



**USE OF DATA ANALYSIS TECHNIQUES BY SMALL AND MEDIUM-SIZED
AUDIT PRACTICES**

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DECLARATION

DECLARATION

I, Bonginkosi Goodwill Mhlongo, declare that this dissertation is a representation of my own ideas in my own words, both in conception and execution. This work has not been submitted to any other university or institution of higher learning for another degree. All information mentioned from published or unpublished works has been acknowledged.

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DEDICATION

I hereby dedicate my research work to my late grandmother. “You will forever be important in my life since you have played a big role in shaping my life. You were my biggest role model and strongest support system when no one else believed in me. Words cannot express my gratitude and the love I have for you, I’m, therefore, humbled and grateful.”

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LIST OF ACRONYMS

AI	Artificial Intelligence
CAAT	Computer-Assisted Audit Techniques
CAE	Chief Audit Executive
CDA	Confirmatory Data Analysis
CIA	Certified Internal Auditor
DA	Data Analytics
DAGW	Data Analytics Working Group
EDA	Exploratory Data Analysis
EDW	Enterprise Data Warehouse
ERP	Enterprise Resource Planning
FRC	Faculty Research Committee
HIA	Head of Internal Audit
ICAEW	Institute of Chartered Accountants of England and Wales
IIA	Institute of Internal Auditors
IPPF	International Professional Practices Framework
IS	Information Systems
IT	Information Technology
KPA	Key Performance Areas
KPI	Key Performance Indicators
ML	Machine Learning

QAIP	Quality Assurance and Improvement Program
SME	Small and Medium-Sized Enterprise
SQL	Structured Query Language

ABSTRACT

Organisations are facing growth in the digitisation of their processes, causing rapid growth in the creation of electronic data. Electronic data arise from different sectors of business processes such as operational, financial and others. The introduction of the Industrial Age has accelerated the Information Age. This rapid growth has brought the world to the Fourth Industrial Revolution.

Internal auditors are expected by their professional body to fulfil the mandate of adding value to organisations by reducing risks that threaten the achievement of their goals. This calls for better techniques that are modern.

The purpose of the study was to investigate the factors that contribute to the successes and failures in other areas of audit by small and medium-sized audit practices. This was necessary because the Global Institute of Internal Auditors (IIA) regards an effective internal audit organisation as that which applies data analysis, data extraction and analytical software tools. The study was conducted using a qualitative research approach.

This study adopted two theoretical frameworks, which is fuzzy set theory and grounded theory. The fuzzy set theory works best when there are no or few researchers in that field of study. Indeed, this study has random elements of fuzzy set variables, which are vague and imprecise information. In addition, it was necessary to use grounded theory because of the intention to reveal insights.

Data was collected through unstructured questionnaires conducted with 10 internal auditors. Data was analysed through themes using NVivo. The empirical findings indicated that the transformation of the internal audit activity by small and medium-sized internal audit practices require much more data analytical development than the technical capabilities to be at the most matured state of using data analytics.

TABLE OF CONTENTS

DECLARATION.....	i
DEDICATION	ii
ACKNOWLEDGEMENTS	iii
LIST OF ACRONYMS	iv
ABSTRACT	vi
TABLE OF CONTENTS	vii
LIST OF TABLES.....	xiii
LIST OF FIGURES.....	xv
LIST OF CHARTS.....	xv
CHAPTER 1: INTRODUCTION TO THE STUDY	- 1 -
1.1 Introduction	- 1 -
1.2 Research Problem and Aims.....	- 2 -
1.2.1 Aim.....	- 3 -
1.2.2 Research Objectives.....	- 3 -
1.2.3 Research Questions	- 3 -
1.3 Rational/Motivation for the Study	- 4 -
1.4 Theoretical Framework	- 4 -
1.4.1 Exploratory Data Analysis (EDA)	- 5 -
1.4.2 Confirmatory Data Analysis	- 6 -
1.4.3 Grounded Theory of Analysis	- 6 -
1.4.4 Fuzzy Set Theory.....	- 7 -
1.5 Research Design.....	- 7 -
1.6 Ethical Considerations	- 8 -
1.7 Conclusion	- 8 -

CHAPTER 2: LITERATURE REVIEW	- 10 -
2.1 Introduction	- 10 -
2.2 Overview	- 10 -
2.3 Explanation of Key Concepts	- 13 -
2.3.1 Data Analytics	- 13 -
2.3.2 Big Data	- 14 -
2.3.3 Add Value	- 14 -
2.3.4 Fraud	- 14 -
2.3.5 Internal Audit.....	- 14 -
2.3.6 Institute of Internal Auditors (IIA).....	- 15 -
2.3.7 Certified Internal Auditor (CIA)	- 15 -
2.3.8 Small and Medium-Sized Enterprise (SME).....	- 15 -
2.3.9 ACL Analytics	- 16 -
2.3.10 SQL.....	- 16 -
2.4 Differences Between Internal Auditor and External Auditor	- 16 -
2.4.1 Internal Auditors.....	- 16 -
2.4.2. External Auditors.....	- 18 -
2.5 Conformance with the IIA’s International Standards	- 18 -
2.6 Section 1220.A2 of the IIA Standards	- 19 -
2.7 The Data Analysis Principles.....	- 20 -

2.8	Data Analytics Vs Traditional Internal Auditing.....	- 23 -
2.9	Data Analytics Characteristics.....	- 26 -
2.10	The Implementation of Data Analytics in Audits.....	- 32 -
2.11	Correlation and Causation	- 36 -
2.12	Opportunity for Audit Practices that Use Data Analytic Techniques	- 37 -
2.13	Benefits of Data Analytics	- 37 -
2.14	Matters Relating to the Objectives Presented and Linked with Relevant Literature.....	- 39 -
2.14.1	Data Analysis Expertise a Much-Needed Skill	- 39 -
2.14.2	How Small and Medium-Sized Audit Practices Can Position Audit Data Analysis into the Audit Process.....	- 40 -
2.14.3	Software Packages for Data Analytics	- 44 -
2.14.4	Factors to Consider by Small and Medium-Sized Internal Audit Practices .	- 46 -
2.14.5	Leveraging on Data Analytics by Strengthening Risk Assessments and the Audit Plan	- 47 -
2.14.6	Strengthening Individual Audit Engagements	- 51 -
2.14.7	The Pathway to Maturity Using Data Analytics	- 62 -
2.14.8	The Concerns Around Data Analytics	- 64 -
2.15	Conclusion	- 68 -
CHAPTER 3: RESEARCH METHODOLOGY		- 69 -
3.1	Introduction	- 69 -

3.2	Research Design.....	- 69 -
3.2.1	Qualitative Research Design	- 70 -
3.2.2	Questionnaire Validity	- 71 -
3.3	Target Population.....	- 73 -
3.4	Case Study.....	- 74 -
3.5	Measuring Instrument	- 76 -
3.6	Interview Administration	- 77 -
3.7	Pilot Testing	- 78 -
3.8	Process Performed Before Analysing the Data.....	- 79 -
3.9	Data Analysis	- 81 -
3.9.1	Coding	- 84 -
3.9.2	Inductive Coding	- 84 -
3.10	Reliability	- 84 -
3.11	Validity	- 85 -
3.12	Ethical Considerations	- 86 -
3.12.1	Information and Consent Letters.....	- 88 -
3.12.2	Anonymity	- 89 -
3.12.3	Confidentiality	- 89 -
3.12.4	Data Storage.....	- 90 -
3.13	Limitations.....	- 90 -

3.14	Conclusion	- 91 -
CHAPTER 4: PRESENTATION AND DISCUSSION OF THE RESULTS		
4.1	Introduction	- 92 -
4.2	The Analysis of Results According to the Study Objectives	- 93 -
4.2.1	Objective 1: To determine the extent of use of data analytical software by small and medium-sized audit practices	- 93 -
4.2.2	Objective 2: To examine the impact or consequences of non-compliance of the use of data analytic software by the small and medium-sized audit practices. ...	- 111 -
4.2.3	Objective 3: To determine factors and reasons for any non-compliance	- 115 -
4.2.4	Objective 4: To recommend the steps to be considered in the implementation of data analytics by small and medium-sized audit practices.	- 119 -
4.3	Discussion of the Findings	- 120 -
4.3.1	IIA Standard and its Applicability.....	- 121 -
4.3.2	Effect of Computer Age Era and Fourth Industrial Revolution in the Practice	- 121 -
4.3.3	Data Analytics Implementation Maturity in the Practice	- 122 -
4.4	Conclusion	- 123 -
CHAPTER 5: SUMMARY AND CONCLUSIONS		
5.1	Introduction	- 124 -
5.2	Summary of the Study Overview	- 124 -
5.3	Discussion on Achievement of Research Objectives	- 126 -

5.3.1	Objective 1	- 126 -
5.3.2	Objective 2.....	- 128 -
5.3.3	Objective 3.....	- 129 -
5.3.4	Objective 4.....	- 130 -
5.4	Limitations of the Study.....	- 132 -
5.5	Summary of the Theoretical Study	- 133 -
5.6	Conclusions of the Findings	- 133 -
5.7	Recommendation for Small and Medium-Sized Audit Practices	- 135 -
	REFERENCES.....	- 136 -
	Appendices	- 145 -
	Appendix A: Gatekeeper's Permission.....	- 145 -
	Appendix B: Letter of Information.....	- 146 -
	Appendix C: Letter of Consent	- 148 -
	Appendix D: Research Questions	- 150 -
	Appendix E: Editing Certificate	- 153 -
	Appendix F: Turnitin Report	- 154 -

LIST OF TABLES

Table 2. 1: Basic Concepts of Data Analysis	- 27 -
Table 2. 2: Five-Point Methodology for Successful Implementation of Analytics ...	51 -
Table 2. 3: How Audit Data Analytics Differs from Traditional Auditing	- 58 -
Table 2. 4: The Frequent Uses of Data Analytics for Internal Audit	- 61 -
Table 3. 1: Case Study Evidence	- 75 -
Table 4 1: How Long Have You Been in Practice as an Internal Auditor?	- 93 -
Table 4 2: Applicable IIA Standards	- 95 -
Table 4 3: Effect of Computer Age Era and Fourth Industrial Revolution in the Practice	- 96 -
Table 4 4: Effect of the Change of Internal Controls to Automaton	- 99 -
Table 4 5: Data Analytics Implementation Maturity in the Practice	- 101 -
Table 4 6: Data Analytics Software in Use, Comfortability, Reason for Not Using Other Software	- 104 -
Table 4 7: Experience of Data Analytical Software and Differences from Traditional Internal Audit	- 106 -
Table 4 8: Advantages and Disadvantages Associated with Using Data Analytical Software	- 108 -
Table 4 9: Support of the CAE and Audit Committee to Adopt Data Analytics and IIA Standards	- 112 -
Table 4 10: Consequences of Non-Conformance with IIA Standards in the Practice	- 113 -

Table 4 11: Efforts Shown by the Practice in Promoting Data Analytics Capabilities
..... - 115 -

Table 4 12: Development and maintenance challenges of an effective data
analytics capability - 117 -

Table 4 13: Strategy Used to Phase in Data Analytics in the Internal Audit Function
..... - 119 -

LIST OF FIGURES

Figure 2 1: Understanding How Data Analytics Can Help.....	- 34 -
Figure 2 2: Introducing Data Analytics into the Internal Audit Function.....	- 35 -
Figure 2 3: Identifying Trends and Connections	- 36 -
Figure 2 4: Different Sets of Analytic Tools.....	- 44 -
Figure 2 5: Functions of ERP Systems	- 46 -
Figure 2 6: Data Analytics - The Future of Audit	- 55 -
Figure 3. 1: Data analysis Process	- 83 -

LIST OF CHARTS

Chart 1: The Pathway to Maturity.....	- 64 -
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CHAPTER 1: INTRODUCTION TO THE STUDY

1.1 Introduction

Kiyosaki (2012) notes that the world is in the Information Age and not the Industrial Age. In the Information Age, the most significant asset is the newness of that information. History has further taught that people who frequently get left behind in life are those held in traditional ways of thinking and doing things (Kiyosaki and Lechter 2012). The internal audit function carried out by small and medium-sized audit practices has been described as being held in the Industrial Age, while there is growth in the digitisation of an organisation's operations (Mokhitli and Kyobe 2019). Coderre (2017) notes that internal audit practices should be using technology-based audit techniques to embrace the change brought by the Information Age. It enables an auditor to check a larger set of information and increase focus on high-risk areas. However, the pace at which these tools and skills are being incorporated was said to be slow. Kaya, Akbulut and Ozoner (2018) support the views of Coderre (2017) that the majority of the internal audit functions are in 'analytics infancy'. Although there has been slow progress in adopting data analytics, it has been observed that it adds value to the work of internal auditors (Coderre 2017).

Nevertheless, incorporating data analytic techniques in the internal audit functions was said: "not to be an easy process" (Davis and Cernautan 2017: 1). Coderre (2017) echoes the same sentiment as Davis and Cernautan (2017) by indicating that a majority of the small and medium-sized internal audit practices were finding it difficult to incorporate data analytic tools because the implementation process was not approached with a clear plan of action. Furthermore, over the past 20 years, Chief Audit Executives (CAEs) have struggled to implement a successful analytical program in their internal audit function (Coderre 2017). The problems identified were a poor method of implementing change, "1) difficulty in accessing data; 2) lack of data analytics skills; and 3) the high costs to implement" (Davis and Cernautan 2017: para 4). The research indicates that the shortage of data analytic skills was another

cause contributing to the difficulty of incorporating data analytic tools in audit practices (Earley 2015).

There is a need to strengthen the internal audit function, especially in this Information Age period. The Institute of Internal Auditors North America (2016) claims that, as long as there are limitations of implementing a strong data analytic program within small and medium internal audit practices, progress will not be visible. This is due to the increase of data created from organisations, which calls for strengthening audit practices that integrate data analytics in the internal auditing function. High-risk items can be automatically flagged, inversely enabling auditors to focus on high-value areas.

This research shows that those internal audit practices, which have successfully incorporated the software, will have reliable results. This is due to the data analytic software having the ability to identify all the high-risk items, enabling internal auditors to direct attention to high-risk areas (The Institute of Internal Auditors North America 2016). That is why modern audit engagements now consist of clients making use of Big Data and analytics due to striving to remain relevant and competitive in today's business environment (Appelbaum, Kogan and Vasarhelyi 2017).

1.2 Research Problem and Aims

There is growth in the digitisation of an organisation's operations where process activities are changing from manually operated to computer dependent (Kambatla et al., 2014: 1). This change creates new risks, places pressure on the organisation's stakeholders and requires using data and technological tools to address risks in new methods. Most of the organisation's information is in a computer-readable format, and it also has inherent risk at a high level. Organisations need innovative ways of assessing and managing risk and enhancing performance. However, Coderre (2017: 1) points out that a small percentage of CAE have incorporated the data analytics program. This is because of the challenges associated with analysing data. These challenges of analysing data did not occur all of a sudden but have been there for several years (Soileau, Soileau and Sumners 2015: 1). As of the 1930s, the creation of

data by the computer system occurred more easily than finding useful things from the data and compared to today's computer system; the large-scale data is still a strain to analyse (Tsai et al., 2015).

Therefore, this study investigates the use of technology-based audit and other data analytics techniques by small and medium-sized audit practices to mitigate or reduce risk.

1.2.1 Aim

The purpose of this study is to investigate the factors of the Institute of Internal Auditors (IIA) requirements of technology-based audit and other data analysis techniques by the small and medium-sized audit practices.

