all of their auditors (on a rotation base) to attend the training courses in the main audit firm abroad.

The same point was mentioned by the computer audit partner in Audit Firm C who stated that he joined the computer audit department in his Audit Firm in the UK for two years for training. After this period, it was his responsibility to establish the computer audit department in the Egyptian branch of Audit Firm C. The rationale behind establishing this department in the Egyptian branch was to be cost effective. The computer audit partner in Audit Firm C stated that:

> *Previously, in the 1980s, our colleagues in the UK branch used to come to audit the general computer controls when we audited a client with a computerised system. During this time, to be more cost effective we decided to establish this department [the computer audit] in our branch in Egypt*

2. Funding CISA exam: The information system auditors in the three audit firms mentioned that audit firms do not fund their computer auditors to be CISA holders. Audit firms do not pay them the cost of attending the courses, or the cost of registering in the CISA exam and as a result a relatively small number of computer auditors become certified because of financial considerations. The computer audit partner in Audit Firm A explained this problem by stating that:

> *The registration and the material costs about $ 500 and the course cost another $500. $ 1000 [in total] is a huge cost for many people compared to their income. For someone to be convinced to pay such amount, with some doubt that he may not pass, as the exam is not easy from the point of view of many people, he should be aware of the importance of investing in himself. He should be very interested in the area and besides he should be able to afford taking such a risk, from his point of view*

However, the computer audit partner in Audit Firm B explained why the audit firm does not fund computer auditors to become CISA holders by stating that:

> *We see it as a primary qualification so it is self funded. We have a training budget every year, but CISA is not included as the employees should come with it; even if they do not come with it, it is their responsibility to do it.*

In Audit Firm C, they refund their auditors the exam fees only after passing the exam, but if they do not pass the audit firm do not pay them.

3. Hiring and retaining qualified computer auditors: Another financial consideration mentioned by the computer audit division partners in the three audit firms is the great demand for information system auditors in Egypt and in Gulf countries. Audit firms cannot face the competition in salaries offered to their qualified information system auditors by either the petrol companies in Egypt or the companies and audit firms in Gulf countries. In other words, there is a problem in acquiring and retaining skilled information system auditors. The computer audit partner in Audit Firm B presented this problem by stating that:

> *Our audit firm policy is designed to encourage the qualified employees to stay with us through giving them recognition, sending them abroad for training courses and providing them with a suitable work environment. We offer high salaries compared to other audit firms but competition in salaries offered from the petrol companies and the companies in the Gulf countries is considered as an essential problem.*

4. Using CAATs: An audit partner in Audit Firm A pointed to a problem that faces some of the 100% Egyptian audit firms, who do not have a foreign partner. He stated that they do not use any audit software or any other kind of

CAATs because of financial considerations. Moreover, they do not have a computer audit division because they cannot afford to hire qualified auditors to conduct the computer audit. However, the interviewee mentioned that his audit firm and all international audit firms do not face such a problem.

7.11.2. Financial Considerations Related to the Auditors' Clients

The interviewees stated that some of their clients are governed by the cost of the electronic system when choosing it. An audit manager in Audit Firm A exemplified such governance by indicating that some clients buy programs from individual unknown vendors as they offer cheap prices although such vendors do not continue to provide the necessary follow up for the electronic system and this causes the failure of the system. He added that in some cases hiring IT clients' staff is governed by their salaries, rather than their qualifications.

An audit partner in Audit Firm B gave another example on the governance of the cost when choosing electronic systems in some of the manufacturing companies who receive a grant from the Egyptian government, as the Egyptian government tries to encourage the adoption of electronic systems by giving a grant 200,000 L.E. to any manufacturing company who plans to transfer from a manual system to an electronic one. In addition, the government pays 90% of the training cost of their employees. He stated that:

> "*some clients restrict the choice of the system to be within the grant without considering enough the suitability of the systems to the needs of the company, and even without believing in the importance of such transfer… they look for the point as if it is a chance they cannot afford to miss, without looking at the benefits they may have.*"

7.11.3. Financial Considerations Related to the Audit Fees

The interviewees indicated that there is a difference between what should happen and what actually happens when discussing audit fees with their clients. All the interviewees, in the three audit firms, believe that dealing with advanced electronic systems should cause an increase of audit fees to cover the cost of the audit. They stated that both financial auditors and computer auditors need to spend more time and exert more effort when dealing with advanced electronic system which increases the cost of the audit and should be translated into an increase in the audit fees.

Moreover, a computer audit partner in Audit Firm A added that dealing with advanced electronic systems needs highly specialised staff and in some cases they may need to depend on outsourcing those specialists with a very high rate per hour. Furthermore, dealing with advanced electronic systems needs advanced automated tools use that have a high cost. She expressed this point stating that:

> *Dealing with advanced electronic systems needs more time from the computer audit team to understand the system and to identify the higher risk areas and this needs more specialised people. Most of the time these specialised people are from our audit team but in some cases we may need to depend on outsourcing those specialists at a very high rate per hour, which increases the cost of the audit and should be translated into an increase in the audit fees.*

However, the interviewees stated that clients always resist any increase in audit fees. One of the interviewees in Audit Firm A explained this by stating that clients think that using an advanced electronic system means that the audit will be easier and the auditor will be able to rely on the outputs of the system without exerting greater effort and as a result the audit fees should not be high if the system is advanced. A computer audit partner in Audit Firm A stated that:

> *Some of them [clients] do not believe the importance of the work we do. If we tell them that we will take more time or exert more effort to audit the system, they say, "do not worry, the system is perfect".*

A computer audit partner in Audit Firm A gave another explanation for the behaviour of their clients regarding audit fees. She indicated that clients know there is high competition between audit firms to attract new clients, and offering lower fees is one of the methods some of the audit firms use to compete. An audit partner in Audit Firm B mentioned three reasons that force the managing partner of his audit firm to accept the pressure of fees. The first is to increase his firm's local market share in order not to depend only on referral work[1]. The second is not to lose his clients as other audit firms offer less audit fees. And the third one is not to lose the potential services that can be provided to this client. He expressed these three points stating that:

> *The point is that the managing partner sometimes accepts the pressure of the fees as he aims to increase his firm's local market share in order not to depend only on referral work, and he knows that [he mentioned the name of another international audit firm] is competing by offering low audit fees that cannot even cover the cost of the audit. Besides, we have to look on our client as an investment...we can provide this client with other services as well as auditing, such as security services or taxation services which will be another good source of income*

However, the interviewees stated that if the client is obtained by referral negotiation around audit fees it is easier as such clients know that they cannot change their external auditor. A supervisor in Audit Firm C summarised the debate of the audit fees by stating that:

> *Whether the system is electronic or not, advanced or not, the audit fees is negotiable, it depends upon the name of the audit firm, the size of the client and the complexity of the systems…but I believe that auditing advanced electronic systems should increase the audit fees.*

[1] If a parent multinational bank is audited in its home country by an international audit firm, the branch of this bank in Egypt has to be audited by the Egyptian member firm of this international audit firm. This is known as a referral work.

7.12. Standards and Guidelines

Standards and guidelines can be classified into auditing standards and computer audit standards.

7.12.1. The Auditing Standards

In June 2008 Ministerial Decree 166/2008 was issued to approve the release of 38 Egyptian audit and limited inspection standards. The new 38 standards replaced the current standards, and became effective in January 2009. These standards are in harmony with the International Standards on Auditing as they are the Arabic translations of the ISA. However, the interviews were conducted in 2007, before the release of the new Egyptian auditing standards. During that time, there were six Egyptian auditing standards discussing reporting issues. These standards are mainly translated from the International Standards on Auditing (ISA). In the case of the absence of an Egyptian standard regarding a specific treatment, the ISA are applied.

All the interviewed financial auditors, except one, indicated that there is no need to release an Egyptian auditing standard in relation to electronic systems. They mentioned three reasons for their opinion. The first reason is that the Egyptian auditing standards that have been released are just a translation of the ISA.

The second reason is that there is a general tendency towards harmonisation in accounting and auditing standards. A supervisor in Audit Firm C expressed this point stating that:

> *There is a general tendency towards harmonisation. Even the Egyptian accounting standards that have been released were just translations of the international standards except for 3 or 4 differences in the Egyptian standards to fit the Egyptian environment.*

An audit partner in Audit Firm A added that there are many international companies in Egypt and it will be easier if there is harmonisation in accounting and auditing

standards worldwide. Finally, the interviewees stated that the ISA cover all the needed points regarding auditing in electronic environments and any other standard will not add anything new.

All the interviewees accorded that the translation of the accounting and auditing standards should have considered the core of the standard, not translating the words exactly. They indicated that some words in the Arabic version of the international standards are not clear. An audit partner in Audit Firm A expressed this point stating that:

> *But what I do not accept is the way of translating these standards. Translation does not mean translating every word, it means translating the meaning in an understandable way, which is not the case in the Arabic version of the standards, the translation is meaningful in some cases.*

One of the interviewees gave an example of the translation of the word "amortisation". Unclear translation may cause misunderstanding for the users of the standard.

Only one audit partner in Audit Firm A indicated that there is a need to release an Egyptian auditing standard regarding auditing electronic systems to be more suitable for the Egyptian environment as a developing country.

7.12.2. Computer Audit Standards

The information system auditors in the three audit firms indicated that there is no specific standard or guideline for the computer audit in Egypt. Although the ISA determined that computer auditors have to be involved in auditing advanced electronic systems, the need of their involvement is to conduct the financial statement audits not for the computer audit itself. In other words, the standards give an important role for the computer audit as an essential part of the financial statement audits if this audit is conducted in an advanced electronic environment. However, the

IT audit is not required for itself by any standards or laws which decrease the chance for the information system auditors to open new markets for new services.

The computer audit partner in Audit Firm B gave an example of the Privacy and Security Laws[1] in developed countries, she stated that the members of Audit Firm B in developed countries can provide privacy enhancement services to their clients as privacy is required by law and if any client cannot protect the privacy of his customers this means that he is committing an illegal act, so this client knows that even if he pays more money to have such a service from the IT auditors, he knows that he will avoid breaking the law. The interviewee added that *"in Egypt, privacy is not required by law, and as a result I cannot sell this service, how can I convince my client to pay money for a service he does not feel that he needs it?"*

7.13. Comparison of the Findings in Audit Firms A, B, & C

Voss et al. (2002: 203) state that *"when building theory case studies, case selection using replication logic rather than sampling logic should be used. Each case should be selected so that it either: predicts similar results (a literal replication); or produces contrary results but for predictable reasons (a theoretical replication)".* Although audit firms A, B, & C selected in this study are international audit firms to provide literal replication[2], there are some differences between the three audit firms.

Table 7.1 presents the main similarities and differences in the findings between the three audit firms (A, B, & C), and table 7.2 presents a checklist of these differences and similarities.

[1] Privacy and security refer to protecting the personal information of any customer and keeping it private and secure from any other use except for its main purpose.
[2] Criteria for case selection are discussed in Chapter Five section 5.3

Categories and sub-categories	Audit Firm A	Audit Firm B	Audit Firm C
Electronic systems • Types of the electronic systems. • Problems of dealing with the electronic systems. ▪ The conversion period. ▪ The unsuitability of the electronic system. ▪ Hosted electronic systems. ▪ Lack of awareness.	Most of the clients use advanced electronic systems like ERP. Classified into dominant, significant and minor environments. The auditors face problems during this period The auditors sometimes face this problem The auditors did not face this problem Computer auditors face this problem	Most of the clients use advanced electronic systems like ERP. Classified into dominant, significant and minor environments. The auditors face problems during this period The auditors did not face this problem The auditors face this problem Computer auditors face this problem	Most of the clients use advanced electronic systems like ERP. Classified into dominant, significant and minor environments. The auditors face problems during this period The auditors did not face this problem The auditors did not face this problem Computer auditors face this problem
Electronic audit evidence	Many internal integrated transactions cause the disappearance of the audit trail. Backup copy of the data file is used to reprocess the data using the automated tools to ensure that the results are the same as produced from the client's system.	Many internal integrated transactions cause the disappearance of the audit trail. Backup copy of the data file is used to reprocess the data using the automated tools to ensure that the results are the same as produced from the client's system	Many internal integrated transactions cause the disappearance of the audit trail. Backup copy of the data file is used to reprocess the data using the automated tools to ensure that the results are the same as produced from the client's system.

Competence of financial auditors	Has to be improved	Has to be improved	Has to be improved
• Formal university education	Does not provide auditors qualified to deal with electronic systems.	Does not provide auditors qualified to deal with electronic systems.	Does not provide qualified auditors to deal with electronic systems.
• Practical training			
▪ In-house training	Important source to enhance the competence of financial auditors. Training courses are organised by the computer audit department to teach the financial auditors how to use the audit software and to introduce to them the general computer controls. There is an intention to expand the computer audit training for the financial auditors to overcome the problem of limited skilled IT auditors	Important source to enhance the competence of financial auditors. Training courses are organised by the computer audit department to teach the financial auditors how to use the audit software and to introduce to them the general computer controls	Important source to enhance the competence of financial auditors. Training courses are organised by the computer audit department to teach the financial auditors how to use the audit software and to introduce to them the general computer controls
▪ Vendor training	Important source to enhance competence, but the financial auditors do not attend (one interviewee indicated that he attends)	Important source to enhance competence but the financial auditors do not attend.	Important source to enhance competence but the financial auditors do not attend.

• Experience	Important source to enhance the competence of financial auditors.	Important source to enhance the competence of financial auditors.	Important source to enhance the competence of financial auditors.
Competence of information system auditors	Trusted by the financial auditors	Trusted by the financial auditors	Trusted by the financial auditors
• Formal university education	The educational background is either accounting or auditing or computer science. Qualifications are enhanced through in-house training and self-study.	The educational background is either accounting and auditing, computer science, or engineering. Qualifications are enhanced through in-house training and self-study.	The educational background is either accounting and auditing, computer science, or engineering. Qualifications are enhanced through in-house training and self- study.
• Practical training			
▪ In-house training	Essential to enhance the information system auditors' competence. Training courses are conducted in the audit firm in Egypt and also provided online through the learning system designed by the audit firm abroad	Essential to enhance their competence. Training courses are conducted in the audit firm in Egypt and also provided online through the learning system designed by the audit firm abroad. Selected computer auditors are sent for training in the audit firm abroad	Essential to enhance their competence. Training courses are conducted in the audit firm in Egypt and also provided online through the learning system designed by the audit firm abroad. Selected computer auditors are sent for training in the audit firm abroad
▪ Vendor training	Enhance the competence of the auditors. Attend if they do not know enough about the electronic system.	Enhance the competence of the auditors. Attend if they do not know enough about the electronic system.	Enhance the competence of the auditors. Attend if they do not know enough about the electronic system.
• Experience	Important source to enhance competence.	Important source to enhance competence.	Important source to enhance competence.

• Criteria of hiring information system auditors	CISA holders are the best, then computer auditors with accounting and auditing background and studied computers extensively to perform the computer audits that support the financial audit. Then the computer auditors with computer science background and provided training courses about audit concepts and audit risks as they can perform IT services. Personal attributes are considered.	Prefer to hire information system auditors with computer science educational background with suitable knowledge of accounting and auditing concepts. Previous experience in auditing electronic systems is a must. Personal attributes are considered. A rule that no one will reach the supervisor level without being a CISA holder.	Prefer to hire information system auditors with accounting and auditing background with some studies in IT to perform the computer audits that support the financial audit. Prefer to hire information system auditors with computer science background to provide the IT advisory services. Previous experience is not a condition.
The relation between financial auditors and information system auditors	-The approach of the audit firm requires the involvement of the information system auditors when auditing a client with dominant or significant environments. -The financial auditors emphasised the importance of the involvement of the information system auditors to perform the following tasks: -Audit the electronic system	-The approach of the audit firm requires the involvement of the information system auditors when auditing a client with dominant or significant environments. -The financial auditors emphasised the importance of the involvement of the information system auditors to perform the following tasks: -Audit the electronic system	-The approach of the audit firm requires the involvement of the information system auditors when auditing a client with dominant or significant environments. -The financial auditors emphasised the importance of the involvement of the information system auditors to perform the following tasks: -Audit the electronic system

	and evaluate the automated controls built in it. -Submit a report to the financial auditors presenting the findings about the system. This report is the first step for the financial auditors to plan their audit. -Provide newly employed financial auditors with training courses about using the audit software and the general computer controls. -Help the financial auditors to understand the electronic system and to extract the needed information.	and evaluate the automated controls built in it. -Submit a report to the financial auditors presenting the findings about the system. This report is the first step for the financial auditors to plan their audit. -Provide newly employed financial auditors with training courses about using the audit software and the general computer controls. -Help the financial auditors to understand the electronic system and to extract the needed information.	and evaluate the automated controls built in it. -Submit a report to the financial auditors presenting the findings about the system. This report is the first step for the financial auditors to plan their audit. -Provide newly employed financial auditors with training courses about using the audit software and the general computer controls. -Help the financial auditors to understand the electronic system and to extract the needed information.
Automated internal controls • The responsibility of evaluating automated controls. • Problems of automated controls	Automated controls built in the electronic systems are tested. The computer audit department Weakness in security controls. Lack of segregation of duties.	Automated controls built in the electronic systems are tested. The computer audit department Weakness in security controls. Lack of segregation of duties.	Automated controls built in the electronic systems are tested. The computer audit department. Weakness in security controls. Lack of segregation of duties.
Computer assisted audit techniques • Usage of CAATs:			

▪ Using audit software ▪ Using CAATs to extract data. ▪ Using CAATs to test the effectiveness of the automated controls. • Problems of using CAATs	Used by all the financial auditors. Used by some financial auditors and all the information system auditors. Used by the information system auditors only. Some clients do not allow the information system auditors to use their automated tools for confidentiality reasons.	Used by all the financial auditors. Used by some financial auditors and all the information system auditors. Used by the information system auditors only. Some clients do not allow the information system auditors to use their automated tools as they concern running such tools may cause a crash in their production environment.	Used by all the financial auditors. Used by some financial auditors and all the information system auditors. Used by the information system auditors only. The auditors did not specify any problems regarding this point.
Vendors of the electronic system. • Well known vendors • Local less known vendors	An indicator of the quality of the system and its performance. -More controls will be built in the system. -Will provide the needed maintenance and technical support. -Will provide useful training courses. Poor system without maintenance or technical support is expected.	An indicator of the quality of the system and its performance. -More controls will be built in the system. -Will provide the needed maintenance and technical support. -Will provide useful training courses. Poor system without maintenance or technical support is expected.	An indicator of the quality of the system and its performance. -More controls will be built in the system. -Will provide the needed maintenance and technical support. -Will provide useful training courses. Poor system without maintenance or technical support is expected
IT client staff	Important source for the financial auditors and the information system auditors to	Important source for the financial auditors and the information system auditors to	Important source for the financial auditors and the information system auditors to

	collect information about the electronic system, how it operates, and how to extract the needed information from it.	collect information about the electronic system, how it operates, and how to extract the needed information from it.	collect information about the electronic system, how it operates, and how to extract the needed information from it.
Problems of dealing with IT client staff			
• Different interests between the auditors and the IT client staff.	The information system auditors face this problem	The financial auditors face this problem	The auditors did not suffer from this problem
• Lack of awareness	The information system auditors face this problem	The financial auditors and the information system auditors face this problem	The financial auditors and the information system auditors face this problem
• Lack of co-operation.	The financial auditors and the information system auditors face his problem	The financial auditors and the information system auditors face his problem	The financial auditors and the information system auditors face his problem
• Resistance of using automated tools	The information system auditors face this problem	The information system auditors face this problem	The information system auditors face this problem
• Ignorance of security controls	The information system auditors face this problem	The information system auditors face this problem	The information system auditors face this problem
Financial considerations:			
• relate to the audit firms	-The number of auditors receive training abroad is governed by cost.	-The number of auditors receive training abroad is governed by cost.	-The number of auditors receive training abroad is governed by cost.
	-The audit firm does not fund the computer auditors to be	-The audit firm does not fund the computer auditors to be	-The audit firm does not fund the computer auditors to be

	CISA holders. -hiring and retaining qualified computer auditors because of competition in salaries from petrol companies in Egypt, or companies and audit firms in Gulf countries.	CISA holders. -hiring and retaining qualified computer auditors because of competition in salaries from petrol companies in Egypt, or companies and audit firms in Gulf countries.	CISA holders. However, they refund the auditors the exam fees if passing it, and the material is available in the audit firm. -hiring and retaining qualified computer auditors because of competition in salaries from petrol companies in Egypt, or companies and audit firms in Gulf countries.
• relate to the auditors' clients	Some clients are governed by the cost of the electronic system when choosing it.	Some clients are governed by the cost of the electronic system when choosing it.	Some clients are governed by the cost of the electronic system when choosing it.
• relate to the audit fees	The auditors believe that dealing with advanced electronic systems should cause the increase of the audit fees to cover the audit cost. The clients resist increasing the audit fees. Other audit firms compete through offering low audit fees.	The auditors believe that dealing with advanced electronic systems should cause the increase of the audit fees to cover the audit cost. The clients resist increasing the audit fees. The managing partner accepts the client pressure when negotiating the audit fees in order: -To increase the local market share of the audit firm and not depending only on referral work.	The auditors believe that dealing with advanced electronic systems should cause the increase of the audit fees to cover the audit cost. The clients resist increasing the audit fees. Audit fee is negotiable. Negotiating with referral clients about audit fees is easier than negotiating with local clients.

