

**AN EMPIRICAL SURVEY OF CERTAIN
KEY ASPECTS OF THE USE OF
STATISTICAL SAMPLING BY SOUTH
AFRICAN REGISTERED AUDITORS
ACCREDITED BY THE
JOHANNESBURG SECURITIES
EXCHANGE**

by
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of Accounting (Auditing) at the University of Stellenbosch*



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DECLARATION

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ABSTRACT

The quality of external audits has increasingly come under the spotlight over the last decade as a result of a number of audit failures. The use of scientifically based statistical sampling as a sampling technique is allowed, but not required by International Standards on Auditing. The science behind this sampling technique can add to the credibility and quality of the audit. Accordingly the main objective of this study was to explore certain key aspects of the use of statistical sampling as a sampling technique in the audits of financial statements done by South African Registered Auditors accredited by the Johannesburg Stock Exchange (JSE).

A literature review of the most recent local and international studies related to the key aspects addressed in this study was done. An empirical study was then done by means of a questionnaire that was sent to the JSE-accredited auditing firms for completion. The questionnaire focused on what was *allowed* by the firms' audit methodologies regarding the key aspects investigated in this study and not on the *actual usage* of statistical sampling in audits performed by the firms.

The following main conclusions were drawn in respect of the four key aspects that were investigated:

1. In investigating the *extent to which statistical sampling is used by auditing firms*, it was found that the majority of them was allowed to use the principles of statistical sampling. Upon further investigation it was found that only 38% were explicitly allowed to use it in all three sampling steps (size determination, selection of items and evaluation of results). The evaluation step was identified as the most problematic statistical sampling phase.
2. Two *reasons why auditors decided not use statistical sampling as a sampling technique* were identified, namely the perceived inefficiency (costliness) of the statistical sampling process, and a lack of understanding, training and experience in the use thereof.
3. In investigating *how professional judgement is exercised in the use of statistical sampling*, it was found that the audit methodologies of the majority of the auditing firms prescribed the precision and confidence levels to be used, and further that the minority

indicated that they were allowed to adjust these levels using their professional judgement. The partner in charge of the audit was identified to be typically responsible for final authorisation of the sampling approach to be followed.

4. It was found that approximately a third of the auditing firms did not use computer software for *assistance in using statistical sampling*. The majority of the auditing firms did however have a written guide on how to use statistical sampling in practice available as a *resource* to staff.

The value of this study lies in its contribution to the existing body of knowledge in South Africa regarding the use of statistical sampling in auditing. Stakeholders in statistical sampling as an auditing technique that can benefit from this study include Registered Auditors in practice, academics, and, from regulatory, education and training perspectives, the Independent Regulatory Board for Auditors and the South African Institute of Chartered Accountants.

UITTREKSEL

Na aanleiding van 'n aantal oudit mislukkings in die afgelope dekade het die kwaliteit van eksterne oudits toenemend onder die soeklig gekom. Die gebruik van wetenskaplik gebaseerde statistiese steekproefneming word deur die *International Standards on Auditing* toegelaat, maar nie vereis nie, as 'n steekproefnemingstegniek. Die wetenskap agter hierdie steekproefnemingstegniek kan tot die geloofwaardigheid en die kwaliteit van die oudit bydra. Die hoofdoel van hierdie studie was gevolglik om sekere sleutel aspekte van die gebruik van statistiese steekproefneming as 'n steekproefnemingstegniek in die oudits van finansiële state soos gedoen deur Suid-Afrikaanse Geregistreerde Ouditeure geakkrediteer deur die Johannesburgse Effektebeurs (JSE), te verken.

'n Literatuurstudie van die mees onlangse plaaslike en internasionale studies wat verband hou met die sleutel aspekte wat in hierdie studie aangespreek word, is gedoen. 'n Empiriese studie is daarna gedoen met behulp van 'n vraelys wat vir die voltooiing aan die JSE-geakkrediteerde ouditeursfirmas gestuur is. Die vraelys het gefokus op wat *toegelaat* word deur die firmas se oudit metodologieë ten opsigte van die sleutel aspekte ondersoek in hierdie studie en nie op die *werklike gebruik* van statistiese steekproefneming in oudits wat deur die firmas uitgevoer word nie.

Die volgende hoofgevolgtrekkings is gemaak ten opsigte van die vier sleutel aspekte wat ondersoek is:

1. In die ondersoek na *die mate waarin statistiese steekproefneming gebruik word deur ouditeursfirmas*, is gevind dat die meerderheid toegelaat was om die beginsels van statistiese steekproefneming te gebruik. By verdere ondersoek is gevind dat slegs 38% uitdruklik toegelaat word om dit te gebruik in al drie steekproefneming stappe (grootte-bepaling, keuse van items en evaluering van resultate). Die evalueringstap is geïdentifiseer as die mees problematiese statistiese steekproefnemings fase.
2. Twee redes waarom ouditeure besluit het om nie statistiese steekproefneming as 'n steekproefnemingstegniek te gebruik nie is geïdentifiseer, naamlik die vermeende ondoeltreffendheid (hoë koste) van die statistiese steekproefnemingsproses, en 'n gebrek aan begrip, opleiding en ondervinding in die gebruik daarvan.

3. Met die ondersoek van *die wyse waarop professionele oordeel uitgeoefen word in die gebruik van statistiese steekproefneming*, is gevind dat die presisiepeil en vertrouensvlakke wat gebruik word deur die meerderheid van die ouditeursfirmas se audit metodologieë voorgeskryf word, en verder het die minderheid aangedui dat hulle hierdie vlakke mag aanpas deur hul professionele oordeel te gebruik. Die vennoot in beheer van die audit is geïdentifiseer as tipies verantwoordelik vir die finale goedkeuring van die steekproefnemingsbenadering wat gevolg word .
4. Daar is gevind dat ongeveer 'n derde van die ouditeursfirmas nie gebruik maak van rekenaarsagteware vir *bystand in die gebruik van statistiese steekproefneming* nie. Die meerderheid van die ouditeursfirmas het egter 'n geskrewe gids oor hoe om statistiese steekproefneming in die praktyk te gebruik as 'n *hulpmiddel* aan personeel beskikbaar.

Die waarde van hierdie studie lê in sy bydrae tot die bestaande liggaam van kennis in Suid-Afrika met betrekking tot die gebruik van statistiese steekproefneming in auditkunde. Belanghebbers in statistiese steekproefneming as 'n oudittechniek wat kan baat vind by hierdie studie sluit in Geregistreerde Ouditeure in praktyk, akademici, en, vanuit regulerings-, opvoedings- en opleidingsperspektiewe, die *Independent Regulatory Board for Auditors* en die Suid-Afrikaanse Instituut van Geoktrooieerde Rekenmeesters.

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CHAPTER 1

INTRODUCTION

In their authoritative textbook, which is extensively used in the education of Registered Auditors in South Africa, Marx, Van der Watt, Bourne and Hamel (2009:11-3) state that once an auditor has entered into an assurance engagement, the following are required:

- Firstly, from a legal point of view, to obtain sufficient appropriate audit evidence to reach a conclusion on the fair presentation of financial statements.
- Secondly, from a client's point of view, to perform a cost-effective audit.

On the one hand, when the auditor is striving for cost-effectiveness, it is not possible for him or her to test all the transactions underlying all the balances, classes of transactions and disclosures in the financial statements. On the other hand, in fulfilling his legal responsibility, he needs to do enough testing to be able to justify a conclusion on the fair presentation in the statements. The auditor therefore needs an effective and efficient method of obtaining audit evidence for only a sample of items selected from all the items in a population. On the basis of the evidence obtained regarding the sample items, the auditor has to reach a conclusion about the population as a whole (Puttick & Van Esch, 2007:291).

Statistical sampling is the use of a combination of mathematical and statistical applications to do the following (Marx *et al.*, 2009:11-9):

- determine the number of items to test (size of the sample);
- select the items to be tested (inclusion of items in the sample); and
- evaluate the results of the test performed and project those results to the affected population as a whole.

1.1 Development of the use of statistical sampling as an audit tool up to the early 1980s

The Industrial Revolution in the early 1800s caused an increase in the use of the company as an entity form. Investors (shareholders) entrusted substantial amounts of capital to the professional management teams (directors) of these companies to manage on their behalf.

The investors required assurance that their money was being used to their best advantage and auditors were appointed by them as agents to provide this assurance (Puttick & Van Esch, 2007:4).

The rapid growth of those companies, as well as the resulting increase in financial transactions generated by them, soon made it impossible for auditors to verify the correctness of all the transactions in a specific financial period. Therefore it is not surprising that the first references in literature to sampling as an audit tool are found during the 1800s (Wilburn, 1984:3).

However, the first reference in literature to *statistical* sampling as an audit tool is found much later, in the 1930s. Furthermore, statistical sampling was used more commonly as an audit tool in audits only from the 1950s (Wilburn, 1984:2).

A study done by Tucker and Lordi (1997) identified the following as factors that drew the attention of the auditing profession (especially the bigger auditing firms) to the possibility of using statistical sampling as an audit tool during the 1950s:

- Other professions were using it with great success. It was commonly used in the medical profession, for quality control in the manufacturing field, in engineering designs, as well as in military logistics at that time.
- Large companies started using it in their financial accounting and internal audit procedures. This forced the external auditors to learn how it worked to enable them to express an opinion on the resulting financial statements. Examples of such companies included United Airlines, Western Electric and Reader's Digest.
- In the early 1950s a number of court cases made it clear that auditors were exposed to legal liability should the audit opinions they express be inappropriate. They needed an objective and legally defensible method of sampling. (Consequently, Price Waterhouse was one of the first of the larger firms that started to develop a statistical sampling approach, which was implemented by them in 1958.)
- Studies also showed that in some situations the use of statistical sampling resulted in a reduction in the volume of fieldwork to be done, without significantly increasing the audit risk.

Schwartz (1998) stated that, in addition to the benefits of the use of statistical sampling in audits as identified in the 1950s, the profession also focused in the 1970s on the ability of statistical sampling to quantify the auditor's level of assurance derived from applying a particular audit procedure to a sample of items. The type of conclusion on the results of an audit procedure that is applied using statistical sampling would be, for example, the following:

Based on these [statistical] results, we can be 95% confident that the amount of misstatement in the account does not exceed \$50,000.

According to Hitzig (2004), the large auditing firms in particular invested significant resources in the development and implementation of statistical sampling as an audit tool in the 1960s and 1970s. New policies and guidelines were written, computer programs developed and staff trained. A new statistical method called "monetary unit sampling" was developed. Statistical sampling was widely used in the auditing profession during this period.

1.2 Standardisation of the use of statistical sampling as an audit tool

The use of statistical sampling by auditors had to be standardised in the 1950s as a result of the increase in the use thereof as described above. In 1956 the American Institute of Certified Public Accountants (AICPA) formed a subcommittee, the Committee on Statistical Sampling (AICPA-CSS), to investigate the appropriateness of statistical sampling as an audit tool in the audit process. Members of AICPA-CSS who did pioneering work in this field included Robert M Trueblood (first chairman of the committee and a partner in Touch, Niven, Bailey & Smart – now Deloitte), Oscar Gellein and Kenneth W Stringer (both representatives from Haskins & Sells - now Deloitte) (Tucker & Lordi, 1997).

The AICPA-CSS's work resulted in the first official reference to statistical sampling in an auditing standard appearing in an annexure to the Statement on Auditing Procedures (SAP) 54 in 1964 (Stringer, 1975:1).

In 1980, after the Auditing Standards Board (ASB) had been formed by AICPA, the Statement on Auditing Standards (SAS) 39 was issued as a separate standard with the

title “Audit Sampling”. Members of the Statistical Sampling Subcommittee who had been involved in writing SAS 39 expected that in this stand-alone standard, statistical sampling would be made the principal selection method. However, the opposite happened: the new standard included both statistical and non-statistical sampling as alternative sampling methods. It awarded the same importance to both methods of sampling, requiring the auditor to use his professional judgement to decide which selection method to use (Hitzig, 2004).

Since the early 1970s the rapid growth in investing and capital raising in the global markets emphasised the need for a set of standardised international accounting and auditing standards. As a result, the International Federation of Accountants (IFAC) was established in 1973 and it founded the International Auditing Practices Committee (IAPC) (currently known as the International Auditing and Assurance Standards Board (IAASB)) in the late 1970s (ICAEW, 2009). The result of the initial work of the IAPC is still with us in the form of the International Standards on Auditing (ISAs). This set of international standards is used in various countries globally, including in South Africa (Roussey, 1999).

Included in the current ISAs is ISA 530, titled “Audit Sampling” (SAICA, 2010a), the international equivalent of the American SAS 39 previously mentioned. ISA 530 was included in a recent IAASB project initiated to clarify ambiguities in existing ISAs. A redrafted version of the standard was subsequently issued in October 2008. No material changes were made to the standard in the clarification process. Paragraph A9 of ISA 530 (SAICA, 2010a:ISA530-5) reads as follows:

“The decision whether to use a statistical or non-statistical sampling approach is a matter for the auditor’s judgment ...”

Hitzig (2004) commented as follows on the abovementioned requirement:

“... contemplated revisions to auditing standards leave untouched ambiguities and unresolved issues... One of the longest-standing issues concerns the role and appropriateness of statistical sampling ...”

1.3 The change in the use of statistical sampling in practice since the early 1980s

Schwartz (1998) stated that it became clear in the early 1980s that the use of statistical sampling as an audit tool had reached a turning point. Not only did the international auditing standards give the same importance to both statistical and non-statistical sampling methods, but the benefits of statistical sampling as identified from the 1950s to the 1970s were not sufficient to keep auditors convinced to use it. The reasons auditors gave at the time for choosing not to use statistical sampling included the following:

- the underlying mathematical principles were too complex; and
- based on their professional judgement, the resulting size of the samples was too large, causing too much field work to be done.

Further, Sherer and Turley (1997:210-211) found in their study that the decline in the use of statistical sampling in the 1980s was the result of the following developments in the auditing profession:

- In the early 1980s auditors moved away from reliance on internal controls to extensive substantive testing, causing fewer tests of controls to be used during a typical audit.
- In the 1980s analytical procedures became widely used as an audit tool. In the mid-1980s they were used in conjunction with substantive procedures, justifying a reduction in the overall level of substantive procedures used during the audit.
- In the late 1980s the implementation of the then newly developed business risk-based audit strategies increased. General business risks are assessed and taken into account during the planning phase of the audit. Khalifa, Sharma, Humphrey and Robson (2007:833) described this audit strategy as an audit strategy based on an analysis of management's overall business strategy and their attitude towards internal controls. This analysis would be used as part of the process of determining the overall audit risk used in the audit planning phase. Sherer and Turley (1997:206) also describe this change in overall audit strategy as a change in the focus of the auditor away from the specific internal controls implemented towards management's control over the overall internal control environment. This strategy resulted in a reduction of specific control and transaction testing needed.

South African auditors followed the international trend during the abovementioned period. De Bruyn (1981:492) found in his doctoral study in 1981 that only 29% of South African auditing firms were using statistical sampling as an audit tool in more than 71% of their audits. He further found that 33% of the auditing firms used statistical sampling as an audit tool in less than 10% of their audits.

Since the 1980s the auditing profession has been compelled to continue to develop and change, given that the business environment has grown more complex and the “new accounting” of using fair values more extensively for measurement has become a reality (Fraser & Pong, 2009:112).

A study by Khalifa *et al.* (2007:826) found that relatively little international research has been done since the 1980s on the current overall audit strategies and audit practices of auditing firms. In South Africa, the 1981 study by De Bruyn appears to be the most recent on this topic. Therefore, scientifically based knowledge on the current extent to which statistical sampling is used by auditors is limited.

1.4 Current questions regarding the quality of external audits globally

The recent global economic crisis (Fraser & Pong, 2009:104) as well as the numerous international audit scandals of the past decade (such as Enron, WorldCom and Parmalat), raised questions about the auditor’s role in the business environment from both a legal and a regulatory perspective (Hitzig, 2004). The abovementioned lack of available research on certain aspects of modern auditing practice makes answering some of these questions problematic.

As a result of these recent audit failures, auditing firms’ compliance with the IAASB’s International Standards on Quality Control (ISQC) are currently strictly monitored by financial reporting regulators in certain countries. They perform audit practice inspections as set out by the requirements in their countries in an attempt to evaluate and uphold the quality of external audits (Cosserat & Rodda, 2009:275).

These financial reporting regulators recently reported concerns about the quality of external audits internationally as well as locally. Examples of such concerns include the following:

- In the United States of America (USA):

The Public Company Accounting Oversight Board (PCAOB) reported concerns about high-risk areas in audits, and specifically referred to sampling. The report was based on the review of the eight largest public auditing firms' 2003 to 2006 audits (McCollum, 2009:16).

- In the United Kingdom (UK):

The Audit Inspection Unit (AIU) reported concerns similar to those in the USA mentioned above for audits conducted in the period June 2007 to March 2008 (McCollum, 2009:16). The report was based on a review of seven of the largest auditing firms in the UK (POB, 2008:2).

- In South Africa:

The Independent Regulatory Board for Auditors (IRBA) reported concern mainly about the substandard quality of the documentation of audit evidence. This report was based on a review of 718 assurance engagements in the period from April 2008 to March 2009 at various firms of Registered Auditors (IRBA, 2009:43).

Further to the abovementioned regulators' findings, Khalifa *et al.* (2007:827-828) found that there was a demand for a more scientific approach to external audits, as well as a new awareness of the importance of the quality of audits (2007:837-839).

A study by Fraser and Pong (2009:107) also supported the abovementioned notion, and stated further that it could indicate that there are no shortcuts to effective audits and that quality does come at a high price. It also suggested that a combination of the modern business risk-based audit strategy and more traditional overall audit strategies could possibly optimise the effectiveness of audits and audit quality in certain business environments.

1.5 The objective of this specific study

In the light of the questions being asked about the quality of external audits as discussed above, as well as the lack of available research on the topic (in particular in South Africa), the focus of this study was to explore the extent to which statistical sampling is currently being used in audits of financial statements, since it is one of the key concerns identified in the quality inspections done by regulators, as well as in the abovementioned existing studies. Therefore, the **main** objective of this study was **to explore certain key aspects of the use of statistical sampling as a sampling technique in the audits of financial statements done by South African Registered Auditors accredited by the Johannesburg Stock Exchange (JSE).**

In order to achieve this objective the study focused on the following key aspects of the use of statistical sampling in the modern external audit environment in South Africa:

1. Exploring the extent to which statistical sampling is being used in auditing firms; the steps in the audit process in which it is being applied; the sampling methods being used and the types of audit procedures being performed with the aid of statistical sampling.
2. Identifying factors that cause auditors to decide against using statistical sampling as a sampling technique.
3. Exploring the extent to which professional judgement is exercised in the use of statistical sampling in the audit process and by whom it is typically exercised.
4. Exploring the assistance and resources available to audit teams in using statistical sampling as a sampling technique.

The focus of the study is to explore certain key aspects of the *application* of statistical sampling in audits of financial statements. The *statistical details* of the sampling techniques (theory and formulas) do not fall within the scope of this study.

Further, a key assumption was made that all the auditing firms that fell within the scope of this study complied in all material respects with the requirements of ISQC 1. This assumption is made based on the fact that each of these firms is subjected to a practice review performed by the IRBA, which ensures that they comply with the requirements of ISQC 1. As set out in ISQC1, paragraph A32 (SAICA, 2010a:ISQC1-18), the firm should

therefore have standardised policies and procedures in place to ensure consistency of engagement performance. These policies and procedures are normally set out in the audit methodologies of the firms. ISQC 1, paragraph 35 (SAICA, 2010a:ISQC1-8), further requires that all audits of listed entities should be reviewed by an objective reviewer. The purpose of this review is to ensure that these audits comply with the audit methodology of the firm and to evaluate the material judgements made and conclusions reached. This study was therefore based on the assumption that the abovementioned procedures were in place in the firms accredited by the JSE, and that the methodologies were being properly applied on audits performed by the firms.

A **secondary** objective of this study was to compare the key aspects of the current use of statistical sampling in South Africa investigated in this study with the most current international trends identified in the literature review and to the findings reported in the South African study by De Bruyn done approximately 20 years ago in 1981.

1.6 Design of this study

The study design is illustrated in Annexure A. This diagram summarises and links the research objective (discussed in section 1.5 above); the research questions (discussed in section 1.6.1 below) and the research method used (briefly discussed in section 1.6.2 below and expanded upon in Chapter 5). The diagram further links the research objective, questions and methods to an outline of the remainder of the thesis, as given in section 1.7 below.

1.6.1 Research questions

In order to achieve the objectives of the study as set out in section 1.5, the following research questions were addressed in the study (each linked to the particular key aspect of the research as set out in section 1.5):

1. Key aspect 1 was addressed by the following research questions, which determined whether statistical sampling is allowed in audits performed by Registered Auditors in South Africa, and if so, how it is being applied:
 - (a) Do the auditing firms' audit methodologies allow for the use of statistical sampling?

- (b) What is the estimated extent to which statistical sampling is being used in audit engagements?
 - (c) Is statistical sampling allowed to be used in determining sample size, in identifying items for inclusion in the sample and in the evaluation of the results (projection to the population)?
 - (d) Which statistical sampling methods are being allowed?
 - (e) Are these statistical sampling methods allowed in both tests of controls and substantive procedures?
2. Key aspect 2 was addressed by determining what the main reasons were for South African auditors to decide not to use statistical sampling in an audit.
3. Key aspect 3 was addressed by the following research questions, which determined how South African Registered Auditors exercise professional judgement in the use of statistical sampling:
- (a) What is the impact of the use of statistical sampling on the need for exercising professional judgement when using sampling in an audit?
 - (b) Is professional judgement necessary in determining sample size, in identifying items for inclusion in the sample and in evaluating the results?
 - (c) Who is responsible for exercising this professional judgement?
4. Key aspect 4 was addressed by the following research questions, which determined what assistance and resources are available to audit teams using statistical sampling:
- (a) What resources are available to audit teams regarding the practical use of statistical sampling?
 - (b) Are computer applications used in statistical sampling? If so, are these developed specifically for the firm, or bought in?
 - (c) Are all the audit steps in using statistical sampling (set out in 1(c) and 3(b) above) supported by software?
 - (d) Does the level of knowledge of the trainees of statistical sampling meet the expectations of the Registered Auditors in practice?

1.6.2 Research method

In order to answer the research questions set out in section 1.6.1, the study was done in the three parts set out below.

1. A review of existing literature was done on the key concepts relevant to this study in respect of the use of statistical sampling by auditors in the audit of financial statements (refer to questions 1 and 3), covering the following areas:
 - Standard setters' and regulators' requirements with regard to statistical sampling (for example ISA 530).
 - The sampling methods available for use that qualify as statistical sampling.
 - The application of these methods of statistical sampling in the different audit steps (set out in questions 1(c) and 3(b) of section 1.6.1).
 - The application of statistical sampling in tests of controls and substantive procedures.
 - The general advantages and disadvantages of the use of statistical sampling.
 - The role of professional judgement in statistical sampling.
2. A review of the most recent local and international studies done on the use of statistical sampling in auditing (refer to questions 1, 2 and 4).
3. An empirical study of the use of statistical sampling by South African Registered Auditors accredited by the Johannesburg Stock Exchange (JSE) (refer to questions 1, 2, 3 and 4). The research method employed in this part of the study is described in Chapter 5. A summary of the research method is provided below for the reader's convenience.

The empirical study was conducted using a questionnaire. The questionnaire was designed in such a way that it addressed all the questions set out in section 1.6.1. It was designed as a web-based questionnaire using the online survey software platform www.surveymonkey.com. This format was chosen as it was expected to be convenient and user-friendly and could therefore contribute to improving the response rate.

The questionnaire was sent to a sample of auditing firms to complete and return for data capturing and analysis. The auditing firms were selected by focusing on firms that were exposed to a high level of public accountability due to the fact that they engage in audits of public companies listed on the JSE. The revised Companies Act of 2008 and related Regulations lend credibility to this basis of selection, as in the future it requires compulsory audits of mostly only public companies. The JSE publishes a list of accredited auditors on a regular basis. In order to audit a listed company, an auditing firm has to have been approved by the JSE and included in the published list. See Annexure B for the list of the 26 accredited auditors on 9 March 2010 used in this study.

Upon receipt of the completed questionnaires, the data they contained was captured and analysed to provide answers to the research questions set out in section 1.6.1. Furthermore, where applicable, the data was stratified into data received from the “Big Four” firms (Deloitte, Ernst & Young, KPMG and PwC) and data received from other firms accredited by the JSE. Data was analysed with the aid of the Statistica software package.

1.7 Overview of the remainder of the thesis chapters

The framework of the study is diagrammatically set out in Annexure A, showing the logical flow of the study from the research objective to the related research questions necessary to achieve it, the methods that were used to answer the research questions and ultimately in which chapter they are presented in the thesis. A high-level description of the content of each chapter in the remainder of the thesis follows.

- *Chapter 2: A theoretical overview of how audit evidence is obtained*

The chapter gives a broad overview of the process of obtaining audit evidence as prescribed by the ISAs and textbooks. The overview walks through the concept of audit risk, its components and the role it plays in determining the nature and extent of the audit procedures to be done. The procedures need to enable the auditor to obtain appropriate and sufficient evidence on which to base his opinion on the set of audited financial statements, with his exposure to audit risk set at an acceptable level. In the

summary of the chapter a diagram is given to illustrate where sampling fits into the audit process.

- *Chapter 3: A theoretical overview of audit sampling*

Sampling is introduced as an audit tool in this chapter. The differences between statistical and non-statistical approaches in sampling are discussed broadly on a sampling-step level, as well as in detail on a test-type level (tests of controls and substantive procedures). The best-known statistical sampling plans for both tests of controls and substantive procedures are broadly explained with additional focus on monetary unit sampling. The chapter concludes with the perceived advantages and disadvantages of the use of statistical sampling in audits of financial statements.

- *Chapter 4: The use of statistical sampling in practice: a literature overview*

The focus of this chapter is to identify the most recent trends and problems in the practical use of statistical sampling in audit firms both in South Africa and internationally from a review of published studies. In South Africa the study by De Bruyn (1981) appears to be the most recent. Published international studies included in the review were limited to those published after 1990.

- *Chapter 5: Statistical sampling in South African audits: research design and methodology*

A description of the development of the questionnaire used to achieve the main and secondary objectives as defined in section 1.5 is given. The reasoning behind choosing the participants to include in the study and to send questionnaires to is discussed. The process of handling data received back from respondents from capturing to analysis is described. In conclusion, the possible limitations of the study due to the methodology followed are discussed.

- *Chapter 6: Statistical sampling in South African audits: results and analysis of empirical study*

This chapter presents the findings of the empirical study as described in chapter 5. The analysis of the collected data is presented, as are comparisons to the findings of the studies included in the literature study presented in chapter 4. Identified differences in the practices of the “Big four” auditing firms and those of the other auditing firms accredited by the JSE, are indicated where applicable.

- *Chapter 7: Conclusion*

On the basis of the findings presented in chapter 6, an overall conclusion on the use of statistical sampling by Registered Auditors in South Africa accredited by the JSE is presented in this chapter. The value of this study, as well as opportunities for future research, is also discussed.

CHAPTER 2

A THEORETICAL OVERVIEW OF HOW AUDIT EVIDENCE IS OBTAINED

The development in audit approaches since the early 1980s was discussed in Section 1.3 of Chapter 1. It could be seen that the focus was shifting from examining physical evidence by using either tests of controls or detailed substantive procedures to using more intuitive methods in order to identify possible material misstatements. Examples of these more intuitive methods were substantive analytical procedures and business risk evaluations.

However, according to Porter, Simon and Hatherley (2008:25, 55), in the early 2000s, after the Enron audit failure in 2001 and the subsequent collapse of the auditing firm Arthur Anderson, auditors shifted their focus back to the earlier audit risk approach of examining evidence from both internal and external sources to address audit risk for the financial statements as a whole.

The current ISAs support the abovementioned approach with regard to planning and performing an audit. ISA 200 (SAICA, 2010a:ISA200-3) in paragraphs 11 and 12 describes the overall objectives of the auditor as follows:

- Firstly to: "... obtain reasonable assurance about whether the financial statements are free from material misstatement ... thereby enabling the auditor to express an opinion ...", and
- Secondly to: "... report on the financial statements ... in accordance with the auditor's findings."

ISA 200 (SAICA, 2010a:ISA200-6) continues as follows in paragraph 17: "To obtain reasonable assurance, the auditor shall obtain sufficient appropriate audit evidence to *reduce audit risk to an acceptably low level* and thereby enable the auditor to draw reasonable conclusions on which to base the auditor's opinion."

The Glossary of Terms issued by the IAASB and the ISAs define audit risk (AR) as: "The risk that the auditor expresses an inappropriate audit opinion when the financial statements are materially misstated" (SAICA, 2010a:GLOSS-3).

It is therefore clear from the above that the auditor needs to be able to measure (assess and quantify (numerically or otherwise)) the level of audit risk pertaining to a specific audit. To enable the auditor to do this, the audit risk model was developed more than 20 years ago and is still supported by standard setters in Canada, the UK and the USA, as well as by academics (Allen, Hermanson, Kozloski & Ramsay, 2009:169). In the USA, the audit risk model is adopted and explained in their Statements on Audit Standards AU Section 312, paragraph 26 (AICPA, 2011). The principles and operation of the audit risk formula are described in the ISAs and not explicitly presented as a mathematical formula as they are in the USA's Audit Standards.

2.1 The audit risk model

The audit risk model assists the auditor in measuring and understanding the overall audit risk involved in an audit by:

- breaking overall audit risk up into its constituent risk components and thereby guiding the auditor to assess each component, and
- conceptualising the relationship between these components in the form of a mathematical equation to be able to quantify them.

2.1.1 Components of audit risk

The Glossary of Terms issued by the IAASB and the ISAs define audit risk (AR) further as: "... a function of the risks of material misstatement (RMM) and detection risk (DR)" (SAICA, 2010a:GLOSS-3). Therefore, audit risk consists of the following two components:

- The *risk of material misstatement*. Porter *et al.* (2008:82) describe it as the risk that the financial statements are materially misstated upon engagement. Porter *et al.* (2008:83) further state that this audit risk component is a function of both inherent risk (IR) and control risk (CR). This corresponds with the definition of RMM given in the Glossary of Terms (SAICA, 2010a:GLOSS-15), which defines these two components as follows:
 - "*Inherent risk* - The susceptibility of an assertion about a class of transaction, account balance or disclosure to a misstatement that could be material, ... , before consideration of any related controls."

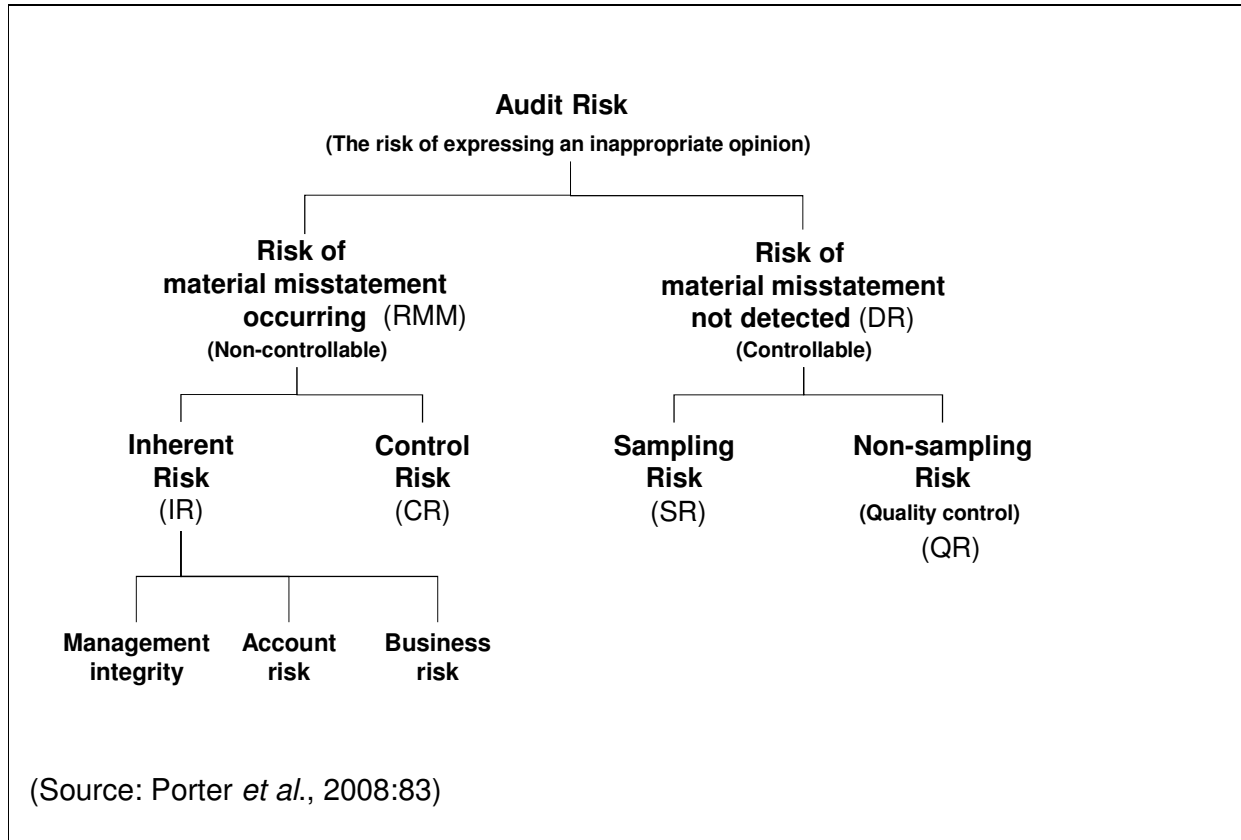
- “*Control risk* - The risk that a misstatement that could occur in an assertion about a class of transaction, account balance or disclosure and that could be material, ... , will not be prevented, or detected and corrected, on a timely basis by the entity’s internal control.”

As these risks should be managed by the entity, the auditor cannot control either of them.