1.2.2 Research Objectives

- To determine the extent of use of data analytical software by small and medium-sized audit practices.
- To examine the impact or consequences of non-compliance of the use of data analytic software by the small and medium-sized audit practices.
- To determine factors and reasons for any non-compliance.
- To recommend the steps to be considered in the implementation of data analytics by small and medium-sized audit practices.

1.2.3 Research Questions

- To what extent do small and medium-sized audit practices use data analytical software?
- What is the impact or consequences of non-compliance of the use of data analytic software by the small and medium-sized internal auditors?
- What are the factors and reasons for non-compliance?
- What steps should be taken to implement the use of data analytics by small and medium-sized audit practices?

1.3 Rational/Motivation for the Study

The purpose of this study was to demonstrate first that small and medium-sized audit practices are challenged in crossing over from a traditional internal audit technique to that which incorporates data analytics. Second, to highlight how data analytics software (tools) can offer many opportunities to improve the internal audit quality, and third, to also find out the reasons why small and medium-sized audit practices fail to successfully use data analytics when the IIA rate an effective internal audit organisation as that which applies data analysis, data extraction and analytical software tools.

1.4 Theoretical Framework

The process that was followed by the researcher in inspecting, cleaning and modelling data relied on a theoretical framework that would assist in revealing insight and information which would have been otherwise unobtainable. The correct theoretical framework was critically chosen to inform reporting that reveals accurate insights “to answer pressing problems, test hypotheses, and disprove theories” (Clark 2021: para 2). Most people look at this process differently, and depending on the person performing the research, this process can encompass a variety of techniques and approaches. Maxwell (2012: 86) states that theoretical frameworks provide a general illustration of the relationships between different aspects in a given study. This means the success of the theoretical framework in use was based on its usefulness in understanding, dealing, and supporting the case of the study.

Maxwell (2012: 856) draws attention to the benefits of a theoretical framework in the study as the following:

- The reader is permitted to critically evaluate theoretical assumption statements that are explicit.
- The researcher can use the theoretical framework to lay a hypothesis foundation and have a choice of research methods. In addition, it connects the researcher to current knowledge.

- It permits the researcher to address why and how questions in an intellectual manner by taking a broad view of various facets of that phenomenon.
- It assists the researcher to identify the key variables that influence that which is being studied (i.e., it limits broad view) and enables the examination of how those key variables differ and under what circumstances.

The researcher considered four techniques and chose the best one to apply for the purpose of this research:

- Exploratory Data Analysis (EDA);
- Confirmatory Data Analysis (CDA);
- Grounded Theory;
- Fuzzy Set Theory.

According to Clark (2021: para 4), “no one technique is categorically ‘better’ than others”; however, each theory follows some best practices. Adhering to the guidance of these best practices determined the chosen technique:

1.4.1 Exploratory Data Analysis (EDA)

The theory of EDA and CDA complement each other, and to perform one method without performing the other would not make sense (Clark 2021: para 5). The theory of EDA involves evaluating the research data as a whole to find clues and patterns similar to how a police “detective would look at all the evidence available to her and try to make sense of it” (Clark 2021: para 5), thus making sense of the case under investigation. A police detective would establish probing questions to ask and determine the most appropriate approach, sometimes outside the box, to “manipulate the information to draw out important insights” (Clark 2021: para 5). In other words, this theory allows the exploring of the information for clues that signal more meaning. The information identified during this phase of EDA helps “establish the right

questions to ask and, more importantly, what areas of data deserve more exploration (Clark 2021: para 5).

1.4.2 Confirmatory Data Analysis

According to Clark (2021: para 6), one can think of CDA as “the discovery phase of a trial”. The detective can work extra hard to prove a hypothesis based on the gathered information but will not win a case if the evidence at hand cannot be proven with accuracy. CDA looks for bad data, answers to the anomalies and if it was possibly a coincidence for any deviation from the norms. Clark (2021: para 7) states that CDA relies on the following to be successful: regression analysis, variation analysis, testing hypotheses and developing estimates that adhere to a certain level of exactness.

1.4.3 Grounded Theory of Analysis

This study employed this theoretical framework. The grounded theory approach was regarded as unpredictable (Clark 2021). It used a data analysis method that involved the collection and analysis of information simultaneously. It required that “data be analyzed from the moment data mining begins and continues until the research ends” (Clark 2021: para 8). This process repeats itself as additional data was collected and analysed. As the process repeats itself, certain concepts or anomalies will be removed or added subject to them being suitable to the hypotheses. Should there be too many changes, it may cause the initial hypotheses to be relooked and to be changed entirely by the analyst (Clark 2021). The grounded theory approach revealed insights as more and more data were collected. After gaining confidence in the collected information being sufficient, a report was created based on the collected information. Grounded Theory was pertinent to this study because it enabled the discovery of new theoretical principles from data, which was systematically obtained and analysed using comparative analysis.

1.4.4 Fuzzy Set Theory

This study also employed this theoretical framework which deals with imprecise judgments from participants (e.g. fuzzy set theory). Using this approach enables a research study to explain, predict, and understand the phenomena (Maxwell 2012: 86). This approach also allows a researcher to challenge and lengthen existing knowledge in a manner that can hold or support a research study theory (Kruse, Held and Moewes 2013: 354). Therefore, the fuzzy set theory was a useful approach to this study since the data of the study was vague, ambiguous, and subjective with imprecise judgments (Creswell 2014: 159). The fuzzy set theory was pertinent to this study because it afforded the opportunity to challenge and lengthen existing literature knowledge, especially when it was subjective with imprecise judgments.

1.5 Research Design

This study used a qualitative research approach, which gave meaning in terms of the professional working experiences, specifically internal auditors working for small and medium-sized audit practices in Durban (Umhlanga and CBD area). An approach, which is systematic and subjective, was selected, i.e., qualitative research approach. Qualitative research can progress knowledge in a variety of areas as well as provide detailed connotations (Creswell 2014: 16). Furthermore, this approach helped assess the impact of data analytic software on the internal audit population, giving an understanding of people's individual working experiences (Grbich 2013: 3). With qualitative research, the objective was to understand the use of data analytic software phenomena. Attention to narratives and personal experiences of internal auditors who have used data analytic software was applied. The aim of using qualitative research was to find themes emanating from narratives of internal auditors' experiences as a result of using data analytics software. A qualitative inquiry assisted in focusing on the in-depth interviews based on relatively small numbers of participants.

This study was relevant for a case study. Babbie (2011) states that a case study is something used or analysed to illustrate a principle. In accordance with Olsen (2012: 24), a case is required to be studied holistically considering a wider set

of data sources. This means that facts should be collected from numerous sources to reduce misstatements (Olsen 2012: 24). The participants were drawn from various small and medium-sized audit practices resulting in a wider set of data being collected. This ensured that misstatements were offset by the views of others.

1.6 Ethical Considerations

The researcher ensured that the study adheres to DUT's ethical requirements on research. Participants were provided with consent and information letters.

1.7 Conclusion

This chapter revealed the case associated with this study by presenting the background on the research problem. Additionally, the relevant elements of the study, namely, the research problem, objectives, limitations of the study, were discussed in this chapter. The audit practices are challenged in crossing over from a traditional internal audit technique to that which incorporates data analytics. These challenges slow progress in adapting to data analytics. It has, therefore, become critically important for these audit practices to gain an understanding of the importance of attaining the obligatory knowledge, which is technology-based audit and other data analysis techniques per the IIA standards.

Chapter two revealed the literature related to the velocity of Big Data creation across all business functions and how audit practices have adapted to this change. The literature also focused on explaining key concepts, including the theoretical framework used and the importance of conformance with the IIA's International Standards. This chapter discussed the distinction between using Data Analytics versus Traditional Internal Auditing by audit practices. The chapter also discussed and summarised previous studies. The related literature was reviewed using academic journals, books and different reports relating to the study.

In addition, the subsequent chapter three explained this study's chosen research design (qualitative research) and why it was applicable in this study.

Thereafter the subsequent chapter four discussed the findings of this study because of the research design applied in gathering and analysing information. Lastly, the final chapter five revealed the findings of this study and the required intervention in order to be at the most mature state of using audit data analytics in the internal audit activity.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The previous chapter presented the background for this study. Relevant elements of the study, namely, the research problem, objectives, limitations of the study, were discussed. The purpose of the literature review was to offer a context for the research study (Booth, Sutton and Papaioannou 2015). In this context, the researcher was able to develop a strong case for undertaking the study. Reviewing existing and related literature for this study allowed the researcher to find existing gaps. The gaps were achieved by performing a detailed review of the existing literature. The detailed review involved identifying limitations on the existing literature and creating potential contributions. However, with the limited number of information available, searching and locating valuable literature on this hypothesis was challenging. This chapter also discusses models of data analysis and theories.

2.2 Overview

There was evidence of change taking place worldwide due to digital products that are introduced in the business sector. This was confirmed when Standard Bank, a South African financial services group (i.e. bank) and Africa's biggest lender (measured by assets), closed most of its branches because most services are rendered using technology. Most employees lost jobs because banks in South Africa had introduced and increased digital banking products (eNCA 2019: para 2). This was an indication that business process tools used were changing dramatically whilst the business process objectives remained the same (Kiyosaki and Lechter 2012: 219). Despite these changes in business processes, internal auditors still have a mandate to add value and improve an organisation's operation. In addition, internal auditors are to help an organisation accomplish its objectives by evaluating and improving the effectiveness of processes (The Institute of Internal Auditors North America 2018).

Global Technology Audit Guide [GTAG] (2012) recognises the advantages of computer-aided audit techniques; hence its requirement for CAEs was to obtain tools such as data analysis. The observed strength of data analysis was to provide a more real-time perspective of the IT risk landscape. It offers the CAE an approach to review indicators of emerging risks and assess the operating effectiveness of internal controls constantly. Auditing data information using data analysis proved increased functionality, especially with this tool's ability to efficiently process larger amounts of data (The Institute of Internal Auditors North America 2018). Coderre (2017) supports the reasons why the IIA now regards an effective internal audit organisation as that which applies data analysis, data extraction and analytical software tools, and Kiyosaki and Lechter (2012: 221) indicate that new technology will change things for all humankind.

Recent studies have deliberated on data, data analysis and internal auditors from different points. Consultancy.uk outlines that data analytics was changing the internal audit profession because it allows the user to gain competitive advantage, manage operations and plan strategically in this Computer Age era (Data analytics to become a game changer for internal audit 2018: para 1). These highlighted abilities of data analytics mitigate the key risks board members want to resolve. However, current maturity in data analytics within many audit practices was rated low because of the lack of innovative technology (Data analytics to become a game changer for internal audit 2018: para 5).

The above statement agrees that the Digital Age carries new challenges and opportunities for the internal auditor. Pan and Seow (2016) explain that the Digital Age has seen a change in how internal auditors can perform their duties effectively by no longer focusing on resolving issues on back-end processes. However, they propose solutions that strategically focus on end-to-end process improvements, thereby forecasting the organisation's future (Pan and Seow 2016). Since organisations are in a Digital Age, the International Standards for the Professional Practice of Internal Auditing now recommends technology-based audit and other data analysis techniques. The Institute of Internal

Auditors (2017) brings a mandate to internal auditors to use innovative technology. This mandate comes through the word 'must', which internal auditors have a responsibility to take (IIA 2017).

Deloitte notes that traditional internal audit methodologies have significantly achieved their designed purpose for the past few years (Adding insight to audit transforming internal audit through data analytics n.d.). The mentioned designed purpose included sampling data for testing, which was revealed to have inherent limitations, including the limited views about the exceptions, control breakdowns, or risk. Nevertheless, the progressively complex and fast-paced business landscape is moving in the direction that calls for implementing advanced business analytic techniques (Adding insight to audit transforming internal audit through data analytics n.d.). The purpose of implementing these data analytical techniques is to enhance the attention on risk and acquire more insight into the organisation (Adding insight to audit transforming internal audit through data analytics n.d.).

Lowe et al. (2018) state that small and medium-sized internal audit practices continue to fall behind on IT use and the perceived importance for audit testing, audit report writing, and client administrative management applications. Auditors from these practices consider data analytics as being less important than the other larger audit firms. Lowe et al. (2018) further state that auditors from small and medium-sized internal audit practices may not recognise that this positions them at a competitive disadvantage, especially since their clients may not demand this type of IT. Other challenges faced by small and medium-sized internal audit practices when implementing data analytic software are: "1) difficulty in accessing data; 2) lack of data analytics skills; and 3) the high costs to implement" (Davis and Cernautan 2017: para 4).

The study intended to assist the small and medium-sized internal audit practices to understand the importance of attaining the obligatory knowledge, which was technology-based audit and other data analysis techniques per the IIA standards. This knowledge was in support of the advisory and assurance services, which was to mitigate the non-compliance issues of the IIA

requirements standards (IIA 2017). This knowledge was mandated by the Standards about data analytic techniques, in accordance with Standard 1210 – Proficiency, 1220.A2 – Due Professional Care and Standard 2201 – Planning Considerations (IIA 2017).

2.3 Explanation of Key Concepts

The subsequent concepts constitute the fundamental elements of this study:

2.3.1 Data Analytics

This is a process that uses computer-generated data to draw attention to meaningful information. It involves cleaning incorrect, improperly formatted, duplicated and incomplete data, therefore, preparing the computer-generated data for analysis (DeKroon and Karp 2017). This process extracts important insights from the computer established processes that transmit electronic data (ACL Analytics II 2014: 1). These established insights differ according to real-time, historical, and predictive information being transmitted from the retrieved computer-generated data (DeKroon and Karp 2017).

Despite the research topic relating to data analysis, there are references to data analytics. Both data analysis and data analytics contribute significantly to revealing important, valuable insights about data, which begs the question of whether there was any difference or similarity between the two concepts. The literature has revealed that without data, both these concepts were valueless.

Although data analysis is a subsection of data analytics, data analysis focuses on the detailed examination of past collected data, enabling any person to go through the process of understanding the storyline depicted by the data in question. In this data analysis process of trying to make sense of the storyline, by questioning the data, useful insights are collected (De Bonhome et al., 2017). Although conversely, data analytics uses many tools that predict future outputs, the mentioned tools involve a “systematic computational analysis” helpful in decision making about future trends (Botez 2018: 62).

2.3.2 Big Data

Big Data means the size of data is excessive. The acronym '3V' was used to describe this excess data and represents "volume, velocity, and variety". The 3Vs were explained as implying (1) the size of the data is large, (2) the creation of data is at a fast rate, and (3) the data will be captured from various sources and will have occurred in various data forms (Tsai et al., 2015).

2.3.3 Add Value

Value is added to the organisation (and its stakeholders) when the internal audit activity delivers objective and relevant assurance and adds to the effectiveness and efficiency of risk management, control processes and governance (The Institute of Internal Auditors North America 2018).

2.3.4 Fraud

According to The Institute of Internal Auditors [IIA] (2018), fraud involves any act which is illegal, consisting of deceit, concealment, or violation of trust. The act of fraud is not reliant on violence, threat or physical force to organisations and parties with the intention of attaining money, property, or services to avoid payment or loss of services; or to secure personal or business advantage (IIA 2018). According to Bănărescu (2015), fraud involves significant financial risks that threaten the image of an economic entity and profitability.

2.3.5 Internal Audit

Internal Audit is defined by the Institute of Internal Auditors North America (2018: para 1) as "an independent, objective assurance and consulting activity designed to add value and improve an organization's operations. It helps an organization accomplish its objectives by bringing a systematic, disciplined approach to evaluate and improve the effectiveness of risk management, control, and governance processes". Although accounting is an important skill for an internal auditor, the focus for internal auditors is the evaluation of operational, risk management, internal control and the governance processes of the organisation (IIA 2017: 7).