		-Not to lose his clients as other audit firms compete through offering less audit fees. -Not to lose the potential services that can be provided to the client. Negotiating audit fees with referral clients is easier than negotiating with a local client.	
Standards and guidelines • Auditing standards.	The financial auditors and the information system auditors believe that the ISA are suitable to be applied when dealing with electronic systems in the Egyptian context. Only one financial auditor suggested the release of an Egyptian auditing standard to be more suitable to the Egyptian environment.	The financial auditors and the information system auditors believe that the ISA are suitable to be applied when dealing with electronic systems in the Egyptian context.	The financial auditors and the information system auditors believe that the ISA are suitable to be applied when dealing with electronic systems in the Egyptian context.
• Computer audit standards.	The information system auditors pointed out to the need for releasing standards or laws that require the computer audit by itself, not only as a part of the financial audit.	The information system auditors pointed out to the need for releasing standards or laws that require the computer audit by itself, not only as a part of the financial audit.	The information system auditors pointed out to the need for releasing standards or laws that require the computer audit by itself, not only as a part of the financial audit.

		The absence of such requirement decreases the chance of the computer audit department to open new markets for new services.	

Table 7.1: Comparison of the Findings in Audit Firms A, B, & C

Audit Firms / Categories & Sub-categories	A	B	C
➢ Dealing with electronic systems	√	√	√
➢ Types of electronic systems	√	√	√
• Problems of dealing with the electronic systems: ▪ The conversion period. ▪ The unsuitability of the electronic system. ▪ Hosted electronic systems. ▪ Lack of awareness	 √ √ ✖ √	 √ ✖ √ √	 √ ✖ ✖ √
➢ Electronic audit evidence • Many internal integrated transactions cause the disappearance of the audit trail • Backup copy of the data file is used to reprocess the data using the automated tools to ensure that the results are the same as produced from the client's system	 √ √	 √ √	 √ √
➢ Competence of financial auditors: has to be improved • Formal university education: does not provide auditors qualified to deal with advanced electronic systems • Practical training ▪ In-house training ▪ Important source to enhance the competence ▪ Training courses are organised by the computer audit department ▪ An intention to expand the computer audit training for the financial auditors to overcome the problem of the limited skilled IT auditors ▪ Vendor training: source to enhance competence but auditors do not attend • Experience: important source to enhance the competence of the financial auditors	√ √ √ √ √ √ √	√ √ √ √ ✖ √ √	√ √ √ √ ✖ √ √
➢ Competence of information system auditors: trusted by the financial auditors • Formal university education: the educational background is either accounting or auditing or computer science, qualifications are enhanced	√ √	√ √	√ √

through in-house training and self-study • Practical training ▪ In-house training ▪ Essential to enhance information system auditors' competence ▪ Training courses are conducted in the audit firm in Egypt ▪ Training courses are provided online through the learning system designed in the audit firm abroad ▪ Selected auditors sent for training in the audit firm abroad ▪ Vendor training: enhance the competence • Experience: enhance the competence • Criteria of hiring information system auditors	√ √ √ × √ √ ✖	√ √ √ √ √ √ ✖	√ √ √ √ √ √ ✖
➢ The relation between financial auditors and information system auditors • The approach of the audit firm requires the involvement of the information system auditors for auditing electronic systems. • The financial auditors emphasised the importance of the involvement of the information system auditors to perform the following tasks: ▪ Audit the electronic system and evaluate the automated controls ▪ Submit a report to the financial auditors presenting the findings about the system ▪ Provide newly employed financial auditors with training courses ▪ Help the financial auditors to understand the electronic system and to extract the needed information	√ √ √ √ √	√ √ √ √ √	√ √ √ √ √
➢ Automated controls built in the electronic systems are tested • Evaluating automated controls is the responsibility of the computer audit department. • Problems of automated controls ▪ Weakness in security controls ▪ Lack of segregation of duties	√ √ √ √	√ √ √ √	√ √ √ √
➢ CAATs: • Usage of CAATs			

▪ Using audit software ▪ Using CAATs to extract data ▪ Using CAATs to test the effectiveness of the automated controls • Problems of using CAATs ▪ Some clients do not allow using CAATs for confidentiality reasons ▪ Some clients do not allow using CAATs as they concern running these tools may cause crash in their production environment.	√ √ √ √ ✖	√ √ √ ✖ √	√ √ √ ✖ ✖
➢ Vendors of the electronic system are indicators of the quality of the system and its performance • Well known vendors indicate: ▪ More controls built in the system ▪ The needed maintenance and technical support will be provided ▪ Training courses are conducted • Local less known vendors indicate ▪ Poor system without maintenance or technical support is expected	√ √ √ √ √	√ √ √ √ √	√ √ √ √ √
➢ IT client staff: important source for the financial auditors and the information system auditors to know about the electronic system • Problems of dealing with IT client staff: ▪ Different interests between the auditors and the IT ▪ Lack of awareness ▪ Lack of co-operation ▪ Resistance of using automated controls ▪ Ignorance of security controls	√ √ √ √ √ √	√ √ √ √ √ √	√ ✖ √ √ √ √

➢ Financial considerations:			
• Relate to the audit firms			
▪ The number of auditors receive training abroad is governed by cost	√ √	√ √	√ √
▪ The audit firm does not fund the computer auditors to be CISA holders	√	√	√
▪ The audit firm refund the computer auditors after passing CISA exam	✖ √	✖	√
▪ Difficulty of hiring and retaining qualified computer auditors because of competition	√	√	√
• Relate to the auditors' client: some clients are governed by the cost of the electronic system when choosing it	√	√	√
• Relate to the audit fees: should increase	√	√	√
➢ Standards and guidelines			
• Auditing standards	√	√	√
• Computer audit standards	√	√	√

Table 7.2: Checklist of the Similarities and Differences between Audit Firms A, B, & C

√ refers to similarities
× refers to differences

Reasons behind the existence of differences vary between the three audits firms.

Some differences occur because the type of the clients varies from one audit firm to another. For example, Audit Firm B has clients who have hosted electronic systems; while Audit Firms A and C do not have clients with electronic systems hosted outside Egypt. This is why auditors in Audit Firm B face problems related to central computerised systems (discussed in Section 7.2.2) while auditors in the other two firms did not need to consider this problem.

Size of the clients can also explain the existence of the unsuitability of the chosen electronic system problem in Audit Firm A, while this problem did not exist in the other two audit firms. As Big Four international audit firms, most of the clients of Audit firms B & C are large companies that pay attention to the quality of the systems and the features that suits their needs, rather than to the cost of the system.

However, Audit Firm A is not from the Big Four audit firms: not all of its clients are large companies and the choice of electronic system may be governed by its cost. Financial considerations can be another reason which explains some of the differences that occur between the audit firms. For example, Audit Firm A announced its intention to expand computer audit training for the financial auditors to overcome the problem of the limited skilled information system auditors. This suggestion is not considered by the other two audit firms. Audit Firm A is an international audit firm; however, it is not among the Big Four. This indicates that there are some differences between the audit firms regarding the financial resources that can be allocated to hire, and retain, qualified information system auditors. Instead of allocating more resources to hire qualified computer auditors, Audit Firm A can provide extensive training courses for its existing financial auditors. Financial considerations can also explain why Audit Firm A does not fund its computer auditors to be certified. However, Audit Firm b indicated that they do not fund their computer auditors to be CISA holders as this is a primary requirement for the information system auditors.

7.14. Summary

This Chapter presented the main findings of the study. It introduced the main categories, and sub-categories, generated from the data analysis. In addition, it presented the main differences and similarities between the three audit firms in dealing with advanced electronic environments. Each of the categories presented is considered an actor in the network of auditing electronic environments.

The actors presented this chapter in conjunction with the ANT concepts introduced in Chapter Three, will be used in the next Chapter to build the network of auditing in electronic environments and to define how they interact with each other.

8. Chapter Eight: Constructing the Network of Auditing in Electronic Environments

8.1. Introduction

The main aim of this chapter is to follow the actors, and the intermediaries that connect them, that constitute the network of auditing in electronic environments to explain how these actors interact together to define (and redefine) their roles to build their relationships and to build their network, or as Latour (1997: 6) stated to explain how the actors *"redefine their identities and their mutual relationships in some new way and bring new elements into the network*".

To be achieved, this main aim is split into two sub-aims. The first is to explore how and why heterogeneous actors are enrolled to build the network of auditing electronic environments (the third objective of the study). The second is to explore how these actors interact together and how circulating intermediaries among them plays a significant role in shaping their interaction and in defining their roles in the network (the fourth objective of this study).

Building the network and defining the roles of the intermediaries will be based on the findings of the qualitative data analysis that were introduced in Chapter 7. Moreover, this chapter will be based on the ANT conceptual framework. It will be guided by the concepts and ideas of ANT that were introduced in Chapter 3. Maxwell (2003: 131) indicated that when theories are used as a lens, or perspective, to guide a study they should also guide *"how the final written accounts need to be written"*.

The chapter will be categorised into two sections. The first section, after this introduction, will achieve the first sub-aim of the Chapter. It will consider building the network of auditing in electronic environments. The relationality concept (discussed in Section 3.7) and the mutual constitution concept (discussed in Section

3.4) will shape the way of thinking during the process of building the network. These concepts will help to understand how the relationship between external financial auditors and the electronic systems they deal with is not a one-to-one relationship; rather there are other actors who play important roles in configuring the outcome of their interaction. These concepts will help to understand how many actors are associated and allied together in an attempt to build the network of auditing in an electronic environment and how each actor performs in, by, and through its relation to the other actors. In other words, the network will not be built by identifying the one-to-one relationship between the actors; it will be built according to their relationality. All the actors will be seen as black boxes (as discussed in Section 3.6); however some of these boxes will be opened to pick the useful insides that can help in understanding the performance of the actors.

The second section will achieve the second sub-aim of the Chapter. It will explain how actors that are enrolled in the network (presented in Chapter 7) are connected together through the intermediaries that have been introduced (in Section 3.8) by Callon (1991): texts, human beings, money, and technical artefacts. The role of each intermediary in connecting the actors will be presented separately in order to gain a thorough understanding of the role of each intermediary and in order to avoid looking into endless networks. This section will help to understand the one-to one relationship between the different actors through the circulation of intermediaries.

It is important to indicate that the actors and network are not just things out there to be seen or apprehended by the researcher. Rather, actor-network is in itself the conceptual frame, as it is a way of understanding social and technical processes (Calas & Smircich, 1999).

8.2. Building the Network of Auditing in Electronic Environments

This section considers building the network of auditing in electronic environments. It highlights how and why the actors, presented in Chapter 7, are enrolled in this network and what are the roles they play in it. One of the key advantages of ANT lies in its emphasis on the construction of networks. As discussed previously, the relationality concept (discussed in Section 3.7) and the mutual constitution concept (discussed in Section 3.4) guides the way of thinking during the process of building the network. These concepts will help to understand how different actors are associated and allied together in an attempt to build the network of auditing in an electronic environment and how each actor performs in, by, and through its relation to the other actors. This means that the network will not be built by identifying the one-to-one relationship between the actors; it will not discuss the relationship between each two actors separately as any actor is not fixed and does not have significance or attributes in and of itself; the attributes of any actor in the network is entirely defined in relation with the other actors. In other words, actors are not seen as fixed entities, but as flows or as circulating objects that are collected together to perform a network of relations. Instead of a purified world of categories relationality emphasises the connections, interdependence, mutuality and flux of the actors (Latour, 1999a; Latour, 1999b; Callon, 2002; Law, 1999; Law & Mol, 2000; Law & Urry, 2002) as all the actors affect, and are affected by, each other during their interaction. So, auditing in an electronic environment network will be built according to the actors' relationality.

To choose a starting point for any network can be seen as a difficult task as it will always face the questions posed by Hull (1999: 414) "*Why choose one object of study rather than another?; Why choose to start at one point and not another?; Why*

choose to follow some network-tracing activities and not others?". However, I believe that the starting point can be any logical point that helps the researcher to understand how the network is constituted and that allows him/her to tell the story of the actors he/she is following in an understandable way. Starting from any point or by any actor does not mean that this actor has privilege over other actors as ANT calls to adopt a symmetrical approach for all the actors without differentiating or giving priority to any of them.

As this research aims to explain how the network of auditing in an electronic environment in Egypt is constituted, I chose the type of the electronic systems to be a starting point for this network as auditors have to consider the type of the electronic system they will deal with and the audit evidence that is obtained from this system.

The type of electronic systems adopted by clients seems to have an influence on the audit process when auditing is conducted in an electronic environment. It can be seen from the analysis (in Section 7.2.1) that the complexity of the electronic systems has an influence on the audit process. When auditors are dealing with a minor IT environment they tend not to pay attention to the computerised applications used by their clients as these applications are simple and do not have a significant effect on the financial statements or on the presence of the audit evidence as traditional paper audit evidence is still available. However, dealing with an advanced internal integrated electronic environment, as in the case of dealing with dominant or significant IT environments, seems to have a direct influence on the audit process. The findings showed that the financial auditors (included in the study) believe that the financial statements are the outputs of these electronic systems which mean that what happens inside the system itself will affect the accuracy of these outputs. Moreover, when dealing with advanced electronic systems financial auditors face

problems related to the audit evidence as the audit trail of the entity's transaction may be retained only for a limited period of time, so it cannot be accessible or available for the auditor to perform the relevant audit and in some cases the audit trail may be totally lost as a result of the internal integrated transactions (as discussed Section 7.3).

From the findings, the influence of the interaction between financial auditors and the advanced electronic systems can be highlighted through two main issues. The first issue is the need to enrol other actors who can help in improving and configuring this interaction. The need for enrolling other actors and the role they play will be explained during the process of constituting the network. The second issue is that the auditors who are dealing with advanced electronic environments are different from those who are dealing with a paper environment[1]. As a result of the interaction between the financial auditors and the advanced electronic systems a new link is created that modifies the original actors to be, as Latour (1999a: 180) mentioned, "*someone something else"*. Financial auditors have redefined themselves in accordance to their relation with the electronic systems. In other words, such interactions caused the need of the financial auditors to modify their competence in dealing with advanced electronic systems. Electronic systems became an active participant, or an active actor, that caused them to redefine their skills from auditors who only have skills in accounting and auditing to auditors who possess IT skills as well, at least to some extent.

The findings of the study show that financial auditors believe in the need to enhance their competence in dealing with the electronic environment by enhancing their IT skills in order to be able to deal with the electronic systems; to be able to extract the

[1] This point relates to the Mutual Constitution notion that has been discussed in details in chapter 3, section (3.4).

needed information from the system; and to be able to use CAATs, at least in the form of using audit software designed specifically for their audit firms. Besides, it became an essential requirement for any auditor who aims to join a well known audit firm to be qualified, to some extent, in IT (as discussed in Section 7.4) as the competence of auditors who deal with the electronic systems affects the total quality of the audit. In other words, from the relationality concept perspective, dealing with electronic systems affects the competence of the financial auditors and at the same time is affected by such competence.

However, the findings show that although financial auditors enhance their skills in IT still they do not believe that they are competent enough to deal with the advanced electronic systems without the help of the information system auditors in their audit firms (as discussed in Section 7.6). They indicated that the information system auditors are more qualified in evaluating the automated controls of the electronic systems. Moreover, the information system auditors can help them in performing other tasks they may need during their interaction with the advanced electronic systems (as discussed in Section 7.6). This point shows that evaluation of automated controls is an important point, among others, that is considered in the interaction between financial auditors and electronic systems, and there is a need for information system auditors to evaluate such automated controls as a task among other tasks they perform. In other words, from a relationality concept perspective, because of the attributes of the advanced electronic systems, as there are many internal integrated transactions that need strong automated controls, and because of the attributes of the financial auditors, as incompetent to deal with electronic systems, there are other actors who found places for themselves in the network. Other actors are enrolled in the network which are the automated controls and the information system auditors.

Before moving to understand these actors and their position in this network, it is worth opening the black box of the competence of financial auditors to define the hidden actors inside this box and to present how these actors redefine, or did not redefine, their roles to have an influence on financial auditors' competence in dealing with advanced electronic systems and to understand why Egyptian financial auditors are not competent enough to deal with such systems. The main sources to enhance the competence of financial auditors in dealing with advanced electronic systems are formal university education, practical training and experience (Boynton et al., 2001).

With regard to formal university education, the findings (as in Section 7.4.1) show that accounting and auditing curricula provided for undergraduates in faculties of commerce in Egyptian universities hardly include even the very basics of dealing with simple electronic systems and that there is a wide gap between what is taught and the practical real world. It is important to indicate that an accounting and auditing curriculum is not expected to provide practical training courses for the students on how to use a specific package to audit electronic systems. However, auditing curriculum should include, at least, the impact of information technology on the audit process and assurance services (Johnson et al., 2003). It has to move from auditing around the computer to auditing through the computer.

In other words, formal university education can be seen as having an ineffective influence on the competence of financial auditors and, using ANT language, can be seen as a weak node in the network of auditing in electronic environments. The findings included different points that can explain the weakness of the formal university education in enhancing the competence of financial auditors in dealing with advanced electronic systems.

Undergraduate-level accounting and auditing courses are designed to focus mainly on elementary and more general conceptual topics as some of the module leaders are not up to date with new topics that should be considered in accounting and auditing curricula. Although there are many faculty members who have been educated in America and Europe, still there are an insufficient number who can undertake such a practical change in the accounting and auditing curriculum. In addition, financial considerations lead most of them not to settle in Egypt for a long time as they are looking for contracts in Gulf countries' universities that provide them with higher salaries than in the public Egyptian universities.

The huge number of students who are enrolling each year in faculties of commerce is another reason for the graduation of incompetent auditors. According to the World Bank report (2002: 5), the teacher-student ratio in accounting departments of public universities is about 1 to 1000 which hinders instructional quality and constrains essential teacher-student communication. Another problem, which is a general one not only related to accounting and auditing curriculum, is that the educational system in Egypt depends mainly on indoctrination; academic programs are not improving students' critical thinking and do not help the students to be creative or to use their skills (World Bank, 2002), so even if they learn some useful topics in the university, they may not be able to use them successfully in their work.

Moreover, according to the Accounting Practice Law in Egypt[1], university graduates in the field of accounting can register as Certified Accountant, and this registration does not require a qualifying examination for entry. Moreover, the law does not require those registered auditors to undertake regular training or to continue their professional education. Besides, although the Egyptian Society of Accountants and

[1] Laws and regulations of auditing in Egypt have been discussed in chapter 5.

Auditors[1] has established qualification examination requirements for its membership, it does not require continuing education for the members. Such omissions highlight the importance of the inscriptions (or the texts) as an important intermediary that connects the actors and modifies their actions, as will be discussed in the next section of this Chapter.

As there is no specialised Egyptian professional institution that provides the required training to perform audits in general, and audits in an advanced electronic environment in particular, financial auditors can obtain such training from two sources: the training provided by the clients' electronic system vendors (the vendor training), and the training provided to them by their audit firms (the in-house training).

Attending training courses provided by the vendors can be a good way for financial auditors to enhance their ability to understand the electronic systems they deal with; however, the findings (as discussed in Section 7.4.2.2) show that most financial auditors do not attend these courses. (Only one interviewee in Audit Firm A mentioned that he attends these training courses and he found it useful). The reasons they mentioned for not attending these courses are lack of time and the dependency of the information system auditors in their audit firms to understand the electronic system and get over any problem related to the system. In other words, the financial auditors thought that the enrolment of the information system auditor, as an active actor, can prevent their need to interact, directly, with the vendors of the electronic system. However, this does not mean that the vendor of the electronic system is not an actor in the network as will be discussed later.

[1] The role of the Egyptian Society of Accountants and Auditors has been discussed in Chapter 5

As for the in-house training, the findings (as discussed in Section 7.4.2.1) indicate that this type of training has an effective influence on enhancing the competence of the financial auditors in dealing with electronic systems, to some extent. The financial auditors explained that they are satisfied with the knowledge they have in such training courses as it covers their needs as financial auditors. The in-house training includes provision of courses concerning general computer controls, how to use the audit software of the audit firm and how to use CAATs to extract the information needed from the electronic system to perform the audit. Also, on-the-job training is another source for increasing the competence of the financial auditors. Conducting such training courses is in line with the recommendations of the POB (2000) that recommended audit firms develop training programmes to enhance the financial auditors' information technology skills. With regard to experience, the findings imply that practical work experience has an effective influence on the competence of financial auditors where knowledge is performed in practice. Experience in dealing with the client and its electronic system is an important source to enhance the competency of the financial auditors.

All the financial auditors (included in the study) pointed out the effective influence of in-house training and the practical experience in enhancing their competence in dealing with electronic environments. However, they highlighted, as mentioned previously, that they cannot depend totally on themselves when auditing in an advanced electronic environment (i.e. dominant or significant IT environments) and they need the involvement of the information system auditors as they need to pay attention to other types of controls: automated controls. In other words, two more actors found their places in the network of auditing in an electronic environment, namely, the automated internal controls and the information system auditors.

Auditors have to pay attention to manual controls when dealing with both manual and electronic systems. However, dealing with advanced electronic systems caused auditors to pay attention to automated controls built into the electronic systems if they deal with dominant or significant IT environments. The findings indicate that the automated internal controls are affected by the vendor of the electronic system and the competence of the IT client staff, which means that more actors are enrolled in the network: the vendor of the system and the IT client staff.

Regarding the vendor of the electronic system, the findings (in section 7.9) pointed out that automated controls built into the electronic system are expected to be strong if the system is provided by a reputable vendor. However, the interviewees emphasised the importance of the implementation process, as sometimes these controls can be neglected during the implementation to save time and money. Moreover, the findings indicated that reputable vendors have an effective influence in the general performance of the electronic systems as they provide the technical support, the maintenance, the upgrades and the modifications needed to enhance the performance of the electronic system. These relationships, between the vendors of the electronic systems and the performance of the electronic system and its automated controls, imply that the vendor of the electronic system can be seen as an actor in the network of auditing in electronic environments. Although the financial auditors tried to prevent the direct interaction with this actor, by not attending the training courses provided by the vendors on the subject of electronic systems, the vendor found other trajectories to be enrolled in the network. It is important to indicate that the vendor of the system interacts with other actors in the network, which will be discussed later.