- *Detection risk*. The Glossary of Terms (SAICA, 2010a:GLOSS-6) defines it as the “ ... risk that the procedures performed by the auditor ... will not detect a misstatement that exists and that could be material ...”. According to Porter *et al.* (2008:85), this risk component is a function of sampling risk (SR) and quality control risk (QR):
 - *Sampling risk* refers to the risk that the auditor’s conclusion on the basis of the sample results differs from the conclusion he would have reached should the test have been applied in the same way to the entire population (SAICA, 2010a:GLOSS-15). It is therefore inherent to the sampling process and refers mainly to sample size (Guy, Carmichael & Whittington, 2002:9). This indicates that sampling risk relates to ISA 500, paragraph 4 (SAICA, 2010a:ISA500-2) as well, which requires that the audit evidence obtained has to be sufficient.
 - *Quality control risk* refers to the risk that the evidence obtained is not appropriate or not evaluated properly. This is also referred to as non-sampling risk (Porter *et al.*, 2008:85). This indicates that quality control risk relates to ISA 500, paragraph 4 (SAICA, 2010a:ISA500-2) as well, which requires that the audit evidence obtained should not only be sufficient but also appropriate.

As Porter *et al.* (2008:85) state, both these risk components can be controlled by the auditor, and therefore the level of the overall audit risk can be reduced by planning audit procedures to reduce these risks to a specified level.

Figure 2.1 below illustrates the risk components and how they are interrelated, providing a broad overview of the abovementioned concepts.

Figure 2.1 Components of audit risk

This study focused on one of the controllable factors of audit risk, namely sampling risk, and specifically the methods used to determine sample size, selecting sample items to test and evaluating the test results.

2.1.2 Quantifying audit risk

The auditor needs to be able to conceptualise the relationship of the different components of audit risk as identified above with one another in order to quantify overall audit risk. The audit risk model is based on a simple probability multiplication rule to achieve this. This statistical rule states that the combined probability that two events will both happen ($p[Y \text{ and } Z]$) is the multiple of the probability of each of them happening separately ($p[Y] \times p[Z]$) (Porter *et al.*, 2008:354). The audit risk model consequently expresses these risk component relationships as follows using a mathematical equation (AICPA, 2011):

$$AR = RMM \times DR$$

If the risk of material misstatement (RMM) is replaced with its components as identified in section 2.1.1 above, the equation changes as follows (Cosserat & Rodda 2009:148):

$$AR = (IR \times CR) \times DR$$

Considering the auditor's control over the components in the given equation as it stands, the only component of audit risk that can be controlled by the auditor in performing his audit procedures is DR (detection risk). It can be deduced from the equation that if DR is reduced, AR will reduce as well. Therefore, the audit procedures need to be planned in such a way that the risk of not detecting a material misstatement in the financial statements is at a level that will reduce the overall audit risk to a predetermined acceptable level.

If detection risk is replaced with its components as identified in section 2.1.1 above, the equation changes as follows:

$$AR = (IR \times CR) \times (SR \times QR)$$

The auditor therefore has to plan his procedures in such a way that sampling risk (SR) and quality control risk (QR) will be at an acceptable level. This supports ISA 500's (SAICA, 2010a:ISA500-2) requirement for evidence to be sufficient (sampling risk) and appropriate (quality control risk), as was discussed previously.

When applying the audit risk model in an audit engagement, the auditor will first need to use his professional judgement to determine the level of audit risk (AR) at which he will be comfortable to issue an opinion. Next, assessment procedures need to be performed to evaluate the levels of IR and CR at the particular client. The types of assessment procedures generally used are discussed in section 2.2.1 below. The equation can then be populated with the acceptable AR level as well as with the assessed levels of IR and CR. By solving the equation using simple algebra, the auditor can now determine what the maximum permissible level of detection risk (DR) is for the specific engagement.

The values used to populate the equation can be either numerical or non-numerical (descriptive) (Cosserat & Rodda, 2009:148). Although some widely used textbooks (including Porter *et al.*, 2008 and Cosserat & Rodda, 2009) use numerical examples in

their explanations of the audit risk model, it was found in a study done in the USA by Elder and Allen (2003:985) that the participating firms preferred a non-numerical approach. This finding agrees with the findings of a previous study by Houston in 1999 (as cited by Elder and Allen, 2003).

Knowing what the maximum permissible level of DR is for the audit, the auditor can continue to plan the procedures to perform during the audit, focusing specifically on *inter alia* the following:

- The nature of the procedures: making sure they are appropriate and effectively address quality control risk (QR), and
- The extent of the procedures: making sure it is sufficient, specifically referring to the use of sampling and the size of samples to reduce sampling risk (SR) to the required level.

2.2 Nature of audit procedures (quality control risk)

ISA 500, paragraph A10 (SAICA, 2010a:ISA500-5) groups the audit procedures according to their nature into three broad categories namely:

- Risk assessment procedures;
- Tests of controls; and
- Substantive procedures.

ISA 500 further gives detailed descriptions of specific types of audit procedures that can be performed within each of these categories in paragraphs A14 to A25 (SAICA, 2010a:ISA500-5). Each of these types can be used in more than one category, depending on the objective for which it is performed. The specific types of audit procedures are:

- Inspection of records, documents and/or tangible assets;
- Observation of processes and/or procedures;
- External confirmation, written or otherwise;
- Recalculation of arithmetical calculations on records and/or documents;
- Re-performance of procedures of internal control;
- Analytical procedures of financial and non-financial data; and

- Inquiry of persons within or external to the entity.

A brief description of each of the three categories of audit procedures, with examples of specific types of audit procedures applicable to each, is given in sections 2.2.1 to 2.2.3 below.

2.2.1 Risk assessment procedures

In assessing the level of inherent (IR) and control risk (CR) as discussed in section 2.1.2 above, the auditor has to perform certain risk assessment procedures. According to ISA 315, paragraph 3 (SAICA, 2010a:ISA315-2) the objective of these procedures is to gain an understanding of the entity, the environment in which it functions as well as the internal controls in place within the entity.

According to ISA 315, paragraph 6 (SAICA, 2010a:ISA315-2), the nature of these procedures is mainly inquiries of management and others within the entity, confirmed by analytical procedures, observation and inspection of operations, assets, records and management reports.

2.2.2 Tests of controls

Only if the risk assessment procedures as described in section 2.2.1 resulted in the level of control risk (refer to 2.1.2) being assessed to be at an acceptably low level may the auditor choose to perform tests of controls and rely on the effective controls identified that are relevant to the audit. By doing so, the level of substantive procedures to be done can be reduced (Cosserat & Rodda, 2009:205).

ISA 330 paragraph 8 (SAICA, 2010a:ISA330-3) states that performing tests of controls can have two objectives: firstly to obtain evidence to justify reliance on the operating effectiveness of the internal controls, and secondly to support the evidence obtained from substantive procedures where necessary. Therefore, tests of controls will only be performed on internal controls that are assessed by the auditor to be likely to be effective in preventing, or detecting and correcting errors.

The type of audit procedures used to perform tests of controls, as explained in ISA 330 paragraph A26 (SAICA, 2010a:ISA330-10), is mainly inquiry of responsible persons combined with other audit procedures, such as re-performance, observation or inspection. The objective is to obtain audit evidence about the operating effectiveness of controls in preventing, or detecting and correcting, material misstatements in the financial statements. A further objective is to determine if these controls rely on the effectiveness of any other controls (if so, those other controls will have to be tested as well).

Should the tests of controls indicate a higher than expected deviation rate than that used in the initial assessment of control risk, indicating that control risk is in fact higher than anticipated, the auditor needs to reassess control risk. According to the audit risk model, this increase of control risk will cause the overall audit risk to increase as well. The auditor needs to compensate for the increase in audit risk by adjusting the planned substantive procedures in such a way that detection risk will once again be reduced to an acceptable level. The net effect of the increase in the control risk and the decrease in the detection risk should be insignificant in order to keep the desired audit risk at the required level as determined in the planning phase of the audit (refer 2.1.2).

2.2.3 Substantive procedures

The Glossary of Terms (SAICA, 2010a:GLOSS-17) defines a substantive procedure as follows: “An audit procedure designed to detect material misstatements at the assertion level.” Porter *et al.* (2008:411) states that these procedures should be designed for each amount, account and accounting period as presented in the financial statements. The information in the financial statements to be verified includes the totals and balances on the faces of the statements, as well as disclosures in notes to the financial statements. ISA 330 clearly states in paragraphs 18 and 19 that substantive procedures shall be designed and performed “... for each material class of transactions, account balance and disclosure”. The standard goes further in stating that the auditor “... shall consider whether external confirmation procedures are to be performed...” (SAICA, 2010a:ISA330-4).

Substantive procedures therefore have to be performed in every audit. These procedures can be broadly categorised as either substantive analytical procedures or tests of details, where:

- *Substantive analytical procedures* are defined as follows by ISA 520 in paragraph 4 (SAICA, 2010a:ISA520-2): "... evaluation of financial information through analysis of plausible relationships among both financial and non-financial data. Analytical procedures also encompass such investigation as is necessary of identified fluctuations or relationships that are inconsistent with other relevant information or that differ from expected values by a significant amount."

Hughes, Sander, Higgs and Cullinan (2009:31) emphasised that there are no specific procedures or rules the auditor is required to follow. When using analytical procedures, the auditor has to rely on his professional judgement, and therefore maintain professional scepticism.

From ISA 520 paragraph A6 (SAICA, 2010a:ISA520-3), it is clear that substantive analytical procedures tend to be more applicable to data that consists of a large volume of transactions and that can be reliably predicted over time. This is supported by the finding of the study by Hughes *et al.* (2009:40) that indicated that the participants were better in determining expected values for income statement items that are normally associated with higher volumes of transactions than balance sheet items. The study further found that auditors with a higher level of experience were better in predicting data than entry-level auditors.

- *Tests of details* are further classified as either tests of balances or tests of transactions:
 - *Tests of transactions* are defined by Cosserat and Rodda (2009:315) as: "... tests to obtain evidence of a sample (or all) of the individual debits and credits that make up an account to reach a conclusion about the account balance."

The type of procedures performed will typically include the inspection of records and/or related source documents, and the recalculation of arithmetical calculations on records and/or related source documents.

- *Tests of balances* on the other hand focus not on the underlying transactions of a balance, but the balance itself. An example would be debtors' confirmations as audit evidence of debtors' balance on the Statement of Financial Position (Porter *et al.*, 2008:262).

The type of procedures performed in tests of balances will typically include inspection of tangible assets and external confirmation.

2.3 Extent of audit procedures (sampling risk)

Once the nature and type of audit procedures to be performed have been determined, thereby addressing the quality risk component of detection risk, the remaining component, sampling risk, needs to be addressed (refer 2.1.2 above). This is done by determining the number of items to be tested and the method of selecting the items from the total population. According to ISA 500 paragraph A52 (SAICA, 2010a:ISA500-12), the auditor has the following selection options:

- Testing the entire population that makes up a specific balance or a class of transactions;
- Selecting specific items on the basis of certain criteria, for example high value, key items, items over a certain value threshold or items containing specific information; and
- Using audit sampling, as defined in ISA 530, paragraph 5(a) (SAICA, 2010a:ISA530-2): Selecting "... less than 100% of items within a population... such that all sampling units have a chance of selection... to provide the auditor with a reasonable basis on which to draw conclusions about the entire population."

The main focus of this study was to investigate certain key aspects of the use of the third option above, namely sampling, in audits by South African Registered Auditors accredited by the JSE.

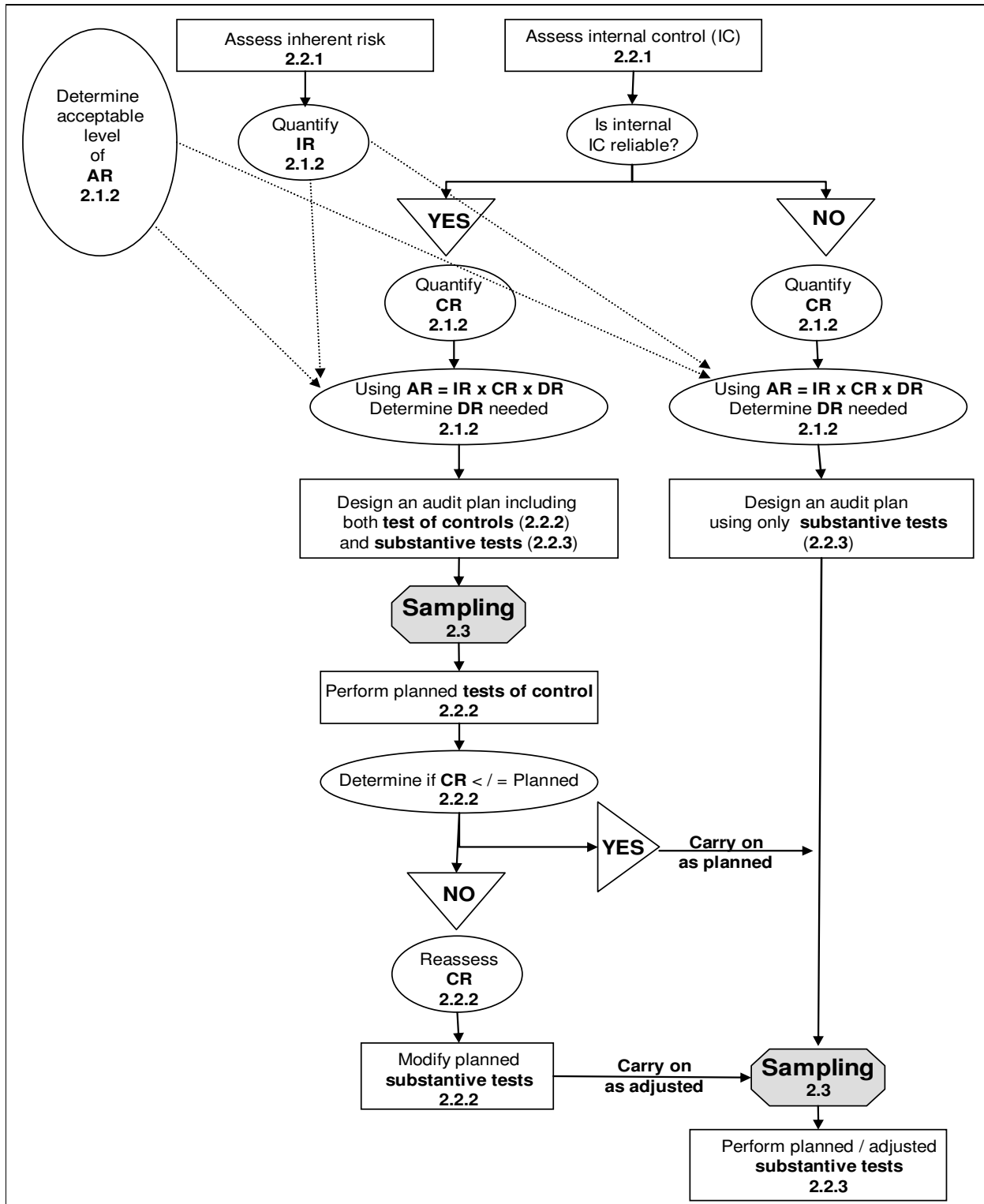
2.4 Summary

This chapter provided a broad overview of the process of obtaining the necessary audit evidence to enable an auditor to express an opinion on financial statements. The overview was based on a review of the relevant ISA requirements and internationally recognised textbooks.

Figure 2.2 illustrates the logical flow of this process as described in the chapter. The shaded blocks indicate where audit sampling fits into the audit process for both tests of controls and substantive procedures.

The next chapter provides an overview of how the use of audit sampling is prescribed in audit textbooks for use in both tests of controls and substantive procedures, should an auditor decide to use audit sampling as defined by ISA 530. The main differences between statistical and non-statistical sampling approaches are also discussed.

Figure 2.2 Sampling and risk assessment in the audit process



CHAPTER 3

A THEORETICAL OVERVIEW OF AUDIT SAMPLING

In the previous chapter the audit risk model and its components were briefly introduced. This chapter focuses on the sampling risk (SR) component of the audit risk model, therefore on the *extent* to which audit testing is to be done. To achieve this, a literature review of the relevant ISAs and textbooks¹ that focus specifically on statistical sampling in auditing and that were published after 2000, was done.

3.1 The relationship between sampling risk and sample size

The sampling risk (SR) component of the audit risk model was described in chapter 2, section 2.1.2. By minimising sampling risk (SR), audit risk (AR) is also reduced. This can be seen from the audit risk model in its extended form below:

$$AR = (IR \times CR) \times (SR \times QR)$$

From the audit risk model it can be seen that once inherent risk (IR) and control risk (CR) have been determined and quantified (numerically or otherwise) and quality control risk (QR) assessed, the only remaining variable the auditor can control is sampling risk (SR). Therefore the auditor needs to determine the level to which sampling risk (SR) has to be reduced in order to reduce audit risk (AR) to the predetermined acceptable level.

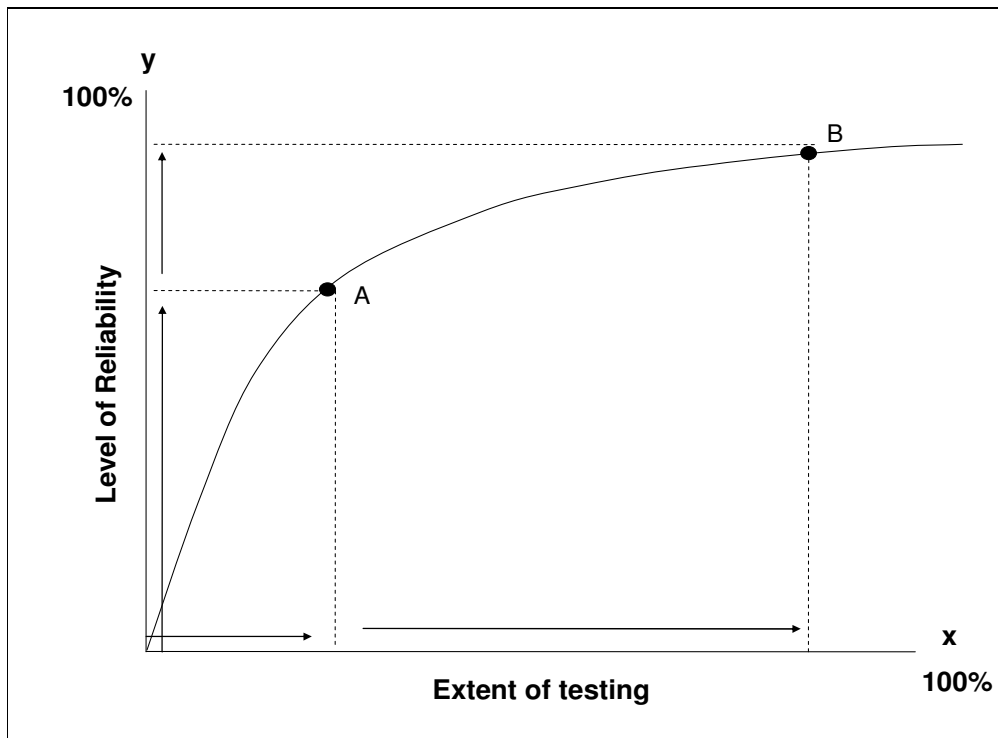
Since sampling risk (SR) refers to the risk that the auditor's conclusion based on the sample results differs from the conclusion he would have reached when applying the same tests to the population as a whole (refer to chapter 2, section 2.1.1), the sampling risk will reduce as the sample size increases. In other words, the higher the extent of testing (greater sample size), the higher the reliability of the test results (lower sampling risk). Therefore, it will only be in the rare circumstances where the auditor needs a maximum level of assurance that he will test all the items in a population.

The relationship between the extent to which testing is done and the level of assurance (being the inverse of sampling risk) obtained regarding the financial information tested is a

¹ This chapter includes a review of relevant textbooks, whereas a review of relevant academic research papers is presented in Chapter 4.

positive non-linear relationship that can be illustrated using a graph (see Figure 3.1 below) (Guy *et al.*, 2002:9).

Figure 3.1 Relationship between extent of testing and reliability of test results



By performing audit procedures on a small sample, a relatively high degree of assurance can be achieved – point A on the graph in Figure 3.1. By increasing the sample size from A to B, a relatively low degree of additional assurance can be obtained from the extra testing done – point B. *Therefore, somewhere between points A and B is an optimum sample size where reward (in the form of assurance) for effort (in the form of extent of testing) is maximised.* Should less than the optimum testing be done, the resulting reliability of the findings of the tests would be significantly lower, causing sample risk (SR) to increase, therefore detection risk (DR) to increase, and ultimately the audit risk (AR) to increase. On the other hand, should more than the optimum testing be done, the resulting reliability of the findings would not significantly increase, causing sample risk (SR) not to decrease significantly, and consequently having no significant effect on the audit risk (AR). In the latter example the additional testing done would be inefficient and would add unnecessary costs to the audit.

ISA 530 paragraph A11 (SAICA, 2010a:ISA530-5) gives the auditor a choice to use either a statistical or a non-statistical approach in attempting to find this optimal sample size.

3.2 The fundamental differences between statistical and non-statistical sampling

The basic difference between a statistical and a non-statistical sampling approach is that in using a statistical approach the auditor can mathematically calculate and quantify the reliability of the test and the level of sampling risk involved. This is done by using the scientific principles of probability to calculate what the extent of testing should be in order to achieve a given level of assurance that was determined previously by using the audit risk model. This also enables the auditor to scientifically project the results of the tests after they have been performed to the population in order to form an opinion on the population as a whole (Guy *et al.*, 2002:8). When a non-statistical approach is used, all of the above are done purely by exercising professional judgement as opposed to applying scientific probability theory.

ISA 530 paragraph 5(g) (SAICA, 2010a:ISA530-2) states specifically that for an audit sampling approach to qualify as a statistical approach, the following elements should be present:

- The selection of the sample items is *random* (therefore each item has to have an equal chance of being selected (Steyn, Smit, Du Toit & Strasheim, 2003:21)); and
- *Probability theory* is used to evaluate the sample results, as well as to measure sampling risk.

This supports the notion in Marx *et al.* (2009:11-9), as was mentioned in chapter 1, that statistical sampling is the use of a combination of mathematical and statistical applications to the following ends:

- determining the number of items to test (size of the sample);
- selecting the items to be tested (inclusion of items in the sample); and
- evaluating the results of the tests performed and project those results to the affected population as a whole.

Table 3.1 below illustrates for each of these steps the main differences between a statistical and a non-statistical sampling approach.

Table 3.1 Steps in sampling: statistical versus non-statistical

Sampling step	Statistical	Non-statistical
<p>1. Determine size</p>	<p>Size is calculated mathematically by using statistical formulas based on probability theory to reduce sampling risk below the acceptable level as determined in the planning phase (ISA 530 paragraph A11 (SAICA, 2010a:ISA530-5)).</p>	<p>Size is determined purely on the basis of professional judgement, taking into consideration the acceptable level of sampling risk as determined in the planning phase (ISA 530 paragraph A11 (SAICA, 2010a:ISA530-5)).</p>
<p>2. Select items</p>	<p>Items are selected using a structured random selection method, guaranteeing that each item has a known probability of being selected (ISA 530 paragraph A12 (SAICA, 2010a:ISA530-5)).</p> <p>Examples of statistical sample selection methods include the following:</p> <ul style="list-style-type: none"> • <i>Simple random</i> – items are selected by using random digits that can be generated in various ways. Statistical random number tables are readily available, as are computerised versions (Steyn <i>et al.</i>, 2003:22). • <i>Stratified random</i> – items with specific characteristics are grouped into different strata. Items are then randomly selected from each stratum. The number of items to be selected from each stratum is proportional to the size of that stratum in the population (Steyn <i>et al.</i>, 2003:25). • <i>Systematic with a random start</i> – the starting point is determined using a random number generator, and subsequent items are selected on a fixed interval calculated on the basis of the required sample size (e.g. each 10th item) (Steyn <i>et al.</i>, 2003:30). 	<p>Items are selected using professional judgement (ISA 530 paragraph 12 (SAICA, 2010a:ISA530-5)).</p> <p>Examples of non-statistical sample selection methods (ISA 530 Appendix 4 (SAICA, 2010a:ISA530-11)):</p> <ul style="list-style-type: none"> • <i>Haphazard</i> – no structured technique, attempting to avoid bias as far as possible. • <i>Block selection</i> – using blocks of continuous items in population (e.g. all invoices in a specific month of a financial year).

<p>3. Evaluate results</p>	<p>Results of tests performed are scientifically projected to the population as a whole by using statistical inference, which assists in drawing conclusions by performing certain mathematical calculations (Steyn <i>et al.</i>, 2003:5).</p>	<p>Projection of findings is done using professional judgement.</p>
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It can be seen from the comparison of the statistical and non-statistical sampling steps in Table 3.1 that the auditor has more structured guidance available when using a statistical approach. The structure of the statistical approach makes documenting all the steps in the sampling process easier, which is an additional benefit.

At a glance the assumption can easily be made that professional judgement is really used only in non-statistical sampling. That assumption would be incorrect. Professional judgement plays a key role in each of the statistical sampling steps:

- **Sample size:** The statistical formulas used are based on the assessed level of sampling risk as determined in the planning phase. In chapter 2 it was indicated that this assessment is done by the auditor using his professional judgement.
- **Selecting items:** There are three possible statistical selection methods from which the auditor has to choose. He makes this choice by using his professional judgement.
- **Evaluate results:** The evaluation process and calculations used will be a direct result of the sampling plan chosen by the auditor in the planning phase. He makes this choice by using his professional judgement.

Table 3.1 focused on the main differences between an overall statistical or non-statistical approach. Audit sampling can be used as a tool in performing tests of controls and substantive procedures, as was illustrated in Figure 2.2. The more specific differences between a statistical and a non-statistical approach in each of these types of testing are discussed in the following two subsections.

3.2.1 Statistical versus non-statistical approaches specifically in tests of controls

Presented in Table 3.2 are the general steps followed when tests of controls are performed, as well as the differences between a statistical and a non-statistical approach

in each of these steps, as adapted from Guy *et al.* (2002:52). For illustration purposes the statistical approach is based on the fixed-sample-size sampling plan (refer to section 3.3.1), since it is the least complex of the options.

Table 3.2 Steps in tests of controls: statistical versus non-statistical

Step in tests of controls	Statistical approach	Non-statistical approach
1. Define the objective of the audit procedure to be performed.	No difference between statistical and non-statistical approaches.	
2. Define the following: <ul style="list-style-type: none"> • The populations to be tested. • The controls to be tested. • What would constitute an “error” or deviation. 	No difference between statistical and non-statistical approaches.	
3. Ensure the populations to be tested are complete and available for selection.	No difference between statistical and non-statistical approaches.	
4. Determine the following variables: <ul style="list-style-type: none"> • Risk of assessing control risk (CR) too low • Level of tolerable error (the maximum level of deviation the auditor will accept without adjusting his original evaluation of control risk) 	<p>All three variables below are quantified as a percentage by applying professional judgement.</p> <ul style="list-style-type: none"> • As this is by definition the inverse of reliability, it can be calculated as $(1 - \text{reliability})$. For example, should the auditor need a reliability (confidence) level of 95%, the risk of being wrong will equal $(1 - 0.95) = 0.05 = 5\%$. • On the basis of the initial assessment of control risk and the level of assurance needed from the test, the auditor will, for example, set the acceptable deviation rate at 2% for control risk at a low level, or 7% at a medium level (in some firms predefined within the firm’s audit methodology). 	<p>The levels of each variable are also determined judgementally. It is, however, not necessary to quantify each level as a percentage (mostly classified as high, medium or low).</p>

Step in tests of controls	Statistical approach	Non-statistical approach
<ul style="list-style-type: none"> The expected deviation rate 	<ul style="list-style-type: none"> This should be either very low or zero. Should there be a significant expected error rate; the question arises if you should be relying on this control at all. 	
<p>5. Determine the sample size using the above variables.</p>	<p>The sample size is determined by using specific statistical tables and the quantified variables in step 4 above.</p> <p>The specific statistical table to be used depends on the sampling plan the auditor decides to use. The auditor takes the objective of the test into account in deciding which sampling plan to use.</p> <p>(The specific statistical theory and formulas behind the tables do not fall within the scope of this study.)</p> <p>Guy <i>et al.</i> (2002:44) describe the following sampling plans:</p> <ul style="list-style-type: none"> Fixed-sample-size (attribute estimation) Sequential (stop-or-go) Discovery sampling <p>The discussion presented in this table is based on the fixed-sample-size plan.</p> <p>The main differences between this sampling plan and the remaining two are briefly discussed in section 3.3.1 below.</p>	<p>Sample size is determined purely on the basis of professional judgement, without any mathematical calculations.</p>
<p>6. Select the items to be tested from the population.</p>	<p>The items to be included in the sample are selected by using one of the statistical methods as discussed above in Table 3.1, point 2.</p>	<p>The items are selected using either haphazard selection or block selection as discussed above in Table 3.1, point 2.</p>
<p>7. Perform planned audit procedure on items in the sample.</p>	<p>No difference between statistical and non-statistical approaches.</p>	

Step in tests of controls	Statistical approach	Non-statistical approach
<p>8. Evaluate results of audit procedures.</p>	<ul style="list-style-type: none"> • Quantitatively: Statistical tables are used to extrapolate the deviation rate as found in step 7 above to the population as a whole. These tables adjust the actual rate of deviations found in the sample with a sampling risk factor in order to project it to the population as a whole. (The specific statistical theory and formulas behind the tables do not fall within the scope of this study.) • Qualitatively: For each deviation found regardless of monetary value, the impact on the overall audit strategy is considered by using professional judgement. 	<ul style="list-style-type: none"> • Quantitatively: Using professional judgement only (no specific indication of the adjustment of the actual deviation rate of the sample with a sampling risk factor to a projected deviation rate for the population as a whole). • Qualitatively: For each deviation found regardless of monetary value, the impact on the overall audit strategy is considered by using professional judgement only.
<p>9. Consider the combined effect of the results of the tests of controls on the initial CR assessment.</p> <p>Should the projected deviation rate be higher than the tolerable deviation rate, CR would increase. If this increase is significant, the nature, timing and extent of the planned substantive procedures should be reassessed.</p>	<p>No difference between statistical and non-statistical approaches.</p>	

When the more specific steps within a specific type of test are considered, as was done above for tests of controls, the higher extent of structure of the statistical sampling approach compared to that of a non-statistical approach becomes more obvious than in Table 3.1.

The necessity for and high level of reliance placed on professional judgement when using a typical statistical approach is also more noticeable, as is summarised below:

- *Size calculation:* In step 4 it is clear that all the variables needed for the calculation of the sample size in step 5 are determined using professional judgement. Further, the auditor has to select a sampling plan (which is discussed briefly in section 3.3) using his professional judgement. Then only can he calculate the sample size given the requirements of the sampling plan chosen.
- *Selection method:* The auditor then has to decide, again using his professional judgement, on the statistical selection method to use (discussed previously).
- *Evaluation:* In evaluating the results quantitatively, the results are projected to the population using the sample risk factor as determined judgementally in step 4. The qualitative evaluation is done purely by applying professional judgement.

All three the overall sampling steps therefore require the auditor to use his professional judgement in one way or another.

3.2.2 Statistical versus non-statistical approaches specifically in substantive procedures

Presented in Table 3.3 (based on the same format as in Table 3.2) are the general steps followed when substantive procedures are performed, according to Guy *et al.* (2002:161). The differences in each of these steps when using a statistical approach (Guy *et al.*, 2002:161) and a non-statistical approach (Guy *et al.*, 2002:225) are presented in the adjacent columns. For illustration purposes the statistical approach is based on the unstratified mean per unit method (refer to section 3.3.2), since it is the least complex of the options.

Table 3.3 Steps in substantive procedures: statistical versus non-statistical

Step in substantive procedures	Statistical approach	Non-statistical approach
1. Define the objective of the audit procedure to be performed.	No difference between statistical and non-statistical approaches.	
2. Define the specific balance to be tested.	No difference between statistical and non-statistical approaches.	
3. Ensure all items making up the balance are available for testing (the population to be tested is complete).	No difference between statistical and non-statistical approaches.	
<p>4. Determine the following variables:</p> <ul style="list-style-type: none"> • Risk of incorrectly identifying a balance to be materially misstated (alpha-risk). • The reliability factor (UR), by using the above reliability estimation. • Tolerable misstatement amount (TM) for the specific population. 	<ul style="list-style-type: none"> • As this is by definition the inverse of reliability, it can be calculated as $(1 - \text{reliability})$. For example, should the auditor need a reliability (confidence) level of 95% based on his professional judgement, the risk of being wrong will equal $(1 - 0.95) = 0.05 = 5\%$. • UR can be read off a statistical table, namely the normal curve area table. (The specific statistical theory and formulas behind the tables do not fall within the scope of this study.) • TM is quantified as a maximum acceptable rand amount, based on the professional judgement of the auditor. (See ISA 320 – performance materiality.) 	<ul style="list-style-type: none"> • Not applicable • Not applicable • Referred to as the basic allowance (Ba) by Guy <i>et al.</i> (2002:226), this is determined purely through professional judgement, adjusting the planned overall materiality figure to the specific population estimations of uncorrected known misstatements, expected projected misstatement, increase in imprecision as well as a safeguard against possible over-estimates.

Step in substantive procedures	Statistical approach	Non-statistical approach
<ul style="list-style-type: none"> • Estimated standard deviation (SD). • Population size (N). • Risk of not identifying a material misstatement as a result of using sampling, in statistical terms known as beta-risk (TD). • The beta-risk coefficient (Zbeta) by using the above estimated value of beta-risk (=SR). • Acceptable precision amount (A). • A risk factor (Rf) based on beta-risk. • Cut-off limit for individually significant items. 	<ul style="list-style-type: none"> • Estimation is done by using a pilot sample to calculate SD as a rand value. • Determine number of items making up the total balance. • Using the audit risk model as described in 2.1.2, the auditor can calculate sampling risk (SR). Sampling risk is the same as beta-risk by definition. • Zbeta can be read off a statistical table, namely the normal curve area table. (The specific statistical theory and formulas behind the tables does not fall within the scope of this study.) • TM needs to be adjusted taking into account the above alpha and beta-risk calculation by using the following statistical formula: $A = TM \times [UR / (UR + Zbeta)]$ (The specific statistical theory behind the formula does not fall within the scope of this study.) • Not applicable • Not applicable 	<ul style="list-style-type: none"> • Not applicable • Same as statistical approach • Same as statistical approach • Not applicable • Not applicable • On the basis of TD and using professional judgment, the auditor determines a risk factor (Rf) to adjust sample size for possible imprecision. • The auditor determines judgementally, on the basis of the basic allowance amount, above which amount specific items would be considered individually significant.