2.3.6 Institute of Internal Auditors (IIA)

This is the leading professional body representing the interests of internal auditors worldwide. It is the internationally recognised authority, principal educator and acknowledged leader in certification, research and technological guidance for the profession. The Institute is the creator and custodian of the International Standards for the Professional Practice of Internal Auditors and the Code of Ethics to which all members must adhere (IIA 2018).

2.3.7 Certified Internal Auditor (CIA)

The Institute of Internal Auditors South Africa (2018) is the only globally recognised internal audit certification. This qualification demonstrates your credibility as an internal audit professional, giving you an individual competitive edge over your peers. The IIA South Africa regards the CIA qualification as a vital element of the value proposition to IIA members in South Africa (Institute of Internal Auditors South Africa 2018).

2.3.8 Small and Medium-Sized Enterprise (SME)

Smit and Watkins (2012; 1) state that, in South Africa, the National Small Business Act 102 of 1996 amended by Act 29 of 2004 (South Africa 2004), categorises small organisations into four:

- Micro enterprises, including survivalist enterprises.
- Very small enterprises.
- Small enterprises; and
- Medium enterprises.

Berisha and Pula (2015) state that SMEs employ 63% of the workforce and account for 90% of businesses globally. The common criterion to differentiate amongst small and large businesses is the sum of employees within the organisation. Small and medium-sized enterprises (SMEs) function within the same situation as larger enterprises but without the associated benefits such

as “adequate capital and extended human resources” (Smit and Watkins 2012:1). Smit and Watkins (2012: 1) note that the rise of globalisation, legislation, the relaxing of trade barriers and the increase of market expansions due to new technologies and innovation have increased competitive pressure facing SMEs. Despite the above factors, SMEs flourish when they can quickly adapt, take a risk-taking approach, and be open to new ways of working (Smit and Watkins 2012: 1).

2.3.9 ACL Analytics

ACL is one of the recognised technology solutions in the data analytics field. It offers unique control for businesses looking to transform their audit and risk management processes and practicality. With ACL, repeatability of data and accessibility using analytics is easier for the organisation. Hence, scripts can be packaged and distributed as a joint analysis application despite high data volumes and source of data within an organisation (ACL Analytics II 2014: 1).

2.3.10 SQL

SQL refers to the formal programming computer language, such as an instruction given to computers in the form of algorithms and used to produce code output for machines. Hence, a data analyst aiming to generate insights that are useful for a decision-making process uses SQL when gaining access to data, reading, analysing, and manipulating the stored data within a database (Tsai et al., 2015).

2.4 Differences Between Internal Auditor and External Auditor

2.4.1 Internal Auditors

The definition of internal auditing shapes the ultimate purpose, nature, and scope of internal auditors. Jackson and Stent (2016: 1-2) note that internal auditors perform independent assignments on behalf of the board of directors of the organisation. The assignments cover the extensive scope and relate to the evaluation of the efficiency, economy and effectiveness of the organisation’s internal control systems and business activities. The IIA (2017)

indicates that the International Professional Practices Framework (IPPF) expects internal auditors to apply and uphold four principles: integrity, objectivity, confidentiality, and competency. The principle of competency calls for engagement only in assignments for which internal auditors have the necessary knowledge, skills, and experience. These assignments also include evaluating whether the company has identified and is responding to the business risks encountered by the organisation (Jackson and Stent 2016: 1-2).

Gleim (2017) notes that the internal audit activity assists management in meeting their responsibilities in running the organisation through providing independent information about the company's operations. Jackson and Stent (2016: 1-2) support Gleim's (2017) view that the internal audit activity improves management's confidence that the company's systems are functioning as planned and that risks are being addressed and assessed. During this pursuit, internal auditors ensure suitable attention is made to fundamental risks and controls to allow and sustain an effective control environment (IIA 2017). However, in order for the mentioned suitable attention to be made, internal auditors are required to understand the business processes. This includes a solid understanding of the internal auditing processes and requirements, including the IIA professional standards application (Coderre 2017).

Jackson and Stent (2016: 1-2) note that the internal auditor is a member of the company's staff (an employee), alternatively must be independent of the division or subsidiary, department in which the assignment is being carried out. Gleim (2017) supports Jackson and Stent's (2016) views that the design of the reporting line and structure within the company where the internal auditor is conducting their duties will be designed to ensure that the internal audit function is as independent as possible. Most individual internal auditors choose to affiliate with the IIA as it gives them credentials when they seek employment. Nevertheless, many other internal auditors are chartered accountants and will be registered with the South African Institute of Chartered Accountants (Jackson and Stent 2016: 1-2).

2.4.2. External Auditors

Jackson et al. (2016: 1-2) states that external auditors are auditors that express an independent opinion on the annual financial statements (AFS) on whether the AFS of a company fairly present the financial position and results of the organisation's operations. Jackson et al. (2016: 1-2) states that the external auditor is not an employee of the company. The external auditor enhances the confidence of the users of the financial statements. Registered auditors offer their services to the public and must be registered with the Independent Regulatory Board for Auditors (IRBA).

Jackson et al. (2016: 1-2) states that the financial statements audit conducted by the registered auditors is not the only assurance engagement that is conducted. However, registered auditors also perform review engagements, which are also assurance engagements; nevertheless, these reviews provide a lesser level of assurance than an audit provides (Jackson et al. 2016: 1-2).

2.5 Conformance with the IIA's International Standards

The IIA has established rules by which the individual internal auditor and the internal audit activity must abide; one of these rules are called "International Standards for The Professional Practice of Internal Auditing (Standards)."

The Institute of Internal Auditors and Global Technology Audit Guide (2017: 1) also notes that the internal auditing function is furthermore performed in diverse legal and cultural environments, including organisations that "differ in purpose, size, complexity, and structure, and by persons within or outside the organization". There is a possibility that these differences may affect the practice of internal auditing in each environment; as a result, conformance with The IIA's International Standards for the Professional Practice of Internal Auditing (Standards) is important to meet the responsibilities of internal auditors and the internal audit activity (The Institute of Internal Auditors and Global Technology Audit Guide 2017: 1).

The Institute of Internal Auditors (2018) highlights that internal audit is effective when it complies with the IPPF. The IIA North America (2019) supports that the

IIA broadcast the IPPF, which is a conceptual framework that organises authoritative guidance. The IIA North America (2019) outlines that the purpose of IPPF is to protect and enhance organisational value. It provides a clear and concise description of what internal audit aims to achieve within organisations. These aims are demonstrated in the form of mandatory elements by the IPPF, which are the Core Principles for the Professional Practice of Internal Auditing, the Code of Ethics, the Standards, and the Definition of Internal Auditing (IIA 2017: 1).

The IIA (2017) maintains that conformance with the Standards proves conformance with all mandatory elements of the IPPF. Francis (2019) states that the IIA Standards provide the tools and expectations required to conduct an internal audit. Hirth (2009) emphasises that members must follow the mandatory elements of the IPPF or face disciplinary action, including expulsion. The mandatory elements of the IPPF include the Definition of Internal Auditing, the Code of Ethics, and the IIA Standards. Francis (2019) notes that non-compliance with these mandatory elements may not produce the best results. Therefore, compliance with the IIA Standards reduces the opportunity to misuse audit resources while promoting audit efficiency (Francis 2019).

2.6 Section 1220.A2 of the IIA Standards

Section 1220 of the above-mentioned standards discusses Due Professional Care (IIA 2017: 6). This section highlights one of many responsibilities that internal auditors must achieve. The section requires internal auditors to possess the skill and apply care in their work capacity expected of a reasonably prudent and competent internal auditor (IIA 2017: 6). Furthermore, the section is expanded by IIA through Section 1220.A2 requiring internal auditors to exercise due professional care and “must consider the use of technology-based audit and other data analysis techniques” (IIA 2017: 7).

Technology-based audit techniques are defined as “any automated audit tool, such as generalized audit software, test data generators, computerized audit programs, specialized audit utilities, and computer-assisted audit techniques (CAATs)” (IIA 2017: 24). Hoelsing (2010) indicates that using these techniques

can help the auditor comply with standards. Effective 1st January 2009, internal auditors must (instead of should in the prior standard) “consider the use of computer-assisted technology-based audit tools and other data analysis techniques when conducting internal audits” according to the Institute of Internal Auditors’ (IIA) Professional Practice Standard Section 1220.A2.2 (Hoelsing 2010: 1). Bahtiar et al. (2017) agree with Hoelsing (2010) by illustrating that Section no. 1220.A2 of the Standard advises internal auditors to consider the use of information technology. By using information technology, the audit conclusions on red flags of fraud can be from the entire business data and not only from samples chosen for the audit test. This withstands increased demands of work for internal auditors, for instance, increased volume, complexity and scope of the audit implemented in line with business development. Hence the requirement to consider the use of information technology because software supporting the information systems designed to assist internal audits has been developed (Bahtiar et al., 2017).

2.7 The Data Analysis Principles

The Institute of Internal Auditors and Global Technology Audit Guide (2017) outlines that due to increased demand, emerging risks resulting from developing business changes and opportunities that are not systematically managed or broadly understood by companies have created a need for more guidance in this area. Internal auditors in the small and medium sector must now develop knowledge of data analytic principles to effectively provide assurance that risks are addressed and benefits realised. The Institute of Internal Auditors and Global Technology Audit Guide (2017) demonstrates a clear principle about Big Data that describes the exponential growth and availability of data created by people, applications, and smart machines.

De Bonhome et al. (2017) supports the views about the importance and benefits of data analytics. It was noted that data analytics enhances audit quality. The population tested is larger with the objective that 100% of the data is screened. As a result, auditors can generally derive a combination of quality and value from its use (De Bonhome et al., 2017: 3). Peters (2017) illustrates

that due to resource constraints, the testing of 100% of the transactions was previously undertaken manually in exceptional circumstances. As an alternative, internal auditors relied on statistical sampling to extrapolate the number of errors in the total population and determine the accuracy of transactions. The sample sizes were often large and resulted in human errors and false assurance (Peters 2017).

Peters (2017) argues that the testing of the entire population does not give rise to 100% assurance. Auditors are bound to limitations such as errors, especially in assignments that consist of tedious processes and procedures. However, the use of data analytics does enable auditors to test 100% of the population. Practices that master the evolving discipline of Big Data management can differentiate themselves from their competitors and gain substantial rewards (The Institute of Internal Auditors and Global Technology Audit Guide 2017). Boshuizen and Elder (2016: 1) state that “the technique of data analytics is the key to unlocking this additional value”. They further state that by using “advanced technology and statistical methodologies to collect, integrate, analyse, and present the data, companies can gain powerful insights into important elements of a business and the way in which it operates” (Boshuizen and Elder 2016:1).

Alternatively, Coderre (2017) agrees that data analysis can transfer multiple benefits to the internal audit process. However, the majority of audit teams are using data analysis in very simple ways (Coderre 2017). Data analysis can transform the effectiveness of the entire internal audit process, from audit planning and risk assessment, through many aspects of testing, including audit fieldwork, reporting findings and follow up (Coderre 2017). In support of data analysis’s positive impact on the internal audit process, Boshuizen and Elder (2016) highlight that these insights can produce significantly better bottom-line performance, strengthening a company’s competitive advantage. De Bonhome et al. (2017) also supports the views of Coderre (2017) that data analytics offers the opportunity for more value-added and informed engagement and dialogue with management charged with governance within the audited entity, increasing the credibility of the audit.

It should be noted that the introduction of data analytics does not mean that the audit process will be an easy task. As De Bonhome et al. (2017) illustrated, data analytics means new challenges to the internal auditor. The testing of large populations often generates a frequent number of exceptions. Getting hold of data consumes significant time for the audit team. The information delivered by the client should be in a format that the auditor can use, and this is not always obvious – to the client (De Bonhome et al., 2017). The use of data analytics in the audit can involve a wide range of techniques. Small and medium internal audit practices need to use simple data analytics and complex data analysis techniques. Data analytics needs to be embedded in the audit approach, not purely the acquisition of tools (De Bonhome et al., 2017).

The other technique that has been in the market for a while is CAAT (Computer-Assisted Auditing Tools and Techniques). Soileau and Soileau (2016) claim that tools that perform CAAT have improved and expanded capabilities compared to the past two decades. However, compared to the CAAT tools, the Audit Data Analytics tools involve more specialised knowledge and skills such as advanced statistical techniques or data mining, while many internal auditors do not possess the knowledge, therefore, causing a challenge (Li et al., 2018). Soileau and Soileau (2016: 38) infer that when small audit departments consider growing their audit activity by using data analytics software tools and have limited budgets, using tools already in place within the company is useful. De Bonhome et al. (2017) support that the internal audit approach must include data analytics techniques. However, despite most of the internal auditors who use data analytics within the internal audit activities, their rate of usage was at a basic level or complex.

Soileau and Soileau (2016: 38-39) illustrate that to expand the case of analytics in the early phase, one needs to strive for the accomplishment of “small wins”. These can be easily realised when the budgeted cost to invest in data analytics tools is low. According to De Bonhome et al. (2017: 2):

basic analytics procedures are performed through softwares such as excel that used to sort information (for example, top 10 customer by revenue) and

match data from separate sources (for example, individual fixed assets still in use in the fixed assets management system with the fixed asset as recorded in the general ledger (sic).

They further state:

More advanced procedures involve IT audit techniques and are used, for example, to recalculate the accuracy of trade receivables ageing balance, to realize a three-way match detail testing, to isolate goods shipped without sales invoice (De Bonhome et al., 2017: 2).

2.8 Data Analytics Vs Traditional Internal Auditing

According to Lowe et al. (2018), business operations have fundamentally transformed, resulting in business processes becoming more complex due to widespread innovations in information technology (IT). Lowe et al. (2018) further state that internal auditors are leveraging IT to assist with the audit process, as well as working with the paper review and fraud brainstorming. Lowe et al. (2018) outline that conventional audit practices and techniques have become old-fashioned, thus bringing about the need for IT-driven audit techniques that will potentially improve audit quality, efficiency, and effectiveness. Soileau and Soileau (2016) agree with Lowe et al. (2018) by indicating that most internal auditors would readily take advantage of an opportunity to improve audit quality. However, gaining an understanding of how to use data analytics to improve audit quality with constrained resources is the challenge, as opposed to what to do, for small and medium-sized internal audit practices (Soileau and Soileau 2016:35). Small and medium-sized internal audit practices can use existing tools to introduce audit data analytics “in their audit functions, reducing the need for potentially costly up-front investment” (Soileau and Soileau 2016:35). In their observation, Soileau and Soileau (2016:38) outline that most of the metrics used to measure business performance has been analytics. Lowe et al. (2018) agree with Soileau and Soileau that resource constraints may not be necessarily driving these results; it might be that auditors from small and medium-sized internal audit practices do not perceive these IT applications to be as important to their businesses and

clients. Lowe et al. (2018) emphasise that some technology applications are beginning to affect the conduct of audits, but this relies on the firm size and how long the application has been available.