Regarding the competence of the IT client staff, the findings (discussed in Section 7.10) suggest that there could be a relationship between the competence of the IT

client staff and the strength of some automated controls. Incompetent IT client staff may cause weakness in security issues as they may allow the employees to use blank or weak passwords, or to retain the same password for a long time without change. Moreover, some ex-employees can maintain access to the system as their ID has not been cancelled which means that they have unauthorised access to the system. The Institute of Internal Auditors (IIA, 1992) in Systems Auditability and Control (SAC) identified unauthorised access and changes to data and systems as the main risks associated with computerised accounting information systems. However, the interviewees pointed out that in some cases high competence of the IT client staff does not ensure that all the correct automated internal controls are in place; if the administrator receives a request authorised from the manager to give a new employee access for different conflicting functions that may cause non-segregation of duties as she/he will concede to the request although she/he knows that this will affect controls.

The relationship between the automated controls and the IT client staff indicates that the IT client staff can be seen as another actor that is shaped in relation to the other actors in the network as it affects, and is affected by these other actors. The findings indicate that the training courses provided by the vendors of the electronic systems have an influence on the competence of the IT client staff as such courses are important sources for them to understand how to use the electronic system to perform their tasks. The importance of such training courses increases in the first stage of adopting the electronic system. Moreover, the findings highlighted that the competence of the IT client can have an influence on the work of both the financial auditors and the information system auditors as competent IT client staff can help them to understand the electronic system and to extract the needed information.

However, it seems that IT client staff competence affects the work of information system auditors more than the work of financial auditors as the financial auditors can compensate the incompetence of the IT client staff by more dependency on the information system auditors in their audit firms, while the information system auditors compensate the incompetence of the IT client staff by exerting more time and effort in understanding the system using its manuals to be able to evaluate it. This point can be seen as a clear example of how actors are performing according to their relation to each other; if the financial auditors are not satisfied with their interaction with the IT client staff, their action will be the dependence on the information system auditors, if the latter felt that the IT client staff is incompetent, they will totally move towards depending on the inscriptions.

Returning to the automated controls, the findings (in Section 7.7) indicate that the evaluation of these controls is the responsibility of the information system auditors who issue a report to the financial auditors including any weaknesses they discovered when evaluating the electronic system and their expected direct and indirect impact on financial statements. This report is also submitted to the client management, such a report is expected to affect the performance of the IT client staff as they have to prepare an action plan to overcome any weaknesses in the internal controls. This issue indicates that the two actors, the IT client staff and the information system auditors, from the perspective of relationality, affect and are affected by each other. Moreover, it highlights the importance of texts as an intermediary that connects actors together as will be discussed in the next section.

The information system auditors can be seen as an effective actor in the network of auditing in electronic environments. The findings indicated that the financial auditors

seek the involvement of the information system auditors to perform many tasks (discussed in Section 7.6) when dealing with advanced electronic systems. The more complicated the electronic system (e.g. dominant or significant electronic system) the more the financial auditors need the involvement of the information system auditors. The financial auditors are also affecting the work of the information system auditors as they are the ones who specify their requirements from the system. The dependency of the Egyptian financial auditors on the information system auditors is in line with the study of Bell et al. (1999) who indicated that auditors have historically relied on special experts to assess the reliability of the accounting systems and they feel that they lack the expertise to adequately evaluate and test automated systems.

The findings show that financial auditors believe in the competence of the information system auditors in their audit team and that is why we need to open the black box of the competence of information system auditors using the sources that have been used when opening the black box of the competence of financial auditors: Formal university education, practical training and experience (Boynton et al., 2001).

Concerning formal university education, the findings (discussed in section 7.5.1) show that accounting and auditing curricula in Egyptian universities do not include enough material on the subject of computer audit (lack of inscriptions), which is why some of the computer auditors, who are graduated from faculties of commerce in Egyptian universities, seek to study IT extensively, through self study, to become knowledgeable in both areas (accounting/ auditing and computers) in order to be qualified to work as computer auditors. Other computer auditors seek to be Certified (i.e. CISA holders) as the material provided by ISACA includes a combination between auditing and computer science. Additionally, CISA holders have to maintain their certificate through continuing professional education to ensure that all CISA

holders maintain an adequate level of current knowledge and proficiency in the field of information system audit. These findings highlighted two important issues. The first is that the Egyptian educational system was not able to redefine its role to provide the market with qualified graduates and consequently it became a weak node in this network. As a result, it gave the chance to other institutions to take, at least a part of, its space. The second point relates to the existence of ISACA as a hidden actor. Although the ISACA is an international institution, and although it does not have a Chapter in Egypt, it has an influence on the competence of Egyptian information system auditors. This point shows that the network is moving from the local to the global (Latour, 1993).

As for training, the findings (discussed in section 7.5.2) imply that training courses provided by the vendors of the electronic systems to their clients have an effective influence on enhancing the competence of the information system auditors as such courses help them to overcome the lack of awareness of any new electronic system they are going to deal with. However, these training courses are not the only information source in relation to the electronic system as they depend on the manuals of the system to overcome the lack of awareness problem. This point highlights the important role inscriptions play in shaping the actors in the network.

Concerning the in-house training provided by the audit firms, the findings show that it has an effective influence on the competence of the information system auditors. It takes different forms: The first is provided to computer auditors when joining the audit firm to fill the gaps in their knowledge. If their main educational background is accounting and auditing, the course will be designed to provide them with more information about computers. If they have a computer science educational background, the course will provide them with more knowledge about audit

concepts. The second form of training is conducted online through the learning system designed by the audit firm abroad including the updates of the techniques used in auditing electronic systems. The last form of training is conducted by sending selected auditors to spend some time in the computer audit department of the audit firm abroad then coming back to conduct training courses for their colleagues in the computer audit department of the Egyptian branch. The findings show that experience in dealing with advanced electronic systems is an important indicator for the competence of information system auditors. As with any audit, the quality of auditing electronic systems will be affected by the competence of the information system auditors who audit it which indicated that the electronic systems and the competence of the information system auditors affect and are affected by each other through relationality.

Brazel (2004) conducted a study to determine the factors considered by the financial auditors to judge the competence of the information system auditors. The results of this study showed that the main factors are (1) the technical ability of the information system auditors, (2) the audit manager's opinion of them, (3) whether they submit their internal control working papers in time, (4) previous training they received, (5) years of experience, and (6) how well they know the client. In this current study, previous training, years of experience, and how well the information system auditors know the clients have been mentioned as indicators of the competence of information system auditors. The technical ability of the information system auditors has not been mentioned as the financial auditors, in the audit firms included in the study, believe that the hiring system in their audit firms is restricted and all the auditors who are allowed to join the audit firm will be qualified for the job they perform. However, another reason for not considering the technical ability as an indicator for the

financial auditors to judge the competence of the information system auditors is that the financial auditors do not have self-confidence in their technical abilities. As a result, the financial auditors believe that they are not qualified to judge the competence of the information system auditors. The audit manager's opinion of the information system auditor has been mentioned indirectly as all the financial auditors included in the study depended on experience and qualifications to judge the competence of the computer audit partner and consequently they trust all the staff of the computer audit department as the qualified partner will choose qualified candidates. Whether the information system auditors submit their internal control working papers in the right time has not been mentioned by the financial auditors.

In order to be able to audit electronic systems and to evaluate automated controls, the information system auditors use their automated tools; they use computer assisted audit techniques (CAATs) which can be seen as another actor enrolled in the network of auditing in an electronic environment. The findings show that both the information system auditors and the financial auditors use CAATs to perform different tasks as they help in saving time and effort (as discussed in section 7.8.1).

The findings indicate that there is a relationship between using CAATs and the complexity of the electronic system; the more complicated the system the more the need to use automated tools to evaluate the automated controls and to overcome the problem of losing the audit trail. Moreover, the findings show a relationship between the competence of financial auditors in dealing with the electronic systems and their ability to use CAATs to extract the needed data from the electronic systems; the less competent the financial auditors the more their dependency on the information system auditors to use CAATs to extract the required data.

The previous presentation shows how the network of auditing in an electronic environment is built through the *relationality* between the different actors. It shows that the different actors are performing in relation to each other as no actor can be seen in isolation as it affects and is affected by the other actors in the network. Moreover, it shows that some actors should redefine their roles in the light of the needs of the other actors in the network in order to support and strengthen this network. However, if any of the actors does not respond to the needs of the network in an acceptable way, this means that they will become a weak node in the network, and consequently other actors try to compensate this weakness, even by redefining their roles or by enrolling others who can perform the needed tasks.

Thinking of auditing in electronic environments as a network expands the scope of issues that should be considered. Besides, it allows us to pay particular attention to the interrelations between the various actors enrolled in the network, and how these relations influence the audit process.

8.3. Defining the Relationships of the Actors through Intermediaries

This section aims to shed light on the role of the different intermediaries (discussed in Section 3.8) in connecting the heterogeneous actors that are enrolled in the network of auditing electronic environments. Callon (1991: 134) defines an intermediary as *'anything passing between actors which defines the relationship between them'.* It can be seen as an actor that stands at a place in the network between two other actors and serves to translate between these actors in such a way that their interaction can be more effectively coordinated, controlled or otherwise articulated (Kaghan & Bowker, 2001). It helps the different actors involved in a

situation to improvise responses that are suitable and acceptable under certain circumstances. In other words, intermediaries are the language of the network; they provide the missing links that connect the actors together and at the same time defines the network itself (Callon, 1991). Actors form networks by circulating intermediaries among themselves, thus defining the respective position of the actors within the networks and in doing so constituting the actors and the networks themselves. "*Intermediaries thus both order and form the medium of the network they describes"* (Callon, 1991: 135). Callon (1991: 135) identified four types of intermediaries: texts, which are also known as literacy inscriptions, human beings, money, and technical artefacts.

Before introducing the role of the intermediaries in defining the relationships between the actors, it is important to indicate that the connection between any two actors does not take place through circulating one intermediary only; heterogeneous intermediaries connect actors together. For example, the financial auditors and the information system auditors are not connected together through texts only; they are connected to each other through all types of intermediaries. However, after Callon (1991), for simplification the role of each intermediary in connecting the actors and defining the network will be presented separately as this will provide an in-depth understanding to their role and will help to avoid looking into endless networks. Diagrams will be used to help in understanding the role of each intermediary in connecting the different actors. These diagrams represent the researcher's interpretation of the findings. In other words, the validity of these diagrams stems from the validity of the findings of this research (presented in Chapter 7). Tactics adopted to achieve validity of the findings are discussed in Section 4.7. Reliability of

the diagrams has been addressed by two independent reviewers to ensure that the diagrams represent, accurately, the findings of the study.

8.3.1. Texts (Inscriptions)

Visual inscriptions, like academic texts, reports, laws, standards, etc, have an important effect in defining the role and the position of each actor in any network as they define the actions of their users. Although inscriptions are perceived to be built on many facts, the power of inscriptions can be questionable as some inscriptions are followed while others can be ignored and avoided (Chua, 1995).

The findings of the fieldwork implied that there are many inscriptions that play an important role in shaping the actions of the actors and connecting them together to build the network of auditing in electronic environments. Laws, standards, and reports are important inscriptions that define the actors and define their relationships. Figure 8.1 shows the role of inscriptions in defining the actors and connecting them together.

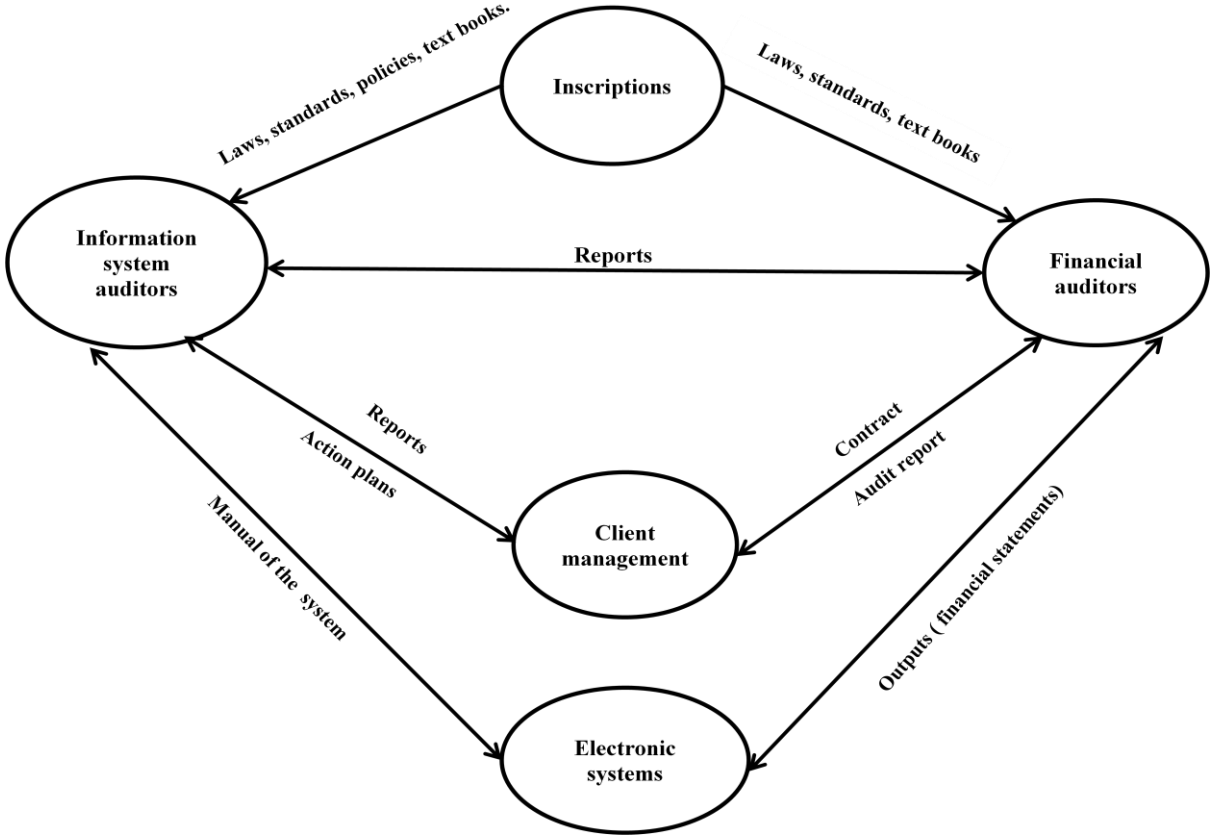

Figure 8.1: Inscriptions Intermediary

Accounting Practice Law 133/1951, governing the professional accountants and auditors in Egypt, is an important inscription that shapes the action of financial auditors towards enhancing their competence in dealing with advanced electronic systems. This law (as discussed in Chapter 5) requires individuals who join the public practice of accounting and auditing to register with the General Register (Registry) for accountants and auditors. However, it does not require a qualifying exam for registration. Further, it does not require auditors to continue their professional education which cause an increase in the knowledge gap of practicing auditors. This means that, according to the law, financial auditors are not obligated to be up-to-date with the new issues in auditing, including how to deal with electronic systems. Besides, as discussed previously, the educational quality of accounting and auditing

in Egyptian universities suffers from lack of modern curricula and the text books taught to the students do not include much about the impact of information technology on the audit process.

The Egyptian Auditing Standards[1] are another inscription that shapes the actions of the financial auditors towards redefining their roles when dealing with advanced electronic systems. The standards indicated that financial auditors have to improve their IT skills when dealing with electronic environment. However, they have to seek the help of IT audit specialists if the audit is conducted in advanced electronic environments. It can be seen that these inscriptions do not include an obligatory requirement for financial auditors to have high IT knowledge to be able to deal with electronic systems which can explain why financial auditors do not have appropriate incentives to have high IT skills.

The findings (as discussed in Section 7.6) show that the lack of ability of financial auditors in dealing, totally, with electronic systems is compensated by the enrolment of the information system auditors in the network. This involvement is inscribed in the ISA, and is also inscribed in the policy of the three audit firms included in this study, as they require the involvement of information system auditors to co-operate with financial auditors when the audit is conducted in a dominant or significant electronic environment. This point shows that inscriptions play an essential role in identifying how the financial auditors and the information system auditors interact with each other.

Moreover, these auditing standards play a significant role in defining the position of the information system auditors in the network. Although the auditing standards required the involvement of the information system auditors when auditing is

[1] The Egyptian Auditing Standards are the Arabic translation of the International Auditing Standards.

conducted in advanced electronic environments, the main aim of this involvement is to serve the financial audits. However, the standards do not require the involvement of the information system auditors to perform a separate computer audit. This point, combined with the lack of privacy and security laws[1] in the Egyptian environment discourage the auditors' clients to seek computer audit as an independent service. In other words, although the inscriptions caused the financial auditors to depend on the information system auditors to evaluate the electronic systems and its automated controls, these inscriptions also identified the roles information system auditors have to play in the network.

Laws and standards are not the only inscriptions that connect the actors together in the network and shape their actions. The manuals of the electronic systems create a link between the information system auditor and the electronic systems. These manuals include facts about the system that can help the information system auditors to understand how it works. According to what they find out from these inscriptions the information system auditors can plan their computer audit. In other words, this inscription connected the two actors together and at the same time shaped the action of the information system auditors.

The information system auditors present their findings of evaluating the electronic system in a report. This report includes, if found, any weaknesses they discovered in the automated controls as well as their recommendations on how to overcome such weaknesses. This inscription connects the information system auditors with the client management and with the financial auditors as this report is sent to both of them to shape their actions.

[1] Like Privacy and Security Laws in the developed countries.

According to this report, the client management should prepare an action plan to show how they will overcome any problems that have been mentioned in the report, and whether they will consider the information system auditors' recommendations. The financial auditors should plan their audit considering the results inscribed in the information system auditors' report. In addition, the financial auditors may request extra tests from the computer audit department; such requests are inscribed in a report that passes from the financial auditors to the information system auditors.

The financial auditors are connected to the electronic system with another important inscription; the financial statements as an output of the electronic system. These financial statements, among others, drive the auditors to act by issuing an essential inscription, namely, the external audit report. This report is the end product of the audit examination and it is the method of communication between the auditors and the shareholders and any other users of the financial statements. The external audit report, as an inscription, has the features identified by Latour (1987: 219-232) that allow it to enable action at a distance, which are mobility, stability and combinability. The external audit report permits *action at a distance* (Latour, 1987) as it helps the different users of the external financial statements to take decisions and to take different actions depending upon what is inscribed in the audit report although, because of legal, physical or economic factors, they are far from the place related to their actions. In other words, it enables people far away from the scene of activity to have a window on those activities. It is important to indicate that the financial auditors are connected to the client management through another inscription which is the contractual agreement.

To sum up, inscriptions that are circulated between the actors play an important role in building their relationships and in defining their actions at the same time.

8.3.2. Human Beings

This intermediary identifies the different relationships between human beings that are derived from position, job, and responsibility. It includes the control and *power* relationships that shape the actors interactions in any network. Moreover, it includes *skills* and *knowledge* and the *know-how* that they incorporate (Callon, 1991). The findings (in Chapter 7) imply that the interaction and negotiation between the human beings in the network produce different relationships that help in shaping each actor and in forming the network at the same time as shown in figure 8.2.

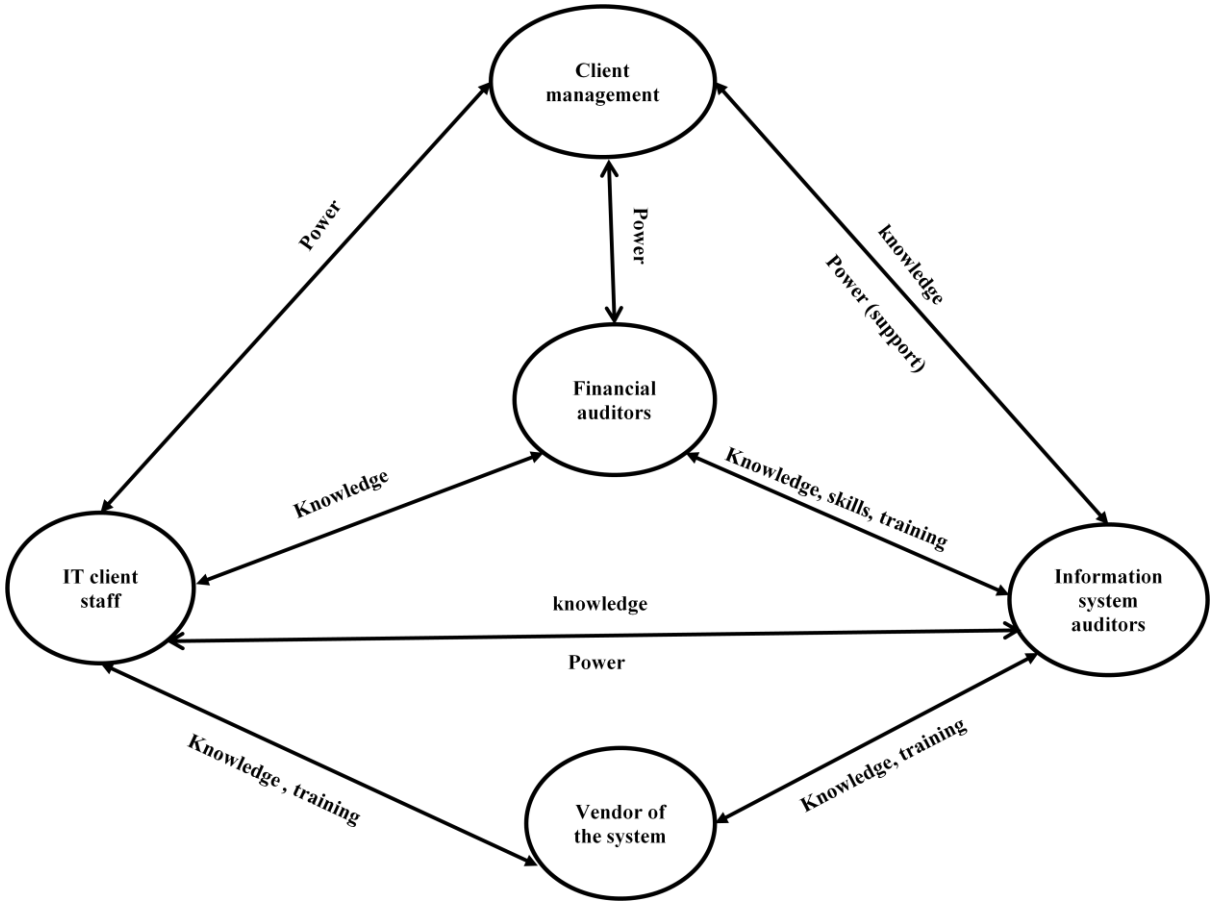

Figure 8.2: Human Beings Intermediary

Difference in *knowledge and skills* between the financial auditors and the information system auditors has shaped their interaction and their role in the network. The information system auditors used their knowledge in technology to justify their position in the network. The information system auditors, who work in the computer

audit departments in the audit firms, have the knowledge that allows them to provide training courses to the financial auditors to teach them about general computer controls and about using CAATs.