Step in substantive procedures	Statistical approach	Non-statistical approach
<p>5. Determine the sample size (n') taking the above into consideration.</p>	<p>The sample size is determined by using the variables as determined above in a specific statistical formula used in the hypothesis testing model.</p> <p>The general formula for calculating sample size on the basis of hypothesis testing is as follows:</p> $n' = [(UR \times SD \times N) / A]^2$ <p>This yields the appropriate sample size for sampling with replacement.</p> <p>Sampling without replacement is normally used in auditing and therefore the sample size can be decreased by the following formula:</p> $n = [n' / (1 + (n' / N))]$ <p>The formula for n' should be adjusted slightly depending on the sampling plan the auditor decided to use.</p> <p>(The specific statistical theory behind the formula does not fall within the scope of this study.)</p> <p>Guy <i>et al.</i> (2002:99) describe the following sampling plans:</p> <ul style="list-style-type: none"> • Unstratified mean per unit (simple extension) • Stratified mean per unit (also referred to in ISA 530 paragraph A8 (SAICA, 2010a:ISA530-3)) • Difference estimation • Monetary unit sampling (probability-proportional-to-size sampling) (also referred to in ISA 530 paragraph A8 (SAICA, 2010a:ISA530-3)) <p>The formulas presented in this table are based on the unstratified mean per unit sampling plan.</p>	<p>The final sample size is determined in two separate steps:</p> <ul style="list-style-type: none"> • The number of all the items that are individually significant is determined, as they have to be included in the sample. • The auditor then determines the value of the remaining items in the population (Rn) (total population value less value of significant items). <p>The number of items to be selected from the remainder of the population can then be determined by using the following formula:</p> $n = (Rn / Ba) \times Rf$

Step in substantive procedures	Statistical approach	Non-statistical approach
	<p>The main differences between this sampling plan and the remaining three are briefly discussed in 3.3.2 below.</p>	
<p>6. Select the items to be tested from the population.</p>	<ul style="list-style-type: none"> • Not applicable • The items to be included in the sample are selected by using one of the statistical methods as discussed above in Table 3.1 point 2. • Guy <i>et al.</i> (2002:169) suggests that a representativeness test be performed after the items have been selected by comparing the average of the book value of the sample to the average of the book value of the population. These two should not differ significantly. 	<ul style="list-style-type: none"> • All the significant items as determined in step 4 above are automatically selected for testing. • The additional items to be tested as determined in step 5 above are selected using either haphazard selection or block selection, as discussed above in Table 3.1 point 2. • Not applicable
<p>7. Apply planned audit procedure.</p>	<p>No difference between statistical and non-statistical approaches.</p>	
<p>8. Evaluate results of audit procedures.</p>	<p>Qualitative:</p> <ul style="list-style-type: none"> • Analyse the identified misstatements for possible individual materiality on the basis of their nature and cause, using professional judgement. <p>Quantitative:</p> <ul style="list-style-type: none"> • Calculate the precision level achieved for the sample (A') as follows: <ul style="list-style-type: none"> ○ Calculate the SD for the sample. ○ Using SD, calculate the standard error of the mean (SE) using the formula: 	<p>Qualitative:</p> <ul style="list-style-type: none"> • Analyse the identified misstatements for possible individual materiality on the basis of their nature and cause, using professional judgement. <p>Quantitative:</p> <ul style="list-style-type: none"> • Calculate for each misstatement the proportion (Mp) to the value of the item for which it has been identified (misstatement value divided by the original book value). • Calculate the sum of all the Mps for the specific sample.

Step in substantive procedures	Statistical approach	Non-statistical approach
	<p>$SE = (SD / \sqrt{n})$</p> <ul style="list-style-type: none"> Now using the above calculate A' as follows: $A' = UR \times SE \times N \sqrt{1 - \left(\frac{n}{N}\right)}$ <p>As for the formula used for calculating sample size, slight adjustments should be made depending on the sample plan used. (The specific statistical theory behind the formula does not fall within the scope of this study.)</p> <ul style="list-style-type: none"> Should the achieved precision (A') not be equal to acceptable precision (A), A' should be adjusted as follows: $A'' = A' + TM [1 - (A'/A)]$ <p>The formula adjusts the achieved precision by a risk factor equal to the planned beta-risk (TD), as was discussed previously.</p> <p>(The specific statistical theory behind the formula does not fall within the scope of this study.)</p> <ul style="list-style-type: none"> Calculate a decision interval using the value of the population as the starting point and the above adjusted achieved level of precision (A''). (Interval beginning at population value minus A'' and ending at book value plus A''). Now calculate an estimated audited value (EAV) by using the adjusted mean of the sample after performing audit procedures and multiplying it by the total number of items in the population (as required by ISA 530 paragraph A20 (SAICA, 2010a:ISA530-6)). 	<ul style="list-style-type: none"> Calculate a projected misstatement (Pm) for the population as a whole (as required by ISA 530 paragraph A20 (SAICA, 2010a:ISA530-6)). The projection can be done by multiplying the sum of the misstatement proportions ($\sum Mp$) by the total book value of the population (Bv) and dividing the answer by the number of items in the sample (n): $Pm = (\sum Mp \times Bv) / n$ <ul style="list-style-type: none"> This projected misstatement (Pm) should be taken into account with all the other misstatements identified in the course of the audit by the auditor in forming his overall audit opinion, taking into account any adjustments made by management (also required by ISA 530 paragraph A22 and 23 (SAICA, 2010a:ISA530-6)).

Step in substantive procedures	Statistical approach	Non-statistical approach
	<ul style="list-style-type: none"> Should the EVA fall within the decision interval, the auditor can conclude that the population value is not materially misstated, as supported by statistical evidence. <p>However, should EVA fall outside the decision interval, the population should be investigated by management at transaction detail level to identify the cause of the misstatements and the possibility of further misstatements. The client then has to make the necessary adjustments to the population value.</p> <p>The auditor should reassess the timing, nature and extent of the remainder of the substantive procedures to be performed on the basis of the results above, taking into account any management adjustments made (also required by ISA 530 paragraph A22 and A23 (SAICA, 2010a:ISA530-6)).</p>	

From Table 3.3 it is evident that when using audit sampling in substantive procedures, the sampling process requires more specific considerations, calculations and steps than in tests of controls for both a statistical and non-statistical approach. The evaluation process for substantive procedures, in particular for both approaches seems more complex than the evaluation process used in tests of controls.

The typical statistical approach above does appear to be very complex, given all the mathematical equations involved. Once the operation is understood, however, the same framework is used in all audit engagements and the application and interpretation stay the same.

The same observations regarding the role of professional judgement in the steps involved in substantive procedures can be made from Table 3.3 as that of tests of controls from Table 3.2 in the previous section.

3.3 Specific statistical sampling plans

In the above comparisons between typical statistical and non-statistical approaches in both tests of controls and substantive procedures, it was mentioned in the statistical approaches that the auditor needs to choose between specific statistical sampling plans. The specific statistical sampling plan the auditor chooses to follow is generally determined by the objective of the audit procedures to be performed, as well as by the characteristics of the population.

The following two subsections contain a brief overview of the relevant sampling plans in tests of controls and substantive procedures. The overview uses Table 3.2 as a reference point for the tests of controls sampling plans presented in section 3.3.1 below, and Table 3.3 for sampling plans used in substantive procedures as discussed in section 3.3.2 below.

3.3.1 Statistical sampling plans used in tests of controls

The following statistical sampling plans are available for use in tests of controls (Guy *et al.*, 2002:44):

- **Fixed-sample-size sampling plan**

The objective of the fixed-sample-size sampling plan is to estimate the deviation rate of a specific control in a population by estimating the probability that a specific proportion of the items is deviating from the control procedure being tested (Arkin, 1974:82).

The statistical approach used in Table 3.2 is based on the fixed-sample-size sample plan and therefore gives a detailed explanation of its operation.

- **Sequential sampling plan**

The objective of the sequential sampling plan is to determine if the projected control deviation is below a specified level (tolerable deviation rate) in a population. The expected deviation rate will therefore be set at zero at first, and if no errors are found in the first round of testing, testing can be stopped and the projected error rate should then be below the tolerable error rate (Cosserat & Rodda, 2009:286).

Guy *et al.* (2002:62) explains the working of the sequential sampling plan in detail. The following main differences between sequential sampling and fixed-sample-size sampling can be identified:

- *Determining variables* (step 4, Table 3.2): In the sequential sampling plan the expected deviation rate is set at zero percent to start with. Therefore, in contrast to the fixed-sample-size sampling plan, no professional judgement is required.
- *Sample size* (step 5, Table 3.2): The same statistical table will be used, but the lower deviation rate used in sequential sampling will generate a smaller sample size than that of the fixed-sample-size sampling plan.
- *Evaluation of results* (step 8, Table 3.2): Should no deviation be found in the sample in a sequential sampling plan, the auditor can conclude that the deviation rate is below the tolerable deviation rate. However, should a deviation be found, the original sample should be expanded. (In contrast to the fixed-sample-size sampling plan, no statistical table is needed for the initial evaluation of the results.)
- *Size of extended sample (only in the sequential sampling plan)*: By using the confidence level initially determined and the number of deviations found in the first round of testing, an adjusted risk factor can be read off a specific statistical table (the specific statistical theory and formulas behind the tables do not fall within the scope of this study). This adjusted risk factor is divided by the tolerable deviation rate to produce an adjusted sample size. The additional items to be selected and tested can be determined by deducting the original sample size from this number.

- *Selection of items and evaluation of results of the extended sample (only in the sequential sampling plan):* These are done in the same manner as the initial sample. When the auditor extends the sample to a point at which further extension is not going to be cost-effective and still finds deviations in the last extension, the conclusion should be drawn that the controls tested cannot be relied upon. The auditor will need to reassess the nature, timing and extent of substantive procedures to be done at this point.

According to Guy *et al.* (2002:62) the sequential sampling plan is only effective in fairly large populations with more than a thousand items.

- **Discovery sampling plan**

The objective of the discovery sampling plan is to find a specific significant deviation. Should this deviation be found, this acts as an indication to the auditor of possible fraud or significant misstatements in the financial statements. Therefore, the auditor would do more detailed testing of the specific balance affected by the deviation (McRae, 1974:3).

Guy *et al.* (2002:70) explain the working of the discovery sampling plan in detail. The following main differences between the discovery sampling plan and the sequential and fixed-sample-size sampling plans can be identified:

- *Determining variables* (step 4, Table 3.2): Like in the sequential sampling plan, in the discovery sampling plan the expected deviation rate is also set at zero percent to start with. Therefore, in contrast to the fixed-sample-size sampling plan, no professional judgement is required.
- *Sample size* (step 5, Table 3.2): The statistical tables used to determine the sample size differ from the one used in the sequential and fixed-sample-size sampling plans. One of three different tables must be used, depending on the population size: one for population sizes between two thousand and five thousand; one between five thousand and ten thousand; and one for more than ten thousand items.

- *Evaluation of results* (step 8, Table 3.2): The evaluation is done in the same manner as in the sequential sampling plan, except that there is no option to extend the sample size. Therefore, if no deviation is found in the sample, the auditor can conclude that the deviation rate is below the tolerable deviation rate. Should a deviation be found, the nature, timing and extent of substantive procedures should be reassessed. (In contrast to the fixed-sample-size sampling plan, no statistical table is needed for the initial evaluation of the results.)

According to Guy *et al.* (2002:70) the discovery sampling plan is only effective in very large populations with more than two thousand items.

3.3.2 Statistical sampling plans in substantive procedures

The following statistical sampling plans are available for use in substantive procedures (Guy *et al.*, 2002:99):

- **Unstratified mean per unit sampling plan**

The objective of the unstratified mean per unit sampling plan is to determine a projected value for the population being tested. This is done by first calculating the mean of the sample after adjusting all items for any identified errors. This adjusted mean is then multiplied by the number of items in the population to calculate an estimated audited value (EAV) for the population (Cosserat & Rodda, 2009:287). Using the performance materiality of the population, an acceptable interval of values over and under the book value is calculated. Should the EAV fall within this interval, the auditor will accept the book value. If not, he will have to refer the population to the client for restatement and reassess the timing, nature and extent of other substantive procedures (Guy *et al.*, 2002:99).

The statistical approach used in Table 3.3 is based on the unstratified mean per unit sampling plan.

- **Stratified mean per unit sampling plan**

The objective of the stratified mean per unit sampling plan is fundamentally the same as that of the unstratified mean per unit sampling plan in that it is used to determine a projected value for the population tested. The main difference between the two sampling plans is that the stratified mean per unit sampling plan divides the total population tested into subpopulations on the basis of specific identifiable characteristics (normally rand value). These subpopulations are tested separately, and projected values for each of them are calculated and added together to determine a projected value for the total population (Cosserat & Rodda, 2009:287).

The reason for this division, as explained by Guy *et al.* (2002:105), is that if an unstratified mean per unit sampling plan is used in a population that includes very high and very low values, it could result in relatively large sample sizes. If the population in a stratified mean per unit sampling plan is divided into strata, the resulting sample size when the samples in each individual stratum are combined is expected to be smaller.

The same steps as in the unstratified mean per unit sampling plan are followed in each stratum of the stratified mean per unit sampling plan. The statistical formulas are also the same, except that in stratified mean per unit sampling they are used separately for each stratum, and the projected audited values for the strata are then added to determine the EAV for the population as a whole (Guy *et al.*, 2002:107).

- **Difference estimation sampling plan**

The objective of the difference estimation sampling plan is to determine a projected value for the population by adjusting the book value by a projected population difference (Cosserat & Rodda, 2009:287).

Guy *et al.* (2002:112) give a detailed explanation of the working of a difference estimation sampling plan. It can be seen that the steps in the unstratified mean per unit sampling plan as set out in Table 3.3 above stay essentially the same in difference estimation sampling, except for the following:

- *Determining variables* (step 4, Table 3.3): In the difference estimation sampling plan a standard deviation of differences (SD_d) is calculated. Guy *et al.* (2002:110) suggest a pilot sample of 30 items, with differences found to be used to calculate the standard deviation of the differences.
- *Sample size* (step 5, Table 3.3): The logic of the statistical formula stays the same, but instead of using the standard deviation (SD) of the value of the population, only the standard deviation of differences (SD_d) of the population as determined above is used.
- *Evaluation of results* (step 8, Table 3.3): The same applies to the evaluation of the results: the logic of the statistical formulas used to calculate the achieved precision of the audit procedures stays the same. The SD is again replaced with SD_d , used in calculating the standard error of differences (SE_d) using the same formula. This SE_d replaces SE in the formula for calculating the achieved precision (A') for the population. A decision interval can now be set using the same principles as in Table 3.3.

To determine an estimated audited value (EAV) for the population, the mean of the differences is calculated first, and then a total population difference is calculated by multiplying the mean by the total number of items in the populations. This calculated population difference is then added to (if the difference is positive) or subtracted from (if the difference is negative) the book value to determine the EAV.

The difference estimation sampling plan can also make use of stratification to increase efficiency in certain circumstances. The same logic in converting an unstratified mean per unit sampling plan to a stratified mean per unit sampling plan as discussed above can be applied.

- **Monetary unit sampling**

Although monetary unit sampling is a substantive procedure of the rand value of a population, it incorporates selection elements typical to those of tests of controls. To achieve this, each rand in a population is seen as an individual item available for selection. Should a specific rand be selected by means of the selection method, the

full amount of which it forms part should be tested. In the event of a deviation being found, the deviation amount of the item is divided by the rand value to determine the specific deviation rate of that specific rand (tainting) that was selected (Cosserrat & Rodda, 2009:287). For example, if an amount of R250 is selected and testing reveals that it was understated by R50 (audited value should be R300), each rand in the amount would be understated by R50 divided by R250, therefore by R0.20 (twenty cents).

Based on the detailed description by Guy *et al.* (2002:203) a brief overview of the workings of the monetary unit sampling plan is presented below in Table 3.4. The same format that was used in Tables 3.2 and 3.3 is used below for easy comparison.

Table 3.4 Steps in monetary unit sampling

Step in sampling plan	Monetary unit sampling (MUS)
1. Define the objective of the audit procedure to be performed.	Specify the specific balance to be tested for possible material misstatement.
2. Define the population to be tested.	Each rand making up the balance as specified above.
3. Determine the following variables: <ul style="list-style-type: none"> • The book value of the population (BV). • Risk of not identifying a material misstatement (beta-risk) (TD). • The upper misstatement limit (UMLx) for the specific risk. • Tolerable misstatement amount (TM) for the specific population. 	<ul style="list-style-type: none"> • Total book value (BV) of the population can be obtained from the accounting records. • TD can be calculated by determining the sampling risk factor (SR) in the audit risk model, as was discussed in section 2.1.2 of chapter 2. • UMLx is found in a specific statistical table based on the expected number of errors. (The theory and formulas behind the statistical tables do not fall within the scope of this study.) • TM is quantified as a maximum acceptable rand amount, based on the professional judgement of the auditor.
4. Determine the sample size using the above variables.	The sample size can now be calculated by using the following formula:

Step in sampling plan	Monetary unit sampling (MUS)
	$n = \frac{UML0 \times BV}{TM}$ <p>(The specific statistical theory behind the formula does not fall within the scope of this study.)</p>
5. Select the items to be tested from the population.	The item, in which the specific rand selected by using one of the statistical methods as discussed above in Table 3.1 step 2 is included, is identified for testing.
6. Perform the planned audit procedure on items in the sample.	The items are tested as usual.
7. Evaluate results of audit procedures.	<ul style="list-style-type: none"> • Quantitatively: <p>Should an error be identified for a specific item, as explained above, the error per rand (t) must be calculated for each specific item (e.g. 20 cents in example above).</p> <p>These differences are then ranked from the largest to the smallest. By using the same table that was used to calculate the sample size, a maximum error can be calculated as follows:</p> $\text{Error value} = (BV \times UML0 \times 1 / n) + [BV \times (UMLi - UML0) \times ti / n]$ <p>(The specific statistical theory behind the formula does not fall within the scope of this study.)</p> <p>Should this error value be greater than TM, the book value should be rejected. If it is less than TM, the auditor can accept the book value given the assessed risk level.</p> • Qualitatively: <p>For each deviation found, the individual impact on the audit as a whole, regardless of monetary value, should be considered. Audit procedures should be performed or changed where necessary.</p> <p>Consider the combined effect of the results on the audit as a whole. If necessary, reassess the nature, timing and extent of other substantive procedures.</p>

When comparing Table 3.4 with Table 3.3, setting out the typical statistical substantive approach, MUS in Table 3.4 appears to be less complex, with fewer mathematical calculations to be done. The similarities between this approach and the typical tests of controls approach as set out in Table 3.2 can also be seen. It has already been mentioned that the tests of controls approach does appear to be less complex than the typical substantive procedures approach (excluding MUS) and that is the reason why MUS is a substantive procedures sampling approach that appears to be easier to apply in practice.

3.4 The advantages and disadvantages of statistical sampling

The auditor has to use his professional judgement to decide whether or not to use statistical sampling. The following advantages and disadvantages have been promoted in textbooks over the years:

Advantages:

- The statistical sampling approach is a scientific approach based on the well-proven principles of the probability theory (Cosserat & Rodda, 2009:289). This increases the objectivity of the sample size, the items selected as well as the evaluation of the results (Wilburn, 1984:16). The greater objectivity makes the sampling process followed by the auditor more defensible in a court of law (Arkin, 1974:9).
- The consideration of all the significant factors is an explicit prerequisite when statistical sampling is used and therefore makes the documentation of all such considerations easier (Cosserat & Rodda, 2009:289). It therefore provides a direct link between risk assessment, precision level and the resulting sample size and evaluation (Wilburn, 1984:16).
- Since statistical sampling is based on specific scientific principles, different auditors at different locations can use the same basis for testing and the results of these tests can be combined and evaluated for the population as a whole. This also ensures continuity, as one auditor can start the process and another can take it over from any point and arrive at the same answer (Arkin, 1974:11).

Disadvantages:

- The training costs related to the use of statistical sampling are higher than those for non-statistical sampling (Cosserat & Rodda, 2009:289).
- Statistical sampling is more complex than non-statistical sampling, and non-statistical sampling is therefore easier and takes less time to apply (Cosserat & Rodda, 2009:289). Since statistical sampling is perceived to take more time to apply, it will also be perceived to be more costly.

3.5 Summary

In this chapter a theoretical overview of the practical application of statistical sampling in auditing was given, with specific comparison with non-statistical sampling. The comparison of statistical sampling with non-statistical sampling was done for both tests of controls and substantive procedures. An overview of the practical application of the different statistical sampling plans, specifically indicating to which type of audit procedure it would be applicable (either tests of controls or substantive procedures) was given as well. The advantages and disadvantages of using statistical sampling were briefly discussed.

A further review of the most recent local and international studies was done in order to investigate the application of the textbook-based theory discussed in this chapter in practice over the past few years. The findings of this literature review are presented in the next chapter.

CHAPTER 4

THE USE OF STATISTICAL SAMPLING IN PRACTICE: A LITERATURE OVERVIEW

In the previous chapter the theoretical difference between a statistical and a non-statistical sampling approach in auditing was discussed. A brief overview of the different sampling plans available for use as an audit tool in both tests of controls and substantive procedures was given as well. This chapter focuses on how the theory as discussed in the previous chapter is applied in practice by reviewing a number of studies done locally and internationally on the subject.

As was stated in chapter 1, section 1.3, the doctoral study by De Bruyn in 1981 appears to be the most recent local study done to investigate the use of statistical sampling by South African auditors². In his study De Bruyn sent a questionnaire to all the registered firms of chartered accountants with more than one partner in South Africa at the time (423 firms in total) (De Bruyn, 1981:234). The questionnaire used in his study was designed on the basis of a similar study done in the United States by JJ Joseph in 1972, and De Bruyn compared the findings of the earlier American study with those of his own 1981 South African study (De Bruyn, 1981:369). The applicable findings of the De Bruyn study are used in chapter 6 to determine if there were any significant changes in the use of statistical sampling in South Africa over the past three decades. In this chapter only a brief overview of some of the findings of the De Bruyn study that are relevant to this study are discussed.

In chapter 6 the current South African use of statistical sampling in auditing is also compared to some international trends. However, in chapter 1, section 1.3, it was stated that relatively little international research has been done on the current audit strategies and audit practices of auditing firms since the 1980s (Khalifa *et al.*, 2007:826). This chapter includes a review of these international studies published after 1990.

4.1 The extent to which statistical sampling is used in practice

The use of statistical sampling has declined steadily over time since the 1980s, as was discussed in chapter 1, section 1.3. A study by Gilbertson and Herron (2003:109) found that studies consistently showed that the use of statistical sampling as an audit tool was

² Searches were done on the following databases: ProQuest – Dissertations and Theses, Sabinet – Current and Completed Research, Sabinet – NDLTD, Sabinet – SA Theses and Sabinet – UCTD.

disappearing. One such study cited by them was that of Sullivan (1992) of the PCAOB. Sullivan reported that in his review of 742 engagements, he could not recall one engagement in which a statistical sampling approach had been used.

The requirements for a sampling approach to be regarded as a statistical sampling approach were discussed in chapter 3, section 3.1. It is clear that all three the sampling steps (determining sample size, selecting items to be included in the sample, as well as evaluating the results of the tests performed on the sample) need to be carried out by means of a formal statistical method. A number of studies have been done in which the participants indicated that their firms were using a statistical sampling approach in a specific percentage of their audits. In some cases the respondents were asked to indicate further in which steps statistical sampling was used. In certain steps, the percentage of usage was indicated as being lower than the previously indicated overall usage rate. Since all three the sampling steps need to be carried out by means of a formal statistical method for the overall sampling approach to be seen as statistical, the overall usage rate cannot be higher than the usage rate in a specific step. Therefore, the stated overall usage rate indicated in these studies could have been inaccurate, as it was higher than that of one or more of the individual sampling steps.

A study by Hitzig (1995) is an example of a study in which the indicated overall usage rate of statistical sampling did not correspond to the usage rate of statistical sampling methods in the specific sampling steps. In this study, in which 163 New York firms participated, it was found that 39% of these firms used statistical sampling. Among the participants who indicated that they used statistical sampling, only 78% indicated that they projected errors found to the population as a whole. Therefore, of the 63 firms indicating they were using statistical sampling, only a maximum of 49 (78% of 63) could be said to have been using a full statistical approach, and only 30% (49 of 163) of the participants could be said to have been using a full statistical approach. This could indicate that at least 9% of those participants originally indicating that they were using an overall statistical sampling approach were doing so incorrectly.

Since evaluation is the last step in the sampling process, it would not be appropriate to use a statistical evaluation method if the sample size was not determined statistically and the selection of the items was not done by means of a statistical selection method. In a study by Hall, Hunton and Pierce (2002:125) investigating the general use of statistical sampling

by American auditors practising in public accounting, industry and government, it was found that only 15% of the respondents were using formal statistical methods to determine the sample size and to select items to include in a sample (Hall *et al.*, 2002:129). However, 36% of the respondents indicated that they used formal statistical methods to evaluate the results of sampling tests. Therefore, 21% of the respondents were using an evaluation method that was not appropriate (Hall *et al.*, 2002:129).

- *Specifically in South Africa*

In the South African context it was found that 92% (De Bruyn, 1981:307) of the respondents found statistical sampling to be a valid audit tool. However, only 35% (De Bruyn, 1981:272) of the respondents indicated that they used statistical sampling in more than half of their audits. Of those who used statistical sampling, 87% (De Bruyn, 1981:287) indicated that they would typically use it in evaluating sample results, although only 82% (De Bruyn, 1981:285) indicated they were using it in determining the sample size. Therefore, the use of an inappropriate evaluation method as discussed above could also be a possibility in the South African study, since 5% of the participants used a statistical evaluation method, but not a statistical method for determining the sample size.

Most of the above studies did not specify what the level of use of statistical sampling was in performing tests of controls and substantive procedures separately. However, the Hitzig (1995) study did. Hitzig (1995) found that 76% of the respondents indicated they used statistical sampling in performing tests of controls, in contrast to 91% indicating they used it in performing substantive procedures. The two subsections below provide an overview of the studies that focused on either tests of controls or substantive procedures alone.

4.1.1 Extent of use in tests of controls

Maingot and Quon (2009:215) did a similar study to that by Hall *et al.* (2002), which was discussed above. The participants in the Maingot and Quon study were limited to the internal auditors of companies listed on the Canadian Standard & Poor's Toronto Stock Exchange. Since the respondents were internal auditors, the study focused on the use of statistical sampling in tests of controls. It was found that 15% of the respondents used statistical methods to determine sample size, 21% to select items and 10% to evaluate results.

The study by Maingot and Quon (2009:215) further found that respondents qualified as chartered accountants (CAs) tended to use statistical sampling less than their colleagues with other professional qualifications, for example certified internal auditors (CIAs) and certified management accountants (CMAs).

4.1.2 Extent of use in substantive procedures

In a study by Elder and Allen (1998:81) in which they examined the audit working papers of 64 audit engagements regarding substantive procedures performed on inventory and accounts receivable, they found that in most engagements a statistical method had been used to select items. However, they found that a statistical method of evaluating sampling results had been used in none of the engagements. Therefore a full statistical sampling approach had been used in none of the engagements.

In a later study in which Elder and Allen (2003:986) examined audit schedules of 432 sampling applications (235 from 1994 and 197 from 1999) as applied in performing substantive procedures on accounts receivable and inventory, it was found that none of them had used a statistical method to determine the sample size. Therefore, once again, none of these sampling applications were full statistical sampling applications.

4.2 Statistical methods used in the sampling steps

Most of the studies reviewed focused on the selection methods that are used to select the items to be included in the sample. However, the current study aims to determine the statistical methods currently being used by Registered Auditors in South Africa accredited by the JSE for determining sample size, as well as for selecting items and the subsequent evaluation of the findings of audit procedures performed on the selected items. In the two subsections below the findings of the literature review of the international studies and the local 1981 study are presented.

4.2.1 Statistical methods for determining sample size

In the review of the relevant international studies, no studies specifically dealing with the statistical methods used for determining the sample size were identified. However, the

study by Elder and Allen (1998:81) discussed in section 4.1.2 above did mention that none of the respondents in that study used a statistical method to determine a sample size.

- *Specifically in South Africa*

The De Bruyn (1981) study did not specifically determine which statistical methods were used for sample size determination at the time.

4.2.2 Statistical methods for selecting items

In the New York study by Hitzig (1995) it was found that the majority (89%) of the respondents used a statistical method for selecting sample items. More specifically, the systematic selection method was used by 53% of the respondents, the simple random method of selection was used by 30% of them and the selection method incorporated in MUS was used by only 27%.

The study by Elder and Allen (1998:81) found that most of the respondents were using a statistical method of selecting sample items, specifically the MUS selection method.

In the study by Hall *et al.* (2002:129) of the 15% of the respondents who indicated that they used statistical sampling methods to select sample items, the majority (80%) indicated that they used the selection method incorporated in the MUS plan. The remaining 20% of the respondents using statistical selection methods indicated that they used simple random selection.

If the studies above are compared, it can be seen that the overall rate of using a statistical method for selecting sample items decreased from the 89% of the respondents in the Hitzig (1995) study to only 15% of the respondents in the Hall *et al.* (2002) study. A further comparison between the two studies revealed that in the Hitzig (1995) study only 39% of the respondents indicated that they used the non-statistical sampling selection method of haphazard selection, and this increased to 74% of the respondents in the Hall *et al.* (2002) study. One can conclude that the decline in the use of statistical selection methods and increase in the use of the non-statistical haphazard method indicate a decline in the use of statistical selection methods in practice. This conclusion supports the previously

discussed indications of a significant decline in the use of statistical sampling as an audit tool since the 1980s (refer to chapter 1, section 1.3).

- *Specifically in South Africa*

In the study by De Bruyn it was determined that the two statistical selection methods that were used most frequently by the participants were the simple random selection method (34%) and the systematic selection method (29%) (De Bruyn, 1981:290). De Bruyn also found that the MUS method of statistical sampling was used by only 17% of the respondents (De Bruyn, 1981:293). Since the steps in the sampling process are not specified separately in the De Bruyn study, the percentage of respondents who used the selection method integrated in MUS could not be determined accurately.

Considering the findings of the above review of the international as well as the local studies, it can be concluded that the selection method integrated in the MUS plan became increasingly popular with auditors from 1981 to 2002. This could indicate that the MUS plan as a whole became more popular amongst auditors. Many studies were done in recent years and are still being done to develop and refine MUS in use in audit procedures, such as those by Gillett (2000), Swinamer, Lesperance and Will (2004) and Higgins and Nandram (2009).

4.3 The main reasons for not using statistical sampling

Schwartz (1998) found in his study that the main reasons auditors gave for not using statistical sampling were firstly that the underlying mathematical principles were too complex; and secondly that the resulting sample sizes were too big. In their professional judgement the costs involved in giving staff the necessary training and doing the additional fieldwork outweighed the benefits (refer to section 1.2 of chapter 1).

In the 2001 edition of the AICPA's Audit Guide reasons for not using statistical sampling were cited to be mainly the perceived costs involved. The two main cost drivers identified were additional training needed for staff and the application of statistical principles. The costs of applying statistical principles specifically concerned the cost of additional time needed to select items and to do the calculations needed for the evaluation of the results (Hitzig, 2004:35).

In the study by Hitzig (2004) it was found that the main reason auditors gave for not using statistical sampling was also cost related, specifically the costs involved in implementing a statistical approach that they perceived in their professional judgement to outweigh the benefits gained from it.

Considering the findings of above studies, it can be concluded that the single main reason why auditors did not implement statistical sampling more extensively over the past number of years was the potential costs involved.

- *Specifically in South Africa*

The study by De Bruyn (1981) did not specifically determine the main reasons for not using statistical sampling in South African firms.

4.4 The role of professional judgement in statistical sampling

In the review of the international literature, a number of studies were found that referred to the professional judgement element involved in sampling in general, including in statistical sampling. The subsections below provide a brief overview of the findings of these studies.

4.4.1 The need for professional judgement in statistical sampling

Hitzig (2004:35) found in his study that auditors argued that the use of statistical sampling impaired their professional judgement. With reference to Table 3.2 and Table 3.3 in chapter 3, it was concluded that in the statistical sampling process there are a number of choices that must be made and variables that must be assessed that rely purely on the professional judgement of the auditor. Therefore, by using a statistical approach the auditor's judgement is not excluded, but in fact an essential part of the process, with the added benefit of the documentation of the process being made easier.

4.4.2 Performance of statistical procedures versus judgemental procedures

A study by Ponemon and Wendell (1995:17) compared the performance of the judgemental selection of sample items and the evaluation of sample errors found to that of recognised statistical methods as applied to the same set of test data. This was done by

judgementally and statistically selecting 50 items from a population of 529 inventory items, and projecting the errors found in them to the population as a whole. The judgemental selection was done by auditors in practice and the statistical selection was done by using computerised sampling modules. Even though both the methods projected an error higher than the actual error, the statistically calculated projected error was significantly closer to the actual error than the judgemental error projections (Ponemon & Wendell 1995:24). Therefore it was concluded that the statistical approach provided a more accurate result than the judgemental approaches.

4.4.3 The influence of experience on making judgemental decisions

Ponemon and Wendell (1995:32) further compared the judgemental projections of the less experienced to those of the more experienced participants. This comparison clearly showed that the more experienced auditors' findings were significantly closer to the actual error, as well as in a closer range to each other than those of the inexperienced auditors. This suggests that should a firm decide not to use statistical sampling methods, they should be mindful of the experience level of the individual who is responsible for applying his judgement in the sampling process.