Coderre (2017) emphasises that unless internal auditors are using analytics, they are not addressing risk, testing controls, examining compliance, and improving business operations to the maximum level. Bănărescu (2015) agrees with Coderre (2017) that this careful examination of data pinpoints data gaps, strengths, dysfunction, weaknesses, vulnerabilities and risk factors that contain threats. Alternatively, Botez (2018) illustrates that the usage of data analytic techniques is increasing, in conjunction with people having the skills to manipulate data and interpret results. That is why the internal audit practices should be more proactive than reactive to possible business disruption by applying the agile approach (Pett, Kristall and Mack 2017: para 5). It requires remaining at the “forefront of possible business disruption” and knowing that “priorities may change rapidly” (Pett et al., 2017: para 5). Once an internal audit function has developed the agility to embrace disruption, it also naturally possesses a broader view of the deemed “auditable risk” than its less agile peers (Pett et al., 2017: para 4). That is why the more data-centric businesses become, the more data analysis will become a primary internal audit skill. With the use of data analytics, the internal audit teams gain an understanding of the traditionally un-auditable risk areas, especially those associated with business disruptions. New testing such as analysing trends and correlations emerge, allowing for more direct exception-based analysis, which would not have been obvious through process understanding or contract testing (Pett et al., 2017: para 3).

ICAEW (2016) supports Pett et al.’s (2017) understanding that improving audit quality requires data analytics in internal auditing activities. Audit quality is the objective of internal auditors, regulators and standard setters since it can help determine whether the organisation complies with the defined quality system processes. The method by which the audited entity manages its data and operations brings a focused, high quality and effective audit into line. Using business analytics results in companies going through large amounts of data

and identify outliers quicker and accurately, compared to the old days when internal auditors had to rely more on sampling items and do testing manually (Pan and Seow 2016).

De Bonhome et al. (2017) asserts that data analytics provide an opportunity to get the most out of the effectiveness of the human element. For example, IT solutions can decrease the time committed to manual analysis (traditional auditing), allowing more time on the more judgmental aspects of an analysis by the auditor. De Bonhome et al. (2017) further illustrates that data analytics increases the automation of the audit process, allowing the auditor's focus on the more fundamental audit procedures. It can, therefore, be viewed that data analytics increases the auditor's focus on the more complex and risky areas of the audit. This study postulates that data analytics can improve the efficiency and effectiveness of internal audits, especially within small and medium-sized internal audit firms. Coderre (2017) outlines that the (IIA) regards an effective internal audit organisation as that which applies data analysis, data extraction and analytical software tools.

De Bonhome et al. (2017) emphasises that professional scepticism application and professional judgment of the auditor that uses data analytics expands when the auditor has a robust understanding of the company and its environment. This indicates that the use of technology and data analytics in an increasingly complex and high-volume data environment offers opportunities for the auditor to enhance the quality of the auditor's risk assessment and responses and achieve a more effective and robust understanding of the entity and its environment. The enhanced usage of professional scepticism and professional judgment in the audit process impacts the attractiveness of auditing as a career option (De Bonhome et al., 2017).

The Institute of Chartered Accountants of England and Wales (ICAEW) argues that data analytics is a new discipline for auditors; it requires substantial investment in software, hardware, skills and quality control. Data analytics is an important part of the auditors' response to market demands. It has the ability to be applied to a wide range of assurance assignments, not just the audit of the

financial statements (ICAEW, 2016). Bănărescu (2015) agrees with ICAEW (2016) that companies that operate using massive volumes of data render it a necessity to implement processes of continuous monitoring to identify anomalies in the behavioural patterns or data stream that is potentially fraudulent. Bănărescu (2015) also supports the above authors' view by indicating that significant information coming from the continuous monitoring processes (data analysis) can be used in directing the investigation and making recommendations to improve the control activities.

Bănărescu (2015) further illustrates that fraud is a significant financial risk that threatens profitability and the image of an economic entity. Accordingly, the amount of processed data has grown exponentially in companies and increases the risk of fraud. In mitigating fraud and creating competitive companies, the development of IT systems/controls, therefore, plays a crucial role (Bănărescu 2015). It can, therefore, be understood that internal auditors need to look at every transaction that takes place; however, this issue can no longer be manually performed (using traditional audit), and it will require the use of data analysis tools and programs.

2.9 Data Analytics Characteristics

Cao, Chychyla and Stewart (2015) argue that the characteristics of data analytics may cause users to rethink how data is used. This is initiated by the opportunity to analyse all or almost all data sets for the process under audit rather than the selection of a small, carefully selected sample. The attributes listed above can give rise to more robust models. Bănărescu (2015) claims that there are many concepts of data analysis in the field, including intelligence analysis, business analysis etc., they all share a common component. It can, therefore, be noted that the differences rest on the nature of the data, scope, analytical products, practical utility and applicability. Cao et al. (2015) further claim that if an auditor's objective is to determine characteristics of journal entries with indicators of risk of error or fraud, using data analytics, it is possible to analyse all the journal entries. The scoping period bears no limitation in terms of how long records of these journal entries have been kept. It can be

understood that the usage of data analytics to identify these current journal entries is not an issue. Cao et al. (2015) argue that in the past, auditors had to ensure the elimination of polluted data; however, when all the data are available, a certain degree of messiness is acceptable.

Bănărescu (2015) postulates that prevention and detection of fraud is one attribute of a data analytical system. Bănărescu (2015) further illustrates that there are over 24 types of data analysis systems, some of them extremely complex, but among all of them, identification of two classical types of analysis can be made: 1) operational analysis and 2) strategic analysis. The basic concepts of data analysis are highlighted in Table 2.1:

Table 2. 1: Basic Concepts of Data Analysis

Methods	Strategic analysis	Operational analysis
Techniques	Risk analysis, Results analysis, Phenomenon analysis, Situational picture analysis, Statistical analysis, SWOT Analysis, PESTEL Analysis, Scenarios technique.	Case analysis, Comparative case analysis Links analysis, Flow analysis, Event analysis of activities, Financial Analysis, Analysis phones, Risk analysis, SWOT Analysis, Profile Suspect Analysis, Geospatial Analysis, Technology scenarios etc.
Procedures	Graphical representation (histograms, relation maps, flow maps, maps of activities, of events, geospatial maps), Space viewing, Three dimensional viewing etc.	
Instruments	Mathematics, Statistics, Office Excel, Access, SAS, iDEA, GeoMedia Professional, GPS, Map, ANB, iBase, Palantir, paper, pencil, etc.	

Source: Bănărescu (2015)

Bănărescu (2015) further outlines that operational analysis is successfully applied to short-term activities through the exploitation of data and current information to comply with current activities to detect fraud with maximum efficiency. It can, therefore, be noted that operational data analysis is a tool for enhancing workplace conditions, resulting in manual activities being avoided

and decreasing mental effort for operations relating to the processing of a significant amount of data. Bănărescu (2015) claims that apart from internal auditors, antifraud managers can use operational data analysis in daily activities to help detect and combat illegal activities, such as, linking between suspects, their characteristics (direct and/or indirect subordination relations, positions in the hierarchy of the group, key positions that impact decision making etc.), the movement of goods, money or other valuables, sequence of certain events.

Cao et al. (2015) outline that a new dimension of analytics is Big Data analytics. This includes datasets too large and complex to interrogate or manipulate with standard methods or tools. With Big Data analytics, almost anything can be measured, recorded, captured digitally, and turned into data. Big Data analytics involves the process of transforming, inspecting, cleaning and modelling Big Data to determine and communicate useful patterns and information, suggest conclusions, and support decision making (Cao et al., 2015).

Soileau and Soileau (2016) argue that adapting analytics to audit more efficiently is a constant struggle, which numerous small internal audit departments and practices face. However, this does not stop the claims that the value-added using analytics is continually talked over in industry publications, research and thought leadership. Botez (2018: 61), therefore, illustrates that “data analytics is the process of examining data sets” with the intention to draw decisions about the information they hold, depending on specialised systems and software. Data analytics involves activities of extracting what is perceived as important from raw data using specialised computerised systems. Such computerised systems will convert, organise, and perfect information to draw decisions and identify their pattern (Botez 2018: 62). Bănărescu (2015) agrees with Botez (2018) that data analysis is an in-depth examination of available meaningful and essential data with the intention to identify substantial information using specific methods and techniques. Data analytics is sometimes confused as a term that only uses large data sets. Therefore, Botez (2018: 62) outlines that data analytics refers to a term that covers the processing of historical information used over time. However, the

increase of information has resulted in this data analytics term developing in favour of systems capable of processing large data (Botez 2018: 62).

According to De Bonhome et al. (2017: 3), “data analytics technologies and techniques are widely used in commercial industries to enable organizations to make more-informed business decisions and by scientists and researchers to verify or disprove scientific models, theories and hypotheses”. As De Bonhome et al. (2017: 3) point out, the “increasing volume of data in businesses today” proves the importance of using data analytics as an audit technique for internal auditors to enhance understanding and analyse large volumes of data. As internal auditors are equipped with a comprehensive knowledge of the “entity’s business, the auditor is able to concentrate on items of greater audit interest” (De Bonhome et al., 2017: 3). Appelbaum et al. (2017) agree that the internal audit environment is gradually using data analytics. Nowadays, modern audit engagements frequently involve examining clients using Big Data and analytics to remain competitive and relevant in the contemporary business environment. Furthermore, numerous clients are now incorporating Big Data with new and complex business analytical approaches to produce intelligence for decision making (Appelbaum et al., 2017).

Botez (2018: 61) agrees with Appelbaum et al. (2017) by noting that numerous organisations have started using the data analytics process in their business activities; such business activities include the field of financial statements audit. The value of this audit is seen to be enhanced significantly by the usage of data analytics. Botez (2018: 70) postulates that the point of view regarding audits of this nature and the usage of new technology and software solutions has changed fundamentally. The use of new technology and software solutions, specifically data analytics in audit, is at the beginning. But the near future calls for auditors to respond to this provocation (Botez 2018: 61). ICAEW (2016) outlines that audit committees regularly ask prospective auditors what method they are going to use in the audit to improve competitive tendering for company audits, and this has sharpened the attention on data analytics. Pan and Seow (2016) note that the audit industry has seen numerous turbulent cycles over the last decade. In particular, the severely dented capital markets also dented

investors' confidence when audit practices scandals became public. The Sarbanes Oxley Act (SOX) was endorsed in the United States to reinforce corporations' internal control systems as a means to regain investors' confidence (Pan and Seow 2016).

Botez (2018) illustrates that data analytics empowers the internal auditor allowing his/her activities to be more effective. Technological solutions decrease the time required to manually apply a procedure, permitting the use of more time for professional reasoning by the internal auditor. Furthermore, applying data analytics includes faster identification of relationships amongst data and nonconformities, facilitating the auditor to maintain professional scepticism at a high level. When internal auditors audit SMEs, data analytics is advantageous in such cases because it is possible to gather more qualitative evidence according to the size of the entity (Botez 2018).

Pan and Seow (2016) support that the timeliness of information is key to work processes; therefore, internal auditors must understand how sophisticated information systems like business analytics and data mining may support them in their work. Technology advances empower auditors to work more efficiently and result in audit work being less tedious (Pan and Seow 2016). Botez (2018) contends Pan and Seow (2016), claiming that when the internal audit firm is small and medium-sized, it may lack the resources and experience to change the existing traditional internal audit methodology. These internal audit practices cannot internally develop tools as large internal audit practices can; nevertheless, the specialised market can offer solutions (Botez 2018).

Pan and Seow (2016) state that SOX prompted the adoption of a more risk-based business approach, which resulted in the re-examination of business processes, internal control systems and supporting information systems infrastructure. Sections 404 and 802 of SOX position direct impacts on IT investment. Section 404 aims at improving corporate governance and reporting through emphasising internal control systems within corporations. While section 802 calls for all business records to be stored for at least five years, resulting in IT storage budgets. These governance regulations resulted in

corporations re-evaluating current financial reporting systems, particularly IT solutions, within their reporting processes. Consequently, SOX requirements resulted in a higher level of corporate investment in IT (Pan and Seow 2016).

Pan and Seow (2016) illustrate that the IT adoption frequency among audit functions is attributed to the drive for improved productivity among audit professionals. There has been increased investment in audit software applications to support audit practices to gather, organise, process, evaluate recent data. Pan and Seow (2016) indicate that the growing demand for advanced IT knowledge and skills for audit professionals is caused by the increasing IT investment among audit functions. Pan and Seow (2016) further support that advanced IT knowledge and skills such as IT audit and data analytics are clearly lacking in numbers among audit professionals. The internal audit practices urgently need professionals that could handle sophisticated IT demands in internal audit services and activities (Pan and Seow 2016).

Pan and Seow (2016) maintain that IT controls and internal audits have to be implemented properly in order to identify vulnerabilities and threats to audit clients. Pan and Seow (2016) illustrate that auditors play an important role in information technology governance, which is to confirm that business systems provide the values expected by the organisation board of directors. Internal auditors are expected to have a very high level of technology-related knowledge and grounding, and using data analytics may improve their proficiency.

The use of technology as a form of business analytics ensures greater transparency (Pan and Seow 2016). Key stakeholders are given close to real-time data allowing them to make timely decisions to support the growth and pace of business. The data analytic technique tools aid in improving decisions making; therefore, internal auditors (in the small-medium sector) now have the opportunity to leverage these new tools in the Digital Age to respond faster and at lower costs (Pan and Seow 2016).

2.10 The Implementation of Data Analytics in Audits

Soileau and Soileau (2016) claim analytics can be used within many phases of the internal audit process, including risk assessment, micro-level audit planning and macro-level audit planning. During risk assessment, analytical data is used in combination with qualitative data to prioritise better and understand the company's risks (Soileau and Soileau 2016). Cao et al. (2015) outline that the implementation of data analytics may require some work effort. This is due to the implementation process requiring individuals with expertise in data analytics and the appropriate hardware and software resources.

Soileau and Soileau (2016) claim that using analytical data to analyse financial and operational information before audit findings and key performance indicators (KPIs) of the organisation can be a useful tool in completing the risk assessment at a basic level. At macro- and micro-audit level planning, analytical data has the potential to assess specific controls and to examine emerging and present risks (Soileau and Soileau 2016). This will assist internal auditors to determine the scope for specific processes of audit coverage and the extent of testing for each process. Cao et al. (2015) indicate that many businesses outsource their Big Data applications to solutions providers that offer specialist services. It was also mentioned that the training related to Big Data analytics might go beyond the scope of the academic and professional level of an auditor. Cao et al. (2015) indicate that internal audit practitioners will need to either hire new analytically trained professionals or more likely use the services of third-party solutions providers for Big Data analytics.

Cao et al. (2015) argue that the reliance on third-party to provide data analytics services promotes a privacy concern; however, the issue of reliance on third-party is not new due to the profession already relying on third parties, such as banks, when conducting audits (Cao et al., 2015). Soileau and Soileau (2016) object that the audit firm size is a limitation factor in determining whether to implement an analytics program but indicate that it has the wrong approach. Soileau and Soileau (2016: 36) also support that there are analytic tools that can accommodate "even one-person audit departments. "With the right

approach, moving analytics from concept to practice can be simple” (Soileau and Soileau 2016: 36). As an alternative, LaValle et al. (2010) suggest that organisations should start at what might seem like the middle process in implementing analytics. This process will consist of defining the insights and questions required to achieve the business object and then establish the related Big Data needed for answers (LaValle 2010).