The knowledge and skills the information system auditors possess elected them to be responsible for auditing the systems and evaluating its automated controls to present the findings to the financial auditors and to the client's management. Besides, the financial auditors seek the assistance of the information system auditors to perform different tasks (as discussed in Section 7.6) because of their *knowledge* in dealing with the electronic systems.

The information system auditors believe that the financial auditors depend on them in technical matters because of this gap in knowledge and skills. However, the financial auditors did not accept the description that their relationship with the information system auditors is a dependency relationship. Although the findings (in Chapter 7) show that the financial auditors believe that they are incompetent to evaluate the quality of the electronic system and its controls and that the information system auditors are the ones who have the required skills to perform these tasks, they preferred to describe the relationship between them and the information system auditors as a "*close collaboration"*, or as "*integration"*, or as *"organising the responsibilities".* The financial auditors defended their point of view by stating that they are the ones who are responsible for issuing and signing the final external audit report, and when they seek the involvement of the information system auditors it is to ensure that qualified people are performing the needed tasks.

In other words, *knowledge and skills* of the information system auditors have defined their roles, or their jobs, in the network and defined how they interact with the financial auditors.

Knowledge and the *"know-how"* play a significant role in defining how the interaction between the vendor of the client's electronic system, the IT client staff and the information system auditors take place in the network. The findings (in Section 7.9) indicate that the training courses provided by the vendor of the electronic system act as a significant source for the IT client staff to understand how to deal with the electronic system. The information system auditors are also keen to attend these training courses as they provide them with more knowledge about the electronic system especially if they are dealing with the system for the first time. However, the financial auditors did not show interest in attending these courses as they depend on the information system auditors to provide them with the knowledge they need in relation to the electronic system.

How knowledgeable the IT client staff is in dealing with the electronic system governs whether the financial auditors and the information system auditors will seek their help. The findings indicate that the financial auditors seek assistance from the IT client staff to extract information from the system if they know how to deal with it. Besides, the information system auditors indicate that it is essential for them to gather information about the electronic system, its modifications, and its work flow. A knowledgeable IT personnel is an important source for them to gain such information, if such a knowledgeable person is available.

Power is an essential intermediary, beside knowledge, to understand the interaction between the IT client staff and the information system auditors. The findings indicate that knowing how to deal with the system should be accompanied by the intention of the IT client staff to co-operate with the auditors. The IT client staff may refuse to co-operate with the information system auditors as they consider all the information about the electronic system as confidential. Moreover, the IT client staff may resist

running the advanced automated tools used by the information system auditors as they think such tools may affect the production environment. In other words, the information system auditors may lack the *power* that drives the IT client staff to co-operate with them.

However, the information system auditors can use their *knowledge* to gain *power*. In some cases, they can use their knowledge to persuade the top client management to support the computer audit. If persuaded, the management will also use its *power* to force the IT client staff to co-operate with the information system auditors.

The findings imply that *power of negotiation*[1] can govern the relationship between the external auditors and their clients' management. For example, while negotiating the auditor/client contract, the client derives power because of the high degree of competition between the audit firms in Egypt to attract and retain clients. The Egyptian audit market is characterised by the presence of competing audit firms who are ready to replace the incumbent external auditor (Aly, 2001; Awadallah, 2007). However, the audit firm size (i.e. the international audit firms) can provide the external auditor with power to resist the management's pressure. Moreover, the findings implied that if the auditor's client is a referral work (as discussed in Chapter 7) then the client management will lose its power in changing the external auditor.

It is important to indicate that the high degree of competition between the audit firms to attract and retain their clients has a direct influence on audit fees, which drive us to another intermediary, namely, money.

[1] Power from ANT perspective has been discussed in Section (3.5).

8.3.3. Money

The importance of money, as an intermediary, is that it has an influence on the actions of the actors who circulate it (Callon, 1991). Figure 8.3 shows how the actors in the network interact through money.

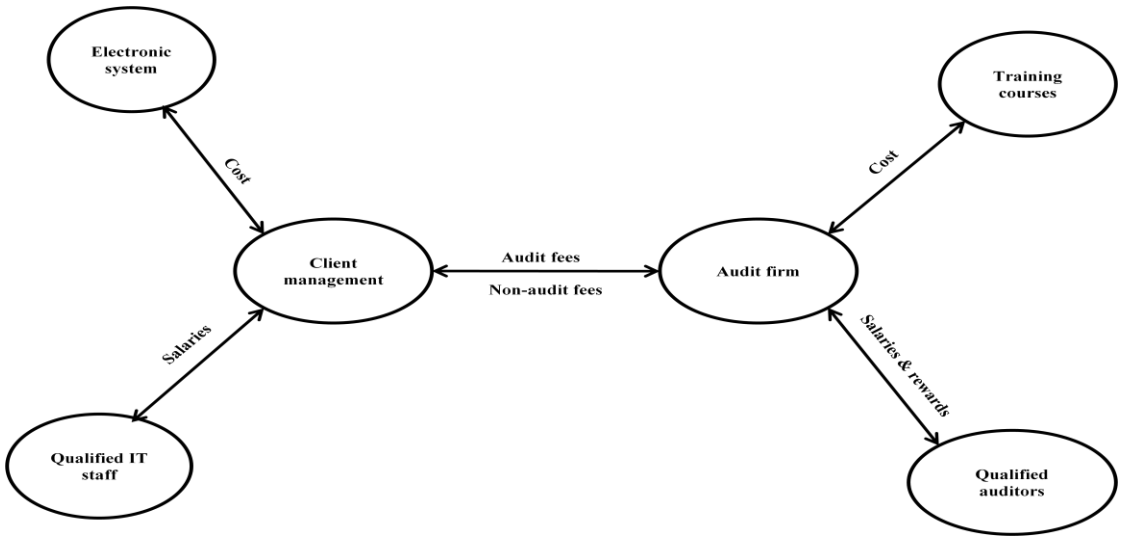

Figure 8.3: Money Intermediary

As stated previously, the Egyptian audit market is characterised by the presence of a high degree of competition between the audit firms to attract and retain the clients (as discussed in Section 7.11.3). Some audit firms in the Egyptian market are ready to accept low audit fees to attract new clients. Moreover, some audit firms have applied cost-free auditing for the first year, and charged their clients an audit fee from the second year (Wahdan et al., 2006). As a consequence, the rest of the audit firms have to respond to the pressure of the client management by reducing their audit fees to face these competitive challenges and to increase their local market share to avoid depending on referral work only (as explained in Chapter 7). Moreover, most of the clients need additional non-audit services (i.e. taxation services) and they become accustomed to dealing with one firm to provide them with both the external audit and the non-audit services as the Egyptian laws and regulations do not prohibit

accounting/ auditing firms from simultaneously providing both auditing and consulting services for the same client. This issue adds more pressure on audit firms to reduce audit fees in order not to lose their income from non-audit services which is in line with the studies conducted by Wahdan et al. (2005a, 2005b, 2006) that marked decreasing the audit fees as one of the competitive polices adopted by audit firms in Egypt to attract and retain clients.

In other words, money has an influential role in shaping the interaction between the auditors and their clients. In addition, the findings show that money affects the action of most of the actors in the network. The electronic system chosen by the client's management is affected, in some cases, by its cost: as some clients in manufacturing companies try to stick to the grant provided to them by the Egyptian government to transfer from manual systems to electronic systems. Further, some clients do not pay enough attention to the reputation of the vendor who will provide them with the electronic system as they may buy the programs from local unknown individual vendors as they offer cheaper prices (as discussed in Section 7.11.2) without considering the ability of this vendor to provide their IT staff with the needed training courses, or to provide them with future technical maintenance and/ or updates that could be needed for the electronic system. Moreover, some clients assume that having an advanced electronic system means that the system can perform its tasks easily without a great need to hire qualified IT client staff. In other words, hiring qualified IT client staff is affected, to some extent, by their salaries.

The findings also indicate that the ability of the audit firms to hire and retain qualified financial auditors and information system auditors is affected by the salaries and rewards offered to them by other competitive places in Egypt and in the Gulf countries. Although the three audit firms consider the salaries they offer to their

auditors as one of the highest salaries in the Egyptian audit market, the findings indicated that the information system auditors who resigned from their audit firms are leaving mainly because they found themselves jobs with higher salaries. Moreover, training courses conducted by the audit firms to the auditors are affected by the cost (as discussed in Section 7.11.1).

8.3.4. Technical Artefacts

Callon (1991) introduced technical artefacts as an intermediary that includes scientific instruments, machines, robots and consumer goods. This intermediary, in the form of machine or any technology, can be seen as structured groups of non-human entities which perform together certain tasks to connect the actors in the network and to shape it at the same time. Figure 8.4 shows how different types of technical artefacts connect the actors in the network.

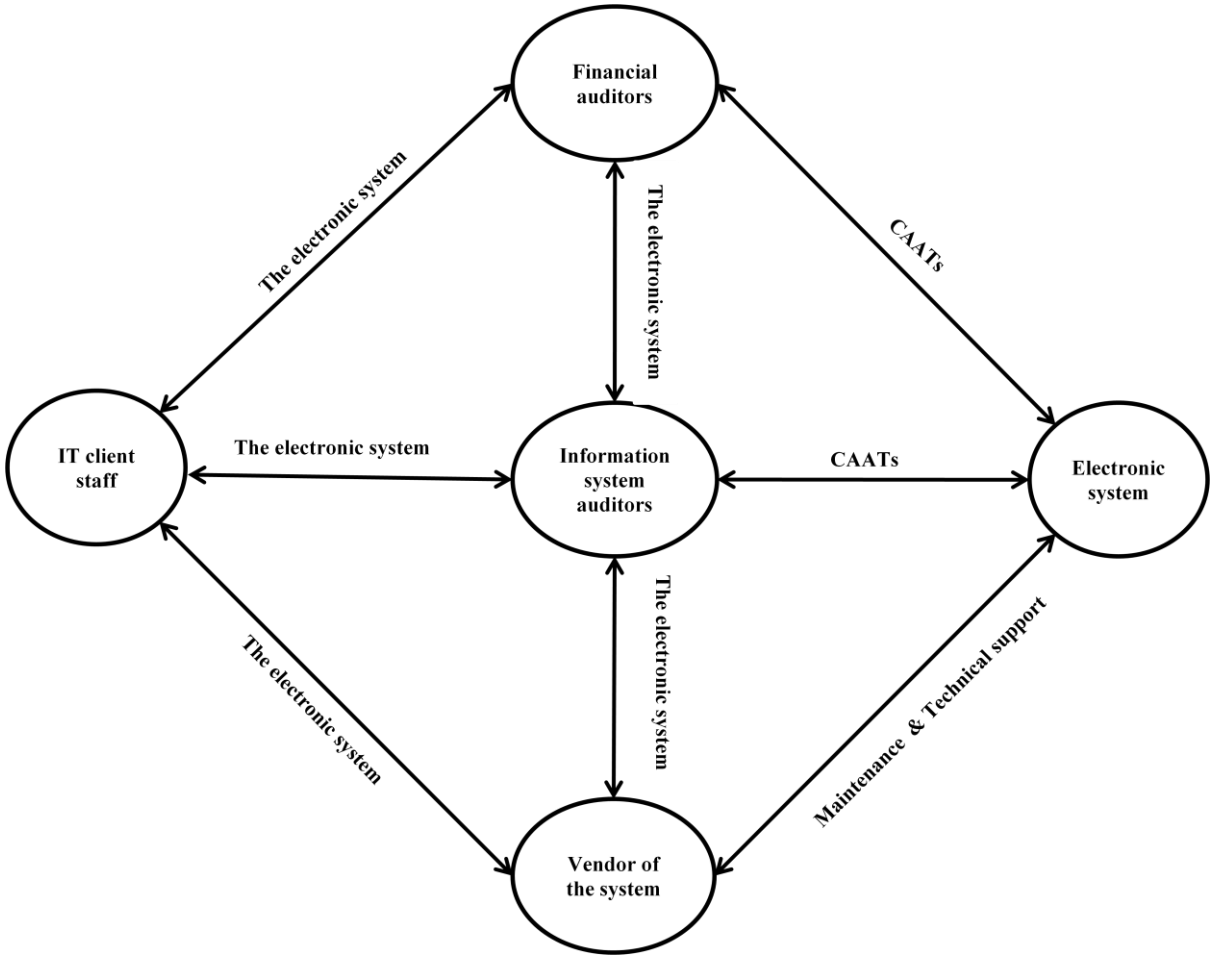

Figure 8.4: Technical artefacts Intermediary

The electronic system is an active intermediary that participates in bringing different actors together. The vendor of the electronic system and the IT client staff are connected together through the electronic system to configure how it will perform its expected tasks. In addition, the electronic system connects its vendor with the information system auditors during the training courses provided by the vendor about the electronic system. It is important to indicate that the vendor keeps his relation with the electronic system, after implementation, through its maintenance and technical support, if there are any problems, using the suitable automated tools.

In addition, the electronic system connects both the financial auditors and the information system auditors with the IT client staff as the IT client staff can help them to collect information about the system and how it operates, and can help them

to extract the needed information from the system. Moreover, the financial auditors and the information system auditors are connected together through the electronic system. The information system auditor seeks to ensure the reliability of the electronic system and its automated controls so that the financial auditor can ensure the reliability of its outputs (the financial statements).

Computer assisted audit techniques (CAATs) are another intermediary that links the actors in the network. Both the financial auditors and the information system auditors use CAATs to perform their tasks in order to help them deal with the electronic system (as discussed in Section 7.8). In other words, financial auditors and the information system auditors are connected to the electronic system using CAATs.

Using the perspective that an intermediary connects actors together, and that CAATs connect the electronic system with the financial auditors and the information system auditors, then the electronic system can be seen as an actor as well as an intermediary in this study. As discussed in Chapter 3, intermediaries can be seen as actors if they are able to associate with other intermediaries to link the actors. Besides, Callon's (1991: 141) definition for the actor which stated that "*an actor is an intermediary that puts other intermediaries into circulation"* supports the acceptance of the electronic system as both an intermediary and an actor at the same time. Figure 8.5 explains this point; in the left hand side of the figure actors (in circles) are connected together through the electronic system: The financial auditors, the information system auditors, the IT client staff and the vendors of the electronic system are all, as actors, connected together through an intermediary which is the electronic system.

In the right hand side of the figure, the electronic system can be seen as an actor (in a circle) which is connected by the other actors through intermediaries. The electronic system is connected to the financial auditors and the information system auditors

through the CAATs (an intermediary), and it is connected to the vendor of the electronic system through the technical support.

To sum up, intermediaries play a vital role in connecting the actors that are enrolled in the network of auditing electronic environments. While circulating intermediaries, the actors define their respective position in the network and in doing so, they perform the final shape of the network.

8.4. Summary

This chapter had two sub-aims. The first was to explore how and why heterogeneous actors are enrolled to build the network of auditing electronic environments. The second was to explore how these actors interact together and how circulating intermediaries among them plays a significant role in shaping their interaction and in defining their roles in the network. To achieve these two aims, the chapter was classified into two sections.

In the first section a holistic perspective was adopted to explore the *relationality* between the different actors and to discover how and why these actors are enrolled and how they build the network of auditing in electronic environments. The second section zoomed in to explore how these actors interact together and to focus on the role of the different intermediaries in performing the final shape of the network.

9. Chapter Nine: Reflections and Conclusions

9.1. Introduction

This chapter aims to present my reflections and conclusions in relation to this study. Reflection is the process of looking back on our experiences. It is a matter of using '*thought experiments'* in which our thoughts should be extended systematically by looking back upon our actions some time after they have taken place (Maxwell, 2005: 58).

The reflective process essentially involves open discussion of the hidden decisions involved in our practices. In other words, it calls researchers to *'stop and think'* (Maxwell, 2005: 62). In this chapter I am thinking, loudly, about the critical issues that can be remarked upon in this study.

The first critical issue I thought about is the suitability of the theoretical lens adopted in the study: ANT. I need to reconsider whether ANT was suitable to guide my way of thinking while conducting this study and whether there are some pitfalls or limitations of its adoption as the framework of this research. The second critical question I should answer is concerning the originality of this research. I have to assess whether this study can be marked as a contribution to knowledge. The third critical question is whether the study was able to achieve the objectives that were identified at the beginning of the study. The fourth critical issue is to consider the implications of the research findings. The last question concerns the limitations of this study and how future researches can overcome these limitations.

The next section of this Chapter will discuss the suitability of adopting the ANT perspective in this study by explaining the reasons that lie behind this choice. Moreover, it will discuss the limitations of adopting ANT in this study. The following section will present the criteria of evaluating the originality of any study

and will clarify whether this research is original. Returning to the research objectives will take place in Section 9.4 to assess the ability of this study to achieve its objectives. Section 9.5 will consider the implications of the research findings. The last section of the Chapter will introduce the limitations of this study and determine studies to overcome these limitations.

9.2. ANT and Auditing in Electronic Environments

One of the critical issues that can be open to discussion is the suitability of adopting ANT to be the theoretical lens that guides a research in relation to auditing in electronic environments. The following sub-sections will discuss the appropriateness of adopting the ANT perspective in this study. It is important to indicate that these sub-sections do not aim to summarise the findings of the study (presented in Chapter 7), or to explain how the enrolled actors interact together to build the network of auditing electronic environments (presented in Chapter 8). Rather, it aims to highlight the achievements, or the pitfalls, of adopting the ANT perspective in this study using examples from the findings.

9.2.1. ANT Ontology

One of the main reasons of adopting ANT in this study is its ontology. ANT is widely valued for its apparently anti-essentialist or relativist ontology (Whittle & Spicer, 2008). ANT is *"ontologically relativist"* (Lee & Hassard, 1999: 393) in that it allows the world to be organised differentially. Because of its ontological relativism, ANT does not produce its own decision about what phenomena are to be studied or create its own discriminations and boundaries; *"ANT removes from itself any terms and conditions that might serve to exclude others"* (Lee & Hassard, 1999: 392). In other words, ANT allows researchers to see the world in different ways or from different perspectives as they embark on the research without a clear picture of what

sort of actors they will discover during their research; they have to follow the actors and make a list of those actors who constitute the network under analysis, no matter how long and heterogeneous the list (Latour, 1987).

The heterogeneity of the actors that constitute any network implies two essential features of ANT which were considered during conducting this study. The first relates to the symmetrical assumption[1] of the social and the technical. Proponents of ANT declare their commitment to anti-dualism with regard to the traditional separation of human and non-human. Such equality brings many different non-human actors, beside the human actors, into the frame while preparing the list of actors involved in this study. The second is the importance of following the actors wherever they are without classifying them into local or global actors[2].

I prepared an inclusive list (Chapter 7) by following the actors who are involved in constituting the network of auditing electronic environments. Following the actors highlighted that auditing in an electronic environment is not only the process of auditing the outcomes (financial statements) of a technical system using technological methods. Rather, it is a network constituted from hybrid human and non-human, local and global actors, who interact together through different intermediaries (e.g. texts, human beings, technical artefacts and money) and have an impact on the audit process.

In other words, this research showed that auditing in an electronic environment is not just a technical process; it is a combination of many socio-technical aspects that comes from the interaction between different actors. It is an association between the external auditor who has the responsibility to sign the external audit report which is the end product of the audit examination; the information system auditors who are

[1] The symmetrical assumption is discussed in Chapter 3, Section 3.9.1.
[2] The micro/macro issue is discussed in Chapter 3, Section 3.9.3.

responsible for auditing the electronic systems and evaluating their automated controls; the automated tools used by both the financial auditors and the information system auditors to deal with electronic systems; the management of the auditor's client and its IT staff as they are responsible for the quality of the internal controls; the educational institutions as they provide financial auditors and information system auditors who can deal with the electronic environment, especially if it is a complicated environment; the standards, laws and regulations that auditors have to apply; the vendors of the electronic systems as they are indicators of the quality of the system; the training provided by the audit firms to their auditors as well as the training provided by the vendors of the electronic systems, and any other human or non-human actor that can affect the audit process when auditing in electronic environments.

Consequently, according to this study, auditing in an electronic environment is understood as a network of these heterogeneous social and technical, local and global actors who are brought together into associations or alliances. Although such a long and heterogeneous list of actors can be daunting, networks become stronger and stronger when they incorporate such human and non-human allies (Latour, 1987).

It is important to re-emphasise that symmetrical assumption between humans (e.g. the financial auditors, information system auditors, IT client staff, vendors of the electronic system) and non-humans (e.g. the electronic systems, the CAATs, the standards) do not deny the differences between them. The main aim of this symmetrical assumption is to build the network. By using Callon's & Latour's words *"Our general symmetry principle is thus not to alternate between natural realism and social realism but to obtain nature and society as twin results of another*

activity...network building, or collective things, or quasi-objects, or trails of force" (Callon & Latour, 1992: 348).