- *Specifically in South Africa*

The exercising of professional judgement in deciding whether or not to use statistical sampling was investigated in the De Bruyn (1981) study. It was found that in 49% of the firms the *initial* decision about whether or not to use a statistical sampling approach was made by the partner in charge of the audit, in 17% of the firms by the manager on the audit, and in 27% of the firms by the senior on the audit. However, the *final* decision about whether or not to use a statistical sampling approach was made by the partner in charge of the audit in 80% of the firms, in 8% of the firms by the manager on the audit and in only 1% of the firms by the senior on the audit. Therefore the partner in charge of the audit was indicated by most of the audit firms as the person who would ultimately be required to exercise his professional judgement in deciding which sampling approach to apply in the audit (De Bruyn, 1981:257).

The study further investigated which factors the auditor would typically consider when deciding whether or not to use statistical sampling. It was found that 18% of the

respondents considered the resulting sample size to be an important consideration, 14% considered the possible influence of other audit procedures and 13% were taking into account the level of overall audit risk acceptable in the engagement. The fact that sample size was a major consideration emphasises the sensitivity of auditors to the possibility that sample sizes are bigger than they would consider necessary, resulting in additional costs (discussed in 4.3 above).

As was discussed in chapter 3, the auditor has to use professional judgement to determine what the confidence and precision levels of the sample should be before calculating the sample size (step 4 in both Table 3.2 and Table 3.3). De Bruyn found in his study that most respondents used a minimum confidence level of 95% in most sampling applications (De Bruyn, 1981:297) and a maximum precision level of 3% or less (De Bruyn, 1981:298).

4.5 The available assistance and resources when using statistical sampling

For the purpose of this study it was decided to interpret assistance available to audit teams when using statistical sampling as either assistance in the form of literature (for example a step-by-step guide) or assistance and resources in the form of professional training. Professional training was further defined as a combination of the university studies of the individual members of the audit team and the on-the-job training given to the members by the firm. Some of the studies reviewed commented on the availability of these sources of assistance in practice and a brief review thereof is provided below.

4.5.1 Literature

In the study by Hall *et al.* (2002:130) respondents indicated that the literature sources they consulted when using sampling were, in order of preference: the specific employing firm's guide, the AICPA audit sampling guide, and the specific AICPA audit standard on sampling – AU Section 350. In South Africa, SAICA or the IRBA does not issue a specific audit sampling guide supplemental to ISA 530 – the second most used resource in the American participating firms.

- *Specifically in South Africa*

De Bruyn found in his study that only 36% of the respondents had an in-house guide available in their firms that explained the steps to follow in each of the different statistical sampling approaches (De Bruyn, 1981:332).

4.5.2 Professional training

Hall *et al.* (2002:131) asked respondents to comment on the extent (none, minor or substantial) of the coverage of statistical sampling in their college studies. The majority (87%) of them indicated only minor coverage. Furthermore most of the respondents (97%) indicated that they had received training in statistical sampling during their post-college training.

The Canadian study by Maingot and Quon (2009:228), which was based on the abovementioned study done in America, found that the Canadian respondents indicated that they had more exposure to statistical sampling methods in their university courses than the participants in the American study: 50% commented that the extent of coverage had been minor, and 47% commented that it had been substantial. Therefore it could be anticipated that the resulting need for post-university training would be less. This was indeed the case, with a lower percentage of respondents (86%) indicating that they had received post-university training in statistical sampling.

In comparing the findings of the two studies, Maingot and Quon (2009:233) found that the higher level of training of Canadian students did not result in statistical sampling being used more often in Canadian auditing firms than in American auditing firms: the extent to which statistical sampling was used in the American and Canadian studies did not differ significantly.

Studies are currently being done in an attempt to find more effective ways to teach the practical application of both statistical and non-statistical sampling at undergraduate level, specifically for auditing purposes (Tate & Grein, 2009:159).

- *Specifically in South Africa*

In the study by De Bruyn (1981) the majority (58%) of the respondents indicated that they felt that the coverage of statistical sampling in the university programmes for the professional training of auditors did not meet their expectations (De Bruyn, 1981:324). The study further found that 50% of the respondents indicated that the firms had their own in-house training in the use of statistical sampling for their employees (De Bruyn, 1981:331). The study did not attempt to determine if there were a correlation between the extent to which statistical sampling was used in practice and the level of coverage of statistical sampling in the professional training of South African auditors.

4.6 Possible problems and non-conformance identified

Some of the studies identified certain uses and tendencies that could highlight possible inappropriate practices in the use of statistical sampling. These studies are discussed in the subsections below.

4.6.1 Problematic issues in sample size determination

In the study by Elder and Allen (2003: 986) it was found that auditors' risk assessment levels reduced over a 5-year time period (1994 – 1999), and that the sample sizes in the applications decreased. The decrease in sample size was to be expected, given the lower assessed risk level and the theoretical relationship between audit risk and sample size, as was explained in chapter 3, section 3.1. However, Elder and Allen (2003:1000) found that the link between the audit risk assessment done by the auditor in the planning phase and the determination of the sample sizes to be used was not clear in all the applications.

A possible explanation for the link between risk assessment and sample size not being clear in all the sampling applications is found in the study of Messier, Kachelmeier and Jensen (2001). Messier *et al.* (2001:81) found that auditors changed original input variables in structured sampling size calculation methods retrospectively (i.e. after the fact). These changes were made to the input variables in order to achieve a sample size that was more in line with what they would have expected it to be, had they exercised solely their professional judgement. The study had a total of 149 participants, of which 79% were Certified Public Accountants (CPAs) and the rest had at least a masters degree.

Even though the study focused on formal non-statistical sample size calculations, the same applies when using a statistical approach. As was explained in chapter 3 (step 5 in Table 3.2 and Table 3.3) the statistical calculation of the sample size is based on certain risk-related variables that are determined by the auditor using his professional judgement. These variables can easily be inappropriately adjusted retrospectively to higher or lower levels, causing an increase or reduction in the resulting sample size.

4.6.2 Problematic issues in sample item selection

It was seen from the overview of the studies in section 4.2.2 that the non-statistical, haphazard method of selecting items for inclusion in the sample was being used by a significant number of auditing firms. According to ISA 530, paragraph A11 (SAICA, 2010a:IAS530-3) those using haphazard selection should attempt to avoid bias as far as possible. In a study by Hall, Hunton and Pierce (2000:232) the question was asked whether this is possible, given human nature. It was found in the study that the participants were subconsciously influenced by physical features of the items in a population, namely the item's size, the brightness of its colour, the convenience of its location and the number of adjacent neighbours it has.

The Hall *et al.* (2000) study was followed by a study done by Hall, Herron, Pierce and Witt (2001:169) that determined further that by increasing the sample size, the influence of the abovementioned features did not change. Therefore the sampling risk was not reduced by increasing the sample size.

4.6.3 Problematic issues in the evaluation of sample results

As was discussed in section 4.1, in the study by Hitzig (1995) it was found that among the respondents whose firms used a statistical sampling approach, only 78% indicated that they projected errors found in a sample to the population. The study further found that among the respondents who had indicated that their firms used a non-statistical sampling approach, only 55% indicated that they projected sampling errors to the population. The fact that the errors found in a sample were not projected to the population could suggest that the final misstatement figure the auditor took into account when he or she formed an opinion regarding the population could be significantly understated.

In the study by Elder and Allen (1998:75) it was found that 33% of the errors found in a sample were not projected to the population. The main reason that was given for not projecting a specific error to the population was that the error was immaterial (46% of the responses). In 26% of the cases no reason was given for not projecting it to the population (Elder and Allen, 1998:77). Since all errors have to be aggregated to determine the materiality of the combined errors in the financial statements, the appropriate amount to include in the aggregation should have been the projected amount of all the errors found in all samples, regardless of their individual materiality. Therefore, all the actual errors that were found in a sample should have been adjusted by taking into account a sampling risk factor before materiality could have been evaluated (Elder and Allen, 1998:84).

Burgstahler, Glover and Jiambalvo (2000:79) presented 61 auditors with the results of substantive procedures performed on a set of financial statements. Included in the results were errors that had been found specifically in samples from inventory and accounts receivable. They were asked to indicate if they would require an adjustment to be made to the financial statements in order to avoid issuing a qualified audit report. The auditors therefore had to determine the aggregate of all the errors, including those found in the samples.

The study by Burgstahler *et al.* (2000:97) consisted of three rounds. In the first round the participants were given the results of the substantive procedures, which included the two errors found in the samples. In the first round 63% did not require any adjustment to be made to reduce audit risk to an acceptable level. In the second round, the same information was given, except that a schedule of audit differences was included. On the schedule the two errors found in the samples were statistically projected to the populations. Taking this additional information into account, 28% of the 63% who did not previously require an adjustment to be made, changed their opinion. In the final round, the auditors were given the detailed confidence levels used for the samples, which were based on financial statement level materiality. The knowledge of the confidence levels resulted in a further 38% of the remaining 45% of the population who did not previously require an adjustment to be made, changing their opinion. Therefore, 28% of the participants did not require any adjustment to be made to the financial statements, taking into consideration all the information given to them.

The fact that such a high percentage of the auditors participating in the Burgstahler *et al.* (2000) study did not project the errors in the samples to the respective populations in the first round, causing inappropriate audit opinions to be expressed, is a concern. A further concern is that on presentation of the schedule of audit differences including the projected numbers, some of the auditors still did not correct their opinions. This could be an indication that some auditors are oblivious to the effect that sampling risk has in error projection, not only when using statistical sampling approaches, but also in non-statistical sampling approaches.

Even with guidance, the concept of evaluating the results of tests performed on a sample and the projection thereof to a population proves to be problematic to auditors. This is evident not only from the more recent studies discussed above, but also from earlier studies (before 1990), as was commented on by Kahneman and Tversky (1972:444-445), Burgstahler and Jiambalvo (1986:234), Butler (1986:101) and Peek, Neter and Warren (1991:46).

- *Specifically in South Africa*

In the study by De Bruyn (1981) the respondents were asked to indicate the single most problematic step for them in the statistical sampling process. If all the problematic steps identified by the respondents are categorised into the three main steps of the sampling process (determining size, selecting items and evaluating results), the following emerges: 45% of the respondents indicated that determining the appropriate sample size was problematic for them; only 6% indicated selecting items to be problematic for them; and 44% indicated that they experienced problems in evaluating the sample results (De Bruyn, 1981:316).

The findings of the more recent international studies suggest that the calculation of sample size and the evaluation of the results seemed to be the most problematic. Since this is in line with the findings of the De Bruyn study that was done in 1981, it can be seen that these problems have been part of statistical sampling for a long time. The low level of usage in practice of statistical methods to calculate sample size and evaluate results, as was discussed in section 4.1, could be a result of the fact that auditors are finding it difficult to apply this in practice.

4.7 Possible litigation implications

Most of the litigation actions alleging negligence by the auditor in the past were settled before going to court (Gilbertson and Herron, 2003:109). Therefore case law is not readily available to determine if the use of a statistical or a non-statistical method in sampling applications could influence the outcome of court cases.

In the study by Gilbertson and Herron (2003:109) two scenarios were presented to eligible jurors in America (including an actual juror pool) with the following to be determined: "... whether the auditor is guilty of negligence by reason of the sampling procedures not uncovering fraudulent sales invoices". The one scenario stated that a statistical sampling method had been used, but a mistake had been made in the calculations, causing the sample size to be smaller than it should have been if the mistake had not been made. In the second scenario a non-statistical sampling method had been used and the auditor had judgementally decided on the size of the sample. The majority (62%) of the participants found the auditor in the given scenario to be guilty of negligence, but more often so the auditor using the non-statistical approach. Further, the damages amount the jurors awarded to the users of the financial statements were significantly higher in the scenario where the auditor had not used a statistical approach.

The findings of the above study could indicate that the use of a statistical approach in sampling is regarded to be more defensible in a court of law.

4.8 Summary

An overview of various aspects of the use of statistical sampling in practice locally and internationally as described in the most recent available studies was presented in this chapter. The findings were mainly categorised into the four key aspects of the use of statistical sampling on which this study focused within the current external audit environment in South Africa.

In the next chapter the research methodology followed in investigating these key aspects of the current use of statistical sampling by Registered Auditors in South Africa accredited by the JSE is set out.

CHAPTER 5

STATISTICAL SAMPLING IN SOUTH AFRICAN AUDITS: RESEARCH DESIGN AND METHODOLOGY

In the previous chapter the following key aspects of the use of statistical sampling by auditors were identified in the review of the findings of local and international studies:

- *The extent to which statistical sampling is used as an audit tool:* It was found that a full statistical sampling approach has not been the preferred approach for use in practice by auditors, both locally in 1981 and internationally since the 1990s. It was further seen that in the instances where auditors did indicate usage of a statistical method, it was not necessarily used in all three the basic sampling steps.
- *Reasons for not using statistical sampling:* The main reason that was given for not using a full statistical approach was that, in the professional judgement of the auditors, the costs (time) associated with the approach outweighed the benefits it held.
- *The use of professional judgement in statistical sampling:* When applying statistical sampling plans, the variables that form the basis of the calculations involved are determined by the auditor using his or her professional judgement. It was found that the level of experience of the person applying his or her professional judgement could influence the appropriateness of these variables.
- *Assistance and resources available when using a statistical sampling approach:* It was indicated that the coverage of statistical sampling in university courses specifically designed to obtain the professional qualification as an auditor was relatively minor. It was further found that in-house training courses and guides are being used to assist audit teams in audit firms.

As was stated in chapter 1, section 1.3, scientifically based knowledge of the current use of statistical sampling by South African auditors is limited. Therefore it was decided that the main objective of this study should be to explore certain key aspects of the current use of statistical sampling as used by Registered Auditors in South Africa accredited by the JSE, as discussed in chapter 1, section 1.5. It was further decided to add a secondary objective of comparing the current study's findings with the findings of recent international studies, as well as the 1981 South African study by De Bruyn. This chapter provides an overview of the methodology that was used in order to achieve these objectives.

5.1 The instrument of measurement used in the study

Taking into account the objectives of the study, it was decided to use a questionnaire to collect the necessary information. This method was used with success in similar studies such as the 1981 South African study by De Bruyn, as well as the international studies by, amongst others, Hitzig 1995, Hall *et al.* 2002 and Maingot and Quon 2009. The process that was followed in preparing the questionnaire is described in the following subsections.

5.1.1 Design of the questionnaire

Bradburn, Sudman and Wansink (2004:23) suggest that in designing a questionnaire and the specific questions to be asked, a researcher should first search for similar studies asking questions on the same topic as guidance. By using existing questionnaires as guidance the questions compiled by the researcher are indirectly validated, since they were in principle already used successfully once. A further benefit is that the results of the questions asked in the two studies can be compared.

The questionnaire used in the De Bruyn study in 1981 was used as the basis for the development of the questionnaire used in the current study. Applicable questions were identified and reworded slightly in order to update the terminology used and they were then adopted for the purpose of this study. The De Bruyn questionnaire is attached as Annexure C. The studies by Hitzig 1995, Hall *et al.* 2002 and Maingot and Quon 2009 used similar approaches and were therefore used as further guidance. Specific questions were identified that related to particular questions in this study. In some cases the wording of these questions were used to slightly update or change the wording of questions already included in the questionnaire.

The questionnaire used in this study is attached as Annexure D. However, in the attached copy two columns were added to the right of the original questionnaire for reference purposes. The first column contains a reference to the specific research question covered by that question in the questionnaire. For example, the reference Q1 (1.1) refers to the first research question 1(a) (1.1) under the first main key aspect (Q1), as set out in section 1.6.1 of chapter 1. In the second column a reference was included where applicable to refer to the related question from the De Bruyn (1981) study. The reference JJD-36 would, for example, refer to question 36 in the questionnaire used by De Bruyn, attached as

Annexure C. A further reference in the second column would in most cases refer to one of the international studies reviewed in chapter 4 in which a similar question was asked.

For the sake of consistency and ease of referencing the sequence of the questions in the questionnaire was as far as possible kept in the same logical order as that of the overall research questions set out in section 1.6.1 of chapter 1.

5.1.2 Electronic completion and submission option

Given the available technology it was decided to convert the questionnaire to a web-based survey. This made it possible for participants to complete and submit the questionnaire online, although a hardcopy completion option was also available. As the participants are Registered Auditors, they are constantly under severe time pressure, and it was decided that an online option for completing and submitting would be an easy, convenient and quick way for them to complete the questionnaire. The researcher was of the opinion that the response rate would be maximised if participants were able to use this option. The online survey platform of [surveymonkey.com](http://www.surveymonkey.com) was used for this purpose.

5.1.3 Pilot testing of the questionnaire

The success of the study depended heavily on whether the participants could understand and interpret the questions in the questionnaire as had been intended. Therefore before the questionnaire was sent to the participants, it was pilot tested in two stages. The first stage was to test the questions and the second stage was to test the online functionality of www.surveymonkey.com.

- *Pre-testing the questions – understandable and not ambiguous*

Some of the available theory on pre-testing suggests that the persons involved in a pilot test should firstly be individuals representing the participants of the actual study, and secondly include at least one specialist in the use of questionnaires and interpretation of information from questionnaires (Thomas, 2004:111).

The questionnaire was therefore firstly sent to people considered to be representative of the target group of the study, being two partners of auditing firms that are not JSE

accredited, as well as an individual involved in the development of computerised audit methodologies that are commercially used by Registered Auditors in South Africa. All three were Registered Auditors in South Africa. The comments received from them were taken into account and changes were made to the questions in the questionnaire where necessary to avoid the possible misinterpretation of questions.

The questionnaire was then sent to a representative of the Centre for Statistical Consultation (CSC) at the University of Stellenbosch (a specialist in the use of questionnaires and interpretation of information from them). The questionnaire was reviewed to ensure the data generated by it would be usable and of an acceptable quality. The questions were again adjusted where necessary.

- *Pre-testing the web application – user-friendly and trustworthy*

After the final adjustments had been made to the questions, the questionnaire was imported into the online survey platform. Several pilot tests were run, mainly comparing the output received via the platform (in an Excel spreadsheet format) to the intended answers, but also judging the user-friendliness of the application. Two colleagues were asked to assist in the testing process.

After the final adjustments had been made to the questions on the website, the questionnaire was ready for distribution to the participants. The decision as to which participants could be included in the distribution list for the questionnaire is discussed below.

5.2 Selection of participants

In determining who would be approached and requested to complete the questionnaire it was decided to target specific auditing firms, in which either the audit partner or technical partner (depending on the specific firm's structure) would be contacted.

In deciding which auditing firms to include as participants in the study the main consideration was the level of public accountability of such a firm. Since the users of the financial statements of listed companies are generally considered to include the broader public, the auditor who expresses an opinion on the fair presentation of such financial

statements is regarded to have a high level of public accountability. It was therefore decided that the auditing firms who are responsible for the audits of JSE-listed companies were to be the participants in this study. Since the objective of the study focused on Registered Auditors in South Africa, and the target group was those who audit listed companies, auditing firms accredited by the JSE to audit listed companies were included as possible participants in this study.

On 9 March 2010 there were 26 accredited auditors on the JSE List of Accredited Auditors as released on the JSE website (JSE, 2010) (refer to Annexure B). Since it is a manageable number, it was decided to include all of them in the scope of this study.

This approach was also used in the study by Maingot and Quon (2009), who used the Canadian Standard & Poor's Toronto Stock Exchange as basis for the selection of companies to include in their study. However, their focus was on the internal auditors of these companies and not on the external auditors, who were the focus of this study.

5.3 Contacting participants and distributing the questionnaire

The abovementioned list of auditors accredited by the JSE included the contact information for specific partners at the firms. These partners were initially contacted telephonically. Most of the partners engaged in an initial discussion about the objective of the study and their willingness to participate in such a study. The personal assistants of those partners who could not be contacted in person provided a direct email address for the partners, to which an introductory email was sent to request the partners to indicate via return email if they would be willing to participate in the study. An example of this introductory email sent on 12 April 2010 appears in Annexure E.

On 8 June 2010 (approximately two months later) a follow-up email was sent, requesting all partners who had not responded to the first round of emails to indicate if they would be willing to participate in the study or not (an example of this first follow-up email appears in Annexure F). Those partners who had already indicated by 8 June 2010 that they were willing to participate were sent an email to thank them for being willing to participate and to give them an indication when the questionnaires were going to be distributed.

On 16 August 2010 the questionnaires were distributed. All 26 partners received an electronic file (.pdf format) containing the questionnaire in the event they preferred to complete and fax a hardcopy, as well as a link to the specific secure internet address at which they could electronically complete and submit the questionnaire. A copy of this email appears in Annexure G.

5.4 The capturing and editing of the data

The partners were given a month to complete the questionnaire, with the initial deadline being given as 10 September 2010. The deadline was extended by two weeks in order to maximise the response rate. On 28 September 2010 it was decided to close the website and to use the data received up to that point for further analysis. The response rate achieved is presented in chapter 6.

Most of the participants who completed the questionnaire chose to complete it online. The software automatically downloaded the data captured by the participants into a Microsoft Excel spreadsheet for further analysis. No additional manual capturing of data was therefore necessary in these cases, eliminating the possibility of human error.

Only two of the recipients chose to complete the questionnaire manually and send it back via email. The data in these two were captured manually via the internet portal to be downloaded with the rest of the electronically submitted data into a single Excel spreadsheet. The output for the two questionnaires that were manually captured was reviewed in detail to ensure that no capturing errors had occurred. This spreadsheet was used as the basis for presenting the results in chapter 6 of this thesis.

5.5 The analysis of the data

The detailed spreadsheet was manually converted into another spreadsheet that could be used as a template to import the data directly into Statistica. Statistica is a statistical analysis software tool that was used to assist in the analyses and comparisons done that are presented in chapter 6.

The conversion process entailed the coding of all the descriptive data that appeared in the originally downloaded spreadsheet. For each column of the converted spreadsheet, a control total was calculated and compared with the relevant data on the original detailed

spreadsheet, to ensure that no errors had occurred in the coding process. This coded format could be used by Statistica to create statistical graphical presentations as well as to do other statistical analyses. The main reason for performing the statistical analyses was to determine if any statistically significantly preferred ways could be identified in which statistical sampling or the principles thereof are applied by the participants. Therefore in order to achieve the **main objective** of the study, statistical significance was tested based on the binomial distribution. The binomial distribution is typically used to test for significance in discrete (qualitative) data. This method was decided upon in consultation with the representative of the CSC at the University of Stellenbosch referred to in section 5.1.3.

The data was further coded in such a way as to enable the results of the Big 4 auditing firms to be identified separately. This made it possible to draw statistical comparisons between the practices of the Big 4 and those of the other JSE-accredited firms by using the M-L Chi-square test. This test is commonly used to test for significance in relationships between qualitative data in two or more populations. Significant differences or similarities in the application of statistical sampling or the principles thereof in practice were thus identified. This method was also decided upon in consultation with the representative of the CSC at the University of Stellenbosch referred to above.

In order to achieve the **secondary objective** of the study, these findings were then also manually compared to the findings of the review of the local study by De Bruyn in 1981 (chapter 4), as well as the review of international studies since 1990, in order to identify differences and similarities in the findings.

5.6 Possible limitations of the study resulting from the methodology followed

The most significant limitation of this study was the small population of 26 potential respondents. The results of this study can be projected only to the 26 South African Registered Auditors accredited by the JSE. A sample of 26 will not be appropriate to make generalisations for the total population of all Registered Auditors in South Africa. However, the effect of this limitation is mitigated by the fact that these 26 firms were responsible for approximately 95% of the audits of the financial statements of all companies listed on the JSE's Main Board, Alt X, African Board, Development and Venture trading divisions, which makes this study applicable to a wide audience. The

study's coverage of the JSE-listed companies was calculated using the daily market report published in *Business Day* on 23 June 2010 ("Market Wrap", 2010). The auditors of each listed company were researched on the McGregor BFA website's database of statutory information about JSE-listed companies (McGregor BFA, 2010). The auditors of an insignificant number of 28 (7%) of the published 426 companies could not be found on the database at the time.

De Bruyn (1981) did not limit the South African firms in a similar way in his study. He limited his study to those audit firms in South Africa that had more than one partner. The profiles of the typical respondent may therefore be slightly different, since the study by De Bruyn included small, medium and large firms. This could mean that a straightforward comparison could be an oversimplified way of comparing the data of the 1981 study by De Bruyn and the data of this study, and one should be aware of this fact when reading the findings presented in chapter 6. (This limitation is mentioned as an area for potential future research in chapter 7.)

In a similar vein, the possible difference in respondent profiles between the international studies referred to and this study should be carefully considered.

5.7 Summary

This chapter provided an extensive overview of the methodology that was used in order to achieve the objectives of the study. The data collected and captured using the methodology as described above, as well as the analyses thereof, is presented in the next chapter.

CHAPTER 6

STATISTICAL SAMPLING IN SOUTH AFRICAN AUDITS: RESULTS AND ANALYSES OF EMPIRICAL STUDY

The previous chapter provided an overview of the method that was followed in this study to gain insight into the current use of statistical sampling by Registered Auditors in South Africa, specifically focusing on the firms that are accredited by the JSE to audit listed companies. In this chapter the findings from the data collected by means of the completed questionnaires are presented and compared to the findings of existing local and international studies that were discussed in chapter 4.

6.1 Response rate

Upon receipt of the completed questionnaires it was noted that two of the firms listed separately on the JSE List of Accredited Auditors (JSE, 2010) had merged by the time the completed questionnaires were received back from the respondents. The total number of firms available as potential respondents was therefore reduced to 25. In total, 16 of the 25 distributed questionnaires were completed and returned by the respondents. Although this appears to be a relatively low response rate (64%) for an already small population when considered purely on the basis of the number of questionnaires, valuable statistical observations could still be made.

However, considering the footprint of the 16 respondents on the JSE itself, the respondents represented the auditors of 91% of the number of listed companies and 99% of the total market capitalisation of the listed shares on the JSE at the time the study was done. This was calculated using the market data of 23 June 2010, as was discussed in section 5.6 of chapter 5.

As stated in section 5.5 the statistically based binomial distribution theory was used to determine statistical significance in this study. In the event of a sample being sufficiently large (normally larger than 30 items) the actual sample distribution approximates the normal distribution, which is more commonly known in the application of statistical models for inference. In this instance, however, the sample size (16) was too small to make use of the approximation characteristic of a binomial distribution, and any statistical inference made based on the sample must therefore be made by using the actual distribution, which is the binomial distribution (Keller & Warrack, 1997:399). Taking into account the theory

behind a binomial distribution, in a sample of 16, 11 or more observations (69% or more) is required to indicate statistical significance. Many of the questions in the questionnaire were applicable to only some (fewer than 16) of the respondents, as the answer they gave to a previous question determined the applicability to them of a later question. To determine for each of these questions how many observations would be needed to indicate statistical significance, the calculation referred to above was repeated for each possible number of respondents to which a follow-up question could have applied. Table 6.1 below presents the findings of these calculations.

Table 6.1 Responses needed for statistical significance

Total number of respondents to whom question is applicable	Number of observations needed to be statistically significant (binomial distribution theory)	Proportion (%)
16	11	69%
15	11	73%
14	10	71%
13	9	69%
12	9	75%
11	8	73%
10	8	80%
9	7	78%
8	6	75%
7	6	86%
6	5	83%
5	4	80%
4-1	all	100%

Table 6.1 was then used where applicable to evaluate the statistical significance of the findings presented in the remainder of this chapter. A finding is considered statistically significant if the relevant calculated statistic indicates that the proportion of the sample of respondents who provided a particular response is large enough to support a deduction that it is not by chance only that the majority of respondents provided that response. On the basis of this statistical significance, statistical inference can then be made about the population, namely that for the population, the majority will also provide a similar response. The Big 4 auditing firms were all among the 16 respondents mentioned above. This increased the usefulness of the collected data as it was possible to do comparisons

between the practices of the Big 4 auditing firms and the other JSE-accredited auditing firms.

As was stated in section 5.5, The M-L Chi-square test, which is commonly used as a statistical test for significance of the relationship between qualitative data of two populations, was used to determine the significance of the differences between the findings relating to the Big 4 auditing firms and those relating to the other JSE-accredited auditing firms. The M-L Chi-square test calculates a “p-value” between 1 and 0. Should this value be lower than 0.05, it indicates that the two variables are significantly different.

6.2 Background of respondents

In the general questions section of the questionnaire the respondents were asked to indicate the number of years they had been involved in the audits of their respective firms, as well as their current position within the specific firm. The results from these two questions are presented in Table 6.2 below.

Table 6.2 Respondents’ experience and organisational hierarchy level

Background information requested		Proportion of respondents (%)	
Experience level:	5 years or less	31%	100% ↑
	6 – 10 years	25%	69%
	11 – 15 years	31%	44%
	16 years or more	13%	13%
	Organisational hierarchy level:	Manager	19%
	Partner	81% (statistically significant)	

When considering the number of years of experience of the respondents in the audits of the specific firm they represented in this study, as indicated in Table 6.2 above, it can be seen that cumulatively, a statistically significant number of respondents had more than five years of experience (69%).

The table further indicates that an even a higher percentage (81%) of the respondents were at the time partners in the firm they represented, which is also statistically significant.

Considering that the experience level and the authority level of the respondents in the firms they represented, as discussed above, were at acceptably high levels, the validity and quality of the data received from the respondents were also deemed to be acceptable for the purpose of drawing scientifically sound conclusions from it. It was further assumed that, given these high levels of experience and authority, the respondents had an acceptable level of knowledge of the methodology and practices of the firms they represented to be able to provide accurate and complete responses to the questions in the questionnaire.

RESEARCH QUESTION 1:

Is statistical sampling allowed in audits performed by Registered Auditors in South Africa, and if so, how is it being applied?

6.3 The extent to which statistical sampling is used as an audit tool

6.3.1 Inclusion of statistical sampling in audit methodology

The first question in the subject matter section of the questionnaire asked the respondents to indicate if the use of statistical sampling was allowed by their respective firms' audit methodologies. All the respondents (100%) indicated that their firms' audit methodologies allowed the use of statistical sampling as an audit tool.

6.3.2 The estimated extent to which statistical sampling is being used

Even though all the respondents indicated that statistical sampling was allowed to be used as an audit tool by their firm's audit methodologies, it did not necessarily mean that they were using it. Therefore, the respondents were asked in question 2 of the questionnaire (all questions referred to from this point onwards were part of the subject matter section of the questionnaire) to estimate, on the basis of their knowledge of the audit methodology of the firm and their experience within the firm, the extent to which statistical sampling was being used in the firm's audits of JSE-listed companies. The findings are presented in Table 6.3.

Table 6.3 Estimated extent to which statistical sampling was being used in audits

Estimated extent to which used	Proportion of respondents (%)	
		Cumulative
In all audits	31%	
In most audits	44%	75% - majority of audits
In some audits	12.5%	
In very few audits	12.5%	25% - minority of audits

Presented in Table 6.3 are the responses exactly as given by the respondents. If the options given to the respondents are categorised in two categories, namely majority of audits (all and most) and minority of audits (some or few), it can be seen that a statistically significant number of respondents (75%) indicated that their firm used statistical sampling in the majority of its audits of JSE-listed companies.

- **Comparison with the findings of the South African study in 1981**

In South Africa in 1981 only 35% of respondents indicated that they used statistical sampling in more than 50% of their audits (De Bruyn, 1981:272). Therefore it could be concluded that the use of statistical sampling increased considerably from 1981 to 2010. This increase in the use of statistical sampling was not expected, considering the findings of the literature review in section 4.1 of chapter 4. A possible reason for the unexpected increase could be that the difference in the profile of the respondents of the two studies caused the results to not be directly comparable, as discussed in section 5.6 of chapter 5. Another possibility could be that auditors had recently started to recognise the benefits of statistical sampling again, and had started to use it more often.

- **Comparison with the findings of recent international studies**

The following American studies as discussed in section 4.1 of chapter 4 also found that a minority of the respondents indicated that they used statistical sampling in their audits:

Hitzig (1995) found that 39% of the respondents in his study done in New York had indicated that they used statistical principles in the sampling applications in audits.

Sullivan (1992), as cited by Gilbertson and Herron (2003:109), indicated that in his review of 742 audit engagements in his role on the PCAOB he could not recall one engagement in which a statistical sampling approach had been used.

Hall et al. (2002:125) found that 36% of the respondents practising in public accounting, industry and government used statistical principles in the sampling applications of audits they performed (specifically in the evaluation of results).

These findings were very similar to the findings of the 1981 study by De Bruyn, but differ considerably from those of the current South African study. However, the difference in the profile of the respondents in the international studies reviewed and this study should be taken into consideration (refer to section 5.6 of chapter 5.) Further, since the question in this study asked the respondents to estimate the extent of use of statistical sampling, the responses were inherently the perception of the respondents and not based on the actual application of statistical sampling, as was the case in the international studies. Therefore a direct comparison of the data could be misleading. (This issue is mentioned as an area for potential future research in chapter 7.)

- ***Differences identified between the approaches of the Big 4 auditing firms and the other JSE-accredited auditing firms***

No statistically significant differences were identified between the responses of the Big 4 auditing firms and the other JSE-accredited auditing firms regarding this question.

6.3.3 The use of statistical sampling in the specific types of audit procedures

Statistical sampling can be applied in tests of controls and substantive procedures within an audit, as was discussed in sections 3.2.1 and 3.2.2 of chapter 3. In question 3 of the questionnaire the respondents were asked to indicate for each of the two types of audit procedures whether their firms' audit methodology allowed the use of statistical sampling. The findings are presented in Table 6.4.

Table 6.4 The use of statistical sampling in tests of controls and substantive procedures

	Proportion of respondents (%)	
	Tests of controls	Substantive procedures
Did allow	81%	94%
Did not allow	19%	6%

Table 6.4 shows that a statistically significant number of respondents indicated that their firm's methodology allowed the use of statistical sampling in the two types of audit procedures, though more allowed the use of statistical sampling in substantive procedures (94%) than in performing tests of controls (81%).

- **Comparison with the findings of the South African study in 1981**

The study by De Bruyn (1981) did not ask a similar question.

- **Comparison with the findings of recent international studies**

The American study (New York) by Hitzig (1995) found that 76% of the respondents used statistical sampling in tests of controls and 91% in substantive procedures. The findings were therefore similar to the findings of this study. Not only were the levels of usage in both tests of controls and substantive procedures very similar to those found in this South African study, but the respondents in the American study also used statistical sampling

more in the performance of substantive procedures than in the performance of tests of controls.