Soileau and Soileau (2016) illustrate that when beginning to use analytics there are essential first steps in determining what an internal audit practice of any size needs to understand. Although LaValle et al. (2010) indicate that traditionally organisations begin using analytics by gathering all available data which may have an undesirable impact of leaving little time, energy or resources in gaining an understanding of the potential use of data analytics. Nevertheless, Soileau and Soileau (2016: 38) point out that clearly defined performance and goals must be the measure of data analytic initiative. Asking critical questions is of utmost importance, especially in gaining an understanding of the effects on the underlying data as a result of the business objectives and operating cycle that will be analysed; hence internal auditors need to assess these critical questions before enquiring. Soileau and Soileau (2016: 36) indicate that there “are numerous questions an internal auditor may want to answer” with the analytics program; such questions need to be closely correlated with the program’s objectives. Examples include questioning the “frequency of credit limits overridden” (order-to-cash cycle); as well as questioning the “inventory turnover” as stated by historical and or budgeted averages (inventory cycle); and for “vendor management process”, questioning the possibility of company buyers having an over-reliance on key vendors (Soileau and Soileau 2016: 36). This is the reason LaValle et al. (2010) agree with Soileau and Soileau by supporting that desired insights within the subject areas need to be defined and targeted. Once defined and targeted, the readily available data can be used in the initial analytic models. One of the purposes of the analytic models will then be to deliver insights and expose gaps within the data infrastructure and business processes (LaValle et al., 2010). Through this capability, the analytic models save auditors’ time that would have been

spent cleaning up all data. The time gained can be used in targeting data needs and improve specific processes with exposed gaps as a result of the delivered insights (LaValle et al., 2010). The analytic models, therefore, add value, meeting one of the elements of the definition of internal auditing.

Peters (2017) agrees with LaValle et al. (2010) by illustrating that the discovery of trends in Big Data increases the likelihood for the internal auditor to reveal insight. Correspondingly, Peters (2017) illustrates that internal auditors that have the ability to provide greater insights must continue using non-technical skills to explore the root causes of those trends. Incorporating data analytics into the audit methodology as reflected in Figure 2.1. and Figure 2.2. is one way that enables internal auditors to provide more insight.

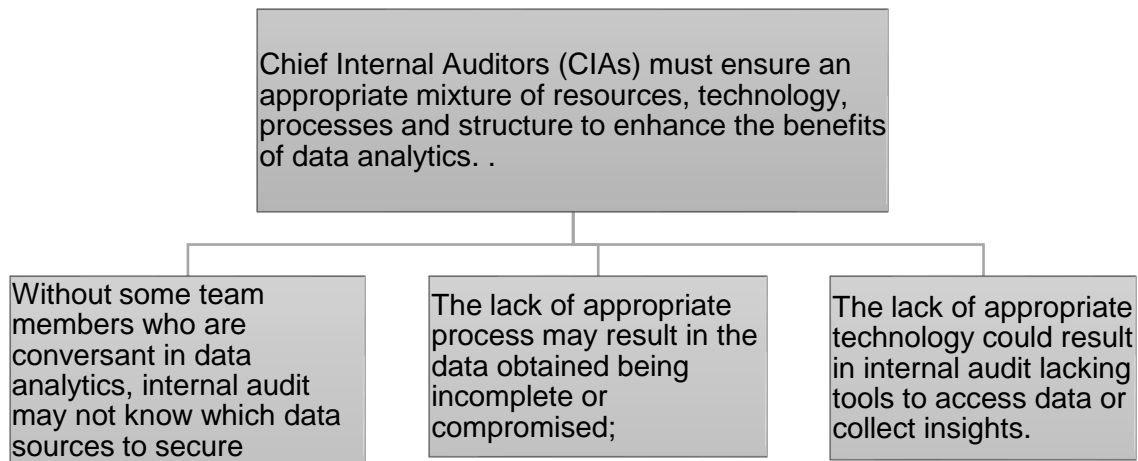


Figure 2 1: Understanding How Data Analytics Can Help

Source: Peters (2017: 5)

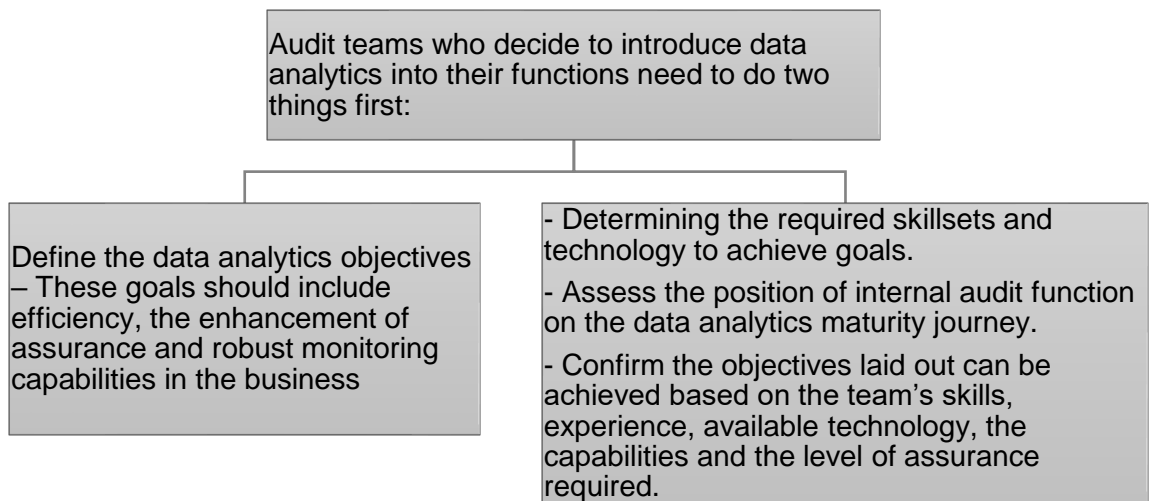


Figure 2 2: Introducing Data Analytics into the Internal Audit Function

Source: Peters (2017: 5)

Peters (2017) outlines that the Head of Internal Auditors (HIAs) should implement the introduction of data analytics after evaluating the specifics of the organisation, the organisational size, the industry, and the board/audit committee’s commitment. The strategic needs for the usage of data analytics must be defined by the HIA. HIAs need to determine the focus on the audit population area, which will be the analytics focal point, before assigning it to the audit plan with no clear strategy or purpose (Peters 2017). The Institute of Internal Auditors and Global Technology Audit Guide (2017) notes that internal audit needs to consider the role of Big Data within organisations as part of risk assessment and audit planning (see Standard 2010 – Planning and 2010.A1). If the risks are significant, the internal audit can determine an appropriate plan to provide coverage of Big Data risks and controls. In doing so, internal audit has the opportunity to educate the board of directors on the organisation’s Big Data initiatives, the resulting risks and challenges, and the significant opportunities and benefits. Internal audit effectively provide significant coverage of Big Data using multiple audits versus a single Big Data audit (The Institute of Internal Auditors and Global Technology Audit Guide 2017)

Internal auditors may also leverage Big Data solutions to support their data analytic efforts for audit projects. Many internal audit clients have already

acquired, consolidated, and integrated the data, and an internal audit could gain significant efficiencies by using data from a data warehouse or data lake, as opposed to targeting many source systems (The Institute of Internal Auditors and Global Technology Audit Guide 2017). Peters (2017) demonstrates that the incorporation of data analytics assists the internal auditor in identifying trends and connections, as revealed in Figure 2.3.

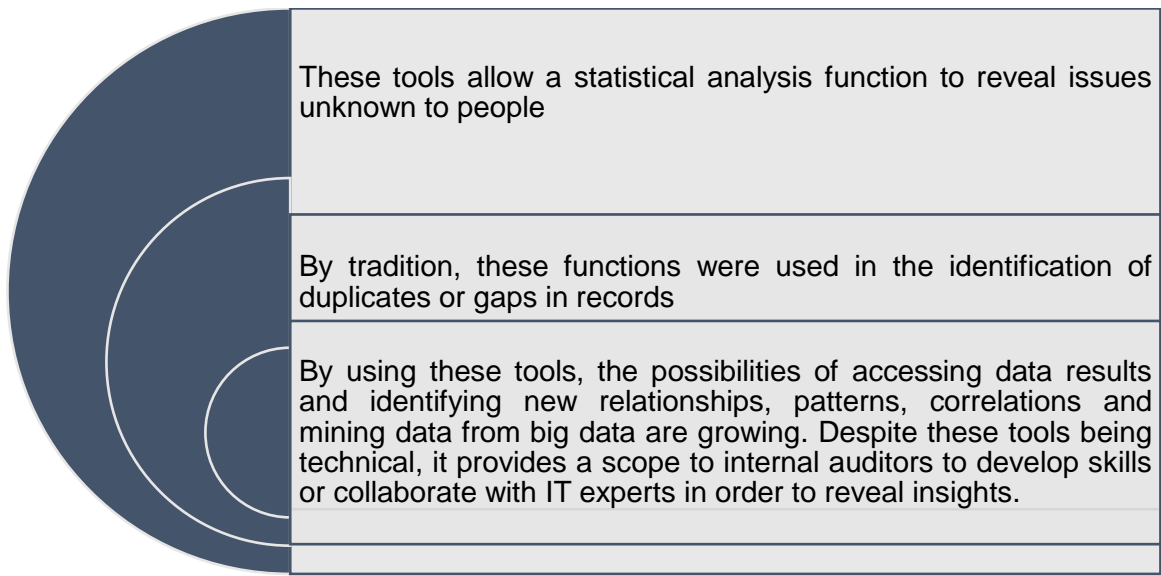


Figure 2 3: Identifying Trends and Connections

Source: Peters (2017: 5)

2.11 Correlation and Causation

Cao et al. (2015) mention that there are numerous concerns that the auditing profession will need to deal with connected to Big Data analytics. This includes the fact that Big Data requires a paradigm shift. As an alternative of using some data in small clean datasets and focusing on causation (plausible relationships), the auditor using Big Data will use ‘all’ the data in large, relatively messy datasets and resolve to focus more on correlation (a mutual relationship or connection amongst two or more things) than causation (Cao et al. 2015).

Soileau and Soileau (2016: 38) indicate that “correlation analysis is the comparison of X and Y” to determine the relationship to each other. An internal auditor might use correlation analysis in a production process audit to

determine the strength of the relationship between product defects and factory overtime. Soileau and Soileau (2016) claim that if the relationship is strong, the auditor queries and observes to assess whether the defect is caused by “overworked and stressed” employees. Alternatively, the auditor can rely on predicting defects through performing a regression analysis, thereafter, using actual defects results to confirm. This determination enables value-added discussions around the differences in the defect of the product as a result of changes over time (Soileau and Soileau 2016: 38).

2.12 Opportunity for Audit Practices that Use Data Analytic Techniques

Cao et al. (2015) state that using Big Data analytics to perform audits can also assist audit practices to potentially use it for internal purposes. Most audit working papers are electronic, and this creates an opportunity for the audit firm to analyse audits across an entire portfolio in search of irregularities and potential quality issues (Cao et al., 2015). Analysing data to generate business value is not a new concept. It is becoming progressively important to interpret data faster and base business decisions on the resulting insights (The Institute of Internal Auditors and Global Technology Audit Guide 2017).

Companies that effectively obtain and leverage Big Data are able to take advantage of emerging business trends more quickly, shifts in customer demands, and operational efficiency opportunities. This enhances the opportunity to improve customer satisfaction and maximise the organisation’s success (The Institute of Internal Auditors and Global Technology Audit Guide 2017).

2.13 Benefits of Data Analytics

Botez (2018) supports the views that data analytics contributes to each step of the audit, this includes the time for preparatory work of the mission when deciding to accept it or not, continuing with the planning, understanding of the entity and its environment, risk assessment, assessment and testing of internal controls, application of substantive procedures and detailed tests, and ending with the conclusion and reporting phase. The Institute of Internal Auditors and

Global Technology Audit Guide (2017: 5) notes that business can benefit from Big Data in the following ways:

- Competitive advantage;
- Increased revenue;
- Innovation and faster product development;
- Market demands predictions;
- Well-informed business decisions;
- Operational efficiency.

Big Data's contribution enables an organisation's transparency to be enhanced, improve management analysis and reporting, and decreases costs in support of continuous improvement programs (The Institute of Internal Auditors and Global Technology Audit Guide 2017: 5). Due to data being centralised and consolidated for strategic Big Data efforts, the expenditure associated with performing incremental analytics using this data is greatly reduced, enabling the entire organisation to benefit from these initiatives (The Institute of Internal Auditors and Global Technology Audit Guide 2017).

However, to completely take advantage of Big Data business benefits, internal audit practices within the small and medium-sized audit practices need to invest in building the appropriate environment, including the hiring and retaining of skilled internal auditors, defining and implementing repeatable processes and installing suitable technologies (The Institute of Internal Auditors and Global Technology Audit Guide 2017). Peters (2017) outlines that the audit data analytics tools assist in automating the routine areas embedded in the internal audit process, providing the internal audit team with more time to focus on other strategical and complex issues. It is important for the internal audit unit to understand the potential benefits of data analytics before applying it in the audit processes (Peters 2017). Peters (2017: 8) outlines the key benefits as:

- Increased efficiency – the repeat use of scripts than the repeated manual analysis in periodic audits, resulting in efficiencies;
- Increased effectiveness – the entire population is testable, avoiding sampling, and enabling continuous auditing. Testing the entire population enable an agile risk monitoring process;
- Improved assurance – the human error margin is reduced, and permit operational performance precision in assessment;
- An enhanced focus on strategic risks through converting routine responsibilities to automation;
- The audit coverage is increased; and
- A longer-term saving on time and money.

Botez (2018: 66-67) outlines that data analytics contains methodologies on:

- Finding and analysing patterns, including major deviations;
- Mapping and visualising financial performance and other data related to operational units, systems, products or other references to address risk-based audit;
- The use of data statistical models that clarifies the data in relation to other known factors and can recognise deviations that are far from the standard norm.
- Obtaining additional information in order to combine information from separate analyses and different data sources.

2.14 Matters Relating to the Objectives Presented and Linked with Relevant Literature

2.14.1 Data Analysis Expertise a Much-Needed Skill

Coderre (2017) illustrates that CAEs in many organisations indicate that data analysis expertise is and continues to be a much-needed skill in internal audit.

A survey conducted by the IIA reveals that within the past 10 to 15 years, data analysis and analytical software has been a critical tool for effective internal audit organisations. This survey illustrates that more than half of internal audit practices still rate their analytic capability as poor or needing improvement. Coderre (2017) argues that most of these internal audit shops that struggle to incorporate analytics within the internal audit methodology have not approached data analytics with a clear plan of action.

Coderre (2017) indicates that he has used and supports analytics for many years of experience as an internal auditor. He continues by demonstrating that in the first two years of auditing using data analytics, the potential of performing a greater job was realised. However, many CAEs give up on the development and maintenance of the analytics capability with lack of effort (Coderre 2017).

2.14.2 How Small and Medium-Sized Audit Practices Can Position Audit Data Analysis into the Audit Process

Peters (2017) claims that data analytics in internal audits is becoming more dominant. Many internal audit practices are beginning to question how these capabilities can be incorporated into their methodologies. Davis and Cernautan (2017: para 1) support Peters' view and adds that a successful data analytics strategy needs to begin by building an internal business case. This phase prevents the loss of momentum if the program is not properly marketed within the organisation. The second phase is to "address the knowledge and skill gaps by allocating funding to resource and train the audit teams" (Davis and Cernautan 2017: para 1). Peters (2017) outlines that, through a strategic discussion between the head of internal audit (HIA) and the board/audit committee, a determination of the value-add in introducing data analytics in the methodology should be made. These discussions should also outline that a large number of companies are creating electronic Big Data information originating from financial transactions, operations and other key metrics (Peters 2017). As well as illustrating that internal auditors are enabling the audit plan and test controls to be driven by data analytics.