It is important to indicate that this study did not focus on the features of any of the actors as ANT seeks to resist explanations that appeal to the essential characteristics of actors. Rather, ANT moves the focus of analysis from the actor, either human or non-human, towards a more complex and less defined phenomenon; that is to explore the interaction of these actors to understand how and why heterogeneous associations of people, things, technology, texts, money, etc, are brought together into a network. This change in focus not only affects the analysis of the phenomena, but also the assumptions regarding the nature of the actors that constitute the phenomena. ANT incites us to reconsider the sociotechnical relationships as an open ended set of interactions where the identities and qualities of the actors are generated and defined, by negotiation, during these interactions.

Accordingly, we are not looking for essence, inherent or embedded characteristics of any of the actors, nor in Latour's terms searching for 'reference'. Rather, what we are looking for is to study how they act and interact within this association. In other words, every actor in the network cannot be seen in isolation as it affects and is affected by the other actors who are enrolled in the network of auditing in electronic environment. This point can be seen clearly when I used ANT as a lens to analyse the findings.

The findings implied that the relationship between external auditors and advanced electronic systems is not a one-to-one relationship. Rather, this study illustrated that the relationship between financial auditors and electronic systems is the outcome of many varied and fluid interconnections between local and global human and non-human actors who affect, and are affected by, each other in the network and

configure the outcome of their interaction. Because of the movement towards the information technology age, financial auditors became responsible for auditing financial statements that are the outcomes of advanced electronic systems. As these auditors believe that what happens inside the system will affect the accuracy of the outputs, where the financial statements are among these outputs, financial auditors discovered that they have to improve their skills and enhance their competence to be able to deal with such advanced systems. In other words, the interaction between electronic systems and financial auditors caused them to redefine their skills from auditors who have skills in accounting and auditing to auditors who possess IT skills to be able to deal with these electronic systems and to use the suitable CAATs to perform their tasks. Such redefinition became an *obligatory passage point* (Callon, 1986b) for any financial auditor who aims to join international audit firms. In other words, mastering technology, to some extent, became an important method for the financial auditors to secure their careers. This point is in line with the predictions of Nearon (2000) who stated that financial auditors with IT knowledge would have a distinct advantage in the future market of financial statement audits.

However, the redefinition of the financial auditors' competence was affected by other intermediaries and actors who are enrolled in the network. For example, it was affected by the International Auditing Standards (as an inscription), which were translated to become the Egyptian Standards on Auditing. The standards indicated that financial auditors have to improve their IT skills when dealing with electronic systems. At the same time, the standards state that financial auditors have to seek the assistance of IT audit specialists if the audit is conducted in advanced electronic environments. This point shows that inscriptions affect the degree of the financial

auditors' competence; they have to know how to deal with the system but they do not have to be experts in auditing the electronic system itself and its automated controls.

The findings showed that the main actors that are enrolled to enhance the competence of financial auditors in dealing with advanced electronic systems were the in-house training provided by their audit firms and the experience of dealing with the electronic systems where knowledge was performed in practice. The significant role in-house training can play to enhance the competence of financial auditors in dealing with advanced electronic environments was prescribed in the literature and by the professional pronouncements (e.g. Helms, 1999; Pathak, 2003c; POB, 2000). This point is not in line with Al-Fehaid's (2003) and Al-Fehaid & Higson's (2008) studies which indicated that the majority of audit firms in Saudi Arabia do not provide IT training to their staff who audit IT-based accounting systems.

Concerning the role of education in enhancing the competence of financial auditors in dealing with advanced electronic systems, accounting and auditing curricula provided by Egyptian universities was defined as a weak node in the network of auditing in advanced electronic environments as discussed in Chapter Eight. This point is in line with previous studies (e.g. Al-Fehaid, 2003; Allinson, 2004; Kotb & Roberts, 2008; Nearon 2000; Arnold & Sutton, 2007) which pointed out that most undergraduate accounting programmes do not offer curricula that allow their graduates to deal with advanced electronic systems and that contemporary accounting education fails in providing the knowledge and skills required for accountants and auditors to succeed in dealing with advanced electronic systems (Arnold & Sutton, 2007). It is important to indicate that accounting and auditing curriculum is not expected to provide training programmes for the students on how to use a specific package to audit electronic systems. However, an auditing curriculum should

include, at least, the impact of information technology on the audit process and assurance services (Johnson et al., 2003). It has to move from auditing around the computer to auditing through the computer using CAATs.

Arnold & Sutton (2007) emphasise the changes needed to accounting and auditing education by stating that:

> *"the education required of students entering the job market today with a degree in accounting should be very different from the education provided 25 or more years ago in a world driven by manual processes or computerized systems that simply automated the manual processes. The days of auditing around the computer should be gone. Today's new accounting professionals must have the ability to approach computerized information systems with the confidence and knowledge to search through the voluminous data and analyze the key portions that explain an entity's financial condition and operations performance"* (Arnold & Sutton, 2007: 18).

When focusing on the previous sub-network, we can find three distinctive features of ANT.

Firstly, the non-human actors (e.g. the electronic system, the auditing standards, the CAATs) came into the frame beside the human actors (e.g. the financial auditors and the information system auditors). All the actors, humans or non-humans, have an important role to play.

Secondly, the boundaries between the local and global virtually vanish; most of the advanced electronic systems are imported from outside Egypt, so it can be seen as a global actor. However it is used by Egyptian companies or by international companies working in Egypt, so it can be seen as a local actor. Moreover, some of the well-known vendors opened a branch in Egypt to provide their customers with the suitable service. For example Oracle opened a branch in Egypt including an Arabisation centre to provide Arabisation services for Oracle applications and products. So, in this case Oracle can be seen as a global actor and at the same time it can be seen as a local one. Another example is the International Standards on Auditing applied in Egypt *"is it local or global?"* (Latour, 1993:117). Generally

speaking, we can say that the International Auditing Standards is a global actor (as it is international). But when these standards are translated and presented in Egypt under the name of the Egyptian Auditing Standards, with reference to the ISA, we can say that they apparently became a local actor. Another clear example that shows the difficulty of identifying the boundaries between the local and the global is the three audit firms included in the study: A, B, & C. They are Egyptian members of three international audit firms. They are global as they are international, but at the same time they are local as they work in the Egyptian context where context is inseparable from the actions and the interactions of the actors in the network.

Thirdly, this sub-network shows how actors affect and are affected by each other. It highlights how the advanced electronic systems affect the competence of the financial auditors, and with no doubt, the competence of the financial auditor would affect the quality of auditing the outputs of the electronic systems (the financial statements). Also, it shows how this competence is affected by the inscriptions and was shaped as a result of training and experience. These inscriptions, as well as the limited competence of the financial auditors in dealing with electronic systems and evaluating its automated controls, caused the need of the information system auditors to be enrolled in the network.

The need for collaboration between the financial auditors and the information system auditors was emphasised in the literature (e.g. Abou-Musa, 2004; Bell et al., 1999; Brazil, 2004; Hunton et al., 2004; Wright & Wright, 2002) as this collaboration ensures a controlled electronic environment and makes the audit more secure. However, in Hunton et al. (2004) study, the researchers found that some of the financial auditors included in their study do not seek consultation from the IT audit specialists when auditing in ERP environments. The findings of the study suggested

that these financial auditors are overconfident in their ability to assess IT-related risks in an advanced electronic environment. Besides, the findings suggest that the participating financial auditors are unaware of the pervasive nature of the risks in an integrated electronic environment. The findings of the Hunton et al. (2004) study are not in line with the findings of this current study. Egyptian financial auditors who participated in this study believe they are incompetent in dealing with advanced electronic systems without collaboration with the information system auditors. Further, they believe that the reliability of the outputs of the electronic systems (e.g. the financial statements) steams from the reliability of the electronic systems themselves, which implicitly mean that they understand the risks of the electronic systems have a different nature.

The participated information system auditors used their knowledge in auditing electronic systems and evaluating its automated controls by using their automated tools (CAATs) to justify their position in the network. Because of their knowledge and skills the information system auditors were able to convince others with their representations, especially those who hold professional qualifications, such as CISA or CISM, offered by ISACA, as there is a high demand in the job market for information system auditors who hold such qualifications. In addition, the presentation of the information system auditors was supported by two main powerful inscriptions. Their presentation is inscribed by both the auditing standards, and the policies of the three international audit firms included in the study which require the involvement of the information system auditors when audits are conducted in advanced electronic environments.

The findings pointed out that competence of the information system auditors is affected by their qualifications as well as the in-house training, the vendor training

and their experience in auditing advanced electronic systems. Brazel's (2004) study, that aimed to identify the factors that affect the IT audit specialists competence from the financial auditors' point of view, marked training and experience in dealing with advanced electronic systems as the first two factors that affect the information system auditors' competence.

Again, this sub-network shows distinctive features of ANT. It shows that human and non-human actors, and intermediaries, come together into the frame and affect each other's performance. Moreover, it highlights the disappearance of the barriers between the local and the global. Training provided to the information system auditors can be a good example for this point. As mentioned by the information system auditors who participated in this study, their training takes different forms. One of these forms is to attend training courses in their Audit Firm abroad, in its home country, then back to their office in Egypt to apply what they have learned and teach it to the rest of the computer audit team. This training approach can be seen as a mixture between the local and the global. Another form of training is conducted online through the Internet and the database of the audit firm abroad. How can we classify using the Internet as a source for training? Is it considered as a local or as a global actor?

In addition, the interviewees mentioned that audit software they use in their audit belongs to their audit firms. Audit software, in each audit firm, is used by all the auditors who work in this audit firm worldwide. Audit software of Audit Firm A is used by the auditor who works in UK, and at the same time is used by the auditor who works in Egypt. Is this audit software local, as it is used by auditors in Egypt to audit companies in Egypt, or is it global, as it is used by the auditors worldwide?

Another significant example is the recognition given to the computer auditors who are CISA holders. Although there is no Chapter for ISACA in Egypt, it has a great recognition and the auditors who hold such qualifications are in high demand, with high salaries, in the Egyptian audit market. Being a CISA holder became an *obligatory passage point* to join a reputable position in some audit firms. For example, the rules of recruitment in Audit Firm B state that no one will reach the supervisor level in the computer audit department unless being a CISA holder.

By combining the sub-networks together, and considering the intermediaries that pass through them to shape their relationships, we will find that auditing in electronic environments is a network that is constituted by the enrolment of heterogeneous actors who interact together. The power of any network comes from the web of relations between the enrolled actors.

To sum up, the non-essentialist ontology of ANT gives an alternative way of thinking about, and explaining, auditing in electronic environments. It helps us to understand auditing in electronic environments from a different holistic perspective that gives us the chance to gain insights of the main hidden actors and intermediaries that are involved in auditing electronic environments and how they interact with each other to build their network.

9.2.2. Science in Action, Auditing in Action

An important reason that lies behind adopting the ANT perspective stems from my belief in one of ANT ideas presented by Latour (1987: 258) who argued that "*we study science in action and not a ready made science or technology".* This idea shows that the main focus of ANT is on the dynamics of the interaction between science and technology rather than on the stability of their relationships. ANT is proposed as an analytical tool that provides the theoretical and methodological

underpinning for the study of these dynamic relationships. That is why ANT is of great interest to those involved in studying the creation of science; as it offers the opportunity to view the activity of scientific investigation, not just in terms of results and its accuracy, but also process. In other words, ANT focuses on understanding how reality becomes reality through understanding the *process* of fabricating such reality. ANT is a suitable framework that can be used empirically to understand how truth was produced (Whitlle & Spicer, 2008).

The idea of science in action was adopted by many accounting scholars[1] such as Preston et al. (1992: 561) who adopted the ANT perspective to study "*accounting in action"*, Chua (1995: 113) who was interested in the "*doing of accounting"*, Lowe (2001b) who was seeking to address the "*making up of accounting numbers"*, Gendron & Barrett (2004: 563) who were studying "*professionalization in action".* These studies show that accounting change, and the process of this change, has been widely studied. However, no previous study was concerned with understanding *electronic auditing in action.*

Many previous studies pointed out the existence of differences between auditing in a paper environment and auditing in an electronic environment (e.g. Helms & Lilly, 2000; Helms & Mancino, 1998; Rezaee & Reinstein, 1998; Williamson, 1997). However, no previous studies considered how financial auditors dealt with these differences from a holistic perspective, who are the actors that get involved as a result of these differences and how they defined their roles in the network. This study is particularly concerned with the dynamics of the interaction between the different actors (e.g. external auditors, information system auditors, IT client staff, vendors of the system, CAATs, the advanced electronic systems, the auditing standards, etc.) in

[1] Accounting studies that adopted ANT perspective are reviewed in Chapter 3, Section 3.10.

the network of auditing electronic environments. ANT is a suitable lens to understand the process of *auditing in action* as it provides a holistic perspective to show the list of the actors and how they interact.

Latour (1987) suggests that the end product of any fabrication process is a black box. Black boxing occurs when facts cease to be the subject of critical evaluation but, rather, are unquestioningly accepted and taken for granted (Callon, 1986a; Callon, 1986b; Callon, 1999; Latour, 1987; Latour, 1999a; Latour, 1999b; Law1992; Law, 1999). Some researchers were able to arrive before the facts are built and the black boxes are closed (e.g. Preston et al., 1992; Chua, 1995). Other researchers (e.g. Robson, 1991; Alcouffe et al., 2008) came after the closing of the black boxes, so they had to open the black boxes and follow the actors.

As for this study, dealing with advanced electronic systems became a fact and auditors are able to issue their external audit reports regarding the financial statements that are the outputs of advanced electronic systems. In other words, the controversies became settled and the black boxes were closed (Latour, 1987). Consequently, I had to open the black box of auditing advanced electronic systems to find out who lies inside it and how they interact with each other.

The starting point I chose to open this black box was the financial auditors who deal with advanced electronic environments, then I followed the actors that constituted the network. The choice of the financial auditors as a starting point to follow the actors in the network stems from their ability to act as a spokesperson (Latour, 1987), or the representative, for the other actors in the network; non-human actors cannot speak because of their lack of both voice and intentionality so they must have representatives. Although human actors have the ability to speak to express their

points of view, they are prevented from speaking as they may not have the right to speak, or they cannot all speak at once (Latour, 1987).

The external auditor can be seen as the formal spokesperson of the network as s/he is the only one who has the responsibility to sign the external audit report which is the end product of the audit examination and the one who has the legal responsibility for the audit process. In other words, auditors can speak through the audit report which includes their opinion about the financial statements which are the final outcomes of the electronic systems.

To sum up, this study looked beyond the fact that financial auditors are responsible for auditing the financial statements that are the outputs of advanced electronic systems, to explore the *process* by which auditing in advanced electronic environments take place. Thinking of the *process* of auditing electronic environments expanded the list of actors that are involved in the process, and expanded the issues that should be considered in their interaction.

Although I believe that ANT contributed in enhancing and widening my understanding of auditing in electronic environments, I cannot ignore that there are some issues that can be seen as limitations of adopting the ANT perspective to guide my way of thinking during conducting this study.

9.2.3. Limitations of Adopting ANT in this Study

Notwithstanding that this research adopted a holistic perspective to follow the actors who constitute the network of auditing in an electronic environment; four main points should be considered in this network.

The first point is that the actors in the network were considered as black boxes (Callon 1986a; Latour 1987; Law, 1992), however when dealing with the actors we have to remember that each actor by itself is a network (Callon & Law, 1997; Latour,

1993; Law, 1992; Law, 1994) which consists of heterogeneous elements that are connected together to form the final shape of the actor. Although some of the black boxes have been opened, they were opened only to pick the useful insides that can help in understanding the performance of the actors and to explain why other actors have been enrolled in the network. For example, the black box of the competence of the financial auditors in dealing with electronic environment was opened to understand why they consider themselves as incompetent and to highlight the need of the enrolment of the information system auditors in the network of auditing in electronic environments.

It is important to indicate that dealing with the actors as black boxes cannot be considered as a point of weakness in the network. Proponents of ANT (e.g., Callon, 1986a; Callon, 1987; Callon, 1991; Latour, 1987; Law, 1992) indicate that considering the details of the network which is inside each actor is a very difficult and complicated task, and will drive the researchers to deal with endless networks. In other words, we have to consider the output of each black box without considering how the network inside this black box transforms or translates its inputs into outputs. The complexity of the network inside the black boxes remains, but for heuristic purposes of analysis it can be moved to the background. This approach is used in different fields of research where the focus of inquiry, to some extent, drives the choice of the most appropriate scale of analysis (Williams-Jones & Graham, 2003: 274).

The second point that should be considered is the boundaries of the network; what actors should be included in the network and what actors should be excluded from it. Latour (1987: 258) indicated that researchers have to follow the actors *'and make a list, no matter how long and heterogeneous of those who do the work'*. However, as

Miller (1997) indicated, following the actors as Latour (1987) suggests will result in a wide range of associations and actors without clear vision about choosing the actors. To overcome this problem, McLean & Hassard (2004: 500) stated that academic researchers cannot follow all the actors everywhere and they will have to engage in a process of ordering, sorting and selecting the actors they will follow, and as a result, they have to mention the guidelines that specify which actors should be included and which actors should be excluded.

The guideline I adopted in this research to specify which actors should be included and which actors should be excluded was suggested by Law (1991). Law (1991) stated that researchers can cut the network at the point when the followed actors stop identifying any linkages with other new actors related to the research topic as *'we take on their categories. We see the world through their eyes. We take on the point of view of those whom we are studying'*. This approach was adopted in this research. As this research considers auditing in electronic environments from the Egyptian auditors' perspective, the actors that have been mentioned by the auditors and are related to the audit in electronic environments were included in the network. However, there are some aspects that have been mentioned by the interviewees, but these points were not related to dealing with electronic environments, these points were excluded from the network. For example, some information system auditors pointed to their personal life conditions to drive their careers; although such points are important in shaping the performance of the actor; these points were excluded from the network as they do not relate to the topic under research, and, as discussed previously, every actor is seen as a black box.

The third point that should be considered is the interaction between the local and the global (Latour, 1991). Although this study aims to build a network of auditing in

electronic environments in the Egyptian context, which can be seen as a local environment, there are many global aspects that have an influence on this local network. Many examples from the fieldwork have been explained previously to highlight this interaction. Blurring the barriers between the local and the global is in line with ANT proponents who campaign against dualistic forms of thinking by suggesting that we refrain from any shift in scale between the global and the local, rather we should simply follow the networks wherever they are.

The last point that should be considered is the non-stability of any network. ANT proponents focus on how a robust and durable network of enrolled actors is constructed and maintained. However, it is important to consider that the network is only stable so long as all human and non-human actors remain faithful to the network. Even if the network becomes irreversible or the black boxes are closed, this closure is neither complete nor final. Changes in the network can take place at any time according to the changes that may take place in any of the existing actors or by the enrolment of new actors. It is the actors' practices that construct the idea of stability or change. In other words, networks, and their products, can be re-interpreted long after they are supposedly stabilised and in that case the alliances between the actors may appear unstable (Whittle & Spicer, 2008). For example, if the auditing standards required the financial auditors to be highly qualified in auditing electronic systems, the final shape of the network will change. Some actors may separate from the network, others may take their place, and the interactions between some of the actors may also become different.

Although the instability of the networks can be seen as a fact in the long term, I believe that nothing is endlessly stable. Change occurs in everything around us as a result of different reasons.

To sum up, adopting the ANT perspective in this study has some limitations. However, these limitations do not reduce its contribution to reconsider our way of thinking about auditing in electronic environments.

9.3. Originality of the Research

Another critical issue I need to consider is the originality of this study. Collis & Hussey (2003: 316) state that an essential element in the defence of any PhD thesis is the presentation of evidence on how the research has been original enough to make a contribution to the body of knowledge. Phillips & Pugh (2005: 61) emphasised the same idea by stating that a PhD degree is awarded for *"an original contribution to knowledge".* For a PhD study to be original *"it is not necessary to have a whole new way of looking at the discipline or the topic. It is sufficient for the student to contribute only an incremental step in understanding"* (Phillips & Pugh, 2005**:** 62)

Ghauri & Gronhaug (2002: 13) elaborate that originality can be shown in PhD studies if they are "*studies which create a new dimension to already existing knowledge. It implies that there is some novel twist, fresh perspective, new hypothesis or assumption or new and innovative methods of handling an existing topic/knowledge that makes the study a distinctive contribution"*. Many scholars (e.g. Collis & Hussey, 2003; Phillips & Bugh, 2005; Phillips, 1993; Sharp &, Howard 1996) note that academic research should demonstrate originality and distinct contribution to knowledge by achieving at least one of the following criteria:

1. Evidence of an original investigation or the testing of ideas
2. Competence in independent research or experimentation
3. An understanding of appropriate techniques

4. Ability to make critical use of published work and source materials Appreciation of the relationship of the special theme to the wider field of knowledge
5. Worthy, in part, of publication
6. Originality as shown by the topic researched or the methodology employed
7. Setting down a major piece of information in writing for the first time
8. Continuing a previously original piece of work
9. Showing originality in testing somebody else's idea
10. Carrying out empirical work that has not been done before
11. Making a synthesis that has not been made before
12. Bringing new evidence to bear on an old one
13. Being multi-disciplinary and using different methodologies
14. Adding knowledge in a way that has not been made before (by following the actors to identify who are involved and how they are involved)

Reflecting on this study, originality is shown through achieving some of the previous criteria. I will discuss how this study shows originality from its beginning, by choosing the topic to be researched passing through the literature presented to the data collection and analysis to reaching the point to judge whether this study adds knowledge in a way that has not been made before.