- ***Differences identified between the approaches of the Big 4 auditing firms and the other JSE-accredited auditing firms***

No statistically significant differences were identified between the responses of the Big 4 auditing firms and the other JSE-accredited auditing firms regarding this question.

In subsections 6.3.4 and 6.3.5 the results of the questions in the questionnaire that focused on key aspects of the use of statistical sampling specifically in tests of controls (6.3.4) and substantive procedures (6.3.5) are presented.

6.3.4 Tests of controls: The use of statistical sampling

From 6.3.3 above it is clear that the audit methodologies of the majority of the firms did allow the use of statistical sampling in the performance of test of controls. Questions 4 and 6 of the questionnaire were designed to focus specifically on the use of statistical sampling in tests of controls. The following key aspects were investigated and the findings are presented below: the sampling steps in which statistical sampling was used within tests of controls (6.3.4.1), the statistical sampling plans and methods used in those steps (6.3.4.2) and the audit areas in which statistical sampling would typically have been used when tests of controls were performed (6.3.4.3).

6.3.4.1 Sampling steps in which statistical sampling was used in tests of controls

Those respondents who indicated in question 3 of the questionnaire that their firm's audit methodology allowed the use of statistical sampling in tests of controls were asked in question 4 to identify those sampling steps (refer to section 3.2 of chapter 3) in which they are allowed to apply statistical sampling. Table 6.5 presents the respondents' feedback.

Table 6.5 Tests of controls: Sampling steps in which statistical sampling may be used

Step in which statistical sampling may be used	Number of respondents	Proportion of 13 respondents allowing use in tests of controls (%)	Proportion of all 16 respondents (%)
Total number of respondents who indicated statistical sampling was allowed in tests of controls	13	100%	81%
Allowed in the following steps:			
• Determination of sample size	10	77%	63%
• Selecting items to be included in the sample	12	92%	75%
• Evaluating the results of sample testing	6	46%	38%

From Table 6.5 it can be seen that a statistically significant number of the respondents who indicated that they were allowed to use statistical sampling in tests of controls indicated that they were allowed to use statistical sampling principles when determining the sample size (77%) and when selecting the items to be included in the sample (92%). However, only 46% (not statistically significant) were explicitly allowed to use statistical principles to evaluate the results of the tests of controls performed on the sample items.

- ***Comparison with the findings of the South African study in 1981***

The study by De Bruyn (1981) did not ask a similar question.

- ***Comparison with the findings of recent international studies***

The Canadian study by Maingot and Quon (2009) found that when performing tests of controls, 15% of the respondents used statistical methods to determine the sample size, 21% used statistical methods to select sample items and 10% used statistical methods to evaluate sample results.

*To compare the Canadian study's results with the results of the current study, this study's results should be adjusted to the proportion of all the respondents (16), since the Canadian study requested all the respondents to indicate the application of statistical sampling in the individual steps, and not only those who did use statistical sampling in tests of controls. The overall level of use of statistical principles in the different steps was noticeably lower in the Canadian study than it was indicated to be in the current South African study. A possible reason for this could be that the question in the South African study asked if statistical methods were **allowed** in each of the steps, and not necessarily **actually used** in them.*

However, the tendencies in the use of statistical methods between the three steps presented in the format: "size – select – evaluate" do tend to be similar, given that in the current South African study the findings were: 63% - 75% - 38%, and the findings of the Canadian study were 15% - 21% - 10%. In both studies statistical selection methods were used most frequently and evaluation methods the least (approximately half of the frequency).

- ***Differences identified between the approaches of the Big 4 auditing firms and the other JSE-accredited auditing firms***

No statistically significant differences were identified between the responses of the Big 4 auditing firms and the other JSE-accredited auditing firms regarding this question.

It was evident from the findings in Table 6.5 that although principles of statistical sampling were allowed to be used in some of the steps of sampling when performing tests of controls, a non-statistical approach was allowed in the remaining step/s. Therefore, the original data was further analysed to determine how many respondents were in fact allowed to use a full statistical approach (all three steps), and how many were allowed to use a combination of statistically based steps and non-statistically based steps. The findings are presented in Table 6.6 below.

Table 6.6 Tests of controls: Full statistical approach versus combined approach

Approach allowed	Number of respondents	Proportion of 13 respondents allowing use in tests of controls (%)	Proportion of all 16 respondents (%)
Total number of respondents who indicated statistical sampling was allowed in tests of controls	13	100%	81%
<ul style="list-style-type: none"> • Full statistical approach (all 3 steps) 	6	46%	38%
<ul style="list-style-type: none"> • Combination of statistical and non-statistical 	7	54%	43%

The findings presented in Table 6.6 revealed that of the 13 respondents who indicated that they had statistical sampling as a permitted sampling tool to use in tests of controls, fewer than half of them (46%) (not statistically significant) indicated that it was permitted in all three the sampling steps, enabling them to use a full statistical sampling approach.

Therefore it can be stated that of the total number of respondents only 38% (6 of 16) (not statistically significant) are allowed to use a full statistical sampling approach when they perform tests of controls.

- ***Comparison with the findings of the South African study in 1981***

The study by De Bruyn (1981) did not ask a similar question.

- ***Comparison with the findings of recent international studies***

The Canadian study by Maingot and Quon (2009) did not analyse the data in the same way as above, but with regard to the “size – select – evaluate” profile of 15% - 21% - 10% it can be seen that no more than 10% of the respondents could be using a full statistical approach, since only 10% used statistical methods in the evaluation step.

The Canadian study could therefore have a maximum of only 10% of its respondents using a full statistical approach in tests of controls, whereas the South African study found that 38% could have been using a full statistical approach. Since the South African study did not specifically ask whether the respondents were using statistical sampling in the steps, but whether the use statistical sampling was allowed in their firms' audit methodologies, these findings cannot be compared directly without qualification.

- ***Differences identified between the approaches of the Big 4 auditing firms and the other JSE-accredited auditing firms***

No statistically significant differences were identified between the responses of the Big 4 auditing firms and the other JSE-accredited auditing firms regarding this question.

6.3.4.2 Specific statistical sampling plans and selection methods used in tests of controls

As was discussed in section 3.3.1 of chapter 3 there are specific statistical sampling plans available for calculating sample size and evaluating results, and specific statistical methods for selecting items to include in the sample, from which the auditor can choose when performing tests of controls. In question 4 of the questionnaire the respondents were asked to identify which sampling plans and selection methods were allowed by their firms' audit methodologies for use specifically in performing tests of controls. The results are presented in Table 6.7.

Table 6.7 Tests of controls: Statistical plans and selection methods that may be used

Statistical sampling plan or selection method ³ available for use	Number of respondents	Proportion of 10/12 respondents allowing use in tests of controls (%)	Proportion of all 16 respondents (%)
<p>Total number of respondents who indicated statistical sampling was allowed in tests of controls in determining sample size</p> <p>Explicitly allowed the following statistical sampling plan:</p> <ul style="list-style-type: none"> • Fixed sample size • Systematic sampling • Discovery sampling • Did not know <p>These statistical sampling plans were discussed in section 3.3.1 of chapter 3.</p>	<p>10</p> <p>5</p> <p>0</p> <p>1</p> <p>5</p>	<p>100%</p> <p>50%</p> <p>-</p> <p>10%</p> <p>50%</p>	<p>63%</p> <p>31%</p> <p>-</p> <p>6%</p> <p>31%</p>
<p>Total number of respondents who indicated statistical sampling was allowed in tests of controls in selecting sample items to include</p> <p>Explicitly allowed the following statistical selection method:</p> <ul style="list-style-type: none"> • Simple random selection • Stratified random selection • Systematic selection using a random start • Did not know <p>These statistical selection methods were discussed in point 2 of Table 3.1 in chapter 3.</p>	<p>12</p> <p>5</p> <p>0</p> <p>7</p> <p>1</p>	<p>100%</p> <p>42%</p> <p>-</p> <p>58%</p> <p>8%</p>	<p>75%</p> <p>31%</p> <p>-</p> <p>44%</p> <p>6%</p>

³ The method used for evaluation of statistical sampling results depends on the sampling plan that was used to determine the sample size. Therefore the auditor cannot choose to use any other evaluation method than the appropriate method inherent to the specific sampling plan used to determine sample size. Consequently, Table 6.7 does not include a separate section in which the findings are analysed for the sampling step of evaluating sample results.

- *Statistical sampling plans for determining sample **size** and for using as basis for **evaluating** test results*

Only 50% of the respondents who indicated that statistical principles were allowed to determine the size of a sample could identify the specific sampling plans their audit methodologies allowed. The plan that was identified by all of these was the fixed sample size plan. Only one respondent mentioned discovery sampling as an additional option that was explicitly allowed to be used in his firm.

The other half of the respondents could not identify the plans allowed and indicated that the main reason why they were unable to identify them was that they used computerised software to generate the sample size and did not know the statistical concept on which the software was based. *Should these respondents find themselves in a situation in which they have to justify their sampling procedures, either to a client or in a court of law; they will have to rely entirely on the developers of the software. They are therefore exposed to the risk of not only being perceived as unprofessional, but also being liable for damages should it be found that reliance on the software developer had been unwarranted.*

- *Statistical **selection** methods used for identifying items to be tested*

Most of the respondents (58%) who indicated that statistical principles were used in selecting the sample items identified the systematic selection method as the preferred method to use according to their firm's audit methodology. The simple random selection method was indicated by fewer (42%) respondents. Only one respondent could not identify the selection method being used.

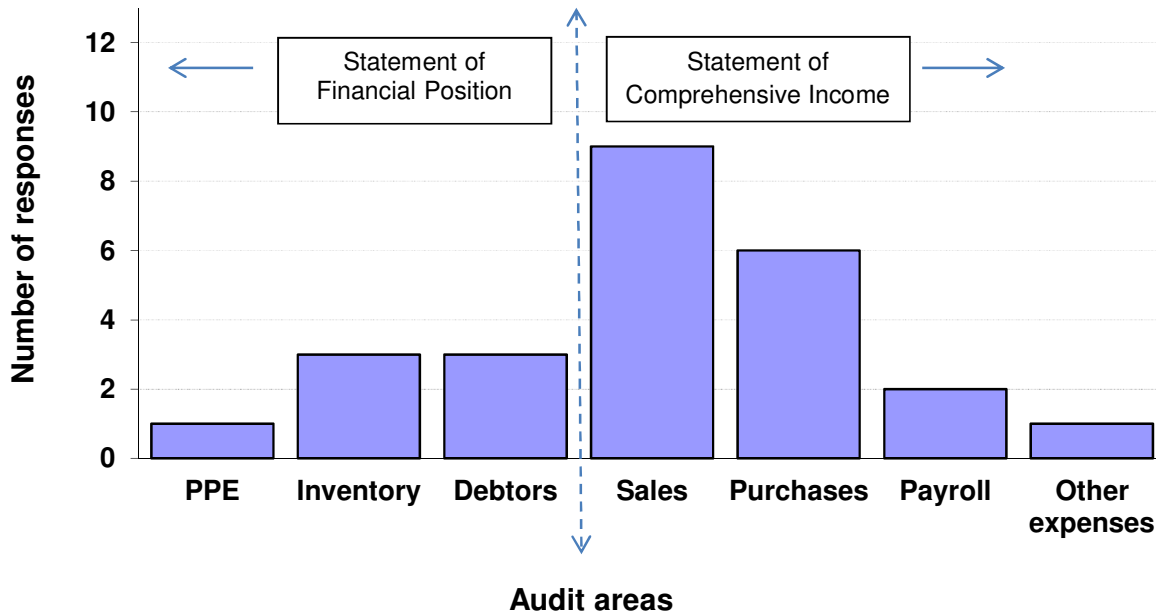
- ***Comparison with the findings of the local De Bruyn (1981) study and international studies, as well as the responses of the Big 4 auditing firms with the other JSE-accredited auditing firms***

The findings of the local and international studies on the statistical sampling plans and methods used did not differentiate between tests of controls and substantive procedures. Therefore a combined comparison of the findings above and the corresponding findings regarding the sampling plans and methods used in substantive procedures is presented in section 6.3.5.2.

6.3.4.3 Audit areas in which statistical sampling was used in tests of controls

The respondents were asked in question 6 of the questionnaire to identify the audit areas in which statistical sampling was used most often when performing tests of controls. Their responses are illustrated in Figure 6.1 below.

Figure 6.1 Tests of controls: Audit areas in which statistical sampling was used



From the graph in Figure 6.1 it can be seen that 9 of the 13 (69%) respondents who indicated that their firm's audit methodology did allow the use of statistical sampling in tests of controls indicated that this was most often applied in the testing of the controls in the sales cycle. A further 6 (46%) respondents indicated that statistical sampling was used in the testing of the controls in the purchases cycle.

The areas indicated by the respondents to be those in which statistical sampling is used to the largest extent are related. The debtors balance (statement of financial position) is related to the sales cycle (statement of comprehensive income) and the inventory balance (statement of financial position) is related to the purchases cycle (statement of comprehensive income).

Figure 6.1 also indicates that, when performing tests of controls, statistical sampling is most often applied when testing items that appear in the statement of comprehensive income. When considering the nature of these items it is to be expected that the majority of audit procedures would be in the form of tests of controls. This is so as they typically comprise large numbers of homogenous transactions processed by an automated system, about which substantive procedures alone would often not provide sufficient appropriate audit evidence.

- **Comparison with the findings of the South African study in 1981**

The study by De Bruyn (1981) asked the respondents to rank the audit areas from the area most frequently tested by using statistical sampling to that used least frequently, but not differentiating between tests of controls and substantive procedures. The respondents ranked sales first and purchases second (De Bruyn, 1981:292).

- **Comparison with the findings of some of the more recent international studies**

None of the international studies reviewed in chapter 4 asked a similar question.

- **Differences identified between the approaches of the Big 4 auditing firms and the other JSE-accredited auditing firms**

No statistically significant differences were identified between the responses of the Big 4 auditing firms and the other JSE-accredited auditing firms regarding this question.

6.3.5 Substantive procedures: The use of statistical sampling

From 6.3.3 above it is clear that the audit methodologies of the majority of the firms also allowed the use of statistical sampling in the performance of substantive procedures. Questions 5 and 7 of the questionnaire were designed to focus specifically on the use of statistical sampling in substantive procedures. The following key aspects were investigated and the findings are presented in the subsections below: the sampling steps in which statistical sampling were used (6.3.5.1), the statistical sampling plans and

methods used in those steps (6.3.5.2) and the audit areas in which statistical sampling would typically have been used when performing substantive procedures (6.3.5.3).

6.3.5.1 Sampling steps in which statistical sampling was used in substantive procedures

The respondents who indicated in 6.3.3 above that their firm’s audit methodology allowed the use of statistical sampling in substantive procedures were asked in question 5 of the questionnaire to identify the sampling steps (refer to section 3.2 of chapter 3) in which they are allowed to applied statistical sampling. Table 6.8 contains the respondents’ feedback.

Table 6.8 Substantive procedures: Sampling steps in which statistical sampling may be used

Step in which statistical sampling may be used	Number of respondents	Proportion of 15 respondents allowing use in substantive procedures (%)	Proportion of all 16 respondents (%)
Total number of respondents who indicated statistical sampling was allowed in substantive procedures	15	100%	94%
Allowed in the following steps:			
<ul style="list-style-type: none"> • Determination of sample size 	12	80%	75%
<ul style="list-style-type: none"> • Selecting items to be included in the sample 	14	93%	88%
<ul style="list-style-type: none"> • Evaluating the results sample testing 	8	53%	50%

From Table 6.8 it can be seen that a statistically significant proportion of the respondents who indicated that they were allowed to use statistical sampling in substantive procedures indicated that they are allowed to use statistical sampling principles when determining the sample size (80%) and when selecting the items to be included in the sample (93%). However, only 53% (not statistically significant) are allowed to use statistical principles to evaluate the results of the substantive procedures performed on the sample items.

- **Comparison with the findings of the South African study in 1981**

The study by De Bruyn (1981) did not ask a similar question.

- **Comparison with the findings of recent international studies**

The American study by Elder and Allen (1998:81) found that most of the respondents used a statistical selection method, but none used a statistical evaluation method. A later study by Elder and Allen (2003:986) found that none of the respondents based their determination of the sample size on a statistical sampling plan ("size – select – evaluate" profile = 0% - >50% - 0%).

*To compare the American study's results with the results of the current study, the current study's results should be adjusted to the proportion of all of the respondents (16), since the American study requested all the respondents to indicate the application of statistical sampling in the individual steps and not only those who did actually use statistical sampling in substantive procedures. The overall level of use of statistical principles in the different steps was noticeably lower in the American study than it was indicated to be in the South African study. A reason for this could be that the question in the South African study asked if statistical methods were **allowed** in each of the steps, and not necessarily **actually used** in them.*

To compare the trends in the use of statistical methods between the three steps using the previously introduced "size – select – evaluate" format, the findings of the South African study can be indicated as 75% - 88% - 50%, and the findings of the American study as 0% - >50% - 0%. It can be seen that although the American study indicated that the respondents did not use any statistical sampling plan for sample size calculation and the evaluation of test results, the majority did use a statistical selection method. The South African respondents were also using a statistical sampling method for selecting items more frequently than statistical sampling plans for size calculation and evaluation of results.

- ***Differences identified between the approaches of the Big 4 auditing firms and the other JSE-accredited auditing firms***

As was described in section 6.1, the M-L Chi-square test was used to determine if there was a significant relationship between the responses of the Big 4 auditing firms and those of the other JSE-accredited auditing firms. The findings regarding the use of statistical sampling for the evaluation of substantive procedures' results by the Big 4 and by the other JSE-accredited auditing firms had a p-value of 0.01734, which was smaller than the significance level of 0.05. This indicated that the Big 4 auditing firms used a significantly different approach to evaluate sample results in substantive procedures to the other JSE-accredited auditing firms. Further analysis showed that all the Big 4 auditing firms' audit methodologies explicitly allowed the use of a statistical method to evaluate sample results in substantive procedures, whereas the majority of the other JSE-accredited auditing firms' audit methodologies did not do so explicitly.

Consistent with the findings in Table 6.6 above relating to tests of controls, principles of statistical sampling are allowed to be used in some of the sampling steps when substantive procedures are performed, and a non-statistical approach is allowed to be used in the remaining step/s. Therefore the original data was analysed to determine how many respondents were in fact allowed to use a full statistical approach (all three steps), and how many were only allowed a combination of statistically based steps and non-statistically based steps. The findings are presented in the table in Table 6.9 below.

Table 6.9 Substantive procedures: Full statistical approach versus combined approach

Approach allowed	Number of respondents	Proportion of 15 respondents allowing use in substantive procedures (%)	Proportion of all 16 respondents (%)
Total number of respondents who indicated statistical sampling was allowed in substantive procedures	15	100%	94%
<ul style="list-style-type: none"> • Full statistical approach (all 3 steps) 	6	40%	38%
<ul style="list-style-type: none"> • Combination of statistical and non-statistical 	9	60%	56%

Reviewing the results from this point of view revealed that of the 15 respondents who indicated that statistical sampling was an permitted sampling tool to use in substantive procedures within their firm; only 40% (not statistically significant) indicated that it was allowed in all three the sampling steps, enabling them to use a full statistical approach. This was consistent with the findings of the same analysis done with regard to tests of controls presented in Table 6.6.

- ***Comparison with the findings of the South African study in 1981***

The study by De Bruyn (1981) did not ask a similar question.

- ***Comparison with the findings of recent international studies***

The American studies by Elder and Allen (1998 and 2003) did not analyse the data in the same way as above, but looking at the “size – select – evaluate” profile of 0% - >50% - 0%, it can be seen that none of the respondents could have been using a full statistical approach in performing substantive procedures in either the 1998 or 2003 studies, since

none of the respondents used statistical sample plans to determine the sample size (2003 study) and none were used in the evaluation step (1998 study).

Therefore none of the respondents in the American study could have been using a full statistical approach in performing substantive procedures, whereas the South African study found that 38% (6 of 16) could have been using a full statistical approach. Since the South African study did not specifically ask if the respondents were using statistical sampling in the execution of each of the steps, but asked whether using statistical sampling was allowed in their firms' audit methodologies, these findings cannot be compared directly without qualification.

- ***Differences identified between the approaches of the Big 4 auditing firms and the other JSE-accredited auditing firms***

As was described in section 6.1, the M-L Chi-square test was used to determine if there was a significant relationship between the responses of the Big 4 auditing firms and those of the other JSE-accredited auditing firms. Regarding the use of a full statistical sampling approach when performing substantive procedures, the p-value was 0.00178 (< 0.05), which indicated that there was a significant difference in the responses.

Upon further analysis it appeared that all four the Big 4 auditing firms had indicated that their audit methodologies explicitly allowed a full statistical approach when performing substantive procedures, whereas the majority of the other JSE-accredited auditing firms had indicated that their audit methodologies did not do so explicitly.

6.3.5.2 Specific statistical sampling plans and selection methods used in substantive procedures

As was discussed in section 3.3.2 of chapter 3 there are specific statistical sampling plans available for calculating sample size and evaluating sample results and statistical methods for selecting items to include in the sample, from which the auditor can choose when performing substantive procedures. In question 5 of the questionnaire the respondents were asked to identify the sampling plans and selection methods that were allowed by

their firms' audit methodologies for use specifically in performing substantive procedures. The results are presented in Table 6.10.

Table 6.10 Substantive procedures: Statistical plans and selection methods that may be used

Statistical sampling plan/ method ⁴ available for use	Number of respondents	Proportion of 12/14 respondents allowing use in substantive procedures (%)	Proportion of all 16 respondents (%)
<p>Total number of respondents who indicated statistical sampling was allowed to be used in substantive procedures in determining sample size</p> <p>Allow the use of the following statistical sampling plan:</p> <ul style="list-style-type: none"> • Unstratified mean per unit sampling • Stratified mean per unit sampling • Difference estimation • Monetary unit sampling • Did not know <p>These statistical sampling plans were discussed in section 3.3.2 of chapter 3.</p>	<p>12</p> <p>1</p> <p>0</p> <p>0</p> <p>8</p> <p>5</p>	<p>100%</p> <p>8%</p> <p>-</p> <p>-</p> <p>67%</p> <p>42%</p>	<p>75%</p> <p>6%</p> <p>-</p> <p>-</p> <p>50%</p> <p>31%</p>
<p>Total number of respondents who indicated statistical sampling was allowed to be used in substantive procedures in selecting sample items to include</p> <p>Allow the use of the following statistical selection method:</p> <ul style="list-style-type: none"> • Simple random selection • Stratified random selection 	<p>14</p> <p>5</p> <p>1</p>	<p>100%</p> <p>36%</p> <p>7%</p>	<p>88%</p> <p>31%</p> <p>6%</p>

⁴ The method used for evaluation of statistical sampling results depends on the sampling plan that was used to determine the sample size. Therefore the auditor cannot choose to use any other evaluation method than the appropriate method inherent to the specific sampling plan used to determine sample size. Consequently, Table 6.10 does not include a separate section in which the findings are analysed for the sampling step of evaluating sample results.

<ul style="list-style-type: none"> • Systematic selection using a random start 	9	64%	56%
<ul style="list-style-type: none"> • Monetary unit sampling (MUS) 	8	57%	50%
<ul style="list-style-type: none"> • Did not know 	1	7%	6%
<p>These statistical selection methods were discussed in point 2 of Table 3.1 in chapter 3, except MUS, which was discussed in section 3.3.2 of chapter 3.</p>			

- *Statistical sampling plans for determining sample **size** and for using as basis for **evaluating** test results*

Only 58% (not statistically significant) of the respondents who indicated that statistical principles were used to determine the sample size could identify the sampling plans their audit methodologies allowed. The plan that was identified by most of them (67%) was the monetary unit sampling plan. Only one respondent mentioned unstratified mean per unit sampling as an additional option that was used in his or her firm.

Those who indicated that they did not know the specific plan or plans used, indicated that the main reason why they did not know was that they used computerised software to generate the sample size. Therefore, consistent with what was found in section 6.3.4.2 regarding tests of controls, they did not know the statistical concept on which the software was based. *Therefore, as discussed in section 6.3.4.2, they are also exposed to the risks arising from being reliant on the software developer's work.*

- *Statistical **selection** methods for identifying items to be tested*

Most of the respondents (64%) who indicated that statistical principles were used in selecting the sample items identified the systematic selection method as the preferred method to use according to their audit methodologies. The simple random selection was indicated as a selection option by only 36% of the respondents. Only one respondent could not identify the selection method used by his or her firm.

Since eight respondents had indicated that they were allowed to use the monetary unit sampling plan in determining the sample size and also used it as a basis for the evaluation of the results, it was expected that these eight would also have indicated that they were allowed to use the prescribed principles of selecting items to be tested as embedded in the monetary unit sampling plan. Considering the results as presented in Table 6.10 above, the conclusion could be drawn that this was the case. However, in reviewing the original data again, it was found that only six respondents used monetary unit sampling for all three the abovementioned steps. Two of the respondents made use of a *partial approach*. This raises the question of whether the conclusions the respondents reach during their audits on the basis of the evaluated results of these procedures are appropriate.

- ***Comparison: combined with the findings of 6.3.4.2***

The respondents were asked in this study to indicate the preferred statistical sampling plans and methods used in tests of controls and substantive procedures respectively. The 1981 South African study and the international studies reviewed in chapter 4 asked which methods were preferred, but did not require the respondents to respond separately for tests of controls and substantive procedures. Therefore, to compare the preferred statistical sampling plans and methods found in the current study with those of the 1981 South African study as well as with the international studies that were reviewed in chapter 4, the findings of sections 6.3.4.2 and 6.3.5.2 should be considered on a combined basis.

- ***Comparison with the findings of the South African study in 1981***

The study by De Bruyn (1981) requested the respondents to rank the different statistical sampling plans and methods according to the frequency with which they were being used.

Due to the nature of the question and the difference in the terminology used, it was not possible to make a credible comparison of the sampling plans used for determining the sample size between the current study and the 1981 study.

With regard to the statistical selection methods used, the respondents indicated in the De Bruyn study that the simple random method was used most frequently by them, followed by the systematic selection method (with a single start or multiple starts) (De Bruyn

1981:290). However, in the present study the respondents indicated that the preferred method for tests of controls as well as for substantive procedures is the systematic method with a random start, followed by the simple random selection method.

Therefore the same selection methods have been favoured since 1981, although the systematic selection method with a random start is now preferred by the most respondents.

- **Comparison with the findings of recent international studies**

None of the international studies indicated what the preferred statistical sampling plans were that the respondents followed to determine the sample size to be used. No comparison can therefore be made regarding this aspect.

With regard to the selection methods used as indicated by the respondents in the international studies reviewed in section 4.2.2 of chapter 4, it was found that since the 1995 study by Hitzig the preference for using the MUS-based statistical selection method increased from 27% (Hitzig, 1995) of the respondents using statistical sampling who indicated that they used the selection method embedded in the MUS method, to 80% of the respondents using statistical sampling who indicated that they used this selection method in 2002 in the study by Elder and Allen (2003:129).

In the current study it was found that only 57% of the respondents who used statistical selection methods were explicitly allowed to use the MUS-based statistical selection method. Although this is still the majority of the respondents, it was expected from the trend identified in section 4.2.2 of chapter 4 that it would be a significant majority.

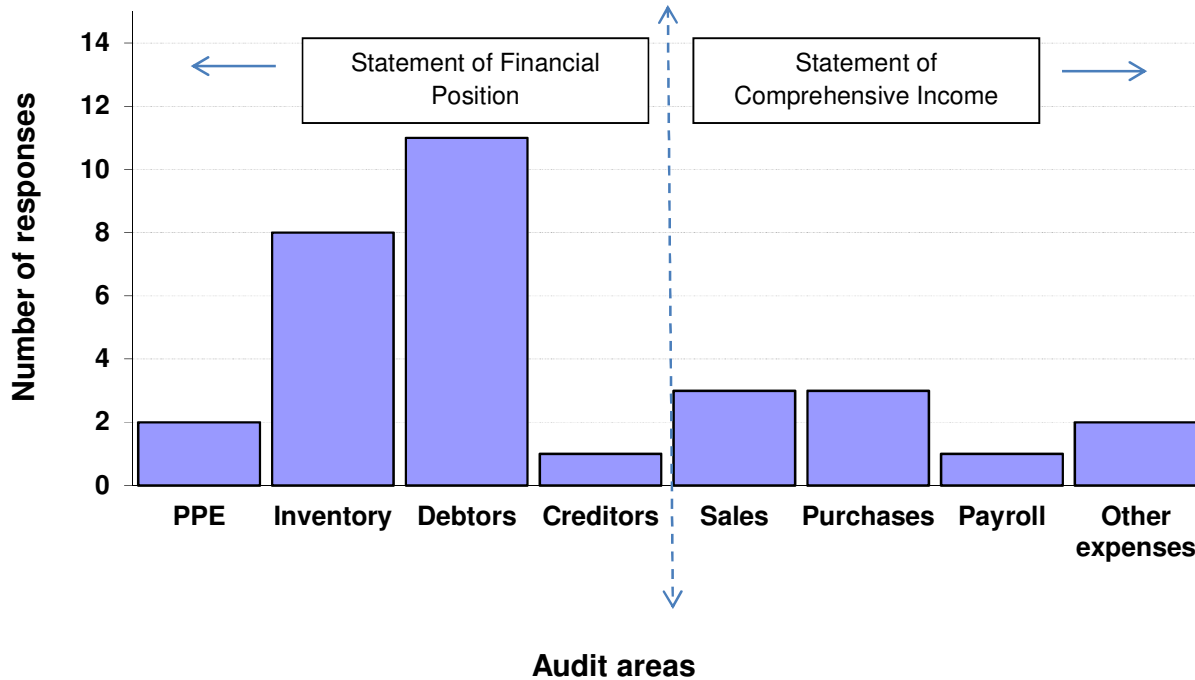
- **Differences identified between the approaches of the Big 4 auditing firms and the other JSE-accredited auditing firms**

No significant differences were identified between the responses of the Big 4 auditing firms and the other JSE-accredited auditing firms regarding this question.

6.3.5.3 Audit areas in which statistical sampling was used in substantive procedures

The respondents were asked in question 7 of the questionnaire to identify the audit areas in which statistical sampling was used most often in the performance of substantive procedures. Their responses are presented in Figure 6.2 below.

Figure 6.2 Substantive procedures: Audit areas in which statistical sampling was used



From the graph in Figure 6.2 it can be seen that 11 of the 15 respondents who indicated that their firm’s audit methodology did allow statistical sampling to be used in substantive procedures (73% and statistically significant), indicated that this was most often applied in the testing of the debtors balance. A further 8 respondents (53%) indicated that statistical sampling was also used in performing substantive procedures on the inventory balance.

Referring to the findings discussed in section 6.3.4.3 and the discussion about the relationship between sales and debtors, and purchases and inventory, it is interesting to note that for tests of controls the sales cycle was the audit area in which statistical sampling was most often used, and for substantive procedures it is the case for the related debtors balance in the statement of financial position. This is also the case for the second-

most popular area for the use of statistical sampling in tests of controls, being purchases, with, for substantive procedures, the related inventory balance in the statement of financial position being the second-most popular.

Figure 6.2 also indicates that when performing substantive procedures statistical sampling is most often applied when testing balances in the statement of financial position, as opposed to when testing totals in the statement of comprehensive income. This is so because, given the nature of the routine classes of transactions reflected in the statement of comprehensive income, a combination of tests of controls and substantive analytical procedures are often a more appropriate audit approach.

- **Comparison with the findings of the South African study in 1981**

The study by De Bruyn (1981) asked the respondents to rank the audit areas from the area most frequently tested by using statistical sampling to that tested least frequently, not differentiating between tests of controls and substantive procedures. Considering that the respondents in the 1981 study ranked the sales area first and purchases second, which was similar to the findings of the present study regarding the areas in which tests of controls were most often used, it was noticed that in the 1981 study the respondents ranked the audit areas of debtors third and that of inventory fourth (De Bruyn, 1981:292). These two audit areas were also the two indicated by respondents in the present study to be the most tested using statistical methods when substantive procedures was done, which therefore correlates with the findings of the 1981 study.

- **Comparison with the findings of recent international studies**

Although none of the international studies reviewed in chapter 4 asked a similar question, many studies that focused on statistical sampling in substantive procedures used either debtors or inventory and many used both as audit areas to test, either by inspecting working papers of actual audits done or by conducting experiments using these audit areas as source of information (Burgstahler et al., 2000:85; Elder & Allen, 1998:75; Elder & Allen, 2003:988; Hall et al., 2001:175; Higgins & Nandram, 2009:174; Peek et al., 1991:38 and Ponemon & Wendell, 1995:21).

This could be an indication that these areas are most likely to be tested using statistical sampling when performing substantive procedures.

- ***Differences identified between the approaches of the Big 4 auditing firms and the other JSE-accredited auditing firms***

As was described in section 6.1, the M-L Chi-square test was used to determine if there was a significant relationship between the responses of the Big 4 auditing firms and those of the other JSE-accredited auditing firms. With respect to the use of a statistical sampling approach when performing substantive procedures on expenses in particular, the p-value was 0.01252 (< 0.05), which indicated that there was a statistically significant difference in the responses.

Upon further analysis it emerged that two of the Big 4 audit firms had indicated that they used a statistical sampling approach when substantively testing expenses, whereas all the other JSE-accredited auditing firms had indicated that they did not.

RESEARCH QUESTION 2:

What are the main reasons for South African auditors to decide not to use statistical sampling in an audit?

6.4 The main reasons for not using statistical sampling

Two different approaches were followed in the design of the questionnaire to determine what the reasons were why only 38% of the respondents used a full statistical approach as an audit sampling tool in both tests of controls and substantive procedures. The first approach was to give the respondents a list of predefined steps that had been identified as problematic in previous studies (De Bruyn, 1981, Hitzig, 1995, Hall *et al.*, 2002 and Maingot & Quon, 2009) and to ask the respondents to indicate in which of those steps auditors in their firms had encountered problems when using statistical sampling in practice (question 11 of the questionnaire). The second approach was to ask the respondents in an open-ended question to indicate what, in their opinion and experience, the reasons were for auditing firms to prefer not to use statistical sampling (question 12 of

the questionnaire). The findings from these two questions are discussed in sections 6.4.1 and 6.4.2 below.