Coderre (2017) argues that the integration of data analytics into the audit methodology calls for a development plan and implementation plan. The plan must disclose recruitment of resources as an obligation measurement at the specific level and the number, and the appropriate technology software; this also includes the process description and data surrounding the processes description (Coderre 2017). Davis and Cernautan (2017: para 2) state that changing how internal auditors think about their work is the crucial element for “developing an effective data analytics strategy”. They agree with Coderre (2017) that “start with defining the objectives ... plan and execute a vision” to achieving the set objectives (Davis and Cernautan 2017: para 2).

Coderre (2017) illustrates that internal audit practices need to introduce new ways they presently perform their internal audits. The integration of data analytics will require a project manager with clear objectives, milestones, and a reporting obligation in order to account for the key performance areas (KPA) of the plan. The reporting needs to go to the organisational level, such as the CAE and the audit committee (Coderre 2017). Davis and Cernautan (2017) outline that when purchasing, internal audit needs to invest in modern technologies that are easy to become accustomed to and apply. The integration of data analytics requirements into the audit methodology is important since this will ensure the maximum impact of the audit. CAEs must make the use of analytics required rather than optional (Davis and Cernautan 2017).

Davis and Cernautan (2017: para 1) note that internal audit needs to “aim for quick wins that will naturally progress to larger successes by phasing the program in with an agile methodology”. This includes the automation of routine areas of the audit, and teams can contribute by self-funding the program through efficiency gains and demonstrated return on investment (Davis and Cernautan 2017: para 1). Coderre (2017) supports the understandings of Davis and Cernautan and adds that having strong support from senior management is critical. This also includes the data analytics program being approved by the audit staff to achieve efficiencies in meeting objectives. Davis and Cernautan (2017: para 2) maintain that tools that “will lead to quick wins” are those which are easy to set up and user friendly. Such tools help in encouraging approval

and in driving the “data analytics strategy momentum” for more progressive strategies of data analytics. There should be analytics leaders or champions responsible for executing the strategy. The analytics leaders or champions will also be tasked with tracking progress, setting targets and monitoring KPIs and ensuring that analytics testing is performed (Davis and Cernautan 2017).

Coderre (2017) outlines that analytics call for business processes to be understood first, including the data associated with business processes, and concrete knowledge of internal auditing processes, the application knowledge of the IIA professional standards. The declared skills may not exist within one individual, and they might not already exist in small and medium-sized internal audit firms. However, there is an opportunity to attain the right resources and assign them with clear KPAs through the implementation of audit data analytics (Coderre 2017).

According to Peters (2017), a survey conducted by Deloitte indicated that only around one-third of HIAs utilise the audit data analytics tools at an intermediary or advanced level. The remaining two-thirds utilises simple, ad hoc analytics (such as spreadsheets) or no analytics at all (Peters 2017). Coderre (2017) also claims that the internal audit practices that already have the appropriate resources, as indicated above, are ahead of the game. These works of literature postulate that internal auditors within the small-medium practices should already be proficient with business processes together with the internal audit skills, and possibly with some data analytical competencies. Coderre (2017) supports the views that internal auditors will need to be provided with skills development through training, especially software training, and sufficient time to grow the skills and implement the analytics functionality. The literature also claims that internal auditors will need to dedicate themselves to analytics because it will be a recipe for failure if they are pulled away to some subset of the required skills (analytics). Should these internal auditors be devoted something different than analytics, the progress of implementation will be unsuccessful (Coderre 2017). Peters (2017) notes that comparing the different sets of analytic tools is important to determine what works best for the internal audit function, as described in Figure 2.4.

Coderre (2017) argues that small and medium-sized internal audit practices often suggest they cannot dedicate a person to analytics because they are a small audit organisation. The literature illustrates that lack of staff is the most common justification for not using data analytics (Botez 2018: 6). Coderre (2017) argues that a small internal audit team does not indicate that small-medium practices should be less efficient and effective. Unless the small and medium-sized internal audit practices are not adopting analytics, they fail to address risk, perform testing of controls, examine compliance, and improve business operations to the highest degree (Coderre 2017). Accordingly, Peters (2017: 6) make known that data analytics “software can be used for basic data analysis and complex data interrogation across numerous transactions”, including the assessment of control performance and exception reporting. However, regardless of the highlighted good uses, numerous internal audit teams still rely on ad hoc analytics such as spreadsheet tools and applications, relatively to more sophisticated data analytics and data mining tools (Peters 2017: 6).

Coderre (2017) claims that small and medium-sized internal audit practices need to make an informed decision about not using data analytics. This includes examining the costs and benefits and thereafter make a decision. Because just looking at current resources, which may be overused, and then deciding about not using data analytics may not be valuable. Coderre (2017) outlines that it is not a question of doing additional work with the same resources. However, small and medium-sized internal audit practices need to ask if there are tasks that should not be performed or if there are better ways to perform the same tasks effectively and efficiently. Small and medium-sized internal audit practices will need to determine the value-add for the tasks not being performed. Then determine if they can continue to do without data analytics (Coderre, 2017). The use of software to detect trends and issues in Big Data is part of the incorporation of data analytics into the internal audit process (Peters 2017).

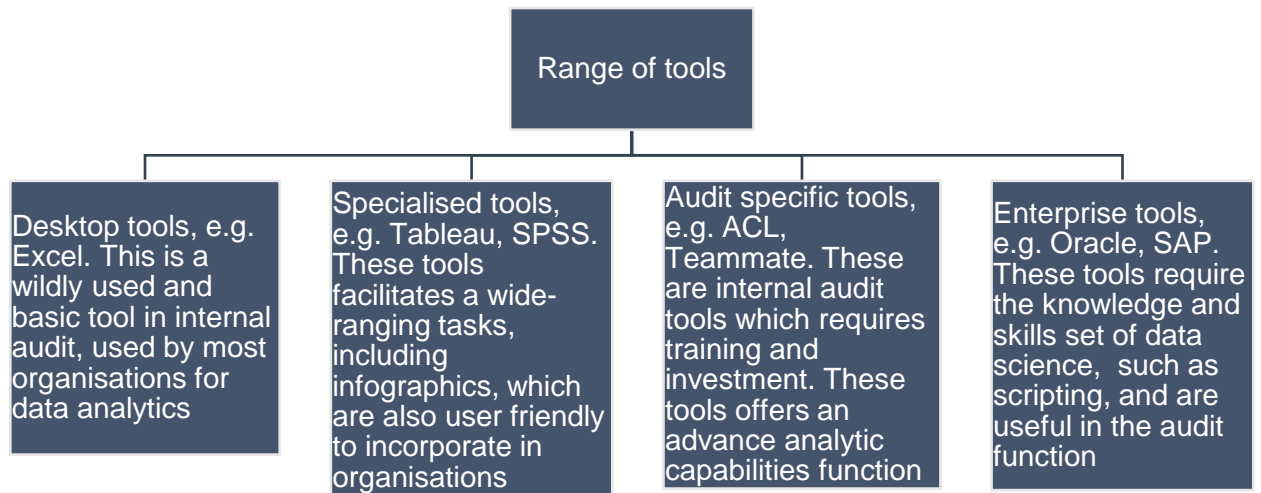


Figure 2 4: Different Sets of Analytic Tools

Source: Peters (2017: 6)

2.14.3 Software Packages for Data Analytics

Coderre (2017) illustrates that the common question for the internal audit practices, which are at the early stage of adopting data analytics, is usually the choice of an appropriate software package. Coderre (2017) notes that the answer should be decided based on the internal audit unit's short and long-term plans of analytics. It was also pointed out that internal audits must start using existing tools, including standard reports and excel, but this does not mean being limited by what the internal audit practice has. The small and medium internal audit practices should find out what analytic software packages are being used by other practices. These practices should then decide according to their requirements, including short and long-term plans for using analytics, and when exhausted, all current capabilities such elsewhere. Other options include ACL, Tableau, SaS, TeamMate Analytics, and many others (Coderre, 2017).

Coderre (2017) indicates that internal auditors should be using data analysis irrespective of the software package. Literature reveals that planning and managing the adoption of analytics is what internal auditors need to undertake. It will take time, resources, and technology, but the benefits are endless.

Coderre (2017: para 10) further outlines that analytics must be “integrated into every phase of the audit process—including planning, fieldwork, reporting, and follow up—and should be developed with an understanding of the business processes and the underlying data”.

Boshuizen and Elder (2016) support Coderre’s understandings and outline that another data analysis enabled system are the enterprise resource planning (ERP) system. Several small-medium practices overlook a significant opportunity to enhance decision making and improve performance that is captured in their systems.

Boshuizen and Elder (2016) demonstrate that the ERP systems can collect and store massive amounts of data derived from running important business functions, such as paying suppliers, managing payroll, invoicing customers, preparing the financials and paying taxes. The ERP system integrates many business functions into one unified system (refer to Figure 2.5), and having the technique of data analytics helps significantly in unlocking the additional value. The data in these business functions holds extremely valuable insights that small-medium practices are often unable to analyse due to complexity or lack of skills (Boshuizen and Elder 2016).

Pan and Seow (2016) also support the adoption of ERP systems due to it having the capabilities of data in practices being stored and transferred in electronic form. Pan and Seow (2016) outline that internal auditors are expected to have an understanding of critical technological components that drive information systems. This is due to technology-related risks and security issues drawing internal auditors’ attention (Pan and Seow 2016).

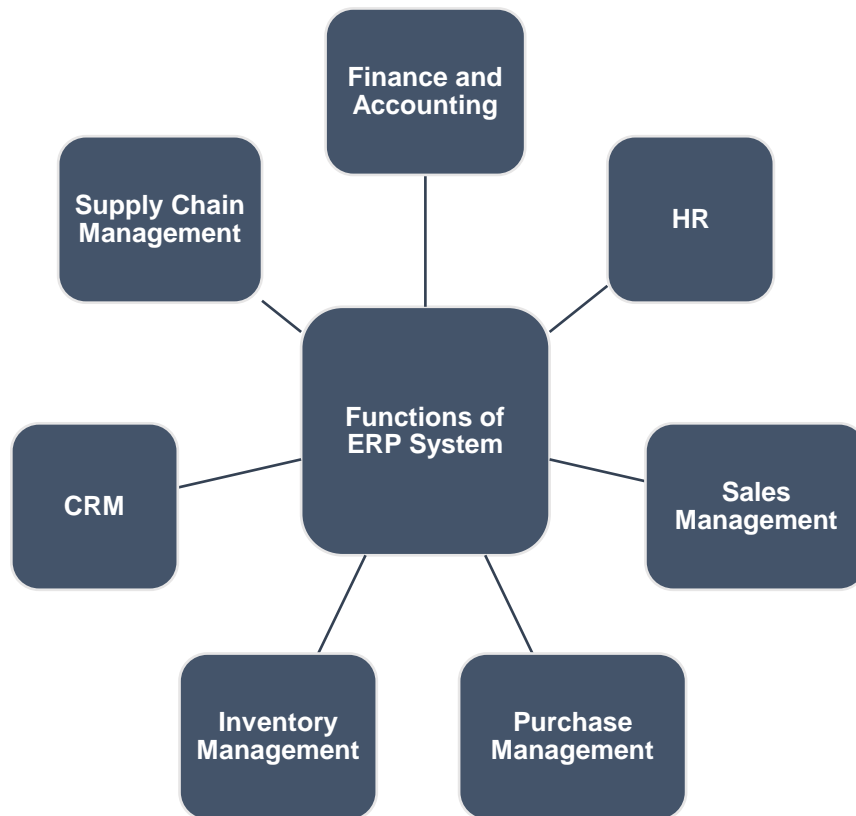


Figure 2 5: Functions of ERP Systems

Source: Boshuizen (2016: 2)

2.14.4 Factors to Consider by Small and Medium-Sized Internal Audit Practices

Davis and Cernautan (2017: para 3) indicate that “changing from traditional audit techniques to incorporating analytics is not always an easy exercise”. The inclusion of analytics is a significant transformation in the methodology, mainly for experienced auditors, and this transformation requires careful change management (Pricewaterhouse Coopers [PWC] 2015). Davis and Cernautan (2017: para 4) demonstrate that over the past 20 years, CAEs who “struggle to incorporate a successful analytics program all cite three factors: 1) difficulty in accessing data; 2) lack of data analytics skills; and 3) the high costs to implement”.

Davis and Cernautan (2017: para 4) further explain that in phasing in data analytics and utilising the tools, expectations for analytics need to be established by the Chief Audit Executive (CAE). This includes informing the audit team about analytics being a priority in order to gain efficiencies, meeting department objectives and audits. Knowing when to apply analytics and identifying opportunities for efficiency gains are critical in implementing a strategy (PWC 2015). Furthermore, Davis and Cernautan (2017) argue that challenges to implementing analytics were dominant in the past. However, “data is easier to access, analytic tools are powerful, flexible, and easy to use, and the cost of not implementing vastly outweighs the cost to implement” (Davis and Cernautan 2017: para 5).

Davis and Cernautan (2017: para 5) indicate that internal audits must adopt analytics knowledge as a basic requirement to remain relevant. Big Data and social media are increasing the risk velocity, and “it is impossible to fulfil the internal audit mandates” ... “using antiquated manual audit processes that focus solely on post-detection techniques” (Davis and Cernautan 2017: 4).

2.14.5 Leveraging on Data Analytics by Strengthening Risk Assessments and the Audit Plan

According to Gleim (2017: 183), there is a probability in business processes of negative events occurring, referred to as risks, which obstruct the business from achieving its objectives. These risks are measured through the use of the internal audit function by internal auditors, rating the impact and likelihood of the risks occurring (Jackson and Stent 2016). When the internal audit activity provides assurance services, both management and the board have an expectation. This expectation is focused on the internal audit activity assuring all-important risks (GTAG 2012). It is, therefore, through the risk assessment process where there is an assessment of the risk and how the risks should be managed (Gleim 2017: 183).

Jackson and Stent (2016: 7-5) agree with Gleim (2017) and illustrate how the risk assessment process gathered information about the business process using the traditional method. Information was gathered through inquiry of

management and others, observation and inspection of operations, analytical procedures such as comparison of prior year's results and other industry, and discussions among the audit team (Jackson and Stent 2016: 7-5). These traditional internal audit methodologies have achieved their designed purpose for decades (Adding insight to audit transforming internal audit through data analytics n.d.).

According to the GTAG (2012), the CAEs should consider data analytics to obtain more real-time risk, especially since the potential to identify anomalies using Big Data is greater. Davis and Cernautan (2017) reveal that the unknown risk is the greatest risk. Adding "analytics into risk assessments confirms the completeness of identified risks, and assumptions made about them" while revealing the possible gaps (Davis and Cernautan 2017: para 6). According to the GTAG (2012), the market offers certain tools for automating the risk analysis process. These tools offer the scoring of the risk, annotating impact, and rating likelihood. Davis and Cernautan (2017) reveal that through the application of data analytics in support of the risk assessments phase of the internal audit process, the subsequent "audit plans will be better informed and developed from objective measures rather than subjective ones" which are susceptible to error. Internal auditor's "assumptions about risk are deeply flawed without the analysis of actual transactional data" (Davis and Cernautan 2017: para 7). Davis and Davis (2017) also reveal that analytics have primarily focused on fieldwork in the past; however, the greatest value-add to risk assessment and planning have been overlooked. Davis and Cernautan (2017: para 8) support the view that in audit planning, data analytics permit the audit function "to collect company, industry, and prior audit results to help drive the audit plan". Regression and trend analysis, in conjunction with visualisation and summarisation, can identify "changing and emerging risks as well as issues to target and explain current and future audit coverage" (Davis and Cernautan 2017: para 8).