Originality as shown by the topic researched or the methodology employed: Auditing in advanced electronic environments is not a new topic to be researched. However, previous studies that considered auditing in electronic environments have adopted a technological perspective. In other words they took into consideration the technical aspects of auditing electronic environments considering that technology

problems can be solved by technology solutions (e.g. Attaway, 2000; Helms & Mancino, 1998; Moreland, 1997; Nearon, 2000; Stevens & Wallace, 2002).

This study adopted a different holistic perspective. It adopted one of the socio-technical approaches, namely the ANT perspective, to be the lens that guided the way of thinking to conduct this research and analyse its findings. Adopting this perspective provided the chance to consider all the actors (social or technical) that can have an influence on auditing electronic environments. No previous research adopted ANT to study auditing in electronic environments[1]. In other words, although auditing in advanced electronic environments is not a new topic to be researched the perspective employed to study this topic can be seen as an original one.

Making synthesis that has not been made before: Previous studies have been conducted to study auditing in electronic environments from different perspectives. Some studies concentrated on the effect of the electronic evidence on auditing (e.g. Helms & lilly, 2000; Nearon, 2005; Williamson, 1997). Other studies paid attention to the techniques that can be adopted to deal with electronic environments such as continuous auditing and computer assisted audit techniques (e.g. Braun & Davis, 2003; Chen, 2003; Helms & Lilly, 2000; Helms & Mancino, 1998; Kogan et al., 1999; Liang et al., 2001; Rezaee et al., 2001; Rezaee et al., 2002). Other studies highlighted the expanding role of information system auditors when the audit is conducted in advanced electronic environments (Baldwin & Kneer, 1986; Curtis & Viator, 2000; Gallegos, 2003; Henderson, 2002; Viator & Curtis, 1998). Others concentrated on explaining the standards and the guidelines that have been pronounced by the professional bodies relating to auditing in electronic environments (e.g. Damianides, 2004; Moreland, 1997; Munter, 2002; Pathak, 2003a; Rezaee &

[1] Table 1.2 in Chapter 1 shows the results of searching for ANT and electronic auditing in different search engines.

Reinstein, 1998; Wallace, 2002; Williamson, 1997; Yang & Guan, 2004). Moreover, other studies concentrated on introducing the electronic systems themselves and their expected technical impacts on the audit function (e.g. Harkness & Green, 2004; Shaikh, 2005; Yu et al., 2000).

Notwithstanding the great effort of these researchers, it can be seen that no previous research has been conducted to study the relationship between all the actors that may affect the auditor's decision when auditing in an electronic environment. Researchers have treated these aspects as if they are isolated, although the report of the external auditor is the result of the combination of many actors.

This study aimed to identify the actors that can have an influence on auditing electronic environments and to explore how they interact with each other to form the final shape of the network of auditing electronic environments. In other words, this study was able to meet the criterion of making a synthesis that has not been made before.

Ability to make critical use of published work and source materials: Chapter 2 and Chapter 3 show evidence of fulfilling this criterion. Chapter 2 presented the implications of adopting advanced electronic systems on the audit function. The Chapter introduced the implications of dealing with advanced electronic systems not only from the researchers; point of view, but it also considered the implications introduced by different professional bodies through their pronouncements. The main aim of considering both the scholars perspectives as well as the professional bodies' announcements is to gain a thorough understanding of the actors they have introduced that can have an influence on auditing electronic environments. Chapter 3 presented ANT with a great emphasise on the concepts and ideas that would enrich this study and its analysis. In addition, the Chapter ended by reviewing the

accounting and auditing studies that adopted the ANT perspective and its concepts in order to gain more in-depth understanding on why and how ANT can be applied in the accounting context.

Evidence of an original investigation or the testing of ideas: Data collected for this study was *original data* which is known as *primary data* (Collis & Hussey, 2003: 160). Unstructured interviews (used in the exploratory interviews) and semi-structured interviews (used in the pilot and in the main cases) were essential methods used for collecting data in this study. Interviewing was the most appropriate way to obtain in-depth views and experience of knowledgeable financial auditors and information system auditors who are involved in dealing with advanced electronic systems.

An understanding of appropriate techniques: Using NVivo8 software to help in analysing data collected is considered as evidence of the usage of appropriate techniques. No previous studies combined ANT, electronic auditing, and using NVivo in analysing the collected data. Table (9.1) presents the results of searching three data bases for studies adopted this combination using different key words to search:

Key words / **Database**	CAQDAS & electronic auditing & actor-network theory	Computer assisted qualitative analysis & computer auditing & actor-network theory	NVivo & electronic auditing & actor-network theory
ABI/INFORM Global	0	0	0
Business Source Premier	0	0	0
Academic search Elite	0	0	0

Table 9.1: Absence of Previous Studies Adopted ANT in Electronic Auditing Using NVivo

Date: March, 2009

Being multi-disciplinary and using different methodologies: This criterion is clearly met in this study. It established a link between three disciplinary research themes: sociology, by adopting the ANT perspective, auditing, and information systems as it aims to study the audit of advanced electronic systems.

Adding knowledge in a way that has not been made before: This study aimed to explore how, and why, heterogeneous actors are interacting together to build their network of auditing electronic environments in the Egyptian context. Following the actors whoever they are (i.e. human or non-human) and wherever they are (i.e. local or global) using the ANT perspective was a useful path to consider all the hidden actors that can have an influence on auditing electronic environments. This point added to our knowledge in a different way as most of the previous studies that considered auditing electronic systems paid attention to individual actors (as discussed previously).

9.4. Returning to the Research Objectives

One of the critical issues I should reflect upon is whether this study was able to achieve its main objectives.

The first objective is to open the *black box* of the audit firms to understand how they consider auditing in advanced electronic environments

Case study strategy was adopted in this study to achieve this objective. The black boxes of three international audit firms A, B, & C were opened to understand how they consider auditing in advanced electronic environments. Most of the clients of these three audit firms use advanced integrated electronic systems (e.g. ERP systems). This point indicates that the considerations of these three audit firms towards auditing in advanced electronic environments are reliable. Table 7.1, in

Chapter 7, summarised the considerations presented by the auditors of the three audit firms.

The second objective is to explore the main actors that have an influence on auditing electronic environments

A heterogeneous list of human and non-human, local and global actors that have an influence on auditing electronic environments is presented in Chapter 7. This list was prepared by following the actors that were identified by the financial auditors and the information system auditors who participated in the three stages of this study[1] as this research aims to study auditing in electronic environments from the Egyptian auditors' perspective so *'we take on their categories. We see the world through their eyes. We take on the point of view of those whom we are studying'* (Law, 1991).

The third objective is to explore how and why heterogeneous actors are enrolled to build the network of auditing in electronic environments

Building the network of auditing in electronic environments is presented in Chapter 8. This objective was achieved by interpreting the data collected in the three stages of the study through the lens of ANT. Relationality concept and mutual constitution concept, presented in Chapter 3, were essential to explore how the actors are performing to build their network. Opening some black boxes (e.g. the competence of financial auditors to deal with advanced electronic systems) was useful to explore why other actors find places for themselves in the network.

[1] The three stages are the exploratory interviews, the pilot cases, and the main cases. Chapter 6 presents the details of these stages.

The fourth objective is to explore how the actors interact together to perform the final shape of the network of auditing in electronic environments

This objective is achieved in Chapter 8 by focusing on the role of the different intermediaries (texts, human beings, money, and technical artefacts) in connecting the actors in the network.

9.5. Implications of the Study

The findings of this study have revealed different implications for various actors. These implications are presented in relation to organisations that adopt, or intend to adopt, advanced electronic systems, auditors who deal with such systems, educational institutions, and professional bodies.

- **Implications of the findings for organisations intending to adopt advanced electronic systems**

Focused attention has to be paid to the suitability of the electronic system that is chosen. The choice of the electronic system should be governed by other considerations as well as cost. This choice should be built upon understanding the features of the electronic system that suit the needs of the organisation. In addition, vendors of the electronic systems have to be chosen carefully, as the type of vendor is an indicator of the quality of the system and its performance. Reputable vendors are expected to provide suitable training courses for the users and to offer the necessary maintenance and technical support for the system. Before the beginning of these training courses, the management has to consider inviting their external auditor(s) to attend.

Finally, the top management should believe in the importance of conducting computer audit, at least as an essential part of the financial statement audit, in order

to convince, and instruct, IT staff to co-operate with the auditors in gaining the necessary information about, and from, the electronic system.

- **Implications of the findings for financial auditors and information system auditors**

Both financial auditors and information system auditors deal with the electronic systems. Financial auditors need to consider how to enhance their IT skills to improve their abilities in dealing with advanced electronic systems. Such skills can be enhanced by attending training courses provided by their audit firms, as well as those provided by their client's electronic system vendor. Attending these training courses is an important source for auditors to understand the features of the electronic system they deal with. Financial auditors should know that auditors with suitable IT knowledge have distinct advantages in the market of financial statement audits.

Information system auditors have to be up-to-date with issues related to information system auditing in order to improve their skills. Such skills can be obtained through significant investment in ongoing technical training; active participation in audit and security related professional associations such as ISACA; and facing the challenge of obtaining and maintaining professional certification related to information systems auditing. Attending conferences and seminars is another good way of obtaining skills.

- **Implications of the findings for educational institutions**

Three main issues should be considered by educational institutions in Egypt. Firstly, students enrolled in faculties of commerce in the state universities should be divided into small groups to provide them with enough opportunity for discussion with their

lecturers. Secondly, accounting and auditing curricula in Egyptian universities need to be modified to include up-to-date topics such as the impact of adopting advanced integrated electronic systems on the work of accountants and auditors. Education required for students entering the job market today with a Degree in Accounting needs to be very different from the education provided when systems were driven by manual processes or computerised systems that simply automated the manual process. Such modification will help to overcome the gap between what students are taught in universities and the practical reality. Thirdly, the number of qualified staff who work in accounting departments needs to be increased in order to undertake the necessary practical changes in accounting and auditing curricula.

- **Implications of the findings for the professional bodies**

The role of the Egyptian Society of Accountants and Auditors (ESAA) needs to be reconsidered. The ESAA should play an effective role in enhancing the competence of auditors in dealing with advanced electronic systems through different methods such as holding regular seminars and conferences that cover up-to-date topics. In addition, the ESAA has to reconsider its curriculum in a way that will address the changes that are taking place in the Egyptian accounting and auditing market and having an impact on future demands of accountants and auditors.

Establishing a Chapter of the ISACA in Egypt is an important issue that needs to be considered. The existence of this Chapter would help in giving more recognition to information system auditing and will focus on the roles information system auditors can play.

9.6. Limitations of the Study and Avenues for Further Research

Section (9.2.3) of this Chapter presented the main limitations of adopting ANT as the framework of this study. However I would like to shed light on other limitations and suggest the conduct of future studies to overcome these limitations.

An essential limitation arises from adopting the case study strategy. Three international audit firms working in Egypt were the main cases that participated in this study. This adoption leads to question the possibility of generalising the findings of this study. Generalisation is a common concern about case studies (Gummeson, 2000) as how we can generalise from a single case or even from few cases (Silverman, 2006; Yin, 1994). For example, are the actors represented by the participants from these three audit firms representative of actors in other audit firms?

In quantitative studies generalisability is normally achieved by statistical sampling procedures which helps the researcher to feel confident about the representativeness of the sample, and then about generalisability (Silverman, 2006). Such sampling procedures are not usually available in qualitative studies. However, Yin (2003) indicated that researchers can increase the generalisability of the case study research findings by using the replication logic in multiple-case studies[1]. Yin (2003) indicated that each case should be chosen carefully so that it predicts similar results (literal replication) or produces contrasting results but for predictable reasons (a theoretical replication). The same idea is introduced by Silverman (2006) who indicated that qualitative researchers can overcome the problem of generalisability by choosing the right cases to be studied depending on purposive sampling. Purposive sampling demands the researcher think critically about the parameters of the population they

[1] The rationale behind choosing multiple-case studies is discussed in Chapter 4.

are interested in and choose the sample carefully on the basis of these parameters. This way of choosing the cases increases the chance of generalising the findings of the study (Silverman, 2006; Yin, 2003).

The guidelines provided by Yin (2003) and Silverman (2006) were adopted when choosing the cases used in this study. The cases were chosen carefully to achieve literal replication. The three audit firms are international audit firms, with nearly the same facilities. Besides, most of their clients are using advanced electronic systems. As the participants in the three audit firms are working in similar circumstances, the findings from the three audit firms were similar, to some extent. Accordingly, the findings of this study can be generalised to other international audit firms working in Egypt as all of them have, virtually, the same conditions.

However, the findings of this study cannot be generalised to non-international audit firms. The first stage of this study, the preliminary interviews, highlighted that the 100% Egyptian audit firms[1] are working under different conditions that do not match with the international firms considered in this study. This limitation can be covered by conducting a further study that aims to explore how the 100% Egyptian audit firms deal with advanced electronic environments and who are the actors that can have an influence on conducting electronic audits in these audit firms.

This study adopted a holistic perspective to explore the actors that have an influence on auditing advanced electronic systems. However, it did not pay close attention to the unique features of every electronic system. The specific features of each electronic system may cause changes in the audit process. To overcome this limitation, future studies could be conducted to consider the impact of the features of

[1] The classification of the audit firms working in Egypt is introduced in Chapter 5.

specific electronic systems on the audit procedures. The interviewees indicated that most of their clients are moving towards adopting enterprise resource planning systems. A study can be conducted to explore the influence of adopting ERP systems on the audit process. E-commerce is another technology that is supported by the Egyptian Government, so a study can be undertaken to understand how adopting e-commerce systems could affect the work of auditors.

The holistic perspective adopted in this study yielded a long list of heterogeneous actors (presented in Chapter 7) that have an influence on auditing electronic environments. Because of the exploratory nature of this study, this research did not focus on the effect of each of these actors on auditing electronic environments. To overcome this limitation, future studies could be conducted to examine, in more depth, the effect of each separate actor on auditing electronic environments.

One of the research problems (discussed in Chapter 1 Section 1.2) is that all well known attempts undertaken to help auditors to deal with advanced electronic environments come from professional bodies and researchers in western developed countries. None of the well known studies has been conducted in Egypt, as a developing country, to help auditors in dealing with advanced electronic systems. To overcome this problem, this study was conducted in Egypt, as an example of a developing country. However, this study did not consider whether auditors working in other developing countries would deal with electronic systems in the same way as Egyptian auditors. As discussed previously, the findings of this study cannot be generalised to the 100% Egyptian audit firms as they work under other conditions that do not match with the international audit forms considered in the study.

Consequently, the generalisability of the findings of this research to other developing countries is questionable. To overcome this limitation, future studies could be conducted to explore the influence of adopting advanced electronic systems on auditing in other developing countries. Some of these studies can take the form of comparative studies between Egypt (using on the findings of this research) and other developing countries.

This study was conducted through the lens of Actor-Network Theory. ANT guided the researcher's way of thinking while performing the research. Consequently, the findings of the study were interpreted (Chapter 8) according to this perspective. These findings were not explained using conventional accounting based theories (e.g. agency theory, accountability theory). To overcome this limitation, future studies could be performed using such more traditional perspectives.

9.7. Concluding Remarks

This study adopted an innovative holistic perspective to study auditing in advanced electronic environments. It highlighted the way in which auditing in advanced electronic environments is not only the process of auditing the outputs (financial statements) of a technical system using technological methods. Rather, it is a network constituted from hybrid human and non-human, local and global actors who are brought into associations and interact with each other through circulating intermediaries. While interacting, the actors define and redefine their identities and mutual relationships in a way that have an influence on the audit process.

This study provided an understanding of how and why such heterogeneous associations (of people, technology, texts, money, etc.) are brought together into the network of auditing advanced electronic systems. In other words, this study looked

beyond the fact that financial auditors are responsible for auditing the financial statements, which are the outputs of advanced electronic systems, to explore the process by which auditing in advanced electronic systems take place. Thinking of the process of auditing electronic environments extended the list of actors that are involved in the process, and expanded the issues that should be considered in their interaction.

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Appendices

Appendix 1: Cultural Differences between Developed and Developing Countries

It is important to identify the cultural differences between developed and developing countries. This importance stems from the fact that what may work well in a developed country may not work at all in a developing country, especially when this relates to information technology.

There are many definitions of culture which led Soeters & Schreuder (1988:75) to state that '*there are nearly as many definitions of culture as there are authors writing on the subject'.* The best known and widely used framework for understanding national cultural differences was developed by Hofstede (Brown & Humphreys, 1995; Simon, 2001). Hofstede's work became the most widely used as it can be used in empirical studies of culture in a variety of contexts (Sondergoard, 1994) as he was able to attach scaled scores to various cultural dimensions thereby allowing culture to be considered from a variety of approaches.

Hofstede (1991:5) defines culture as the *'collective programming of the mind that distinguishes the members of one category of people from those of another'.* He suggests that people share a collective national culture which represents their cultural programming that shapes their behaviour, assumptions, beliefs and expectations. Culture, as such, represents the interactive aggregate of common characteristics that influence a human group's response to its environment, and thus it '*determines the uniqueness of a human group in the same way personality determines the uniqueness of an individual*' (Hofestede, 2001:10). Culture consists of different patterns of cognition, values, norms, beliefs and attitudes which define the range of accepted behaviours in any given society, thus distinguishing societies or cultures from one another. Accordingly we can speak about 'Japanese culture', 'French culture', or

‘Chinese culture’, taking for granted that what this label refers to will be more or less understood (Mathews, 2000).

Hofstede (1980, 1991) identified four main dimensions that can be used to analyse a national culture which are: individualism versus collectivism, high versus low power distance, masculinity versus femininity, and high versus low uncertainty avoidance. A fifth dimension was added which is known as ‘confucian dynamism’ (Hofstede, 1991:164) or long-term versus short-term orientation. The next sub-sections will discuss briefly the differences between the United States, as an example of a developed country, and Egypt, as a developing country, in these dimensions of culture.

Individualism versus Collectivism

This dimension represents the degree to which people in a society have learned to act as individuals rather than as members of organised groups. Members from individualistic societies, in contrast, maintain a high degree of independence from other society members and from their institutions; they focus on their needs regardless the needs of the whole group. They are expected to look after themselves or their immediate families while the rest of society is not given any special consideration. Members of collectivist societies maintain a high degree of loyalty towards the group; they focus on the welfare of the group not of the individual. According to Hofstede (1991), the United States, as an example of a developed country, is considered to be individualistic, while Egypt, as one of the developing countries, is deemed to have a relatively low individualism index and tend towards collectivism and loyalty to the group.

High versus Low Power Distance

Power distance indicates the level of inequality of the distribution of power that the people of a nation are willing to accept. While inequality may exist within any culture, the degree to which it is accepted varies considerably across cultures (Simon, 2001). Basically, cultures reflecting high-power distance value obedience to authority as there is a great distance between subordinates and superiors and superiors are expected to be autocratic. This means that individuals who come from cultures exhibiting high power distances might be expected to respond in socially desirable ways designed to please those in higher positions of power (Simon, 2001).On the other hand, cultures with low-power distance are more democratic societies as there is less distance, or more equality, between subordinates and superiors. Moreover, these societies are more expected to question authority rather than passively obeying rules and regulations. Hofstede (1991) reports that the United States is classified as a low-power distance country, while Egypt is classified as a high power distance country.

Masculinity versus Femininity

This dimension emphasizes the social roles of gender in a given culture; while a culture representing high masculinity tends to maximize the social differentiation between genders, a culture reflecting high femininity tends to minimize social differentiation between them (Kalliny et al., 2006). In masculine cultures men are expected to be assertive, tough, and focused on material success, while women are expected to be more modest, tender, and concerned with quality of life. A culture has a higher femininity score when men tend to act less like the stereotypical man and exhibit higher degrees of feminine tendencies. In feminine societies, gender roles overlap; both men and women are modest, tender, and concerned with quality of life.

Although United States falls in the middle of the masculine versus feminine variability scale (Hofstede, 1991) Egypt is a very male oriented country compared to the USA.

High versus Low Uncertainty Avoidance

Essentially, the uncertainty avoidance dimension measures a society's willingness to tolerate ambiguity when there are no formal rules to guide them. A low uncertainty avoidance score means a high tolerance for ambiguity and thus this society is likely to be less conservative, less adherence to law, have less need for written roles and have less elaborate legal system. On the other hand, a culture representing high-uncertainty avoidance is more conservative and has a more elaborate legal system. These cultures are expected to be more emotional, security-seeking and intolerant. Moreover, these cultures also abide by strict beliefs, rules, and principles. Hofstede (1991) reports that Egypt represents a culture with high uncertainty-avoidance; in contrast oppositely the United States represents a culture with low uncertainty-avoidance.

Long-term versus Short-term Orientation

This dimension measures how societies view the importance and meaning of time. According to Hofstede (1991:165-166) a culture with a high long term orientation score is not very concerned with time constraints and acts upon several tasks at the same time, employing an intuitive approach (Calhoun et al., 2002). Such a culture is characterised by persistence, relationships that are ordered according to status, thrift and having a sense of shame. On the other hand, a culture with a low-long term time orientation score is concerned with schedules, concentrates more on the immediate time frame and prefers to act on tasks sequentially using an analytic approach

(Calhoun et al., 2002). The focus is on one task and there is emphasis on achieving resolution quickly. This culture is characterised by personal steadiness, face saving, respect for tradition and reciprocal favours and gifts. Egypt was not among the twenty-three countries that have been identified to determine their long-term orientation score (Hofstede, 1991:166).