6.4.1 Sampling step in which respondents most frequently encounter problems

Table 6.11 below presents the statistical sampling steps in which the respondents indicated to have most frequently encountered problems (question 11 of the questionnaire).

The specific steps given as options (first column of Table 6.11) were categorised as follows into the three main sampling steps:

- Steps to determine sample size:
 - Defining test objectives
 - Defining “error”

- Steps to select items to be included in the sample:
 - Selecting sample items

- Steps to evaluate the results of the tests performed on the sample:
 - Investigating errors found
 - Extrapolation of errors
 - Interpreting results

The right-hand column of Table 6.11 presents the results after they had been categorised as described above.

Table 6.11 Problematic steps in using statistical sampling

Problematic steps given	Proportion of respondents (%)	
	Discreet	Cumulative
*Only 13 respondents indicated problematic areas. Proportion calculation was therefore done as a percentage of 13 available responses.		
Defining test objectives	8%	
Defining "error"	8%	16% - sample size
Selecting sample items	8%	8% - sample selection
Investigating errors found	38%	
Extrapolation of errors	30%	
Interpreting results	8%	76% - evaluating results

The categorisation of the steps, as presented in Table 6.11, indicated that a statistically significant number of respondents (76%) who had answered this question indicated that evaluating the sample results was problematic to them. This could explain the findings as discussed in sections 6.3.4.1 (tests of controls) and 6.3.5.1 (substantive procedures), indicating that although the majority of the respondents in each case were explicitly allowed to apply statistical principles in determining the sample size and selecting the items to be tested, only 47% (38% of 16) in tests of controls and 40% (38% of 16) in substantive procedures were explicitly allowed to use a statistical method to evaluate the results of the tests performed.

A possible conclusion that could be drawn from the above is that the difficulties auditors experienced in applying statistical principles in the evaluation process caused the audit firms to adjust their audit methodologies to allow for the use of a non-statistical approach in evaluating sampling results (either explicitly or by being silent on the approach to be followed). It can be speculated that the additional time, training and resulting costs could be the reason for opting not to specifically require statistical evaluation of results.

- **Comparison with the findings of the South African study in 1981**

In the study by De Bruyn (1981) the respondents were asked a similar question with similar predefined problematic steps. For purposes of comparison the steps were categorised in the same way as was done in this study (2010), as described above. When using the “size – select – evaluate” format, the findings of the 1981 study were as follows: 45% - 11% - 44% (De Bruyn, 1981:316). When compared with the current study’s findings in the same format and adjusted to show the proportions relative to all 16 the respondents, the corresponding result is 13% - 6% - 63%. It can be seen that the relationship between the three steps has changed since the 1981 study. Selecting the items to be included in a sample was still the least problematic step when using statistical sampling, but since 1981 the evaluation process became problematic for a greater proportion of the respondents.

This supports the conclusion drawn earlier that this could be the reason why fewer respondents indicated that they were not specifically required to use statistical evaluation methods by their firms’ audit methodologies, whereas statistical selection and size calculation methods were allowed.

- **Comparison with the findings of recent international studies**

None of the international studies reviewed in chapter 4 asked a similar question.

- **Differences identified between the approaches of the Big 4 auditing firms and the other JSE-accredited auditing firms**

No statistically significant differences were identified between the responses of the Big 4 auditing firms and the other JSE-accredited auditing firms regarding this question.

6.4.2 The main reasons why peers do not use statistical sampling

Table 6.12 below presents the reasons why, in the respondents’ opinions and experience, auditors would prefer not to use statistical sampling (question 12 of the questionnaire).

Table 6.12 Reasons for peers to not use statistical sampling

Reasons for not using	Proportion of respondents (%)	
	Discreet	Cumulative
*Only 13 respondents indicated possible reasons for their peers not to use statistical sampling. Proportion calculations were therefore done as a percentage of 13 available responses.		
Lack of understanding	46%	62% - lack of confidence based on level of knowledge and experience
Lack of training	8%	
Lack of experience	8%	
Sample size too large	23%	76% - not perceived to be efficient enough
Takes up too much time	38%	
Prefer using Computer Assisted Audit Techniques (CAATs) for tests of controls	15%	

This was an open-ended question, and therefore the reasons given by the respondents were from their own experience, and not selected from a list of predefined possible answers.

The reasons identified were categorised in the following two categories for further consideration, similar to that in the right-hand column of Table 6.12:

- Lack of confidence in the use of statistical sampling due to the level of knowledge thereof:
 - Lack of understanding of the complex mathematical principles supporting it
 - Lack of training to use it
 - Lack of experience in using it

- Not seen as efficient audit procedure:
 - Sample sizes are too large – too much field work has to be done
 - Takes up too much time – either the process, or the amount of work
 - Prefers using CAATs for tests of controls – therefore no sampling needed, as the whole population can be tested.

Both of these categories indicated the reasons why the respondents thought auditors would not use full statistical sampling approaches in the audits of financial statements. Firstly, 62% of the respondents (the majority, although not statistically significantly so) indicated a lack of confidence in using a full statistical approach (based on the auditor's lack of understanding, training and experience in using it) to be a deterrent.

Secondly, a statistically significant number of respondents (76%) indicated that the perceived inefficiency of the full statistical sampling process was the main deterrent for using statistical sampling. The efficiency of the process was measured by them by considering the resulting sample sizes, the time spent on the application thereof and the availability of other audit tools, for example CAATs.

The findings described above pose the question whether, if a person's understanding of and experience in a specific process (statistical sampling in this case) is not at a level at which he/she feels confident in using it, he could be knowledgeable enough to objectively evaluate the efficiency of the process.

- **Comparison with the findings of the South African study in 1981**

The study by De Bruyn (1981) did not ask a similar question.

- **Comparison with the findings of recent international studies**

As was discussed in chapter 4, section 4.3 the following international studies investigated the reasons why auditors were not using statistical sampling approaches:

The study by Schwartz (1998:1) found that auditors gave two main reasons for not using statistical sampling: firstly that the underlying mathematical principles were too

complex (confidence), and secondly that resulting sample sizes were too large (efficiency).

The AICPA Audit Guide (America) states that the main reason why auditors do not use statistical sampling is the costs involved, which are perceived to be too high (efficiency) (Hitzig 2004:35). The American study by Hitzig (2004:35) also found that the main reason given by respondents was the perceived costliness of the statistical sampling approach (efficiency).

This study (2010) found that the main reason for not using a statistical sampling approach was indicated by the respondents to be the perceived inefficiency of the approach, resulting in additional costs. Another reason given was the auditor's lack of understanding, training and experience in using it, causing the auditor to not be confident enough to use it. Both these reasons were identified by the international studies reviewed in chapter 4, section 4.3, and the efficiency of the process was also the most prominent of these two. The findings of this South African study were therefore similar to those of the international studies.

- ***Differences identified between the approaches of the Big 4 auditing firms and the other JSE-accredited auditing firms***

As was described in section 6.1, the M-L Chi-square test was used to determine whether there was a significant relationship between the responses of the Big 4 audit firms and those of the other JSE-accredited audit firms. Regarding the reasons given by the respondents as to why they thought their peers were not using statistical sampling, the p-value was 0.03902 (< 0.05), which indicated that there was a statistically significant difference in the responses.

Upon further analysis it was found that all of the Big 4 audit firms indicated that they considered the reason for not using statistical sampling to be the perceived inherent inefficiency of the process, whereas the other JSE-accredited audit firms indicated the lack of confidence in using it because of its perceived complex nature to be the reason.

RESEARCH QUESTION 3:

How do South African Registered Auditors exercise professional judgement in the use of statistical sampling?

6.5 The role of professional judgement in statistical sampling

In section 4.4.1 of chapter 4 it was found that in previous studies auditors felt that the use of their professional judgement was limited when they used a full statistical sampling approach. Research question 3, as discussed in section 1.6.1 of chapter 1, was designed to investigate the current use of professional judgement when statistical sampling is applied in practice.

The respondents were firstly asked to indicate what, in their opinion and experience, the main consideration was that was taken into account when deciding whether or not to use statistical sampling (section 6.5.1), and who would typically be the person responsible for making this decision (section 6.5.2).

It was further seen from the descriptions of the full statistical sampling approaches in tests of controls and substantive procedures that were presented in Tables 3.2 and 3.3 in chapter 3 that key variables need to be determined judgementally by the auditor to be used as basis for calculations. The respondents were asked to indicate if the minimum confidence levels (section 6.5.3) and maximum precision levels (section 6.5.4) were in their firm determined by auditors using their professional judgement or if their firm's audit methodologies prescribed predefined levels. In the event that the levels were predefined, the respondents were asked to indicate what these levels are.

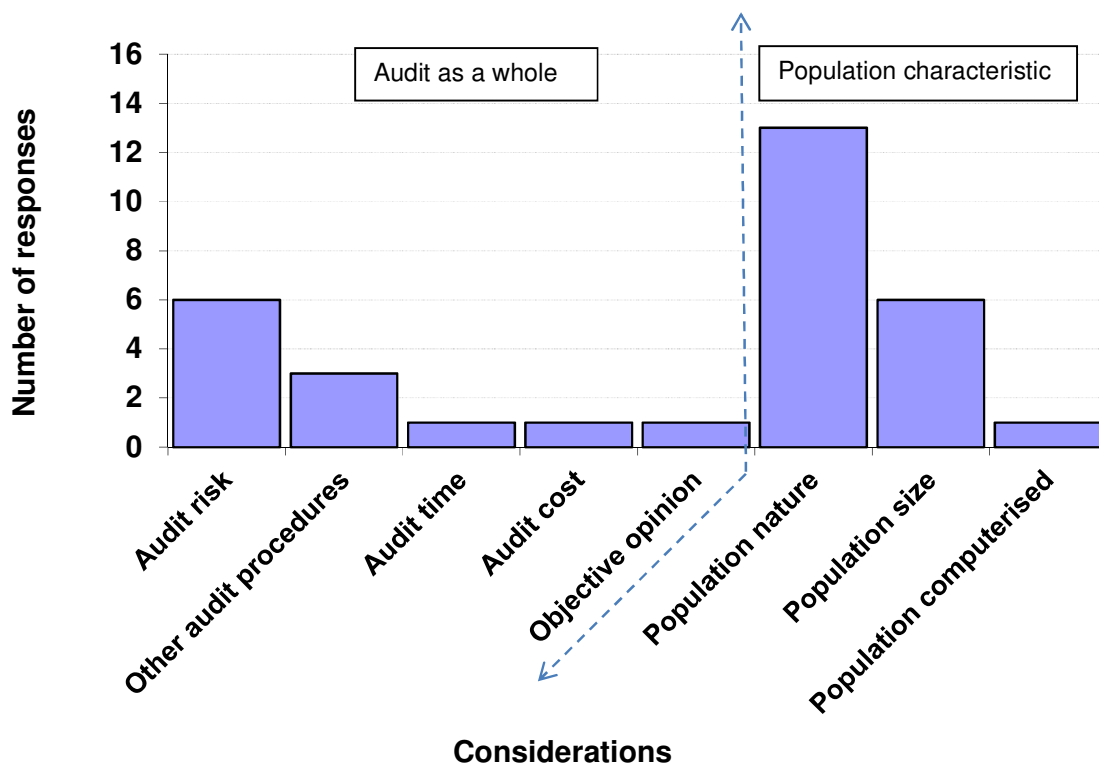
The respondents were then asked to indicate if their firm's audit methodologies allowed the use of professional judgement by the auditor in each of the three main sampling steps, thereby allowing the auditor to override the calculations of a full statistical approach if deemed necessary. In cases where this was allowed, the respondents were asked to indicate, in their opinion and experience, who the person would be who would typically be responsible for using his or her professional judgement to make such adjustments (section 6.5.5).

The results of these questions are discussed in the subsections below.

6.5.1 Considerations when deciding whether or not to use statistical sampling

All the respondents indicated that statistical sampling was allowed by their respective firms' audit methodologies (6.3.1), either in tests of controls or substantive procedures (6.3.3). Most of the respondents (12 of the 16, which equates to 75%) had the option to use statistical sampling in both types of procedures. Question 10 of the questionnaire asked what the specific considerations were that were taken into account at the point when it had to be decided to either use the statistical sampling principles, or not to. The respondents were asked to indicate the two most important considerations from a predefined list of considerations as identified in studies done previously (De Bruyn, 1981, Hitzig, 1995, Hall *et al.*, 2002 and Maingot & Quon, 2009), based on their experience. The graph in Figure 6.3 illustrates the findings from this question.

Figure 6.3 Considerations in deciding whether or not to use statistical sampling



A statistically significant number of the respondents (81%) indicated that the nature of the population to be tested was one of their main considerations when they had to decide whether or not to use statistical sampling. The second most frequently indicated

considerations taken into account were the size of the population to be tested (38%) and the audit risk involved (38%), neither of which was statistically significant.

On the basis of their nature, the predefined considerations were categorised in the following two main categories for further analysis:

- Considerations regarding the role the specific procedures play in the audit as a whole:
 - Audit risk
 - Other audit procedures
 - Audit time
 - Audit cost
 - Objective opinion

- Considerations regarding the specific population to be tested:
 - Population nature
 - Population size
 - Population degree of computerisation

Upon further analysis of the responses to question 10, it was found that all the respondents had indicated at least one population-specific consideration. A statistically significant number of the respondents (75%) indicated that they also considered the role that the specific sample's findings would play in the audit as a whole, when deciding whether or not to use a statistical sampling approach.

- ***Comparison with the findings of the South African study in 1981***

In the study by De Bruyn (1981) the respondents were asked to rank similar predefined considerations in order of importance. For purposes of comparison the steps were categorised in the same way as in this study (2010) as described above. The respondents in the De Bruyn study indicated that the role the sample played in the audit as a whole (28%) was considered to be slightly more important than the specific population's characteristics (23%) (De Bruyn, 1981:261).

However, this study (2010) found that the focus of the respondents had shifted more to the specific population's characteristics, with all the respondents indicating that they took at

least one aspect of the population into account when making their decision whether or not to use a statistical approach, with fewer (although still a significant proportion) respondents indicating that they also took the role the sample played in the audit as a whole into consideration.

- **Comparison with the findings of recent international studies**

None of the international studies reviewed in chapter 4 asked a similar question.

- **Differences identified between the approaches of the Big 4 auditing firms and the other JSE-accredited auditing firms**

As was described in section 6.1, the M-L Chi-square test was used to determine if there was a significant relationship between the responses of the Big 4 auditing firms and those of the other JSE-accredited auditing firms. With respect to the consideration of the population size when respondents had to decide whether or not to use a statistical approach for sampling, the p-value was 0.03322 (< 0.05), which indicated that there was a significant difference in the responses.

Upon further analysis it emerged that all the Big 4 auditing firms had indicated that they did not consider the population size to be a factor in deciding whether or not to use a statistical approach to sampling, whereas 50% of the other JSE-accredited auditing firms had indicated that they did and 50% that they did not.

6.5.2 The person responsible for deciding whether or not to use statistical sampling

Questions 8 and 9 of the questionnaire required the respondents to indicate who, in their experience, would typically be responsible for deciding whether or not statistical sampling should be used in an audit, taking into account the considerations mentioned in section 6.5.1. Question 8 specifically asked who would make the initial decision and question 9 specifically asked who would make the final decision, thereby approving and possibly overriding the initial decision made. Table 6.13 presents the findings from the answers to these two questions.

Table 6.13 Responsible persons for deciding to use statistical sampling

Person responsible	Proportion of respondents (%)	
	Initial decision	Final decision
Senior on audit	25%	-
Manager on audit	50%	37.5%
Partner in charge of audit	25%	62.5%

From Table 6.13 it can be seen that in most firms (50%) the manager on the audit was typically responsible for making the initial decision whether or not to use a statistical sampling approach. In 62% of the firms the partner in charge of the audit was indicated to have the final responsibility to accept the sampling approach or to require it to be changed.

Although the majority of the firms indicated that the partner in charge was the person responsible to exercise his professional judgement, it was not a statistically significant majority.

- **Comparison with the findings of the South African study in 1981**

The findings of the De Bruyn study as presented in section 4.4.3 of chapter 4 can be presented in a “Senior – Manager – Partner” format for the initial decision whether or not to use a statistical sampling approach as follows: 27% - 17% - 49% (De Bruyn, 1981:257). The findings of this study (2010) for the initial decision in the same format were as follows: 25% - 50% - 25%. It can be seen that a shift in the level of responsibility at which the initial decision was made had taken place. The 1981 study indicated that the partners were identified as the responsible person by 49% of the respondents, compared to 25% in 2010. Considering the results presented in the “Senior – Manager – Partner” format, it can be deduced that this responsibility had more recently been shifted to the manager on the audit.

Following the same approach as above regarding the final decision whether or not to use a statistical sampling approach, the findings of the 1981 study can be presented as follows: 1% - 8% - 80% (De Bruyn 1981:257). The findings of this study (2010) for the final decision were as follows: 0% - 38% - 62%. The trend identified above regarding the initial decision can also be identified for the final decision. In 1981 the partners were indicated by 80% of the respondents to be the person responsible to decide on the use of statistical principles for sampling. However, only 62% of the respondents in this study (2010) indicated that the partner was the responsible person. Considering the results presented in the "Senior – Manager – Partner" format, it can be deduced that in many of the firms this responsibility had to some extent more recently been shifted to the manager on the audit.

Therefore, although the partner in charge of the audit is still (since 1981) the person indicated by the majority of the respondents to be the person responsible to make the final decision whether or not to use a statistical approach to sampling, the above could indicate that this is changing, since in 2010 fewer of the respondents indicated the partner to be the responsible person and more indicated the manager on the audit to be that person.

- **Comparison with the findings of recent international studies**

None of the international studies reviewed in chapter 4 asked a similar question.

- **Differences identified between the approaches of the Big 4 auditing firms and the other JSE-accredited auditing firms**

No significant differences were identified between the responses of the Big 4 auditing firms and the other JSE-accredited auditing firms regarding this question.

The decision flow from initial to final decision as was discussed above poses the question of how many firms used more than one person to exercise his or her professional judgement in making this decision, and in how many firms this decision was made by a single individual. In analysing the original data the following possible decision flows were identified:

- Initial decision at senior level, with final decision at manager level.
- Initial and final decision at manager level.
- Initial decision at manager level, with final decision at partner level.
- Initial and final decision at partner level.

Table 6.14 presents the results of categorising the original data into the above categories of possible decision flows.

Table 6.14 Decision flows when deciding to use statistical sampling

Decision flow	Proportion of respondents (%)		
	Two persons involved	Only individuals	Level of final approval
Senior, then manager	25%	-	Cumulative 37.5%
Only manager	-	12.5%	
Manager, then partner	37.5%	-	62.5%
Only partner	-	25%	
<i>Total</i>	<i>62.5%</i>	<i>37.5%</i>	<i>100%</i>

Table 6.14 indicates that in the majority of the firms (62.5%) (not statistically significant) more than one person was involved in deciding whether or not to use a statistical sampling approach. There are, however, firms (37.5%) (not statistically significant) in which only one person had the responsibility of making this decision, namely two of those at manager level and four at partner level.

Although having only one person responsible to decide on whether or not to use statistical sampling could be indicative of exposure to possible risk, it is mitigated by the fact that this decision is made in the majority of the firms at the highest level of seniority and experience, namely by the partner.

6.5.3 Prescribed minimum confidence levels

In section 3.1 of chapter 3 the underlying principle of the confidence level in statistical sampling, as well as the impact it has on the resulting sample, was discussed. The determination of the level of confidence was identified in step 4 of both Tables 3.2 and 3.3 in chapter 3 as an area where professional judgement was needed. Question 13 of the questionnaire asked the respondents if their firm's audit methodology prescribed the confidence levels to be used, or if they had to use their professional judgement to determine it. Further, in the event of the audit methodology predetermining the confidence level to be used, they were asked in question 14 of the questionnaire to indicate for both tests of controls and substantive procedures what this level would typically be. Table 6.15 below presents the findings.

Table 6.15 Prescribed minimum confidence levels in statistical sampling

Confidence level predetermined	Proportion of respondents (%)	Predetermined level	Tests of controls	Substantive procedures
Yes	56%		*of the 9 respondents, only 8 indicated levels allowed	*of the 9 respondents, only 7 indicated levels allowed
		80%	38%	71%
		90%	50%	29%
		95%	12%	-
No	44%			

From the results presented in the table in Table 6.15 above, it can be seen that the majority of the respondents indicated that their firm's audit methodology had a predetermined minimum level of confidence to use in statistical sampling. Of those who did indicate what the typical confidence level would be, the majority indicated a minimum confidence level of 90% to be used for tests of controls (50% of the respondents) and a lower level of 80% for substantive procedures (71% of the respondents).

- **Comparison with the findings of the South African study in 1981**

In the De Bruyn study it was found that for tests of controls a minimum confidence level of 95% was used by the majority (62%) of the respondents (De Bruyn, 1981:297), compared to this study's indicated prescribed level of 90% (50% of the respondents).

The De Bruyn study found for substantive procedures that the minimum confidence level used by the majority (54%) of the respondents was also 95% (De Bruyn, 1981:297), compared to this study's indicated prescribed level of 80% (71% of the respondents).

Therefore it could be concluded that since 1981 the minimum confidence levels had been adjusted downwards for both tests of controls and substantive procedures. A downwards adjustment in the minimum confidence level required by firms' methodologies implied that they were content to accept a higher risk of the results from the sample not being a true reflection of the population. (The respondents were 95% sure about the conclusion they had drawn regarding both tests of controls and substantive procedures in 1981, but now were only 90% sure about conclusions regarding tests of controls and only 80% sure about conclusions regarding substantive procedures.) A possible explanation for this could be the introduction of business risk based audit strategies in the late 1980's (as was discussed in section 1.3), which introduced a greater focus during the audit planning process on the specific risks of the company being audited, which in turn reduced the extent of testing of specific controls, transactions and balances required, given the more rigorous and reliable risk assessment process.

- **Comparison with the findings of recent international studies**

None of the international studies reviewed in chapter 4 asked a similar question.

- **Differences identified between the approaches of the Big 4 auditing firms and the other JSE-accredited auditing firms**

No significant differences were identified between the responses of the Big 4 auditing firms and the other JSE-accredited auditing firms regarding this question.

6.5.4 Prescribed maximum precision levels

In section 3.1 of chapter 3 the underlying principle of the precision level in statistical sampling, as well as the impact it has on the resulting sample, was discussed. The determination of the level of precision was identified in step 4 of both Tables 3.2 and 3.3 in chapter 3 as an area where professional judgement was needed. Question 15 of the questionnaire asked the respondents if their firm's audit methodology prescribed the precision levels to be used, or if they had to use their professional judgement to determine it. Further, in the event of the audit methodology predetermining the precision level to use, they were asked in question 16 of the questionnaire to indicate for both tests of controls and substantive procedures what this level would typically be. Table 6.16 below presents the findings.

Table 6.16 Prescribed maximum precision levels in statistical sampling

Precision level predetermined	Proportion of respondents (%)	Predetermined level	Tests of controls	Substantive procedures
Yes	44%		*of the 7 respondents, all 7 indicated levels allowed	*of the 7 respondents, only 6 indicated levels allowed
		3%	14%	-
		5%	57%	67%
		10%	29%	33%
No	56%			

From the results presented in the table in Table 6.16 above it can be seen that the majority of the respondents indicated that their firm's audit methodology did not have a predetermined maximum level of precision to use when using statistical sampling. Of the respondents who did indicate that their firm's audit methodology did in fact prescribe the maximum precision level to use, the majority indicated a maximum precision level of 5% to be used for both tests of controls (57% of the respondents) and substantive procedures (67% of the respondents).

- **Comparison with the findings of the South African study in 1981**

In the De Bruyn study it was found that for tests of controls a maximum precision level of 3% or less was used by the majority of the respondents (55%) (De Bruyn, 1981:298), compared to this study's indicated prescribed level of 5% (57% of the respondents).

The De Bruyn study found for substantive procedures that the maximum precision level used by the majority of the respondents (67%) was also 3% or less (De Bruyn, 1981:298), compared to this study's indicated prescribed level of 5% (67% of the respondents).

Therefore it could be concluded that since 1981 the maximum precision levels had been adjusted upwards. An upwards adjustment in the maximum precision level acceptable to the auditors implied that they were content to accept a higher risk that the results from the sample could contain errors. (They accepted 3% or less errors in samples in 1981, but are currently accepting 5%.) A possible explanation for this could also be the introduction of business risk based audit strategies in the late 1980's (as was discussed in section 1.3), which introduced a greater focus during the audit planning process on the specific risks of the company being audited, which in turn reduced the extent of testing of specific controls, transactions and balances required, given the more rigorous and reliable risk assessment process.

Considering the role these variables play in the calculation of the sample sizes to be used, as was discussed in chapter 3, Tables 3.2 and 3.3, the conclusion can be drawn that the changes in the levels of precision (refer to section 6.5.4) and confidence (refer to section 6.5.3) from 1981 till 2011 could have resulted in the sample sizes calculated by using these variables being smaller.

- **Comparison with the findings of recent international studies**

None of the international studies reviewed in chapter 4 asked a similar question.

- ***Differences identified between the approaches of the Big 4 auditing firms and the other JSE-accredited auditing firms***

No significant differences were identified between the responses of the Big 4 auditing firms and the other JSE-accredited auditing firms regarding this question.

When considering the results presented in sections 6.5.3 and 6.5.4 together, the following conclusions could be drawn from the results obtained in this study:

- *For tests of controls the auditor using the guidelines above would be 90% sure that the deviation rate in the population did not exceed 5%.*
- *For substantive procedures the auditor using the guidelines above would be 80% sure the balance audited was not misstated by more than 5%.*

It is important to note that the fact that predetermined levels for minimum confidence and maximum precision were used did not indicate that the auditor's professional judgement was limited because he or she was using statistical sampling. These levels were predetermined and decided upon within each specific firm, taking into account the audit risk the firm was willing to accept. Therefore the firm's policy was determined by auditors using their professional judgement and it is this policy that is the limiting factor in the particular audit.

6.5.5 Allowing professional judgement adjustments in the statistical sampling steps

Although all the respondents indicated that their firms' audit methodologies allowed the use of statistical sampling, some indicated that they did not use statistical principles in all the sampling steps (refer to sections 6.3.4.1 and 6.3.5.1). Question 17 of the questionnaire asked the respondents to indicate for each statistically based sampling step if their firm's audit methodology allowed the use of professional judgement, and if so, who

would be responsible to apply his or her judgement. The findings are presented in Table 6.17 below.

Table 6.17 Professional judgement allowed in the statistical sampling steps

Sampling step in which professional judgement was allowed	Proportion of respondents (%)	Individual allowed	Proportion of respondents (%)
Determining size	69%	Junior on audit Senior on audit Manager on audit Partner in charge	- 9% 27% 64%
Selecting items	63%	Junior on audit Senior on audit Manager on audit Partner in charge	10% 40% 40% 10%
Evaluating results	75%	Junior on audit Senior on audit Manager on audit Partner in charge	- 33% 50% 17%

It can be seen from the results as presented in Table 6.17 that a statistically significant number of firms allowed the use of professional judgement in determining sample size (69%) and evaluating results (75%) when using statistical sampling. The majority, although not statistically significant, also indicated that when selecting items they allowed the use of professional judgement if deemed necessary.

The level of authority of the individual who would typically apply his/her professional judgement was not the same for all three steps. The partner was the most likely person to make the necessary professional judgement adjustments in determining sample size. The manager and the senior on the audit shared the responsibility for selecting sample items,

and the manager on the audit was most likely to be responsible for evaluating the sample results.

With respect to the findings of section 6.4.1, the results presented above were not expected. In section 6.4.1 only 16% of the respondents indicated that determining sample size was a problematic step in applying statistical sampling, but a significant proportion (76%) indicated that the evaluation of tests results and extrapolation thereof to the population was the most problematic step. Therefore it was expected that in the more problematic step the professional judgement required would be exercised by the more senior level in the organisational hierarchy and therefore by the partner in charge of the audit. However, this was not what was found, since in only 17% of the firms the partner was indicated to be the responsible person to apply his professional judgement in the evaluation of sample test results.

- **Comparison with the findings of the South African study in 1981**

The study by De Bruyn (1981) did not ask a similar question.

- **Comparison with the findings of recent international studies**

None of the international studies reviewed in chapter 4 asked a similar question. However, the study by Ponemon and Wendell (1995:32) as discussed in chapter 4, section 4.4.3, found that the experience level of the individual who was responsible for applying his professional judgement in statistical sampling should be considered carefully as it could have an impact on the accuracy of the results of the sample.

- **Differences identified between the approaches of the Big 4 auditing firms and the other JSE-accredited auditing firms**

No significant differences were identified between the responses of the Big 4 auditing firms and the other JSE-accredited auditing firms regarding this question.

RESEARCH QUESTION 4:

What assistance and resources are available to audit teams using statistical sampling?

6.6 Available resources to assist in using statistical sampling

The first three research questions of this study focused on how statistical sampling is used in practice, reasons why auditors will choose not to use it and the role professional judgement plays in applying it. In section 6.4.2 the two main reasons for not using statistical sampling were identified by categorising the responses received. These two main reasons were identified as being the lack of confidence in applying the statistical principles underlying statistical sampling, and the perceived inefficiency of the process (costs).

The fourth research question investigated the availability of resources to assist in addressing this indicated lack of knowledge and the inefficiency of the process of statistical sampling. In subsection 6.6.1 the findings of the questions asked in the questionnaire relating to efficiency are discussed, and in subsections 6.6.2 and 6.6.3 the findings of the questions asked relating to knowledge-related resources are discussed.

6.6.1 Computer software for increased efficiency

Question 19 of the questionnaire relates to the efficiency of the statistical sampling process. The respondents were asked to indicate if the three main statistical sampling steps were computerised within their respective firms. In the case of it being computerised, they were asked to further indicate if the software used had been specifically self-developed (in-house), or purchased from external suppliers as off-the-shelf applications. The results are presented in Table 6.18 below.

Table 6.18 Computerisation of statistical sampling steps

Sampling step computerised	Proportion of respondents (%)	Software development	Proportion of respondents (%)
Determining size	63%	Bought in Self-developed	60% 40%
Selecting items	63%	Bought in Self-developed	80% 20%
Evaluating results	56%	Bought in Self-developed	33% 67%

From Table 6.18 above it can be seen that most firms indicated that they were using computer software to assist in all three the main steps of sampling, although it was not indicated by a statistically significant majority.

Considering the general availability of statistical software specifically adapted for auditing purposes in the marketplace, it was not anticipated that there would be auditing firms that were not using computerised software to assist in the statistical sampling steps. Possible explanations for this finding are as follows:

- *For determining sample size, some firms' audit methodologies may specify a number of items that are to be selected for testing in particular circumstances (e.g. if the population exceeds 1 000 items, given certain audit risk factors, 30 items should be selected, whereas if risk factors are different, 40 items should be selected). In such cases, the use of a computerised application would be superfluous.*
- *Since it was found in sections 6.3.4.2 and 6.3.5.2 that systematic selection using a random start and MUS were the selection methods most used, auditors may be determining the starting points for selecting items to be included in a statistical sample using a simple random number generator and then counting down the intervals. This might well be done in a simple "computerised environment" (for instance on a Microsoft Excel spreadsheet), but the respondents might not have considered such a*

spreadsheet to be “computerisation” for the purpose of answering the particular question in the questionnaire.

- *The fact that the sampling steps preceding the evaluation step were not computerised in the case of 37% of the respondents could explain the lack of computerisation of the evaluation of the results of audit procedures performed on the items included in the sample.*

Of the respondents who indicated that they did have computer software in their firms to assist them in the sampling steps, the majority indicated they used software packages that had been bought from external suppliers to assist in the calculation of sample size (60%), and a statistically significant majority in selecting items (80%). However, only 33% of the respondents who used computer software to assist in the evaluation process used externally developed software. The majority in this case used software that had been developed in-house specifically for the firm.

Since the evaluation of sample results was identified in section 6.4.1 as being the most problematic step in statistical sampling, it was not anticipated that in practice this would be the only step in which firms develop the software to assist in the process in-house. In section 6.4.2 the majority of the respondents also indicated that the reason why they thought auditors did not use statistical sampling was based on the lack of understanding of and experience in the use of statistical sampling. It was therefore anticipated that auditors would seek the expertise of an external software developer with the necessary knowledge to assist in developing software to be used and relied on by them, which is clearly not the case.

- **Comparison with the findings of the South African study in 1981**

The study by De Bruyn (1981) did not ask a similar question.

- **Comparison with the findings of recent international studies**

None of the international studies reviewed in chapter 4 asked a similar question.

- ***Differences identified between the approaches of the Big 4 auditing firms and the other JSE-accredited auditing firms***

As was described in section 6.1, the M-L Chi-square test was used to determine if there was a significant relationship between the responses of the Big 4 auditing firms and those of the other JSE-accredited auditing firms.

Regarding the use of computer software used to assist in the evaluation step of statistical sampling, the p-value was 0.01766 (< 0.05), which indicated that there was a significant difference in the responses.

Upon further analysis it emerged that all the Big 4 auditing firms had indicated that they did use computer software to assist in the evaluation process of the findings of statistical samples, compared to the majority of the other JSE- accredited auditing firms that had indicated that they did not.

Regarding the source of the statistical sampling software used by those respondents who indicated that their firms did use computer software to assist in determining the sample size, selecting the sample items or evaluating the sample results, the respective p-values were as follows: for size – 0.00547; for selecting – 0.01285 and for evaluating – 0.02969. All three of the steps had a p-value smaller than 0.05, which indicated that there were significant differences in the responses of the Big 4 auditing firms and those of the other JSE-accredited auditing firms.

Upon further analysis it was found that the majority of the Big 4 auditing firms made use of in-house developed software, compared to the majority of the other JSE-accredited auditing firms, who bought sampling software from external suppliers. A possible explanation for this could be that the Big 4 auditing firms are part of large multinational firms that have the capital available to invest in software development, while some of the other firms are not part of such networks.

6.6.2 Knowledge-related resources: Reference material in practice

Questions 18, 20 and 21 of the questionnaire related to the knowledge base and available resources needed to gain the necessary confidence in applying the statistical principles underlying statistical sampling.