Furthermore, Soileau and Soileau (2016) remark that visualisation consists of graphs and charts that clearly explain the content of data. For example, where there has been theft of an asset, internal auditors are able to use visualisation.

This is evident in the case of Russom (2011), who illustrates that the different types of analytic tools exist and are enabled in Big Data, including data visualisation. Therefore, the internal auditor should be informed about analytic requirements before deciding on the tool type that is appropriate in adding value (Russom 2011). In comparison, LaValle et al. (2010) explain that executives are looking for better ways to evaluate complex insights to enable them to gain more understanding of the meaning of data and take action. It was also revealed that emerging reporting approaches would develop accordingly in a few years' time, making information come alive. This will be the focus of executives, consequently improving the standard historical reporting through data visualisation and process simulation (LaValle et al., 2010). Visualisation proves to be able to direct internal auditors to the right area of investigation to discover the root cause of the problem (Soileau and Soileau 2016). If the trend line demonstrates the number of stolen or lost laptops is increasing, "the auditor might investigate to understand the root cause for the increase, including evaluating the effectiveness of the controls in operation" (Soileau and Soileau 2016: 38). De Bonhome et al. (2017) demonstrate that when using data analytics as a method to perform audit procedures, the techniques arising from this method are more structured than exploratory data analytics and tend to be more mathematical and analytical (e.g., regression analysis).

Appelbaum et al. (2017) explain that many of the internal audit procedures performed during the testing phase can be automated, resulting in cost-saving, allowing for more frequent audits, and freeing up the audit staff for tasks that require human judgment. De Bonhome et al. (2017) agree with Appelbaum et al. (2017) by indicating that data analytics can provide the auditor with sufficient appropriate audit evidence regarding the assessed risks. The following types of procedures could be supported by data analytics: 1) Tests of controls; 2) Tests of details, and 3) Substantive analytical procedures:

1) Tests of Controls

Inspection or re-performance of controls — Data analytics can "test the operating effectiveness of controls through inspection of the data for evidence

of the control operating as designed” (De Bonhome et al., 2017: 4). Data analytics “can also reperform the control activity itself” (De Bonhome et al., 2017: 4).

2) Tests of Details

Recalculations — “Data analytics can be used to perform a recalculation of an entire population as opposed to only a sample of items” (De Bonhome et al., 2017: 4).

Reconciliations and Roll forwards — “Data analytics can be used to compare and agree with information from multiple sets of data or roll forward data from one period to the next” (De Bonhome et al., 2017: 4).

3) Substantive Analytical Procedures

Regression Analysis — “Data analytics can be used to analyze the relationships between variables in the data to identify differences between recorded amounts and our established expectations that may warrant further investigation” (De Bonhome et al., 2017: 4). Soileau and Soileau (2016: 38) agree with De Bonhome et al. (2017) by indicating that “regression is the functional relationship between two or more correlated variables that is often empirically determined from data and used specially to predict values of one variable when given the values of others”. It evaluates the relationship between “X and Y when a control exists for other known relationships”. They explain that an example of regression is when “overtime and employee turnover are both increasing; then, regression analysis would provide a more thorough analysis of what is causing the increase in defects”. This allows “for identifying changes, which address the root causes and implementation of actions to bring the defect rate to an acceptable level” (Soileau and Soileau 2016: 38).

4) Other

De Bonhome et al. (2017: 4) state that data analytics may also be useful in other ways:

- 1) Automation of Manual Procedures — Data analytics can perform procedures quicker and, in addition, perform tedious manual audit procedures (De Bonhome et al., 2017).
- 2) Journal Entry Testing to Address the Risk of Management Override of Controls — Data analytics can test journal entries to “address the risk of management override of controls through the use of an electronic approach” (De Bonhome et al., 2017: 4).

2.14.6 Strengthening Individual Audit Engagements

According to LaValle et al. (2010), gaining the benefits of analytics requires big planning, discrete action, and specific management approaches. A survey conducted revealed a five-point methodology for the successful implementation of analytics-driven management and rapid creative value. Based on the maturity standing of an organisation that is either at the Aspirational, Experienced and Transformed stage of analytics adoption, a suitable methodology was recognised, as shown in Table 2.2. The methodology aims to assist organisations in understanding the five-point methodology and learning how to use it.

Table 2. 2: Five-Point Methodology for Successful Implementation of Analytics

	ASPIRATIONAL	EXPERIENCED	TRANSFORMED
Motive	Use analytics to justify actions.	Use analytics to guide actions.	Use analytics to prescribe actions.
Functional proficiency	Financial management and budgeting Operations and production Sales and marketing.	All aspirational functions Strategy/business development Customer service	All aspirational and experienced functions Risk management Customer experience

	ASPIRATIONAL	EXPERIENCED	TRANSFORMED
		Product research/development.	Workforce planning/allocation General management Brand and market management.
Business challenges	Competitive differentiation through innovation Cost efficiency (primary) Revenue growth (secondary)	Competitive differentiation through innovation Revenue growth (primary) Cost efficiency (secondary)	Competitive differentiation through innovation Revenue growth (primary) Profitability acquiring/retaining customers (targeted focus)
Key obstacles	Lack of understanding how to leverage analytics for business value Executive sponsorship Culture does not support the sharing of information.	Lack of understanding how to leverage analytics for business value Skills within line of business Ownership of data is unclear.	Lack of understanding how to leverage analytics for business value Management bandwidth due to competing priorities Accessibility of the data.
Data management	Limited ability to capture, aggregate, analyse or share information and insights.	Moderate ability to capture, aggregate and analyse data Limited ability to share information and insights.	Strong ability to capture, aggregate and analyse data Effective at sharing information and insights.

	ASPIRATIONAL	EXPERIENCED	TRANSFORMED
Analytics in action	<p>Rarely use rigorous approaches to make decisions</p> <p>Limited use of insights to guide future strategies or day-to-day operations.</p>	<p>Some use of rigorous approaches to make decisions</p> <p>Growing use of insights to guide future strategies, but still limited use of insights guiding day-to-day operations.</p>	<p>Most use of rigorous approaches to make decisions</p> <p>Almost all use insights to guide future strategies, and most use insights to guide day-to-day operations.</p>

Source: LaValle et al. (2010: 24)

Alternatively, Davis and Cernautan (2017) postulate that a risk-based audit approach and value-add cannot be achieved in audit practices without being data-driven throughout. Davis and Cernautan (2017: para 9) further indicate that involving analytics in the preliminary phase of the audit to “identify risks that may influence audit scope” is critical. The literature reveals that the advantage of involving analytics at this stage is the attainment of the relevant data aligned to the audit objectives before fieldwork begins. Davis and Cernautan (2017: 10) explain that from performing a “risk assessment to scoping and planning, to executing fieldwork, to raising issues, and all the way to preparing the final audit report, the nature, timing, and extent of procedures to be performed are mainly driven by the significance of the risks.” With the risk significance being the driver of the internal audit process in the internal audit function during a traditional internal audit, the same will apply with the use of data analytics. By analysing actual data, risks can be quantified, resulting in rationalising the audit effort and supporting the results with evidence (Davis and Cernautan, 2017). They agree that auditors need to consider the integration of data analytics in engagement planning. If an audit is recurring, rather than repeating manual testing, the audit programs must be re-visited to identify areas to incorporate analytics in order to add value (Davis and Cernautan 2017).

Davis and Cernautan (2017: para 9) support that in fieldwork, data analytics has the potential to eliminate the use of sampling and will “strengthen an audit through the ability to analyze complete data sets”. A deeper insight into processes and procedures is the resulting effect of using complete testing of data (Davis and Cernautan 2017: para 9). The testing of every instance of control increases the audit coverage providing greater assurance and more robust audit evidence. “When reporting issues, deeper insights can be supported by tangible and measurable valuations” (Davis and Cernautan 2017, para 9). Davis and Cernautan (2017: para 9) further demonstrate that auditors can test 30 purchases using a traditional sampling audit and find only two purchase orders without authorisation. However, Davis and Cernautan (2017) add that analytics allows the internal auditor to test the full population of purchase transactions and find R1 206 736.28 in purchases with unauthorised purchase orders. When management sees the Rand value involved, they have a reason to follow up or correct a control (Davis and Cernautan 2017).

Davis and Cernautan (2017) state that executive management constantly interrogates internal auditors’ reports in order to challenge the value of audit findings. Executive management needs internal auditors to respond and support findings with objectively quantifiable data and key performance metrics. De Bonhome et al. (2017: 2) support that data analytics offers many other opportunities to improve audit quality. Analytics tools assist the auditor in the identification of risks through procedures that include searching for one-time vendors, direct expenditure postings, vendors with duplicated payments and vendor payments on multiple bank accounts. Figure 2.6 demonstrates the capabilities that data analytics can offer many other opportunities to improve audit quality.



Figure 2 6: Data Analytics - The Future of Audit

Source: De Bonhome et al. (2017)

As revealed in Figure 2.6, data analytics is a key element in the strategy to improve audit quality. It offers more in-depth knowledge about the business and equips the auditor to focus on items of greater audit interest. Jackson and Stent (2016: 1-2) agree with De Bonhome et al. (2017) by indicating that internal auditors perform independent assignments on behalf of the company’s board of directors. Although these assignments will vary, they will relate to the evaluation of the efficiency, economy and effectiveness of the company’s internal control systems and business activities and to the evaluation of whether the company has identified and is responding to the business risks faced by the company (Jackson and Stent 2016: 1-2).

De Bonhome et al. (2017) support the idea that internal auditors must limit overall audit risk to a low level, and reasonable assurance must be at a high

level. If audit risk is 5%, the level of assurance is 95% in mathematical terms. The main objective of limiting overall audit risk should be to provide reasonable assurance when analysing exceptions, and the use of data analytics will not be resulting in absolute assurance (De Bonhome et al., 2017).

As in internal audit procedure, De Bonhome et al. (2017: 5) state that abnormalities identified through data analytics need to be “analyzed, sorted and clustered”, because not all abnormalities can be risky; some can be justified, There can be deviations that can be justified, for instance, “when a system is configured to prevent pricing changes, a manual price change is a deviation” (De Bonhome et al., 2017: 5). But, should this price change be duly approved, there is no issue to be reported by the internal auditor (De Bonhome et al., 2017: 5). These authors (2017) state that there are three different types of issues:

- Factual issues are ones “about which there is no doubt” (De Bonhome et al., 2017: 5).
- Judgmental Issues are differences “arising from the judgments of management concerning accounting estimates that the auditor considers unreasonable, or the selection or application of accounting policies that the auditor considers inappropriate” (De Bonhome et al., 2017: 5).
- Projected Issues “are our best estimate of misstatements in populations, involving the projection of misstatements identified in audit samples to the entire populations from which the samples were drawn” (De Bonhome et al., 2017: 5).

De Bonhome et al. (2017: 5) highlight that when data analytics is applied as a test of detail to test 100% of the population, there will be no identification of a projected issue due to not performing an audit sample. Accordingly, “audit sampling procedures are used to draw inferences about the entire population based on the results of testing a sample of selected items from the population” (De Bonhome et al., 2017: 5). Audit sampling involves projecting factual issues

“identified in the sampled items to the remainder of the population” – projected issue (De Bonhome et al., 2017: 5). The ability to analyse the entire population is a sign of value being added from analytics. Therefore, internal audit practices that incorporate analytics are likely to identify a wider range of other capabilities (LaValle et al., 2010). Olley (2021) agrees with De Bonhome et al. (2017) by illustrating that the importance of data analytics in its ability to analyse data, and the discovery of transactions that do not fit normal patterns, assist significantly in the achievements of the internal audit objectives. The discovery of these transactions which do not fit normal patterns may have a higher impact of causing audit risk or even indicate fraud. Hence, data analytics abilities may cause auditors to worry that machines will replace them (Olley 2021).

Olley (2021) emphasises that data analytics tools do not eliminate auditors from the auditing system; however, analytic tools free auditors to look at analysis results and determine what and when additional actions should be taken. Hence when auditors use data analytics tools, more available time is created for providing insight to their clients. In addition, because of audit data analytics results, auditors can also offer value-added services (Olley 2021).

De Bonhome et al. (2017: 5) state that “when using data analytics as a test of details, there may be circumstances in which the auditor identifies a large number of exceptions”, making it impractical to investigate all individual exceptions. However, the auditor can select samples of these exceptions and identify a factual issue in the selected sample. The nature and cause of the issue are specific to the exception population, making it appropriate to project the identified issue to the population of exceptions, resulting in a projected issue for decision making (De Bonhome et al., 2017: 5). Whereas LaValle et al. (2010) demonstrate that as data analytics usage increases in an organisation to support decision making, it enhances that organisation’s ability to move from one level of analytic capability to the next. This causes a direct relationship variable of movement in analytics migration; as one variable (analytics usage) increases, so does the analytic capability. The effect of the analytics usage is a centralised unit beginning at the local line business level thereafter at the enterprise level (LaValle et al., 2010). A centralised unit is based on existing

capabilities with developed data analytics functions, departments and lines of business (LaValle et al., 2010). Conversely, Russom (2011) explains that despite organisations tending toward analytics on a central enterprise data warehouse (EDW), the demand for analytic database platforms has also become permanent.

When data analytics identifies a reportable issue, and when the auditor has established that a reportable issue exists, the auditor should investigate the nature and cause of the issue. The auditor also needs to evaluate the possible effect on the purpose of the audit procedure and other areas of the audit (De Bonhome et al., 2017).

Indeed, De Bonhome et al. (2017: 5) reveals that data analytics can be applied throughout the phases of the audit. For that reason, below are some examples of data analytics considerations and routines per audit phase. Table 2.3 determines that data analytics techniques can be incorporated in the audit approach and that data analytics offers opportunities to improve the audit quality:

Table 2. 3: How Audit Data Analytics Differs from Traditional Auditing

What is new in using data analytics?	Adopting data analytics	Traditional audit
Testing entire data sets	Data analytics software performs testing on the entire data set, not only samples, allowing more thorough audits to be performed. There is the possibility for error when conclusions are established on the auditor’s knowledge of the entity. For example, an auditor might miss the fact that some transactions have been processed	Data is analysed by sampling a data set using traditional spreadsheets and establishing conclusions based on the selected samples and the auditor’s knowledge of the entity. This creates the possibility for error because the entire data set is not examined.

What is new in using data analytics?	Adopting data analytics	Traditional audit
	<p>on a weekend when the entity's business hours are only Mondays to Fridays. In this case, data analytics could capture these transactions as 'Unusual Days'.</p>	
<p>Using data from any source</p>	<p>Data analytics software makes it possible to easily integrate data from multiple sources and extract data from any source, enabling auditors to run analyses quickly and efficiently, providing higher quality insights and more value to their clients.</p>	<p>In the 2020s, audit practices will continue to be under pressure to provide more value to their audit clients. This is because it can be difficult to develop strong insights when data is blown-out across multiple files, systems, and solutions.</p>
<p>Bringing data analytics into the audit workflow</p>	<p>Data analytics brings automated testing into established audit workflows, assisting in simplifying the audit engagements and providing useful reports for future audit evidence.</p>	<p>Analytics software usage is not part of an audit workflow. Auditors use data analysis separately or depend on additional data specialists. Consequently, results in longer audits, more costs and no visibility of the tests that are performed.</p>
<p>Artificial intelligence and machine learning applications</p>	<p>Data analytics software works similarly to human auditors but uses AI. Based on the available data set, the analytic software has machine learning (ML) capabilities that adapts its algorithms to provide the most accurate results.</p> <p>Analytics software provides meaningful results that call for further review because of using AI and ML, this enables analytics software to quickly and accurately examine all of the</p>	<p>None</p>

What is new in using data analytics?	Adopting data analytics	Traditional audit
	transaction and trial balance entries in an engagement's data set. Also, further reviews may look at areas of concern that may have been identified in the initial analyses.	
Tailored analytics	<p>Conducting deep analysis often requires additional time usage and extra money, which most clients are not willing to commit. But, automated data analytics tools allow auditors to dig deeper into data without using significantly additional staff time.</p> <p>Furthermore, data analytics allows audit testing to be tailored based to each entity's characteristics.</p>	Due to the large amounts of available data, fraud detection can often be difficult with traditional auditing practices.