It is important to indicate that different studies have asserted the cultural differences between Egypt and other developed countries. For example, Brown and Humphreys (1995) and Humphreys (1996) surveyed both Egyptian and Anglo-American mangers and reported dimension measures for Egyptian managers that are significantly different from Anglo-American managers across all four of Hofstede's (1980) cultural dimensions. The national culture of Egypt is different from an Anglo-American national culture for all four of the dimensions. Egyptians scored extremely low in individualism while Anglo-Americans scored high. This means that Anglo-American mangers tend to be more individualistic while Egyptians are more collectivist. Anglo-Americans are much more tolerant of uncertain situations. On the other hand, Egyptian managers are not comfortable with ambiguous situations. The power distance scores indicate that Egyptians are more willing to accept that power is distributed unequally. Finally, in Anglo-American nations the social roles between genders overlap while in Egypt there is separation between traditional gender roles.

Kaghan & Bowker (2001) indicated that the sensibility of people's behaviour is affected by the culture or cultures that they operate in. This means that Egyptian auditors may act in a way that they view as sensible in a particular situation although their behaviour may not seem to be suitable from the point of view of auditors in other developed countries. Equally, the behaviour of auditors in the developed

countries may not seem rational from the Egyptian auditors' perspective, as the result of the cultural environment. These cultural differences strengthen the importance of conducting this research in the Egyptian context.

Appendix 2: The Regulations for Listing in the CMA Auditors Registry

Decision No. 96/2006
Dated 22/8/2006
Regarding: The Regulations for Listing in the CMA Auditors Registry

The CMA Chairman

After reviewing the Joint Stock Companies, the Partnerships Limited by Shares and the Limited Liability Companies Law No. 159/1981 and its Executive Regulations, The Capital Market Law No. 95/1992 and its Executive Regulations, and Presidential Decree No. 51/1997 promulgating the management regulations of Cairo and Alexandria Stock Exchange and the Financial Affaires thereof, and The CMA Chairman's approval, issued in the board meeting No. 6/2006 of 26/7/2006, which endorsed the restrictions on listing in the registry of auditors of the companies registered at the Stock Exchange, (official table no. (1), and unofficial table no. (2)), as well as the securities companies and mutual funds, it was

Decided

Article (1): A registry shall be maintained by the Capital Market Authority to list auditors of the companies registered at the Stock Exchange (official table no. (1) and unofficial table no. (2)) and auditors of the securities companies, pursuant to Article (27) of the Capital Market Law, as well as the auditors of mutual funds. Listed auditors only shall be entitled to review the accounts of the companies and mutual funds referred to herein.

Article (2): Listing in auditors registry referred to in Article (1) shall be conditional upon the following:

a) At least five years should have been passed since the date of registration of the auditor in the general registry of accountants and auditors (registry of fund companies auditors), and a certificate to this effect shall further be submitted.

b) The auditor shall be a member of the Accounting and Auditing Free Practitioners Sector at the Accountants Syndicate. The original and a copy of the membership card shall also be submitted to confirm that the auditor is still practicing this profession. A certificate shall be submitted, stating that no disciplinary judgments were rendered against that auditor.

c) Auditor shall fulfil at least one of the following three conditions:

    1. To be listed at the Banks Accounts Auditors Registry of the Central Bank of Egypt,
    2. To be a member of the Egyptian Accountants and Auditors Society, or has obtained any other equivalent professional certificates (ACCA, CA, CPA), or has been granted the Ph.D. from a duly recognized university, or
    3. Has audited joint stock companies accounts for a period of at least five years, and during every year of which, he/she should have audited the accounts of at least five companies.

d) The auditor should have no interest in the company or in the mutual fund, an interest in the form of shareholding, or certificates or participation in management, pursuant to the provisions of Article (104) of Companies Law No. 159/1981 and its Executive Regulations.

Article (3): The CMA Corporate Finance and Corporate Governance Sector shall prepare an independent statement for each auditor; explaining -with dates- the extent of the auditor's compliance with the accounting and auditing standards and the independence rules.

Article (4): Applications for listing in the auditors' registry referred to herein above shall be submitted as from the first of September 2006. The CMA shall decide upon

the applications within 60 days from the date of submission. Appointment of auditors listed in the registry shall commence from the date of appointing the auditors financial reports of companies and mutual funds referred to herein, i.e., as from the first of January.

Article (5): The auditors currently listed by the CMA in mutual fund auditors' registry shall be transferred to the registry referred to herein above.

Article (6): The auditors listed in the registry referred to herein above shall abide by the quality standards and restrictions set forth by the Capital Market Authority. The CMA shall further issue the executive procedures required to confirm their compliance with these standards and restrictions. The CMA shall have the right to suspend or delete any auditor from the said registry in the event of failure by the auditor to abide by these standards and restrictions.

Article (7): Competent authorities shall apply this Decision, each according to its scope of competence.

CMA Chairman

Appendix 3A: Initial Version of the Interview Questions

1. Personal information about the interviewee's position, years of experience and professional qualifications.
2. Do your clients use electronic systems? What kind of electronic systems do they use?
3. Can you identify any problems, or challenges, you face when auditing electronic systems?
4. Are there any problems you face in examining the internal controls in electronic environment?
5. Do you think that the electronic audit evidence has any effect on your audit?
6. Do your audit firm use CAATs? For what?
7. Do you adopt the continuous auditing technique? Why?
8. Do you think that the adoption of advanced electronic systems by your clients has resulted in a change in the skills required for the auditors?
9. Do you think that auditors have enough educational background to audit electronic system?
10. Have you received any training courses to improve your knowledge in auditing electronic systems?
11. To what extent do you rely on the computer audit department in your audit firm when conducting your financial statement audit?
12. Do you think that the involvement of the information system auditors in the audit eliminates the need for the financial auditors to be qualified in information technology?

13. How can you judge the competence of the information system auditor?
14. Do you think that the IT client staff can affect your audit?
15. Do you think that adopting electronic systems by your clients should have an impact on the audit fees?
16. Does your audit firm have any financial problems relating to auditing advanced electronic systems?
17. Do you think that auditing electronic systems in Egypt needs to release an Egyptian standard or guideline?
18. Do you think that the International Auditing Standards provide enough information about auditing in electronic environment?

Appendix 3B: The Arabic Version of the Initial Interview Questions

- معلومات عامه عن الوظيفه و عدد سنوات الخبرة و المؤهلات العلميه للمشترك فى المقابله

- هل يستخدم عملاء المكتب نظم الكترونيه؟ ما هى انواع النظم التى يقومون باستخدامها؟

- هل يمكن ان تحدد اى مشكلات او تحديات تواجهك عند القيام بالمراجعه فى ظل بيئه الكترونيه؟

- هل تواجه اى مشكلات عند القيام بفحص نظم الرقابه الداخليه فى بيئه الكترونيه؟

- هل تعتقد ان دليل المراجعه الالكترونى يمكن ان يكون له اثر على عمليه المراجعه؟

- هل مكتب المراجعه يقوم باستخدام اساليب المراجعه بمساعدة الكمبيوتر؟ ما هى المهام التى تستخدم فيها؟

- هل يقوم المكتب باستخدام اسلوب المراجعه المستمرة؟ لماذا؟

- هل تعتقد ان قيام عملاء المكتب باستخدام النظم الالكترونيه الحديثه ادى الى احتياج المراجع لان يقوم بتنميه مهاراته ؟

- هل تعتقد ان المراجعين لديهم الخلفيه التعليميه الكافيه التى تمكنهم من مراجعه النظم الالكترونيه؟

- هل حصلت على دورات تدريبيه لتساعدك على مراجعه النظم الالكترونيه؟

- الى اى مدى تعتمد على قسم مراجعه الكمبيوترالموجود بمكتبك اثناء قيامك بعمليه المراجعه؟

- هل تعتقد ان اشتراك المراجع الالكترونى فى عمليه المراجعه يحد من حاجه المراجع المالى لان يكون لديه قدر من المعرفه بالنظم الالكترونيه و كيفيه التعامل معها؟

- كيف تحكم على مهارة و كفاءة المراجع الالكترونى؟

- هل تعتقد ان كفاءة الموظفين القائمين على النظم الالكترونيه لدى عميلك يمكن ان تؤثر على عمليه المراجعه؟

- هل تعتقد ان قيام عملاء المكتب باستخدام نظم الكترونيه معقدة يجب ان يكون له اثر على اتعاب عمليه المراجعه؟

- هل يواجه المكتب اى مشاكل ماليه ناجمه عن مراجعه النظم الاكترونيه الحديثه؟

- هل تعتقد انه يوجد حاجه لاصدار معيار مراجعه مصرى خاص بمراجعه النظم الالكترونيه؟

- هل تعتقد ان معايير المراجعه الدوليه توفر المعلومات الكافيه التى تساعد المراجع على القيام بالمراجعه فى ظل بيئه الكترونيه؟

Appendix 4A: The Final Version of the Interview Guide

1. Personal information about the interviewee's position, years of experience and professional qualifications.
2. Do your clients use electronic systems? What kind of electronic systems do they use?
3. Can you mention any problems, or challenges, you face when auditing in advanced electronic environment?
4. Are there any problems you face in examining the internal controls in electronic environment?
5. Do you think that the electronic audit evidence has any effect on your audit?
6. Do you think that your clients always choose the suitable electronic systems depending on their needs?
7. Do you always have enough awareness about the electronic system your client use? How can you gain such awareness?
8. Do you think that the vendor of the system can affect your audit?
9. Do you attend any training courses provided by the vendor to your client to understand the electronic system used?
10. Does your audit firm use CAATs? For what?
11. Do you think that the adoption of electronic systems by your clients has resulted in a change in the skills required for auditors?
12. Do you think that financial auditors have suitable educational background to audit in advanced electronic environment?
13. Have you received any training courses to improve your knowledge in dealing with electronic systems?

14. To what extent do you rely on the computer audit department in your audit firm when conducting your external audit? (for the financial auditors only)
15. Do you think that the involvement of the information system auditors in the audit eliminates the need for the financial auditors to be qualified in information technology?
16. How can you judge the competence of the information system auditors to be able to use his work? (for the financial auditors)
17. What are the rules of hiring information system auditors in your audit firm? (for the partner of the computer audit department only)
18. Do you think that the IT client staff can affect your audit?
19. Do you think that adopting electronic systems by your clients have an impact on the audit fees?
20. Does your audit firm have any financial problems relating to auditing advanced electronic systems?
21. Do you think that auditing electronic systems in Egypt needs to release an Egyptian standard or guideline?
22. Do you think that the International Auditing Standards provide enough information about auditing in electronic environment?

Appendix 4B: The Arabic Version of the Final interview Guide

- معلومات عامه عن الوظيفه و عدد سنوات الخبرة و المؤهلات العلميه للمشترك فى المقابله

- هل يستخدم عملاء المكتب نظم الكترونيه؟ ما هى انواع النظم التى يقومون باستخدامها؟

- هل يمكن ان تحدد اى مشكلات او تحديات تواجهك عند القيام بالمراجعه فى ظل بيئه الكترونيه؟

- هل تواجه اى مشكلات عند القيام بفحص نظم الرقابه الداخليه فى بيئه الكترونيه؟

- هل تعتقد ان دليل المراجعه الالكترونى يمكن ان يكون له اثر على عمليه المراجعه؟

- هل تعتقد ان عملاء المكتب يقومون دائما باختيار النظم الالكترونيه المناسبه لاحتياجاتهم؟

- هل يتوافر لديك دائما المعرفه الكافيه بالنظم الالكترونيه التى يقوم العملاء باستخدامها؟ كيف تتوافر لديك هذة المعرفه؟

- هل تعتقد ان الجهه التى يشترى منها العملاء النظم الالكترونيه يمكن ان يكون لها تأثير على عمليه المراجعه؟

- هل تحضر الدورات التدريبيه التى ينظمها البائع لعملائك؟

- هل مكتب المراجعه يقوم باستخدام اساليب المراجعه بمساعدة الكمبيوتر؟ ما هى المهام التى تستخدم فيها؟

- هل تعتقد ان قيام عملاء المكتب باستخدام النظم الالكترونيه الحديثه ادى الى احتياج المراجع لان يقوم بتنميه مهاراته ؟

- هل تعتقد ان المراجعين لديهم الخلفيه التعليميه الكافيه التى تمكنهم من مراجعه النظم الالكترونيه؟

- هل حصلت على دورات تدريبيه لتساعدك على مراجعه النظم الالكترونيه؟

- الى اى مدى تعتمد على قسم مراجعه الكمبيوترالموجود بمكتبك اثناء قيامك بعمليه المراجعه؟ (هذا السؤال يوجه للمراجعين الماليين فقط)

- هل تعتقد ان اشتراك المراجع الالكترونى فى عمليه المراجعه يحد من حاجه المراجع المالى لان يكون لديه قدر من المعرفه بالنظم الالكترونيه و كيفيه التعامل معها؟

- كيف تحكم على مهارة و كفاءة المراجع الالكترونى؟ (هذا السؤال يوجه للمراجعين الماليين فقط)

- ما هى المواصفات المطلوبه فى المراجع الالكترونى حتى يستطيع ان يلتحق بالعمل فى المكتب؟ (ه1ا السؤال يوجه الى الشريك المسئول عن قسم مراجعه الكمبيوتر)

- هل تعتقد ان كفاءة الموظفين القائمين على النظم الالكترونيه لدى عميلك يمكن ان تؤثر على عمليه المراجعه؟

- هل تعتقد ان قيام عملاء المكتب باستخدام نظم الكترونيه معقدة يجب ان يكون له اثر على اتعاب عمليه المراجعه؟

- هل يواجه المكتب اى مشاكل ماليه ناجمه عن مراجعه النظم الاكترونيه الحديثه؟

- هل تعتقد انه يوجد حاجه لاصدار معيار مراجعه مصرى خاص بمراجعه النظم الالكترونيه؟

- هل تعتقد ان معايير المراجعه الدوليه توفر المعلومات الكافيه التى تساعد المراجع على القيام بالمراجعه فى ظل بيئه الكترونيه؟

Appendix 5: Using NVivo in Previous Studies

Scholars from different disciplines used NVivo for qualitative data analysis. Some of them used it as a helpful programme for coding while others used it to perform different tasks such as performing comparisons and generating themes. The following table simplifies how recent studies from different disciplines used NVivo. This is not a comprehensive list of all studies used NVivo for analysis, as this is not the aim of this research. However, reviewing part of this literature was important for the researcher to understand how scholars used NVivo for the analyses of their studies. Most of these studies did not discuss in detail how they used NVivo, they mentioned that they used it, but they did not mention how they used it. In this study, I tried to overcome this problem by detailing how NVivo was used to perform the analysis

Author	The Usage of NVivo in the Studies
Dixon et al. (2006)	The authors used NVivo to analyse the semi-structured interviews conducted in the study. NVivo was used for coding and for establishing tree nodes to pull down from data key patterns and thematic areas, and to search for interrelationships between the themes.
Donnan (2007)	The researcher used NVivo for the analysis of the interviews conducted. Also, he prepared a summary for all articles, books and online sources used in his study and imported it in NVivo. NVivo was used for coding, generating themes and categories. Memoing also took place with the help of NVivo. It also helped the researcher to find interrelationships.
Frances (2007)	NVivo was used in coding to aid management of the large amount of data. It was used to generate themes and categories, and split them into sub-categories when needed.
Hudson & Inkson(2006)	NVivo was used in the study for coding and developing categories. Moreover, it was used to form quantitative assessment of the relative salience of different themes in the participants' accounts.
Johnson et al. (2007)	NVivo was used in an iterative process in order to code the data and to inductively generate definitional categories and explore aspects of their interrelationships.

	The authors started the analysis by a key general theme in their mind (which is to explore how informants might define qualitative management research) so they used NVivo initially to assign a code to all data from transcripts that fit this general theme. Then hierarchical coding was applied to split this general theme into different categories or sub-themes.
Jones & Holt (2008)	NVivo was used to systemise the data collected from the semi-structured interviews to fit one of the six elements of the Activity Theory Triangle (the theory used in the study). The authors used the systematic and self-documenting aspects of the NVivo software to identify the regularities in the interview data that could be located in each of the six elements of the Activity theory.
Oberg et al. (2003)	Data collected was analysed using NVivo. However, the study did not mention specific uses for NVivo.
Loureiro-Koechlin (2006)	NUD*IST was use to analyse the data collected. The researcher used the program as a storing system to group all the files containing data in one research file project. It was also used to create codes representing categories and sub-categories (tree of categories) and link those codes to segments of texts. These categories were refined to be transformed into abstract concepts. The programme was also used to create annotations and link them to codes. It was also used for searching (searching for keywords within the documents, searching for texts linked to a particular code, and searching for codes linked to a particular segment of texts).
Patterson et al. (2005)	Data analysis of this study started manually by coding, placing coded information into categories and then reducing the number of categories into common themes. In the second stage of analysis the transcripts were transferred into NVivo to identify commonalities across all portions of the coded text to provide greater exploration of the categories and themes identified earlier and to identify additional themes.

Powell & Ennis (2007)	The initial analysis was performed by using another software package called CI-Said to perform a macro level analysis. For further analysis, the transcripts were imported into NVivo. It was used to perform detailed coding and to create free and tree nodes. It allowed for greater exploration of the themes, identified by CI-Said, and to discover additional ideas and themes. The researchers combined the ideas of the grounded theory approach with the use of NVivo. They used NVivo for 'micro analysis' described by Strauss & Corbin (1998) by scrutinising the transcripts line by line, while inductively developing and applying analytical level codes and associated theoretical memos to represent identified categories, patterns and themes along the way. They indicated that the codes and nodes are similar to 'open codes' and 'theoretical memos' found within grounded theory.
Reinaerts et al. (2006)	NVivo was used to code the data. Coding was conducted in two stages: the first one was a broad coding while the second one was a detailed coding that aims to find out themes from data.
Richardson et al. (2006)	- The software allowed for clarity in presenting the data in tree nodes when possible. - Allowed to perform comparisons between the transcripts of the interviews to identify dominant and subsidiary themes. - High speed coding and retrieval capability of the programme allowed the themes to be identified, separated and connected as necessary. - The programme allowed for in-depth exploration of data which allowed the researchers to present theoretical explanation of the findings.
Ross et al. (2007)	Data collected from the interviews was analysed by content analysis using NVivo to code and categorise emerging themes.
Sadiq et al.	NVivo was used for coding and generating categories. Individual nodes were created to capture details of each emerging issue and any related recommendations.
Wang-Cowham (2008)	Data was analysed by using the grounded theory approach with the help of NVivo. NVivo was used for coding segments into free nodes to develop initial themes. Free nodes that shared common ideas were merged into tree nodes. The list of tree nodes represents a list of categories and themes emerged from the coding process. Throughout the process of data analysis and coding, NVivo was also used for node searching, grouping and re-grouping, and exploring correlation between nodes. NVivo was also used for developing figures and importing figures for re-working in power-point and excel.

Yu & Davis (2007)	NVivo was used for coding in an iterative process to generate themes and categories from data using the grounded theory approach for analysis. It helped in identifying trends as well as similarities and differences in the responses.

The following table provides a checklist for the main uses of NVivo in previous studies in different disciplines, and how it is used in the current study.

Author	Date	Title	Journal/Thesis/ Conference	Area of interest	The usage of NVivo													
					Coding	Develop themes	Develop categories	Develop sub-categories	Assign codes in pre-determined themes	Create annotations	Create memos	Searching	Find relationships	Perform comparisons	Form quantitative assessment	Developing figures	Organise data	Literature
Dixon, R. Ritchie, J. Siwale, J.	2006	Microfinance: accountability from the grassroots	Accounting, Auditing & Accountability	Accountability	√	√							√					
Donnan, P.	2007	Conducting assessment online: educational developers' perspective	Thesis	Education	√	√	√				√		√					
Frances, N.	2007	The perceptions & strategies of female administrators regarding the gender regimes in urbanco-educational secondary schools in Uganda	Thesis	Education	√	√	√	√										
Hastmann, T.	2008	Factors influencing the implementation of 30 minutes structured physical activity in after-school programs	Thesis	Physical activities	Indicated that NVivo was used for analysis, but did not explain how it was used													
Hudson, S. Inkson, K.	2006	Volunteer overseas	Career Development	Characteristics of overseas	√		√								√			

		development workers: the hero's adventure & personal transformation	International	volunteer workers														
Johnson, P. Buerhring, A. Cassell, C. Syman, G.	2007	Defining qualitative management research: an empirical investigation	Qualitative Research in Organizations and Management	Management research	√		√	√	√				√					
Jones, O. Holt, R.	2008	The creation and evolution of new business ventures: an activity theory perspective	Journal of Small Business and Enterprise Development	Enterprise development	√				√					√				
Loureiro-Koechlin, C.	2006	Human & social aspects of software development for complex organisations: an online ethnography of software developers	Thesis		√		√	√		√		√					√	
Oberg , D.	2003	Breaking down barriers teacher-librarians as partners in Internet use in Canadian schools	International Association of School Librarian. Selected papers from the Annual Conference	Education	Indicated that NVivo was used for analysis, but did not explain how it was used.													

Patterson, P. Probst, J. Leith, K., et al.	2005	Recruitment and retention of emergency medical technicians: a qualitative study	Journal of Allied Health	Emergency medical services (EMS)	√		√		√					√				
Powell, S. Ennis, S.	2007	Organisational marketing in the creative industries	Qualitative Market Research: An International Journal	Marketing	√		√		√		√							
Reinaerts, E. Nooijer, J. Kar, A. Vries, N.	2006	Development of a school-based intervention to promote fruit and vegetables consumption	Health Education	Health education & promotion	√	√												
Richard-son , J.	2006	Self-directed expatriation: family matters	Personal Review	Career planning and expatriation	√	√								√				
Ross, M. Heany, J. Cooper, M.	2007	Institutional and managerial factors affecting international student recruitment	International Journal of Educational Management	Education and recruitment	√	√												
Sadiq, S. Indulska, M. Bandara, W. Chong, S.		Major issues in business process management: a vendor perspective	11th Pacific-Asia Conference on Information Systems	Business	√		√											

Wang-Cowham, C.	2008	HR Structure and HR knowledge transfer between subsidiaries in China	The Learning Organization	Human resources	√	√	√					√				√	
Yu, H. Davis, M.	2007	The case for curriculum reform in Australian information management & library & information science educations	Information Research	Education	√	√	√							√			
For the current research	2009	Auditing in electronic environments	Thesis	Auditing electronic systems	√		√	√	√	√	√	√				√	√

Checklist of the Usage of NVivo in Previous Studies

Appendix 6: Interview with Annotation using NVivo

Interview with: Partner in the financial audit division, Audit Firm A, Pilot stage.