Question 18 of the questionnaire investigated the availability of reference materials when faced with statistical sampling in an audit in practice. The respondents were asked to indicate if they had the following internal resources available to assist audit teams when applying statistical sampling: a guide (written instructions on the steps to follow when using statistical sampling) and/or a training course that covered statistical sampling. The results are presented below in Table 6.19.

Table 6.19 Reference materials available in practice

Reference material type	Number of respondents	Proportion (%)
<ul style="list-style-type: none"> Firm guide or manual 	14	88%
<ul style="list-style-type: none"> Firm training course 	11	69%

From Table 6.19 it appears that a statistically significant number of the respondents (88%) had a written guide on how to apply statistical sampling available in their firms that staff could consult when using statistical sampling. The majority of the respondents (69%) (not statistically significant) also indicated that they had a training course in their firms through which staff was trained on how to apply statistical sampling according to their firms' methodologies.

- **Comparison with the findings of the South African study in 1981**

The study by De Bruyn (1981) found that only 36% of the respondents had a written guide available for assistance when using statistical sampling (De Bruyn, 1981:332), as was mentioned in chapter 4, section 4.5.1, and 50% of the respondents could attend in-house training courses in the use of statistical sampling within their firms (De Bruyn, 1981:331), compared to the majority that indicated in this study (2010) that they had both available.

Therefore, the availability of reference materials and firm-specific training had increased since 1981, although the use of statistical sampling had not necessarily done the same (refer to the findings in 6.3.4.1 and 6.3.5.1).

- **Comparison with the findings of recent international studies**

In the American study by Hall et al. (2002:130) the respondents indicated that the first literature source they would consult when using statistical sampling would be their firm's guide, and secondly they would consult the AICPA audit sampling guide. In South Africa the firms guide is the only literature source available, as an audit sampling guide equivalent to that of AICPA is not available in South Africa.

- **Differences identified between the approaches of the Big 4 auditing firms and the other JSE-accredited auditing firms**

No significant differences were identified between the responses of the Big 4 auditing firms and the other JSE-accredited auditing firms regarding this question.

6.6.3 Knowledge-related resources: Level of education and training of students and trainees

Questions 20 and 21 of the questionnaire investigated the available education and training in the use of statistical sampling in the current qualification path of a Registered Auditor in South Africa. The questionnaire specifically focused on the education of students at university level and the training of trainees in their three years of traineeship in the respective firms.

Question 20 asked the respondents to consider the competence of the first-year trainees in using statistical sampling and to indicate if they considered the coverage of statistical sampling in the university programmes to meet their expectations or not. The question focused on the education students received in their undergraduate courses at university. Statistics is usually only incorporated at an undergraduate level in the education programmes of these students, since an intermediate knowledge level is required by the SAICA Competency Framework (SAICA, 2010b) regarding audit sampling (ISA 530). The

Competency Framework further defines an intermediate knowledge level as enabling the student to be able to deal with the issues and solve simple problems inherent to the topic and not possible complexities and exceptions thereof.

Question 21 of the questionnaire focused on the training trainees received in the course of their traineeship in the auditing firms. The question asked the respondents to consider their firm's training programme and rate the coverage of training in the practical use of statistical sampling that the firm provided to its trainees.

The results of the above two questions are presented in Table 6.20 below.

Table 6.20 Coverage of statistical sampling in training students and trainees

Training level	Coverage level	Number of respondents	Proportion (%)
Students at universities	Does not meet	12	75%
	Meets	4	25%
	Exceeds	0	-
Trainees in firms	None	0	-
	Minor	9	56%
	Substantial	7	44%

From Table 6.20 it is clear that a statistically significant number of the respondents (75%) indicated that the university programmes' coverage of the use and understanding of statistical sampling as prescribed by the SAICA Competency Framework as discussed above, did not meet their expectations. The table further indicates that all the firms did cover statistical sampling in the course of their training of trainees during their traineeship. However, the majority (not statistically significant) of the respondents (56%) indicated that this coverage was minor.

Since the majority of the respondents indicated that they felt that the university education did not meet their expectations, it was expected that statistical sampling would be covered more substantially during the training of the trainees in the auditing firms. A possible

reason for this not being the case, could be that the additional costs and time involved in the training of trainees outweighs the benefit of using statistical sampling in practice. Since the use of statistical sampling is not required by the ISAs, it might be more cost effective to choose not to use it.

The results of the majority of the respondents indicating that, in their opinion, the university programmes did not meet their expectations in respect of covering statistical sampling, and that the level of coverage of statistical sampling was minor in the traineeship period of trainees with the firms, supports the previous finding that one of the single most pertinent reasons for not using statistical sampling as indicated by the respondents was the lack of understanding of the statistical principles on which it is based (refer to Table 6.12).

- **Comparison with the findings of the South African study in 1981**

The study by De Bruyn (1981) found that the majority (58%) of the respondents felt that the coverage of statistical sampling at university level did not meet their expectations (De Bruyn, 1981:324). In this study (2010) a significant majority (75%) of the respondents indicated that they felt the current coverage of statistical sampling at university level did not meet their expectations. Therefore the proportion of respondents indicating that their expectations were not met had increased since 1981.

- **Comparison with the findings of recent international studies**

As was mentioned in chapter 4, section 4.5.2, it was found in the American study by Hall et al. (2002:131) that the majority (87%) of the respondents indicated that statistical sampling received only minor coverage in their college training. However, in a similar Canadian study by Maingot and Quon (2009:228) the respondents were divided approximately equally between those indicating that statistical sampling received minor and substantial coverage.

Since the present study asked if the respondents' expectations were met or not, its findings cannot be compared directly with the abovementioned international studies' findings, in which the respondents commented on their own college training.

- ***Differences identified between the approaches of the Big 4 auditing firms and the other JSE-accredited auditing firms***

No significant differences were identified between the responses of the Big 4 auditing firms and the other JSE-accredited auditing firms regarding this question.

6.7 Summary

In this chapter the data received from the respondents was discussed and analysed. Significant findings were highlighted and comparisons were made with the findings of the local and international studies as reviewed and discussed in chapter 4.

The next chapter contains a summary of the main findings that were presented in detail in this chapter, as well as the conclusions reached regarding these results, with specific reference to the main and secondary objectives of this study as discussed in chapter 1, section 1.5.

CHAPTER 7

SUMMARY AND CONCLUSION

In chapter 6 the results of the analysis of the completed questionnaires received back from the respondents were presented in detail. In this chapter the results are summarised, firstly addressing the main objective of this study by giving an overview of the main findings of the investigation of certain key aspects of the use of statistical sampling as a sampling technique in the audits of financial statements done by South African Registered Auditors accredited by the JSE. An overview of ancillary findings relating to the main objective, pertaining to difference identified between the indicated uses in the Big 4 auditing firms and the other JSE accredited firms, is also presented.

Secondly, the summary of the main results is used to compare the findings of this study to those of the local study by De Bruyn (1981) and those of the more recent international studies, as discussed in chapter 4, in order to address the secondary objective of this study.

7.1 Main objective: key aspects of current uses of statistical sampling in South Africa

7.1.1 Main findings regarding the key aspects of current uses of statistical sampling in South Africa

The aspects to be explored regarding the use of statistical sampling as a sampling technique in JSE-accredited auditing firms were defined in chapter 1, section 1.5 in the form of four research questions to be answered by the study. An overview of the main findings of this study pertaining to each of these research questions is given below. The related section numbers in chapter 6 where the detailed findings were presented are shown in brackets.

RESEARCH QUESTION 1:
Is statistical sampling allowed in audits performed by Registered Auditors in South Africa, and if so, how is it being applied?

In section 1.6.1 the underlying research questions asked in order to address research question 1 as stated above were formulated. In Table 7.1 the findings in respect of each of these questions are summarised.

Table 7.1 Main findings in respect of research question 1

Specific research questions	Findings	Ref
1(a) <i>Do the auditing firms' audit methodologies allow for the use of statistical sampling?</i>	All the respondents (100%) indicated that it was allowed.	6.3.1
1(b) <i>What is the estimated extent to which statistical sampling is being used in audit engagements?</i>	A statistically significant majority of the respondents (75%) indicated that it is used in the majority of their audits.	6.3.2
1(c) <i>Is statistical sampling allowed to be used in determining sample size, in identifying items for inclusion in the sample and in the evaluation of results?</i>	<p>Those respondents who indicated that the auditing firm allowed the use of statistical sampling in either tests of controls or substantive procedures, further indicated that this was the case in the following specific sampling steps:</p> <p>Test of controls:</p> <ul style="list-style-type: none"> • Determining sample size (77%) – statistically significant majority allowed. • Selecting items (92%) – statistically significant majority allowed. • Evaluating results (46%) – minority allowed. <p>Substantive procedures:</p> <ul style="list-style-type: none"> • Determining sample size (80%) – statistically significant majority allowed. • Selecting items (93%) – statistically significant number allowed. • Evaluating results (53%) – although majority allowed, not a statistically significant majority. 	<p>6.3.4.1</p> <p>6.3.5.1</p>
1(d) <i>Which statistical sampling methods are being allowed?</i>	Those respondents who indicated that the auditing firm allowed the use of statistical sampling in a specific sampling step, either for use in tests of controls or substantive procedures, further indicated that the following sampling plans and selection methods were allowed:	

Specific research questions	Findings	Ref
	<p>Tests of controls:</p> <ul style="list-style-type: none"> Sampling plan for determining sample size and basis for evaluating test results: <i>Only half of the respondents could identify the sampling plans used.</i> <i>All of them indicated that the fixed sample size plan was allowed and one indicated that discovery sampling was also allowed.</i> Sampling method for selecting items: <i>The majority (58%), although not statistically significant, indicated systematic selection using a random start to be allowed.</i> <i>Simple random selection was allowed in 42% of the responses.</i> <p>Substantive procedures</p> <ul style="list-style-type: none"> Sampling plan for determining sample size and basis for evaluating test results: <i>42 % of the respondents could not identify the sampling plans used.</i> <i>The majority (67%), although not statistically significant, indicated that MUS was allowed; one indicated that unstratified mean per unit sampling was also allowed.</i> Sampling method for selecting items: <i>The majority (64%), although not statistically significant, indicated systematic selection using a random start to be allowed.</i> <i>The selection method included in MUS was also indicated to be allowed by a non-statistically significant majority of 57%.</i> 	<p>6.3.4.2</p> <p>6.3.5.2</p>
<p>1(e) <i>Are these statistical sampling methods allowed in both tests of controls and substantive procedures?</i></p>	<p>A statistically significant majority of respondents indicated that they were allowed in both these types of procedures: Tests of controls: 81% Substantive procedures: 94%</p>	<p>6.3.3</p>

On the basis of the findings as summarised in Table 7.1, the overall conclusions below were drawn.

Although all the respondents indicated that statistical sampling was allowed by their firms' audit methodologies (1a), and the majority of the respondents indicated that they did use statistical sampling in audits in practice (1b), when considering all 16 respondents only six (38%) of them could use a full statistical approach in performing tests of controls (Table 6.6) and in performing substantive procedures (Table 6.9).

In both tests of controls and substantive procedures, statistical sampling is used to a significant extent in determining sample sizes and selecting sample items, but to a significantly lesser extent in evaluating sample results.

Various different sampling plans and methods are allowed in both tests of controls and substantive procedures. The respondents could in some instances not indicate which sampling plans and methods were applied when statistical sampling was allowed in the audit methodologies of their firms, particularly regarding tests of controls. The main reason for this could be that the firms use software packages that automate the statistical sampling plan built into it. The auditor relies on this to be appropriate for use in audits by him/her.

RESEARCH QUESTION 2:

What are the main reasons for South African auditors to decide not to use statistical sampling in an audit?

In section 1.6.1, research question 2 was formulated as set out above. The questionnaire contained two separate questions (questions 11 and 12) in order to address research question 2 from two different angles. In Table 7.2 the findings in respect of each of these questions are summarised.

Table 7.2 Main findings in respect of research question 2

Specific research questions	Findings	Ref
2(a) <i>In which statistical sampling steps are problems most frequently encountered?</i>	A statistically significant majority of the respondents (76%) indicated that evaluating the sample results was the most problematic.	6.4.1
2(b) <i>In their opinion, why would auditors prefer not to use statistical sampling?</i>	<p>A statistically significant majority of the respondents (76%) indicated that statistical sampling is perceived to be inefficient and therefore too expensive.</p> <p>A majority (62%), although not statistically significant, also felt that a lack of confidence in the use of statistical sampling due to a lack of understanding, experience and training is a deterrent.</p>	6.4.2

On the basis of the findings as summarised in Table 7.2 the overall conclusions below were drawn.

The evaluation of the sample results was indicated to be the most problematic statistical sampling step. A majority of respondents indicated that auditors do not feel confident using statistical sampling. Since the evaluation of the sample results is the step in which statistical inference has to be made by using test results and the statistical theory that the sampling process was based on, this sampling step is the one that requires an understanding of the whole statistical sampling application. If this understanding is lacking, it explains at least partially why the evaluation of sample results is perceived to be the most problematic statistical sampling step.

Consideration should be afforded to whether the lack of knowledge and experience of auditors in the application of statistical sampling methods in an auditing environment does not possibly cause the statistical sampling method to be perceived to be inefficient, whereas, in fact, if used by a knowledgeable and experienced person, the process could add more value than that perceived by respondents in this study.

RESEARCH QUESTION 3:**How do South African Registered Auditors exercise professional judgement in the use of statistical sampling?**

In section 1.6.1 the underlying questions asked in order to address research question 3 as stated above were formulated. In Table 7.3 the findings in respect of each of these questions are summarised.

Table 7.3 Main findings in respect of research question 3

Specific research questions	Findings	Ref
<p>3(a) <i>What is the impact of the use of statistical sampling on the need for exercising professional judgement when using sampling in an audit?</i></p>	<p>When applying statistical sampling there are many steps in which professional judgement is required (refer Table 3.2 and Table 3.3). Two key variables that have to be determined by applying professional judgement are the minimum confidence level and the maximum precision level.</p> <p>Only 44% of the respondents were allowed to use their professional judgement in determining the confidence levels and 56% in determining precision levels. The remainder had to use levels that were prescribed by the firms' audit methodologies. The typically prescribed level for both levels were indicated to be as follows by the majority (although not statistically significant):</p> <ul style="list-style-type: none"> • Minimum confidence level: <ul style="list-style-type: none"> For tests of controls – 90% For substantive procedures – 80% • Maximum precision level: <ul style="list-style-type: none"> For tests of controls – 5% For substantive procedures – 5% 	<p>6.5.3</p> <p>6.5.4</p>
<p>3(b) <i>Is professional judgement necessary in determining sample size, in identifying items for inclusion in the sample and in evaluating the results?</i></p>	<p>The respondents indicated that professional judgement was allowed by the firms' audit methodologies in each of the following sampling steps:</p> <ul style="list-style-type: none"> • Determining sample size – allowed by 69% - statistically significant majority. • Selecting items – allowed by 63% - majority, although not statistically significant. • Evaluating results – allowed by 75% - statistically significant majority. 	<p>6.5.5</p>

Specific research questions	Findings	Ref
3(c) <i>Who is responsible for exercising this professional judgement?</i>	<p>Since there are many different points during the sampling process at which professional judgement is required, the respondents were asked to indicate who would typically be the responsible person(s) to use his/her professional judgement at some of the key points in the sampling process. The findings were as follows:</p> <ul style="list-style-type: none"> • Initial decision to use either a statistical or non-statistical sampling approach: Manager on audit (50%) – majority, although not statistically significant. • Determining sample size: Partner in charge (64%) – majority, although not statistically significant. • Selecting items: Either senior or manager on audit (40% each) – no majority indicated and neither being statistically significant. • Evaluating results: Manager on audit (50%) – majority, although not statistically significant. • Final acceptance of sampling approach: Partner in charge (62%) – majority, although not statistically significant. 	<p>6.5.2</p> <p>6.5.5</p> <p>6.5.5</p> <p>6.5.5</p> <p>6.5.2</p>

On the basis of the findings as summarised in Table 7.3 the overall conclusions below were drawn.

Considering the prescribed precision and confidence levels in the audit methodologies of the firms, auditors would typically be able to draw the following conclusions from tests of controls and substantive procedures in which statistical sampling was used respectively:

- For tests of controls the auditor would be 90% sure that the deviation rate in the population tested did not exceed 5% (6.5.3 and 6.5.4).
- For substantive procedures the auditor would be 80% sure that the balance audited was not misstated by more than 5% (6.5.3 and 6.5.4).

The minority (not statistically significant) of the respondents indicated that these prescribed precision and confidence levels were allowed to be adjusted by applying professional judgement if deemed necessary. It was further indicated by the majority (not statistically

significant) that professional judgement may be used to make adjustments to determined sample sizes (typically by the partner), selected items (typically by the senior or manager) and evaluations of results (typically by the manager) when statistical sampling was used.

Experienced auditors are responsible for applying professional judgement in all steps in audit sampling. Importantly, the partner in charge of the audit was identified to be the person typically responsible for the final acceptance, on the basis of his professional judgement, of the sampling approach followed in an audit.

RESEARCH QUESTION 4:
What assistance and resources are available to audit teams using statistical sampling?

In section 1.6.1 the specific questions asked in order to address research question 4 as stated above were formulated. In Table 7.4 the findings in respect of each of these questions are summarised.

Table 7.4 Main findings in respect of research question 4

Specific research questions	Findings	Ref
4(a) <i>What resources are available to audit teams regarding the practical use of statistical sampling?</i>	A statistically significant majority of the respondents (88%) indicated that they had a written guide available to staff on how to apply statistical sampling.	6.6.2
	The majority of the respondents (69% - not statistically significant) also indicated that they had training courses in the firm to train staff how to apply statistical sampling according to the firm's audit methodology.	6.6.2
4(b) <i>Are computer applications used in statistical sampling? If so, are these developed specifically for the firm, or bought in?</i>	The majority of the respondents (although not statistically significant) indicated that the statistical sampling process was computerized within the firms. It was further indicated that of those who did use computer software to assist in statistical sampling, the majority used externally developed software for <i>determining sample size</i> and <i>selecting items</i> .	6.6.1

Specific research questions	Findings	Ref
	However, the majority (67%), although not statistically significant, of those who used computer software to assist in <i>evaluating results</i> , made use of in-house developed software.	
4(c) <i>Are all the audit steps in using statistical sampling supported by software?</i>	The respondents indicated that the following sample steps were computerised: <ul style="list-style-type: none"> • Determining sample size (63%) – majority, although not statistically significant. • Selecting items (63%) – majority, although not statistically significant. • Evaluating results (56%) – majority, although not statistically significant. 	6.6.1
4(d) <i>Does the level of knowledge of the trainees of statistical sampling meet the expectations of the Registered Auditors in practice?</i>	A statistically significant majority (75%) of the respondents indicated that the coverage of statistical sampling in the university courses followed by trainees did not meet their expectations. A majority (56%), although not statistically significant, indicated that the coverage of statistical sampling in the firms' training programs was minor, with the remaining (44%) indicating substantial coverage.	6.6.3

On the basis of the findings as summarized in Table 7.4 the overall conclusions below were drawn.

- *Efficiency related assistance and resources*

Although the majority of the respondents indicated that their statistical sampling applications were computerised, this was not a statistically significant majority. Approximately a third of the auditors did not have computer software to assist them in the determination of the sample size and the selection of items to be included in the sample, and even more (44%) did not have this assistance in evaluating the sample results.

The majority (although not statistically significant) of the auditors who indicated that they used computer software for statistical sampling were using externally developed software for determining sample size and a statistically significant majority for selecting sample items. The majority of those who used software for evaluating results used internally

developed software. As was discussed in section 6.6.1 this finding was unexpected, since evaluation was the most problematic statistical sampling step for the respondents as indicated in Table 6.11. One would therefore expect a wider usage of software developed by experts to be used for this purpose. To further investigate the reason for this could assist in understanding the reluctance of auditors to use statistical sampling in practice. However, such an investigation falls outside the scope of this study and has been included as an area for further research in section 7.4.

- *Knowledge related assistance and resources*

It was found that a statistically significant majority of the auditors were making use of a written guide to assist their staff on how to use statistical sampling in practice. As was mentioned in section 4.5.1, in South Africa there is no statistical sampling guide that is published by either of the professional bodies (SAICA or the IRBA). The development of such an endorsed guide for use in the South African audit environment could help address the lack of confidence auditors experience in applying statistical sampling. An investigation of this possibility has been included as an area for further research in section 7.4

It can be concluded that the coverage of statistical sampling at university level did not meet the expectations of the auditing firms. This places the burden to train graduates, in the form of additional costs and time, on the auditing firms employing them. Furthermore, the majority of the firms indicated that the coverage of statistical sampling in the training of a typical trainee was minor. The lack of confidence of auditors to use statistical sampling, given as a reason for not using it (refer to Table 6.12), is therefore understandable considering these low levels of education and training in this area.

7.1.2 Ancillary findings regarding the key aspects of current uses of statistical sampling in South Africa: Big 4 versus other firms.

An overview of the statistical significant differences identified between the indicated uses in the Big 4 auditing firms and the other JSE accredited auditing firms are presented in Table 7.5 below.

Table 7.5 Differences in main findings between Big 4 and other JSE accredited auditing firms

Research question	Big 4 auditing firms	Other JSE accredited auditing firms	Ref
Extent to which statistical sampling was being used as an audit tool			
1(c)	All of the Big 4 audit firms' audit methodologies allowed for the use of statistical sampling methods when evaluating sample results of substantive procedures.	The majority of the other JSE accredited audit firms' audit methodologies did not explicitly allow for the use of statistical sampling when evaluating sample results of substantive procedures.	6.3.5.1
1(c)	All of the Big 4 audit firms' audit methodologies allowed for the use of a full statistical sampling approach when performing substantive procedures (all three sampling steps).	The majority of the other JSE accredited audit firms' audit methodologies did not explicitly allow for the use of full statistical sampling approach when performing substantive procedures (all three steps).	6.3.5.1
The main reasons for not using statistical sampling as an audit tool			
2(b)	All of the Big 4 audit firms indicated that they considered the perceived inherent inefficiency of statistical sampling to be the reason why auditors did not use it in practice.	The majority of the other JSE accredited audit firms indicated the level of confidence in using it because of the perceived complexity of it to be the deterrent.	6.4.2
The role of professional judgement in statistical sampling			
N/A	No statistically significant differences found.	No statistically significant differences found.	N/A
Available resources to assist in using statistical sampling			
4(c)	All of the Big 4 audit firms indicated that they did use computer software to assist in the evaluation process of findings of statistical sampling.	The majority of the other JSE accredited audit firms indicated that they did not.	6.6.1
4(c)	The majority of the Big 4 audit firms indicated that they made use of internally developed software.	The majority of the other JSE accredited audit firms indicated that they mainly made use of software bought from external suppliers.	6.6.1

On the basis of the findings as summarised in Table 7.5 the overall conclusions below were drawn.

Only a few differences were identified between the indicated uses in the Big 4 auditing firms and the other JSE accredited auditing firms. It is clear that the issue regarding the evaluation process not being based on statistical sampling principles is mainly due to the majority of the other JSE accredited auditing firms not explicitly allowing for the use thereof in their audit methodologies. It is then also within these firms that it was indicated that the evaluation step of the statistical sampling process was not computerised in order to assist in applying it.

7.2 Secondary objective: comparison of the results of this study with other international and local studies

The secondary objective of the study as defined in chapter 1, section 1.5 comprised a comparison of the findings of this study (as was presented in chapter 6) with those of the local study by De Bruyn (1981) and recent international studies done after 1990. A summary of the main findings from these comparisons is provided below.

7.2.1 Comparison with the local study by De Bruyn in 1981

An overview of the differences identified in findings between this study and the study by De Bruyn done in 1981 is presented in Table 7.6 below.

Table 7.6 Differences: local study by De Bruyn in 1981

Research question	Findings of this study	Findings of study by De Bruyn in 1981	Ref
Extent to which statistical sampling is used as an audit tool			
1(b)	A statistically significant majority (75%) of the respondents estimated that statistical sampling was used in the majority of audits.	Only 35% of the respondents indicated that statistical sampling was used in the majority of audits.	6.3.2

1(d)	The majority of the respondents indicated that the preferred selection method for items to be included in the sample for both tests of controls and substantive procedures was systematic selection with a random start.	The majority of the respondents indicated simple random selection to be the preferred method for selecting sample items.	6.3.4.2 and 6.3.5.2
The main reasons for not using statistical sampling as an audit tool			
2(a)	The majority of the respondents indicated the evaluation of the results of statistical sampling to be the most problematic step. The relationship between the steps is given in the “size – select – evaluate” order as follows: 13% - 6% - 63%.	Determining sample size and evaluating results were indicated to be equally problematic. The relationship between the steps is given in the “size – select – evaluate” order as follows: 45% - 11% - 44%.	6.4.1
The role of professional judgement in statistical sampling			
3(c)	The majority (50%) of the respondents indicated that the manager on the audit was typically responsible for making the <i>initial</i> decision whether or not to use statistical sampling.	The majority (49%) of the respondents indicated that the partner in charge of the audit would typically make the <i>initial</i> decision whether or not to use statistical sampling.	6.5.2
3(c)	The majority (62%) of the respondents indicated that the partner in charge of the audit was typically responsible for making the <i>final</i> decision whether or not to use statistical sampling.	A much greater majority (80%) of the respondents indicated that the partner in charge of the audit would typically make the <i>final</i> decision whether or not to use statistical sampling.	6.5.2
3(a)	Prescribed minimum confidence levels indicated by the majority of the respondents: Tests of controls - 90% Substantive procedures - 80%	Prescribed minimum confidence levels indicated by the majority of the respondents: Tests of controls - 95% Substantive procedures - 95%	6.5.3
3(a)	Prescribed maximum precision levels indicated by the majority of the respondents: Tests of controls - 5% Substantive procedures - 5%	Prescribed maximum precision levels indicated by the majority of the respondents: Tests of controls - ≤ 3% Substantive procedures - ≤ 3%	6.5.4
Available resources to assist in using statistical sampling			
4(a)	The respondents indicated that the following resources were available for assistance regarding the practical use of statistical sampling within the firms:	The respondents indicated that the following resources were available for assistance regarding the practical use of statistical sampling within the firms:	6.6.2

	Written guide - statistical significant majority (88%) Training courses for staff – majority (not statistically significant) (69%)	Written guide – only the minority (36%) Training courses for staff – only half (50%)	
4(d)	A significant majority (75%) of the respondents indicated that the current coverage of statistical sampling at university level did not meet their expectations.	A majority, although not statistically significant at the time (58%) of the respondents indicated then that they felt that the coverage of statistical sampling at university level did not meet their expectations.	6.6.3

Considering the findings as summarised in Table 7.6, the following significant changes were identified in the use of statistical sampling as an audit tool in the two decades since De Bruyn did his study in 1981:

The estimated use of statistical sampling in audits has appears to have increased since 1981. As was discussed in section 6.3.2 the differences in the profiles of the respondents and the focus of this study on the *allowed usage* in terms of the audit methodologies in contrast to the focus on the *actual usage* in the De Bruyn study, should be taken into account when considering this finding.

The evaluation of sample results has emerged as still being the most problematic step in the use of statistical sampling since 1981.

The responsibility for making the initial decision regarding the use of statistical sampling in audits has shifted from the partners in charge of an audit in 1981 to the managers on the audits in the present study. The final decision remains with the partner in charge of the audit.

The prescribed minimum confidence levels had reduced and the maximum precision levels had increased, resulting in smaller samples with a higher risk of not being representative of the population. This finding was to be expected given the change in the audit strategies in the late 1980's as discussed in section 1.3.

More resources in the form of written guides and in-house training are currently available to staff than in 1981. This was to be expected, since a larger proportion of the

respondents indicated that the firms did not feel that the university level coverage of statistical sampling met their expectations, compared to the 1981 study.

7.2.2 Comparison with international studies since 1990

Since the Big 4 auditing firms (Deloitte, Ernst and Young, KPMG and PwC) in South Africa are regional members of global auditing firms, as are many of the other larger auditing firms in South Africa (especially those accredited by the JSE), it can be expected that most of the international trends in auditing would be mirrored in the South African firms. Supporting this notion is the fact that the auditing firms in South Africa are required by law to adhere to the ISAs, which are also the auditing standards applicable to most of the international auditing firms.

An overview of the differences identified in findings between this study and the international studies since 1990 are presented in Table 7.7 below.

Table 7.7 Differences: international studies since 1990

Research question	Findings of this study	Findings of international studies	Ref
Extent to which statistical sampling is used as an audit tool			
1(b)	A statistically significant majority (75%) of the respondents estimated that statistical sampling was used in the majority of the audits.	The international studies since 1990 showed a minority of less than 40% of respondents using statistical sampling as an audit tool.	6.3.2
1(c)	A statistically significant majority of the respondents indicated that statistical sampling principles were allowed in determining the sample size and selecting items. Only 46% indicated this was the case for evaluating results in tests of controls and 53% in substantive procedures.	In American studies by Elder and Allen (1998 and 2003) regarding substantive testing, it was found that the majority of the respondents used statistical selection methods, but none used statistical methods to determine sample size or evaluate results.	6.3.4.1 and 6.3.5.1
1(d)	The majority (57%) of the respondents indicated they used the MUS method of selection in statistical sampling, specifically when performing substantive procedures.	Internationally, the use of the MUS method of selection increased from the minority (only 27%) in 1995 to the majority (80%) in the study by 2002.	6.3.5.2

The main reasons for not using statistical sampling as an audit tool			
N/A	No significant differences found.	No significant differences found.	N/A
The role of professional judgement in statistical sampling			
N/A	No significant differences found.	No significant differences found.	N/A
Available resources to assist in using statistical sampling			
4(a)	A statistical significant majority (88%) of the respondents indicated that they had written guides available within their firm to assist staff in using statistical sampling as an audit tool.	In the American study by Hall <i>et al.</i> (2002) respondents indicated that staff preferred consulting their firm's written guide <u>and the AICPA audit sampling guide</u> for assistance in statistical sampling.	6.6.2
4(d)	A statistically significant majority (75%) of the respondents indicated that the coverage of statistical sampling in the university programs attended by trainees did not meet their expectations.	In the American study in 2002 it was also found that the majority (87%) of the respondents indicated that statistical sampling received only minor coverage in college education. However, <u>only half of the respondents in the Canadian study indicated minor coverage in their college education.</u>	6.6.3

Considering the findings as summarised in Table 7.7, it seems as if the usage of statistical sampling is more widespread in South Africa than internationally, but care should be taken when looking at these results. As discussed in section 6.3.2 the differences in the profiles of the respondents and the focus of this study on the *allowed usage* in terms of the audit methodologies in contrast to the focus on the *actual usage* in the international studies, should be taken into account.

7.3 The value of this study and its findings

Khalifa *et al.* (2007:847) identified a need for information on the everyday practices of auditors to be gathered and made available. Therefore this study adds value, as it gathered information on a specific area, namely the use of statistical sampling in the current everyday practices of Registered Auditors in South Africa, and made it available publicly.

Furthermore, as Hitzig (2004) pointed out, the role and appropriateness of statistical sampling is one of the longest-standing issues in the auditing profession. On the basis of this, the study added value, as it investigated the current use of statistical sampling by Registered Auditors in South Africa.

In particular, the study and its findings could be useful to *inter alia* the following parties:

- Registered Auditors in South Africa, offering them a point of reference to compare the allowed use of statistical sampling in their firms to that of other South African Registered Auditors. They can therefore benchmark themselves against local as well as international trends in the development of audit strategies regarding sampling.
- Academics conducting research on the audit process, audit risk, audit strategy, audit sampling and related fields.
- The IRBA, by offering information on current practices in auditing firms regarding sampling, with specific reference to statistical sampling.
- SAICA, by offering information on how statistical sampling is currently used in the audits of South African companies. This information might highlight education and training needs, either in the qualification process as a Registered Auditor (in conjunction with IRBA), or as part of the Continuing Professional Development (CPD) programmes of both SAICA and IRBA members.
- Developers of training material, both internal and external to auditing firms.
- Developers of statistical sampling software, specifically focussing on the auditing environment.

7.4 Possible future research

A similar study investigating the use of statistical sampling by South African auditing firms that are not accredited on the JSE can be done. A comparison of the findings of such a study and this study can be done in order to identify possible differences between JSE-accredited auditing firms and auditing firms that are not accredited.

The questionnaire can also be sent to all Registered Auditors in specific geographical areas, regardless of the size of the firm they are associated with, and the results can be analysed on the basis of either firm size or region.

The questionnaire can furthermore be adjusted to focus on the actual usage of statistical sampling, instead of the allowed use. The findings can then be compared to the findings of this study, therein comparing the actual usage to the allowed usage of statistical sampling in practice.

A study of the reasons why evaluating statistical sampling results in audits is problematic to auditors and how it could be addressed could yield interesting and useful results.

The perceived usefulness of a guide on the use of statistical sampling in auditing published by either SAICA or IRBA could be investigated.

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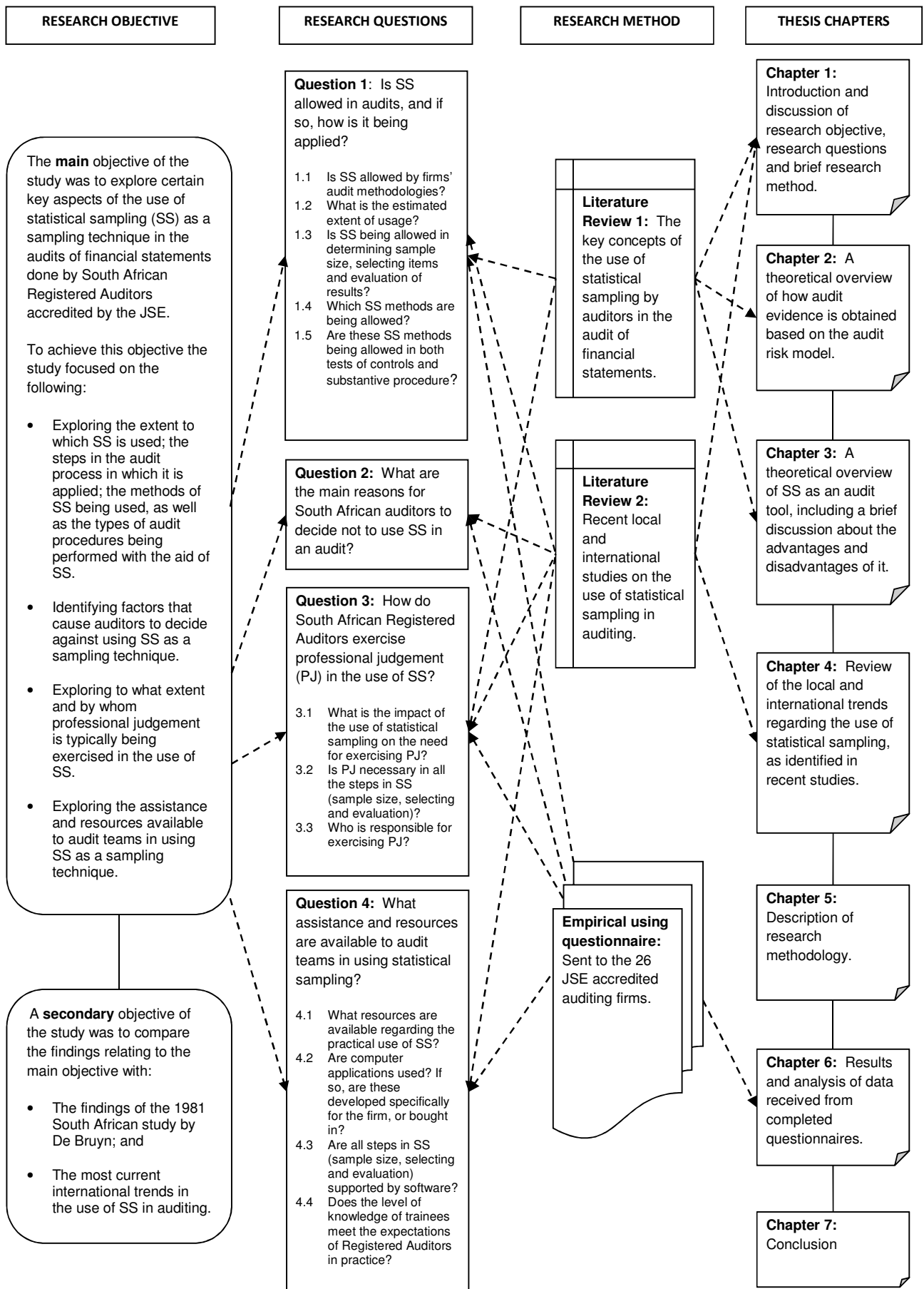
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ANNEXURE A

Diagram of the study design



ANNEXURE B

JSE list of accredited auditors

THE JSE LIST OF ACCREDITED AUDITORS Effective 9 March 2010		
Entity and Address	Contact Details	Accreditation Status
<u>IRBA registered Audit firms</u>		
ACT Audit Solutions Inc P O Box 26072 Gezina 0031	Jacques van der Merwe  (012) 329 0133  (086) 671 6220	Auditor Reporting Accountant
AM Smith & Co Private Bag X2 Strubens Valley 1735	Aidan Smith  (011) 475 9932  (011) 475 0126	Auditor Reporting Accountant
BDO Spencer Private Bag X60500 Houghton 2041	Nigel Griffith  (011) 488 1803  (011) 488 1701	Auditor Reporting Accountant
Charles Orbach P O Box 355 Melrose Arch Johannesburg 1076	Errol Steyn  (011) 994 4015  (011) 994 4010	Auditor Reporting Accountant
Certified Master Auditors (South Africa) Inc. Private BagX168 Halfway House 1685	Floris Du Toit  (011) 315 0215  (086) 614 9882	Auditor Reporting Accountant
Deloitte & Touche Inc Private Bag X6 Gallo Manor 2052	George Tweedy  (011) 209 6494  (011) 388 0679	Auditor Reporting Accountant
Ernst & Young Inc Private Bag X14 Northlands 2116	Mike Bourne  (021) 443 0258  (021) 443 1258	Auditor Reporting Accountant

<p>Fordham & Oshry Inc P O Box 2971 Pinegowrie 2123</p>	<p>Darryl Fordham  (011) 789 4966  (011) 787 8136</p>	<p>Auditor Reporting Accountant</p>
<p>Grant Thornton Private Bag X28 Benmore 2010</p>	<p>David Reuben  (011) 322 4564  (086) 647 8937</p>	<p>Auditor Reporting Accountant</p>
<p>Greenwoods Chartered Accountants P O Box 3311 Cape Town 8000</p>	<p>Christine Rossouw  (021) 410 8500  (021) 419 6705</p>	<p>Auditor Reporting Accountant</p>
<p>Horwath Leveton Boner P O Box 652550 Benmore 2010</p>	<p>Mervin Mittel  (011) 217 8063  (011) 217 8001</p>	<p>Auditor Reporting Accountant</p>
<p>IAPA P O Box 787 Highlands North 2037</p>	<p>David Grawitzky  (011) 887 9593  (011) 887 6672</p>	<p>Auditor Reporting Accountant</p>
<p>KPMG Private Bag 9 Parkview 2122</p>	<p>Devon Duffield  (011) 647 7063  (011) 647 8000</p>	<p>Auditor Reporting Accountant</p>
<p>Logista International Incorporated P O Box 11275 Hatfield 0028</p>	<p>Liza Wood  (011) 875 6000  (011) 658 1212</p>	<p>Auditor</p>
<p>Mazars Moores Rowland P O Box 2785 Cape Town 8000</p>	<p>Kevin Frohbus  (021) 405 4077  (021) 405 4140</p>	<p>Auditor Reporting Accountant</p>

<p>Middel& Partners P O Box 25498 Monument Park 0105</p>	<p>Coenie Middel ☎ (012) 345 1877 ✉ (012) 345 1389</p>	<p>Auditor Reporting Accountant</p>
<p>Moore Stephens P O Box 1574 Houghton 1041</p>	<p>Bert Lopes ☎ (011) 728 7240 ✉ (011) 338 8155</p>	<p>Auditor Reporting Accountant</p>
<p>Ngubane Zeelie Incorporated P O Box 268 Florida Hills 1716</p>	<p>Pieter Zeelie ☎ (011) 475 5393 ✉ (086) 601 5365</p>	<p>Auditor Reporting Accountant</p>
<p>Nolands P O Box 2881 Cape Town 8000</p>	<p>Allan Mundell ☎ (021) 658 6600 ✉ (021) 658 6602</p>	<p>Auditor Reporting Accountant</p>
<p>PKF South Africa Private Bag X10046 Sandton 2146</p>	<p>Theunis Schoeman ☎ (011) 384-8134 ✉ (086) 670 9953</p>	<p>Auditor Reporting Accountant</p>
<p>PriceWaterhouseCoopers Private Bag X36 Sunninghill 2157</p>	<p>Steve Ball ☎ (011) 797-5427 ✉ (011) 209-5427</p>	<p>Auditor Reporting Accountant</p>
<p>RSM Betty & Dickson P O Box 1734 Randburg 2125</p>	<p>Brian Eaton ☎ (011) 329 6000 ✉ (011) 329 6100</p>	<p>Auditor Reporting Accountant</p>
<p>SAB&T Chartered Accountants P O Box 10512 Centurion 0046</p>	<p>Muhammad Rajah ☎ (021) 918 5400 ✉ (021) 918 5404</p>	<p>Auditor Reporting Accountant</p>

<p>SizweNtsaluba VSP</p> <p>P O Box 2939 Saxonwold 2132</p>	<p>Dumisani Manand</p> <p>☎ (011) 231 0600 ☎ (011) 234 0933</p>	<p>Auditor</p> <p>Reporting Accountant</p>
<p>TAG Incorporated</p> <p>Private Bag X35 Lynnwood Ridge 0040</p>	<p>Retief Smith</p> <p>☎ (012) 809 3303 ☎ 0861 824 462</p>	<p>Auditor</p>
<p>Tuffias Sandberg KSI</p> <p>P O Box 2506 Rivonia 2128</p>	<p>Ryan Feinberg</p> <p>☎ (011) 519 0800 ☎ (011) 519 0851</p>	<p>Auditor</p> <p>Reporting Accountant</p>

ANNEXURE C

Questionnaire used in the 1981 De Bruyn study⁵

⁵ A clean copy of the questionnaire is not available. The copy reproduced here was obtained from microfiche.

CONFIDENTIAL

~~CONFIDENTIAL~~

for those questions in which no time period is specified, please reply on the basis of your experience during the past year.

1. Do you consider statistical sampling a valid audit tool or technique? yes no
2. Does your firm have an association with an overseas firm of auditors? yes no
3. What is the total number of auditing staff members, including partners employed by your firm in the Republic of South Africa?
 1-5 6-10 11-20 21-30 31-40 41-50 51-100 101-200 Over 200
4. Please estimate on what percentage of the audits (with fees over R2000) your firm conducted during the past year, that some statistical sampling was used. 0% 1-10% 11-20% 21-30% 31-40%
 41-50% 51-60% 61-70% 71-80% 81-90% 91-100%
5. Has your firm previously used statistical sampling but since decided to disregard it? yes no
 If yes, what were the reasons? _____
6. Do you feel that adequate courses and literature on statistical sampling methods are readily available from external sources? yes no
7. Do you feel that the statistical sampling training for articled clerks at universities is adequate? yes no
8. Has a representative of your firm attended the National Council's course on statistical sampling? yes no
 If yes, has your firm decided to use statistical sampling as a result of attending the National Council's course on statistical sampling?
 yes no
9. What is the minimum sample size your firm would consider to be adequate to draw conclusions about a population?
 1-20 21-50 51-100 101-150 Over 150
10. Considering the following persons, place an (x) in the box beside that person who most often initially decides whether or not to use statistical sampling on an audit and on the box beside that person who most often ultimately decides whether or not to use statistical sampling on an audit.
 senior partner in charge of audit other (specify) _____
 manager partner in charge of office _____
11. Select and place in order from the following criteria the six you consider most important when deciding whether or not to use statistical sampling on an audit, most important first, etc.

a. audit risk	b. error potential	c. reliance to be obtained from overall tests
d. audit time	e. client's business type	f. auditor's statistical expertise
g. audit size	h. population size	i. computerisation of client's records
j. audit fee	k. numbered accounts	
l. avoidance of litigation	m. a more objective audit opinion	
n. other (specify)		

 1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____
12. Does your firm use statistical sampling for:
 sample selection only yes no
 determination of sample size yes no
 evaluation of test results yes no

13. How many years has your firm been using statistical sampling in South Africa? _____
14. Does your firm have an in-house training course or manual describing the use of statistical sampling in auditing?
 firm training course yes no
 firm training manual yes no
15. Under a pledge of complete secrecy, would you allow your in-house training courses or manuals describing the use of statistical sampling in auditing to be examined? yes no
16. Please estimate what percentage of the time during the past year were you using statistical sampling to:
 estimating attributes (occurrence rates)
 0-20% 21-40% 41-60% 61-80% 81-100%
 estimating variables (values)
 0-20% 21-40% 41-60% 61-80% 81-100%
17. Does your firm have or have access to a standard selection and retrieval programme (eg. audiotape) for use on client's who have computers? have have access to no
18. Does your firm have or have access to a standard statistical sampling programme for analysing retrieved data from the client's computer?
 have have access to no
19. Indicate the minimum size population on which you would consider using statistical sampling on an audit when:
 estimating attributes: 0-500 501-1000 1001-5000 5001-50 000 Over 50 000
 estimating values: 0-500 501-1000 1001-5000 5001-50 000 Over 50 000
20. Considering the audits on which you have used statistical sampling during the past year, place in order the following population ranges by letting that range where statistical sampling was most often applied be first, etc.
 a. 0-500 b. 501-1000 c. 1001-5000 d. 5001-50 000 e. Over 50 000
 1. _____ 2. _____ 3. _____ 4. _____ 5. _____
21. Indicate the minimum confidence level and maximum precision you would consider when applying statistical sampling on:
 a. compliance testing (tests of compliance with the prescribed procedures)
 minimum confidence level: 99% 95% 93% 90% 87% Other (specify) _____
 maximum precision: ±1% ±2% ±3% ±5% ±7% Other (specify) _____
 b. substantive testing (tests of transactions and balances)
 minimum confidence level: 99% 95% 93% 90% 87% Other (specify) _____
 maximum precision: ±1% ±2% ±3% ±5% ±7% Other (specify) _____
22. Select and place in order from the following criteria the three most important ones used in deciding what level of confidence and precision to set - most important first, etc.
 a. firm policy b. individual experience c. preceeding year's audit
 d. audit area e. internal control check f. audit reliance in
 g. other (specify) _____ relationship to tests
 1. _____ 2. _____ 3. _____
23. Does your firm have or have access to an expert in statistical sampling to assist field staff with queries?
 have have access to no
24. Has your firm established the mathematical substantiation for the statistical sampling method you have adopted? yes no

ANNEXURE D

Questionnaire used in this study

INSTRUCTIONS
<ol style="list-style-type: none"> Please answer questions based on audits of clients listed on the Johannesburg Stock Exchange, as performed in the past year (Aug 2009 to Aug 2010) only. The subject matter related questions in the questionnaire focus on statistical sampling (as opposed to non-statistical sampling). Statistical sampling has both of the following characteristics: <ul style="list-style-type: none"> Random selection of sample items; AND The use of probability theory to evaluate sample results. If you prefer to print a hardcopy of the questionnaire, complete it and either scan to email, or fax it back to me, it can be arranged. In this case, should the space as provided be insufficient to answer a question, additional pages can be added to the questionnaire. Should this be the case, please ensure that answers on additional pages are clearly cross-referenced to the particular question number. Please do not leave the answer to any question blank. The last page of the questionnaire includes space to indicate any problems encountered during completion. As agreed, the highest degree of confidentiality will be maintained with regard to all aspects of the analysis and safekeeping of completed questionnaires.

GENERAL QUESTIONS	This study reference	External reference
<ol style="list-style-type: none"> Please indicate the name of the firm you are representing: _____ Particulars of the person responsible for completing this questionnaire: <ul style="list-style-type: none"> Name: _____ Position: _____ E-mail address: _____ Telephone number: _____ Number of years involved in the audits of your firm _____ 	Demographic information	JJD – 36 PvW – 3

SUBJECT MATTER RELATED QUESTIONS	This study reference	External reference
<ol style="list-style-type: none"> Does your firm's audit methodology allow the use of statistical sampling as an audit tool? <ul style="list-style-type: none"> <input type="radio"/> Yes <input type="radio"/> No 	Q1 (1.1)	JJD – 1 Add wording Maingot 2009:224 Hitzig 1995:2
<ol style="list-style-type: none"> Taking into account your experience within your firm and your knowledge of your firm's audit methodology, to what extent would you estimate is statistical sampling used as a sampling method in your firm, when performing audits of JSE listed companies? <ul style="list-style-type: none"> <input type="radio"/> In all of the audits <input type="radio"/> In most of the audits <input type="radio"/> In some of the audits <input type="radio"/> In very few of the audits <input type="radio"/> In none of the audits 	Q1 (1.1)	JJD – 2 Added clarification Maingot 2009:224 Hitzig 1995:2

<p>c. Evaluating the test results of a sample?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p>		
<p>6. Taking into account your experience within your firm and the knowledge of your firm’s audit methodology, select from the following audit areas the two areas where you would estimate statistical sampling is most frequently applied in performing Tests of Controls.</p> <p><input type="radio"/> This question is not applicable to me, as my firm’s audit methodology does not allow the use of statistical sampling in performing Tests of Controls.</p> <p><input type="radio"/> Property, plant and equipment</p> <p><input type="radio"/> Inventory</p> <p><input type="radio"/> Debtors</p> <p><input type="radio"/> Cash</p> <p><input type="radio"/> Creditors</p> <p><input type="radio"/> Sales</p> <p><input type="radio"/> Purchases</p> <p><input type="radio"/> Payroll</p> <p><input type="radio"/> Other (please specify)_____</p>	<p>Q1 (not specific)</p>	<p>JJD – 27 Added option</p> <p>Note exp: Hall 2001:175 Ponemon 2001:21 Burgstahler 2000:85 Elder 1998:76 Peek 1991:38</p>
<p>7. Taking into account your experience within your firm and the knowledge of your firm’s audit methodology, select from the following audit areas the two areas where you would estimate statistical sampling was most frequently applied in performing Substantive Procedures.</p> <p><input type="radio"/> This question is not applicable to me, as my firm’s audit methodology does not allow the use of statistical sampling in performing Substantive Procedures.</p> <p><input type="radio"/> Property, plant and equipment</p> <p><input type="radio"/> Inventory</p> <p><input type="radio"/> Debtors</p> <p><input type="radio"/> Cash</p> <p><input type="radio"/> Creditors</p> <p><input type="radio"/> Sales</p> <p><input type="radio"/> Purchases</p> <p><input type="radio"/> Payroll</p> <p><input type="radio"/> Other (please specify)_____</p>	<p>Q1 (not specific)</p>	<p>JJD – 27 Added option</p> <p>Note exp: Hall 2001:175 Ponemon 2001:21 Burgstahler 2000:85 Elder 1998:76 Peek 1991:38</p>

<p>8. Considering the following persons, please indicate the one person who is most often responsible for making the initial decision whether or not to use statistical sampling in an audit.</p> <ul style="list-style-type: none"> <input type="radio"/> junior on audit <input type="radio"/> senior on audit <input type="radio"/> manager on audit <input type="radio"/> partner in charge of audit <input type="radio"/> partner / manager in risk department <input type="radio"/> partner / manager in technical department <input type="radio"/> a statistical sampling expert outside the risk or technical department <input type="radio"/> other (please specify) _____ 	<p>Q3 (3.3)</p>	<p>JJD – 10 Added option</p>
<p>9. Considering the following persons, please indicate the one person who is most often responsible for the final approval or otherwise of the use of statistical sampling in an audit.</p> <ul style="list-style-type: none"> <input type="radio"/> junior on audit <input type="radio"/> senior on audit <input type="radio"/> manager on audit <input type="radio"/> partner in charge of audit <input type="radio"/> partner / manager in risk department <input type="radio"/> partner / manager in technical department <input type="radio"/> a statistical sampling expert outside the risk or technical department <input type="radio"/> other (please specify) _____ 	<p>Q3 (3.3)</p>	<p>JJD – 10 Added option</p>

<p>10. Select from the following criteria the two most important considerations when deciding whether or not to use statistical sampling as an audit tool.</p> <ul style="list-style-type: none"> <input type="radio"/> impact on audit risk <input type="radio"/> impact on audit time <input type="radio"/> the nature and size of the specific population to be audited (e.g. inventory, sales, debtors, purchases, creditors etc.) <input type="radio"/> impact on audit cost <input type="radio"/> reduction in risk of litigation against the auditor <input type="radio"/> client's business type <input type="radio"/> population size <input type="radio"/> filing system used by client, i.e. numbered accounts <input type="radio"/> results in a more objective audit opinion <input type="radio"/> level of audit evidence expected to be obtained from other audit procedures <input type="radio"/> auditor's statistical expertise and experience <input type="radio"/> degree of computerisation of the client's records <input type="radio"/> other (please specify) _____ 	<p>Q3 (not specific)</p>	<p>JJD – 11 Added option and clarifications</p>
<p>11. From the following statistical sampling steps, select the one step with which, in your experience, auditors of your firm attempting to use statistical sampling encounter problems most frequently.</p> <ul style="list-style-type: none"> <input type="radio"/> defining test objectives <input type="radio"/> defining the population (total population as a whole) <input type="radio"/> defining "error" <input type="radio"/> selecting the sample units (items for testing) <input type="radio"/> performing audit tests on selected sample items <input type="radio"/> investigating errors found in the sample units (items tested) <input type="radio"/> using the test results of the sample to determine a result for the population as a whole (i.e. extrapolation of errors) <input type="radio"/> interpreting test results of the sample as extrapolated to the population as a whole (given the complexity of the mathematics behind the theory) <input type="radio"/> other (please specify) _____ 	<p>Q2</p>	<p>JJD – 12 Wording adjusted</p>

<p>12. What would you, in your experience (not limited to your current firm only), consider to be the main reason why statistical sampling is not being used as the main sampling tool in more audits?</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>	<p>Q2</p>	<p>Schwartz 1998</p>
<p>13. When using statistical sampling, does your firm's audit methodology specify the confidence level to be used?</p> <p><input type="radio"/> This question is not applicable to me, as my firm's audit methodology does not allow the use of statistical sampling.</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p>	<p>Q3 (3.1)</p>	<p>No external reference</p>
<p>14. Referring to question 13 above, if your firm's audit methodology does specify the confidence level to be used , please select from below the minimum confidence level (most lenient) that your firm's audit methodology allows:</p> <p>a. Tests of Controls</p> <p><input type="radio"/> 99 %</p> <p><input type="radio"/> 95 %</p> <p><input type="radio"/> 93 %</p> <p><input type="radio"/> 90 %</p> <p><input type="radio"/> 87 %</p> <p><input type="radio"/> Other (please specify)_____</p> <p>b. Substantive Procedures</p> <p><input type="radio"/> 99 %</p> <p><input type="radio"/> 95 %</p> <p><input type="radio"/> 93 %</p> <p><input type="radio"/> 90 %</p> <p><input type="radio"/> 87 %</p> <p><input type="radio"/> Other (please specify)_____</p>	<p>Q3 (3.1)</p>	<p>JJD – 21 Wording slightly changed</p> <p>JJD - 28</p>

<p>15. When using statistical sampling, does your firm's audit methodology specify the precision level to be used?</p> <p><input type="radio"/> This question is not applicable to me, as my firm's audit methodology does not allow the use of statistical sampling.</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p>	<p>Q3 (3.1)</p>	<p>No external reference</p>
<p>16. Referring to question 15 above, if your firm's audit methodology does specify the precision level to be used, please select from below the maximum precision level (most lenient) that your firm's audit methodology allows:</p> <p>a. Tests of Controls</p> <p><input type="radio"/> 1 %</p> <p><input type="radio"/> 2 %</p> <p><input type="radio"/> 3 %</p> <p><input type="radio"/> 5 %</p> <p><input type="radio"/> 7 %</p> <p><input type="radio"/> Other (please specify)_____</p> <p>b. Substantive Procedures</p> <p><input type="radio"/> 1 %</p> <p><input type="radio"/> 2 %</p> <p><input type="radio"/> 3 %</p> <p><input type="radio"/> 5 %</p> <p><input type="radio"/> 7 %</p> <p><input type="radio"/> Other (please specify)_____</p>	<p>Q3 (3.1)</p>	<p>JJD – 21 Wording slightly changed</p> <p>JJD - 28</p>

<p>17. When statistical sampling is used, does your firm's audit methodology allow the use of professional judgement in the following steps:</p> <p><input type="radio"/> This question is not applicable to me, as my firm's audit methodology does not allow the use of statistical sampling.</p> <p>a. Determining the sample size to be used?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p> <p>i. If yes, please indicate the one person who would typically make this professional judgement decision:</p> <p><input type="radio"/> junior on audit</p> <p><input type="radio"/> senior on audit</p> <p><input type="radio"/> manager on audit</p> <p><input type="radio"/> partner in charge of audit</p> <p><input type="radio"/> partner / manager in risk department</p> <p><input type="radio"/> partner / manager in technical department</p> <p><input type="radio"/> a statistical sampling expert outside the risk or technical department</p> <p><input type="radio"/> other (please specify)_____</p> <p>b. Selecting the items to be included in the sample?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p> <p>ii. If yes, please indicate the one person who would typically make this professional judgement decision:</p> <p><input type="radio"/> junior on audit</p> <p><input type="radio"/> senior on audit</p> <p><input type="radio"/> manager on audit</p> <p><input type="radio"/> partner in charge of audit</p> <p><input type="radio"/> partner / manager in risk department</p> <p><input type="radio"/> partner / manager in technical department</p> <p><input type="radio"/> a statistical sampling expert outside the risk or technical department</p> <p><input type="radio"/> other (please specify)_____</p>	<p>Q3 (3.2) Q3 (3.3)</p> <p>Further detail</p>	<p>No external study reference</p>
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<p>c. Evaluating the test results of a sample?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p> <p>iii. If yes, please indicate the one person who would typically make this professional judgement decision:</p> <p><input type="radio"/> junior on audit</p> <p><input type="radio"/> senior on audit</p> <p><input type="radio"/> manager on audit</p> <p><input type="radio"/> partner in charge of audit</p> <p><input type="radio"/> partner / manager in risk department</p> <p><input type="radio"/> partner / manger in technical department</p> <p><input type="radio"/> a statistical sampling expert outside the risk or technical department</p> <p><input type="radio"/> other (please specify)_____</p>		
<p>18. Please indicate whether your firm has the following resources for the use of statistical sampling in auditing:</p> <p>a. an in-house manual or guide (written instructions on what steps to follow when using statistical sampling)</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p> <p>b. an in-house training course</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p> <p>c. Other (please specify)_____</p>	<p>Q4 (4.1)</p>	<p>JJD – 14 Wording changed</p>
<p>19. When using statistical sampling , does your firm use computer software to assist in executing the following steps:</p> <p><input type="radio"/> This question is not applicable to me, as my firm's audit methodology does not allow the use of statistical sampling.</p> <p>a. Determining the sample size to be used?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p>	<p>Q4 (4.2) Q4 (4.3)</p> <p>Further detail</p>	<p>No external study reference</p>

<p>i. If yes, is the computer software used for determining sample sizes bought as off-the-shelf applications (e.g. ProBeta / Caseware) or specifically programmed software (in-house) for your firm?</p> <p><input type="radio"/> off-the-shelf</p> <p><input type="radio"/> in-house developed</p> <p>b. Selecting the items to be included in the sample?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p> <p>ii. If yes, is the computer software used for selecting sample items bought as off-the-shelf applications (e.g. ProBeta / Caseware) or specifically programmed software (in-house) for your firm?</p> <p><input type="radio"/> off-the-shelf</p> <p><input type="radio"/> in-house developed</p> <p>c. Evaluating the test results of a sample?</p> <p><input type="radio"/> Yes</p> <p><input type="radio"/> No</p> <p>iii. If yes, is the computer software used for evaluating sample results bought as off-the-shelf applications (e.g. ProBeta / Caseware) or specifically programmed software (in-house) for your firm?</p> <p><input type="radio"/> off-the-shelf</p> <p><input type="radio"/> in-house developed</p>		
<p>20. Consider the competency of the first year trainees in your firm in respect of the use of statistical sampling. Based solely on that, how would you rate the coverage of statistical sampling in South African university programmes for CA education (undergraduate and CTA-level)?</p> <p><input type="radio"/> Does not meet my expectations</p> <p><input type="radio"/> Meets my expectations</p> <p><input type="radio"/> Exceeds my expectations</p>	<p>Q4 (4.4)</p>	<p>JJD – 7 & 6 Wording changed – different perspective</p> <p>Hall 2002:131</p>

<p>21. Consider your firm's training program (articles). Based solely on that, how would you rate the coverage of statistical sampling in the course of the trainees' practical on-the-job training?</p> <p><input type="radio"/> No coverage</p> <p><input type="radio"/> Minor coverage</p> <p><input type="radio"/> Substantial coverage</p>	<p>Q4 (4.4)</p>	<p>JJD – 7 & 6 Wording changed – different perspective</p> <p>Hall 2002:131</p>
<p>22. Please indicate if I may contact you should I need to discuss any aspects of the completed questionnaire.</p> <p><input type="radio"/> Yes, you may</p> <p><input type="radio"/> No, please do not contact me</p>	<p>Specific arrangements</p>	<p>No external reference</p>
<p>23. Please indicate if you would like to have the results of this study shared with you. (The results will be presented in an anonymous way in line with the agreed highest level of confidentiality of individual responses)</p> <p><input type="radio"/> Yes, I would like to see the results</p> <p><input type="radio"/> No, I would not like the results to be sent to me</p>	<p>Specific arrangements</p>	<p>No external reference</p>

THIS IS THE END OF THE QUESTIONNAIRE

Please describe below any problems encountered during the completion of the questionnaire (if none, please indicate as such):

THANK YOU FOR YOUR VALUABLE TIME

Please retain a hard or electronic copy of your completed questionnaire for your own records and for use in possible follow-up discussions.

ANNEXURE E

Example of the introductory email sent to participants

From: Swanepoel, E <eswanepoel@sun.ac.za>
Sent: 12 April 2010 10:09 AM
To:
Subject: Research project: E Swanepoel at University of Stellenbosch

Sir,

REQUEST FOR PARTICIPATION IN RESEARCH PROJECT

I am a qualified CA (SA) employed by the University of Stellenbosch as a full-time academic. I am currently busy with my Master's Degree under supervision of Prof SPJ von Wielligh (Divisional Head: Auditing).

Overview of the research project

I am doing research in Auditing, specifically focussing on the *extent* to which *statistical* sampling is being used in practice in audits of financial statements. The title of my dissertation is: "South African Registered Auditors' use of statistical sampling as an audit tool". This has always been an area of Auditing that I find to be very interesting, as the auditing standard (ISA 530) does not give clear guidance on the use of statistical sampling - not even after completion of the clarification project of the IAASB.

The emphasis of the research is on the *extent of the use* of statistical sampling and not on the underlying statistical and mathematical details of the various sampling techniques.

The research will be done by:

1. Developing a web-based questionnaire taking into account a literature review of studies done locally as well as internationally on the use of statistical sampling.
2. Sending the questionnaire for completion to the 26 auditing firms on the Johannesburg Stock Exchange's list of accredited auditors.
3. Analysing the data from the completed questionnaires and using the results to draw a conclusion on the extent of the use of statistical sampling in practice.

I believe that the study can be of value to you and your firm, as it will offer you a point of reference to compare your firm's use of statistical sampling to that of other South African Registered Auditors on an anonymous basis, as well as to local and international trends in audit strategies in respect of statistical sampling.

The results of the research will be available in a dissertation and I also intend to submit them for publication in an accredited research journal.

Confidentiality

I would like to emphasise that all information obtained from the questionnaire will be treated as strictly confidential. It will only be used by me and exclusively for the purpose of this research. In the event of my supervisor, Prof SPJ von Wielligh, or internal or external examiners requesting access to this information, it will be made available solely to them and only after I have obtained your written permission. All information contained in the dissertation and publications will be on an anonymous basis.

Request for your participation and commitment

As can be seen from above, ***this research will not be possible without your participation and commitment.*** I am fully reliant on your participation for the success of this project.

I am aware that this is a request for your valuable time. In order to minimise inconvenience, the questionnaire will be designed in such a way that it should not take a significant amount of your valuable time to complete. Furthermore it will be web-based (i.e to be completed and submitted via the internet) for ease of completion and submission.

It would be much appreciated if you could ***please indicate via return email by the end of Friday 16 April 2010 if you would be willing to participate in the research project as described above.***

Conclusion

Thank you for giving me the opportunity to provide you with some information regarding this research project and, if applicable, for agreeing to participate.

Should you have any questions or require any further information, please do not hesitate to contact me either by e-mail, or telephonically on (021) 8083681 or 082 775 6065.

Yours sincerely

E SWANEPOEL CA (SA)
Lecturer: Accounting Department
UNIVERSITY OF STELLENBOSCH

ANNEXURE F

Example of the first follow-up email sent to participants

From: Swanepoel, E <eswanepoel@sun.ac.za>

Sent: 2010/06/08 10:08 AM

To:

Subject: Research project: E Swanepoel at University of Stellenbosch - First follow up

Dear Mr

My e-mail entitled " Research project: E Swanepoel at University of Stellenbosch" dated 12 April 2010 refer.

I fully appreciate that your time is very valuable and apologise for taking up even more of your time with this e-mail. I do, however, need to follow up on my previous email to you as copied below. The success of my research project is heavily reliant on your firm's participation, as it focuses only on the 26 JSE Accredited Auditors.

Subsequent to the previous communication, I decided to distribute the questionnaire in early August 2010 due to the imminent university holidays and potential delays resulting from the FIFA World Cup event. I trust this would be a convenient time for both me as researcher and you as potential respondent.

Kindly confirm by **11 June 2010** whether you are able and willing to complete the research questionnaire at the expected time of early August 2010. Should you not be able or willing to participate, kindly indicate the reason by return e-mail for record purposes.

Should you have any questions or need further information or clarification, please do not hesitate to contact me either per email or telephonically on 082 775 6065.

Kindly acknowledge receipt of this e-mail by return e-mail for record purposes.

Yours sincerely

E SWANEPOEL CA (SA)

Lecturer: Accounting Department

UNIVERSITY OF STELLENBOSCH

ANNEXURE G

Example of the distribution of the questionnaire sent by email

From: Swanepoel, E <eswanepoel@sun.ac.za>
Sent: 17 August 2010 04:24 PM
To:
Subject: Research project: E Swanepoel at University of Stellenbosch
Attachments: [Statistical Sampling Quest~1.pdf](#)

Dear Mr

Kindly acknowledge receipt of this e-mail by return e-mail for record purposes.

My telephonic discussion with you referred. Thank you again for agreeing to participate and for offering your valuable time to assist in this research project.

Please find below the link to the webpage containing the questionnaire (clicking on it will take you directly to the questionnaire).

<http://www.surveymonkey.com/s/XC5DF7Z>

Please read the instructions and information on the first page carefully. In answering the questions, you can click on the most appropriate answer or where drop down boxes were used, click on the most appropriate option in them, and where appropriate enter text in text boxes provided. Once done, please make sure to click the DONE button at the end of the questionnaire, as this will submit it directly to me.

Should you prefer to print a hardcopy of the questionnaire and complete it manually, please print the PDF file attached. After completing it, you can send it to me either by scanning it and emailing it back, or by faxing it to 086 516 5416.

Should you have any questions or require clarification of any aspects relating to the questionnaire or the research project, please do not hesitate to contact me by any of the means listed below. In particular, if you have difficulty with interpreting any of the questions, please do not hesitate to contact me.

Kindly return the completed questionnaire to me as soon as possible, but if at all possible, not later than 10 September 2010. Should you not be able to meet this deadline, please inform me immediately so that we can make alternative arrangements.

Kindly acknowledge receipt of this e-mail by return e-mail for record purposes.

Yours sincerely

E SWANEPOEL CA (SA)

Lecturer: Accounting Department