Q: Do your clients use electronic system?

A: Yes, most of them are dealing with fully integrated systems; some of them use simple electronic systems and others and the minority are still using manual systems.[1]

Q: Can you identify any problems, or challenges, that face you when auditing in an advanced electronic environment?

A: Actually dealing with electronic systems needs us to pay more attention to internal controls. Internal control is an important matter whether you are auditing in a paper environment or in an electronic environment. If you are dealing with paper systems, or simple computerised systems, the manual controls are the only controls you are looking for, but if you are dealing with advanced and complicated systems, you need to pay attention to the computerised controls as well. We cannot ignore the controls built in the systems; evaluating these controls is really important. If you deal with an advanced system provided by a reputable vendor you assume that the controls built in the system are good. However we need to confirm that things go in the right way. Moreover, we classify the IT environment for our clients into three categories, dominant, significant or minor. Dominant means heavy reliance on the electronic systems like banks, significant means that the electronic systems are very important but if it does not exist still the client can do his work, like in hotels, or the minor category is where there is no great difference if the computer exists or not. In a dominant environment, evaluating controls built in the system is a must. It is important to evaluate it in the significant environment as well. In a minor environment, I do not need to waste my time.[2]

Q: Do you think that financial auditors are qualified to evaluate such automated controls?

A: This is not my job, it is the job of the computer auditors; my job is to render an opinion whether the financial statements are prepared in accordance with the Egyptian Accounting Standards. Of course I cannot do everything; I cannot be knowledgeable in both accounting and auditing and information technology as well. I mean I do not think that one person can do everything, I mean auditors are not going to be able to keep up with all the accounting rules that they would need in financial auditing as well as all of the changes in technology. I know how to deal with technology as a user, I know how to deal with the reports coming from the systems, I may know how to extract the needed information from the electronic system, but I am not supposed to know how to audit such an electronic system.[3]

Q: Do you mean that financial auditors depend totally on computer auditors in this point?

A: We cannot say we totally depend on them, it is a close collaboration. We have to explain to them what we need to know, and then we give them free to do their jobs sufficiently. But at the end of the day they know that they have to come back to us with their findings. After that we do the entire job, so depending on them in an initial stage does not mean that we totally depend on them.[4,5]

Q: What other problems can face you when dealing with advanced electronic environment?

A: Sometimes, the system is very advanced and complicated; I mean if this is my first time dealing with this complicated system, I need to be aware of the type of reports the system produces; the screens that will appear when looking for specific

information as the needed information may not appear in the same screen, if I need a transaction from date to date, how I will catch it.[6]

Q: So, how can you have such awareness?

A: I can have such awareness if the client invites me to attend with his IT staff the training course on how to use the system, but this is not always the case. Sometimes the client used these systems before being our clients; sometimes they ignore, or forget to invite us. However, if we have such an invitation sometimes I cannot attend as such courses take about two weeks, eight hours daily. Such a long time is not available for me or for my team; I cannot stop doing everything for all the other clients to attend this course…sometimes I go by myself for some sessions, sometimes I send one of the team, it depends upon the pressure of work.[7]

Q: So if you do not attend the training course what will you do to gain such awareness?

A: In this case I can ask our computer audit team to help us in understanding the system and dealing with our needs from it.[8] However, this situation rarely happens, they help us in what we need and then we complete doing our job.

Q: You told me that the vendor of the system makes some difference?

A: Yes, if we are dealing with systems like Oracle or SAP or PeopleSoft we expect that more controls will be built on the systems and they will provide suitable training courses for the users and the needed maintenance of the system. I mean Oracle, for example, has opened a branch here in Egypt including an Arabisation centre to provide Arabisation services for Oracle applications and products. In this case it will be easy for them to provide their customers with any support they need. If such systems are implemented carefully, they are expected to be more reliable. But if you see the clients who buy their programs from individual unknown vendors as they

offer cheap programmes, oh you cannot imagine, it is really a disaster. This person designs a program and sells it to some companies, he may provide some services for those companies for a while but then if he has another chance to work abroad like in Gulf countries, this programmer disappear, leaving the system without any maintenance or updating. In this case the system will fall, no way, even if the IT client staff is perfect.[9]

Q: Do you mean that the IT client staff can affect your audit to some extent?

A: Not affect my audit directly, but I cannot say that they are not important. Sometimes when I deal with the client's staff I sometimes I feel that we are speaking different languages, I am asking him about specific controls I need to know about and I need him to explain to me, but he does not understand, or does not pay attention to what I am saying or speaking about, what he is thinking about is the maintenance of the system, how he can bring it back to life if it fails and that is it. Moreover, sometimes they cannot help us to obtain the information we need from the system, they do not know.[10]

Q: Do you mean that IT client staff always has negative effect, they never have a positive effect on the audit process?

A: I did not say so, if the staff is qualified and highly skilled, in this case we expect that the implementation of the systems will be correct and we can deal with the system easily. But another point I have to consider in this case is the gap in knowledge between me and him. He knows a lot and I do not know enough about the systems. In this case I need to pay more attention and I can expect fraud. By his knowledge he can cheat me easily.[11]

Q: Do you think that the heavy adoption of electronic systems affects the skills required of the financial auditors?

A: You know that we are a big audit firm, if anyone thinks of working with us he has to improve his IT skills whether he will deal with electronic systems or not. For example you need to know how to use our audit software which is downloaded in your laptop; besides you need to extract information from the electronic system. Another important point is that we need at least to know the automated controls for each business cycle and the expected audit risk if these controls are not working effectively.[12]

Q: Do you think that the educational background of the financial auditors helps them to possess such skills?

A: No, their educational background is very weak, or you can say very basic, you can say that it includes nothing. You know that all faculties of commerce in the Egyptian universities concentrate mainly on the basics of the accounting and auditing, but they do not pay any attention to auditing electronic systems. Even if you find a chapter about it in any audit book, you will find then that the lecturer cancelled it and did not teach it to the students…fresh graduates know how to use computers but they do not have the skills to work in audit firms, they need more training.[13]

Q: So, what is the source of your training?

A: The computer audit division here conduct training courses for the financial auditors to teach us the basics of the general computer controls and provide training on using our audit software for any new employee. Some of our colleagues depend on self-study to enhance their skills in the areas of interest to them; as for myself, I felt that being certified as a CPA is important for me as a financial auditor, so I improved my skills and my qualifications in my area of interest that can help me in my work.[14]

Q: Do you use CAATs?

A: Yes, I told you we have our audit software.

Q: Yes, I mean do you use it for any other purposes?

A: We use CAATs to extract the needed data from the electronic systems and I think the computer audit division use them to test the effectiveness of the internal controls of the electronic system.

Q: Do you mean that the IT auditors are the ones who use CAATs?

A: I didn't say so. Financial auditors; all of them use our audit software without any problem. Some of the financial auditors use CAATs to extract the needed data, but if we face any problem in this our computer audit team helps us. As for testing the automated controls, as I told you this is not my job, so information system auditors do it with the appropriate tools, and again I believe that there is no need to conduct training courses to teach financial auditors how to test the electronic systems itself. When you plan for a training cost you must look at the cost-benefit relation, I already have staff who can do it, and they receive high salaries to do it, so I have to get benefit from them.[15]

Q: Do you adopt continuous online auditing?

A: What is it?

Q: [Explanation provided]

A: I think this is a complicated technique, difficult to be adopted here at least for the time being.[16]

Q: You told me that the computer audit staff receive high salaries, do you think money can play any role related to your work?

A: Money plays an important roles not in my work only but in everything, but if you look at what relates to your topic you will find that everything relates to some

extent to money; the client's choice of the system may be affected by the cost of the system and when they hire the staff they may consider the salaries that will be paid to this staff and this of course affects my work. If the system is not suitable how can I rely on the outputs of such a system? I then need to increase the substantive tests, and if the staff is not qualified this indirectly affects me as I need to spend more time and effort.[17]

Q: These points relate to your client, what about your audit firm?

A: Sure, money has an effect, do you know that some audit firms do not have audit software because of its cost and they do not use any kind of CAATs. This is not a problem in my audit firm as we are a big one, but it is a real problem in other audit firms.

Q: So what are the problems of your audit firm?

A: Hiring qualified staff needs offering high salaries, and higher cost in general. Even if we decide to hire less qualified employees and provide them with the suitable training courses, but after working with us and getting experience they search for other places with higher offers especially in Gulf countries where no place in Egypt can compete.[18]

Q: Do you think that auditing in an advanced electronic environment should affect the audit fees?

A: Look, dealing with advanced electronic systems will need more work and more time from our computer audit team to evaluate the system and from us to extract the information we need. Besides we need to assign qualified auditors to deal with such systems. These things indicate that the audit fees should increase. But the point is that the client does not understand such thing they always try to reduce the audit fees. Some of them think that using an advanced electronic system means that

the audit will be easier and the auditor will be able to rely on the outputs of the system without exerting great effort. However, whether the system is electronic or not, advanced or not, the audit fees is negotiable, it depends upon the name of the audit firm, the size of the client and the complexity of the systems…but I believe that auditing advanced electronic systems should increase the audit fees.[19]

Q: Do you think that there is a need to release an Egyptian auditing standard related to auditing in electronic environment?

A: I think that the International Auditing Standards covered all the points the auditors will need when dealing with electronic systems; moreover if you look at the six Egyptian Auditing Standards, you will find that they are just translations of the international standards. The point is not in releasing a new standard; the point is that if you translate an international standard you have to look at the meaning of the standard, I mean its core as the translation from the English version to the Arabic one is poor in some cases.[20]

Q: Do you have any comments or anything you need to add?

A: I think things are covered. But I would pay more attention to the educational system; I think more attention should be paid to IT auditing in our universities, I mean the auditing curriculum which is taught in all of faculties of commerce of the Egyptian universities does not pay enough, or you can say any, attention to this point, although most of the companies in different industries are going towards adopting advanced electronic systems. I think what we need to get over is to minimise the gap between what the students are studying in the universities and what is happening in the real world…now the gap is really wide, and that is why most of them [the students] get disappointed when they graduate and begin their journey in finding a good job.[21]

Annotations

[1] the types of the electronic system used by the clients in audit firm A

[2] controls are important in both manual and electronic systems.

Controls built in the electronic systems are important.

Hint about the relation between the type of the vendor and the automated controls of the electronic systems.

Classification of the IT environment: dominant, significant and minor

[3] I am not very sure, but I felt that he was aggressive

[4] the relation between the financial auditors and the information system auditors (collaboration)

[5] he did not like my comment about dependency on computer auditors

[6] problem of awareness about the electronic systems

[7] vendor training

[8] computer auditor's role

[9] the effect of the vendor of the system (controls built on the systems, training courses, maintenance).

Example of how oracle serves his clients in Egypt

The effect of individual unknown vendors

[10] IT client staff (negative effect)

[11] The effect of the IT client staff

[12] Electronic systems and the skills of the financial auditors.

[13] Egyptian educational system and electronic auditing

[14] In-house training

[15] CAATs used by the financial auditors and information system auditors.

[16] Continuous online auditing (not applied)

[17] Financial problems (the client)

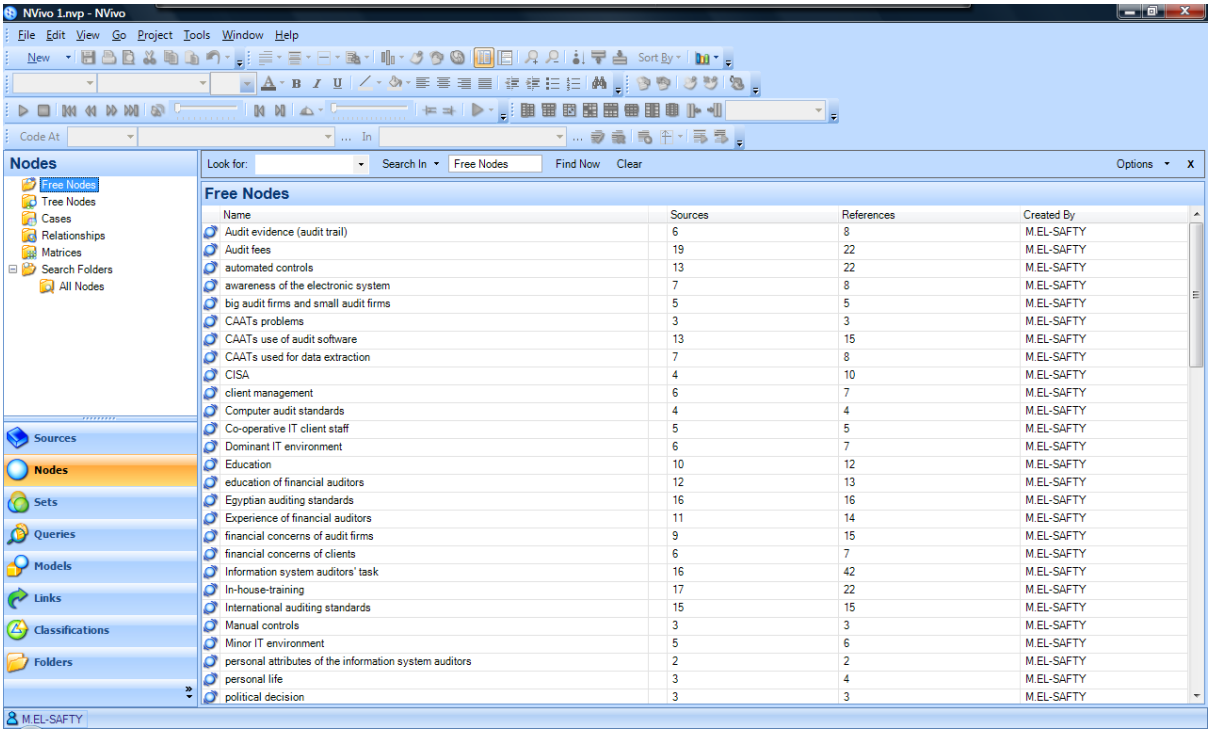
[18] Financial problems (audit firms)

[19] Audit fees: should be higher

[20] International standards and Egyptian auditing standards

[21] Educational system in Egypt

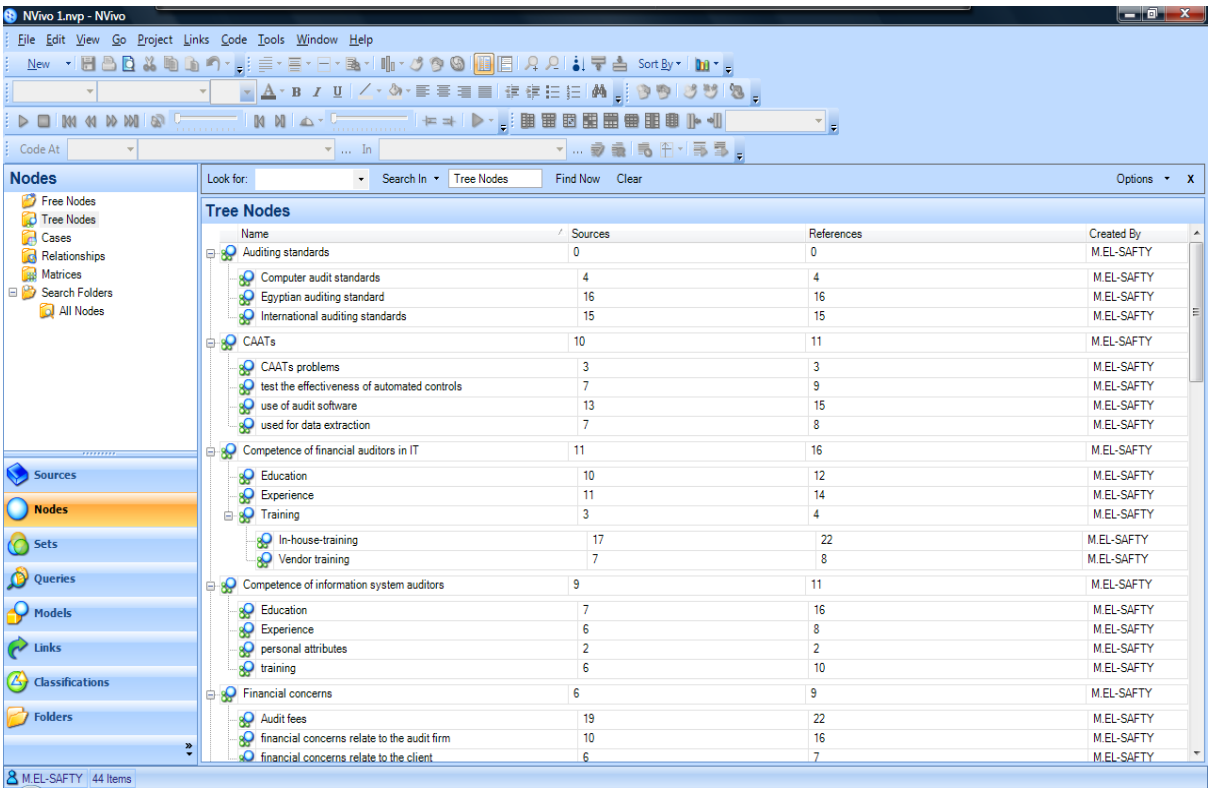
Appendix 7: List of Free Nodes



Type	Name	Sources	References	Created By
Free Node	Audit evidence (audit trail)	6	8	M.EL-SAFTY
Free Node	Audit fees	19	22	M.EL-SAFTY
Free Node	automated controls	13	22	M.EL-SAFTY
Free Node	awareness of the electronic system	7	8	M.EL-SAFTY
Free Node	big audit firms and small audit firms	5	5	M.EL-SAFTY
Free Node	CAATs problems	3	3	M.EL-SAFTY
Free Node	CAATs use of audit software	13	15	M.EL-SAFTY
Free Node	CAATs used for data extraction	7	8	M.EL-SAFTY
Free Node	CISA	4	10	M.EL-SAFTY
Free Node	client management	6	7	M.EL-SAFTY
Free Node	Computer audit standards	4	4	M.EL-SAFTY
Free Node	Co-operative IT client staff	5	5	M.EL-SAFTY
Free Node	Dominant IT environment	6	7	M.EL-SAFTY
Free Node	Education	10	12	M.EL-SAFTY

Type	Name	Sources	References	Created By
Free Node	education of financial auditors	12	13	M.EL-SAFTY
Free Node	Egyptian auditing standards	16	16	M.EL-SAFTY
Free Node	Experience of financial auditors	11	14	M.EL-SAFTY
Free Node	financial concerns of audit firms	9	15	M.EL-SAFTY
Free Node	financial concerns of clients	6	7	M.EL-SAFTY
Free Node	Information system auditors' task	16	42	M.EL-SAFTY
Free Node	In-house-training	17	22	M.EL-SAFTY
Free Node	International auditing standards	15	15	M.EL-SAFTY
Free Node	Manual controls	3	3	M.EL-SAFTY
Free Node	Minor IT environment	5	6	M.EL-SAFTY
Free Node	personal attributes of the information system auditors	2	2	M.EL-SAFTY
Free Node	personal life	3	4	M.EL-SAFTY
Free Node	political decision	3	3	M.EL-SAFTY
Free Node	problems relate to the system	7	7	M.EL-SAFTY
Free Node	qualification of IT client staff	14	18	M.EL-SAFTY
Free Node	relation between financial auditors and information system auditors	16	44	M.EL-SAFTY
Free Node	Resistance of IT client staff	3	3	M.EL-SAFTY
Free Node	Significant IT environment	5	6	M.EL-SAFTY
Free Node	Technical support of the vendor	9	9	M.EL-SAFTY
Free Node	test the effectiveness of automated controls	7	9	M.EL-SAFTY
Free Node	Training of financial auditors	3	4	M.EL-SAFTY
Free Node	type of the electronic system	16	31	M.EL-SAFTY
Free Node	Vendor training	6	7	M.EL-SAFTY
Free Node	Vendor type	6	7	M.EL-SAFTY

Appendix 8: List of Tree Nodes



Type	Name
Tree Node	Vendors of the system

Tree Node	type of the vendor
Tree Node	Training
Tree Node	Technical support

Type	Name
Tree Node	Type of IT environment

Tree Node	Significant
Tree Node	Minor
Tree Node	Dominant

Type	Name
Tree Node	the electronic system

Tree Node	type of the electronic system
Tree Node	problems relate to the system
Tree Node	awareness of the electronic system

Type	Name
Tree Node	IT client staff

Tree Node	Resistance
Tree Node	qualification
Tree Node	Co-operative

Tree Node	Internal controls

Tree Node	Manual controls
Tree Node	automated controls

Tree Node	Information system auditors' task
Tree Node	Financial concerns

Tree Node	financial concerns relate to the client
Tree Node	financial concerns relate to the audit firm
Tree Node	Audit fees

Tree Node	Competence of information system auditors

Tree Node	training
Tree Node	personal attributes
Tree Node	Experience
Tree Node	Education

Tree Node	Competence of financial auditors in IT

Tree Node	Training

Tree Node	Vendor training
Tree Node	In-house-training

Tree Node	Experience
Tree Node	Education

Type	Name
Tree Node	CAATs

Tree Node	used for data extraction
Tree Node	use of audit software
Tree Node	test the effectiveness of automated controls
Tree Node	CAATs problems

Tree Node	Auditing standards

Tree Node	International auditing standards
Tree Node	Egyptian auditing standard
Tree Node	Computer audit standards