Source: Olley (2021)

Peters (2017) indicates that auditors constantly use data analytics for engagement planning and fieldwork and identify irregularities using the results obtained and test controls. In an attempt to drive analytics to create the most impact, analytics should be implanted in the internal audit plan, reporting, and through most of the internal audit activities. Peters (2017) demonstrates that many audit functions, as reflected in Table 2.4, use data analytics. The financial oriented audits for which data analytics is mainly used includes:

- Order to cash;
- General ledger;
- Payroll;

- Purchase to pay; and
- Travel and subsistence/entertainment.

Table 2. 4: The Frequent Uses of Data Analytics for Internal Audit

Internal audit function	Data analytics use illustrations
Compliance	Evaluate transactions related to purchase card usage and expense reports.
	Through the selection of line-by-line billing data, perform audits on suppliers by identifying anomalies and investigating trends.
	Obtain the regulatory requirements and perform an assessment.
	The key drivers of non-compliance risks should be identified, either due to poor data quality and integrity at various data systems.
Fraud, risk assessment, detection and investigation	Perform a fraud risk assessment.
	Identify false suppliers, related parties such as relationships amongst employee-supplier and identify ghost employees.
	Select data irregularities that possess a significant financial and reputational organisational risk.
	In order to respond to the questions of “who, what, when, and where,” investigate the asset misappropriation scheme symptoms.
Operational performance	Identify the key metrics on the spend analysis, such as foregone early-payment discounts, payment efficiency and payment timing.
	Using data analytics perform a duplicate payment analysis and recovery.

Internal audit function	Data analytics use illustrations
	Through the use of data analytics, perform a revenue assurance analysis.
	Using data analytics, perform a slow-moving inventory analysis.
	Through the use of data analytics, identify key risk indicators across industries and business lines. Also, identify key performance.
Internal controls	Anticipatory – business continuity plan.
	Using data analytics, perform a detective and corrective analysis, such as control account reconciliations.
	Directive – code of conduct.
	Preventative – passwords, access controls.
	Through the use of data analytics, perform a division of duties analysis.
	Using data analytics, perform user access analysis.
	Assess control performance.
Using data analytics, generate and perform an exception reporting, for example, identifying potential outliers indicating control failures or weaknesses.	

Source: Peters (2017)

2.14.7 The Pathway to Maturity Using Data Analytics

Peters (2017) establishes that the internal audit teams that have incorporated and use data analytics are at different points on the maturity path. The small internal audit practices considering adopting analytics, teams with members who have the skillset and are knowledgeable in audit data analytics skills, can

implement data analytics at a more advanced/matured level of the maturity path as depicted by Chart 1.

Peters (2017) argues that when adopting data analytics, not all the internal audit team members need be skilled and knowledgeable in technical areas such as scripting. When these small internal audit practices decide to incorporate data analytics at more than a basic level into their internal audit function, they will have to engage internal auditors with data analytics skills and abilities that are more developed. Chart 1 demonstrates the level of required groundwork of data analytics implementation in an organisation, based on the profile of the existing resources and skillset possessed by the internal audit team (Peters 2017).

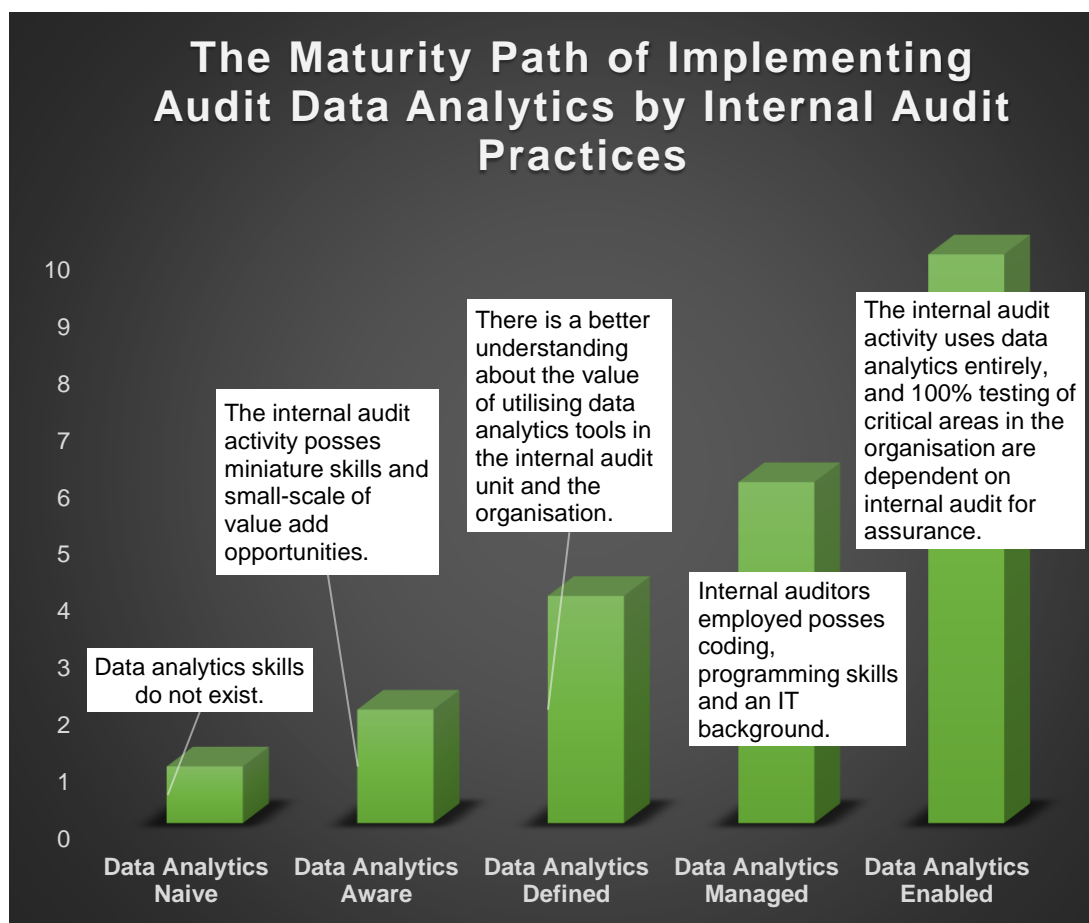


Chart 1: The Pathway to Maturity

Source: Peters (2017).

2.14.8 The Concerns Around Data Analytics

Botez (2018: 63) illustrates that the International Auditing and Assurance Standards Board – IAASB is an independent standards body and managing body of the International Federation of Accountants – IFAC. The IAASB established a Data Analytics Working Group (DAGW) in 2015, with the intention to inform IFAC about how and when to respond to technological developments of public interest (Botez 2018: 63).

Botez (2018: 63) further indicates that In September 2016, the DAGW group launched a document entitled “Exploring the Growing Use of Technology in the

Audit with a Focus on Data Analytics”. In this document, it was indicated that the data volume and its complexity is continually rising, therefore the use of technology such as data analytics (DA) enables auditors to gain a much clearer understanding of their entity of engagement and its environment. The use of these technologies, therefore, allows the audit risk assessment to increase the quality of its objective, and the reaction response from stakeholders or process owners (Botez 2018: 63).

DA is beneficial because of how it discovers deviations and inconsistencies. Literature indicates that the use of data analytics is to discover patterns that are related to a subject that is an audit problem and are discovered through analysis, modelling and visualisation using data analytic procedures for planning or performing the audit (Botez 2018: 63).

Another traditional phase of the audit is the collection of audit evidence as a result of the selected samples. Through performing fieldwork on these samples, “the conclusions are extrapolated to the entire population from which they were extracted” (Botez 2018: 64). This traditional technique is said to be significantly modified by the use of data analytics (Botez 2018: 64). This is because of the increased ability to collect audit evidence and analysing a larger set of data, allowing the best risk-based selections to be tested (Botez 2018: 64). Therefore, the involvement of auditors in the entity and its environment is extended and deepen (Botez 2018: 64).

The author Botez (2018: 64) argues that, even if the benefits are clear, there are limitations on data analytics:

- The quality of the audit may decrease because of detection risk resulting from data that is not relevant to the audit being analysed (Botez 2018: 64).
- The 100% testing of the population does not imply the auditor can provide anything other than reasonable assurance (Botez 2018: 64).

- Professional judgment is still necessary to assess the reasonableness of accounting estimates and presentations (Botez 2018: 64).
- Data analytics cannot replace the reasoning of professional judgment. In addition, technology needs to be used cautiously and not overly trusted (Botez 2018: 64).

Botez (2018: 65) further indicates that the additional concerning factors exist which influences data analytics use in audits:

- The data acquisition process is a challenge since it is connected to the existence of a large database that the entity must transfer to the auditor in order to apply data analytics (Botez 2018: 65). This process will involve data security and confidentiality issues, along with the existence of storage space (Botez 2018: 65).
- Conceptual challenges – when an “audit involves data analytics, it will also involve asking for data and addressing questions that have not been requested in the past. This “may create issues related to the attitude of the audited entity” (Botez 2018: 65).
- Legal and regulatory challenges – “security and confidentiality of data in different jurisdictions and the movement of data between them” can create concerning challenges (Botez 2018: 65).
- Availability of resources – the audit team needs to be supported by people with certain skills (i.e., data analytics).
- Under a rapid change of circumstances, the way in which supervisors and regulatory bodies maintain their supervision may also call for a rapid change (Botez 2018: 65).
- The investment in “preparing and creating auditors’ qualifications (skills) to gain knowledge, abilities and experience in data analytics use” (Botez 2018: 65).

Botez (2018: 65) further illustrates that before relying on data provided by the audit client, auditors should consider various associated obstacles. This includes the fact that data analytics triggers questions on IT generic controls, especially the impact of the test results, the minimum level tested, and the impact of any deficiency in IT controls. When the “auditor believes they can rely on IT systems, the data provided by the IT system should be reliable” (Botez 2018: 65). Since the data used is created mainly by the entity, the auditor should reassess its ability to gather sufficient and adequate data. Auditors should also consider the relevance and reliability of data obtained from third parties, especially “when completeness, accuracy and reliability cannot be established” (Botez 2018: 65). According to Dagilienė and Klovienė (2019: para 12), the nature of audit evidence obtained through data analytic procedures when initially using a Risk-Based Approach procedure should be considered (Botez 2018: 65). The differences in risk assessment procedures, testing controls and background procedures when using data analytic should also be considered. This means also considering the role of controls testing, especially when the auditor looks at 100% of transactions (Botez 2018: 65). Considering the nature of the audit evidence obtained from data analytics in response to the identified risks is important. This is because using data analytics “does not deny the pattern, but it changes the way it is implemented”, including the documentation by the auditor. Hence, even the information the auditor needs to document when applying data analytic should be considered (Botez 2018: 65).

In addition, before relying on data provided by the audit client, the appropriate level of the auditor's activity for the identified exceptions should be considered. This is because analytics presents multiple test procedures to reduce deviations on a significant level. Also, the implication of data analytics usage in risk assessment for assertions should be considered. Indeed, the impact of change in quality control procedures should be considered, especially when the auditor uses data analytic tools and techniques instead of calling on third parties to conduct data analytics (Botez 2018: 66).

2.15 Conclusion

This chapter presented the literature review relating to the use of data analysis techniques by small and medium-sized audit practices. The literature review addressed the IIA's requirements on technology-based audit and other data analysis techniques as a critical tool for effective internal audit organisations. Indeed, it was pointed out that the landscape of the internal audit function is changing because of the rise in Big Data. With this rise in Big Data, data analytics is changing the field of internal auditing significantly because manual processes having transformed into automated processes. Internal auditors, therefore, can use data analytics to provide deeper insights into the workings of a business and provide the best service for their clients.

The literature review in this chapter also revealed that the current maturity of data analytics implementation within audit practices is rated low because of the lack of skill and innovative technology being used. Indeed, a suitable methodology was recognised, assisting audit practices to understand and learn how to use the five-point methodology. It also was revealed that as data analytics usage increases in order to support decision making, it enhanced an organisation's ability to move from one level of analytic capability to the next. However, this chapter also revealed what is new in using data analytics which was not done during the traditional audit. Conversely, this chapter exposed that even if the benefits are clear for using data analytics in audit practices, there are limitations and concerning factors. The next chapter explored the detailed explanations of the research design incorporating qualitative research.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

The preceding chapter outlined the literature review, theoretical framework and models related to the use of data analysis techniques by small and medium-sized internal audit practices. In this chapter, detailed explanations of the research design incorporating qualitative research are explored. The research design chosen played a major role in fulfilling the purpose of this study which was to investigate the factors of IIA's requirements of technology-based audit and other data analysis techniques by the small and medium-sized audit practices. Indeed, this research has four objectives, as revealed in the preceding chapter. These objectives are 1) to determine the extent of use of data analytical software by small and medium-sized audit practices, 2) to examine the impact or consequences of non-compliance of the use of data analytic software by the small and medium-sized audit practices, 3) to determine factors and reasons for any non-compliance, and 4) to recommend the steps to be considered in the implementation of data analytics by small and medium-sized audit practices. In addition, the critical aspects presented in this chapter include the target population, pilot testing, measuring instrument and data analysis. Subsequently, matters relating to validity, reliability and ethical considerations are also discussed.

3.2 Research Design

Creswell (2014: 293) indicates that research designs are the framework of methods and techniques chosen by the researcher and used to collect, analyse, and interpret data for a chosen study of research in order to efficiently handle the research problem. Likewise, Flick (2018: 30) agrees with Creswell (2014) that the research design is the plan for analysing and collecting evidence and making it possible to answer questions posed by the investigator. Creswell (2014: 239) outlines that there are three types of research designs associated with the use of qualitative research design, and these are:

- Grounded Theory Designs;

- Ethnographic Designs; and
- Narrative Research Designs.

In this study, emphasis is on qualitative research design especially using grounded theory. Creswell (2014: 16) illustrates that qualitative design is suited to establish answers in cases where the variables and the need to explore the research problems are mysterious.

3.2.1 Qualitative Research Design

Flick (2018: 10) clarifies that qualitative research is intended to gain an understanding, sometimes explaining social phenomena “from the inside” using a different set of ways such as analysing experiences of groups or individuals, documents, interactions and communications in the making. Creswell (2014: 16) illustrates that in qualitative research, various characteristics can be identified at each stage of the research process this includes:

- Investigate a problem and develop a detailed understanding of a significant phenomenon;
- Have the literature review play a minor part a minor role but justify the problem;
- State the purpose and research questions in a general and far-reaching way to the participants’ experiences;
- Collect data based on words from a small number of individuals to gain the views of participants;
- Analyse the data for description and themes using text analysis and interpret the more significant meaning of the findings;
- Write the report using flexible, emerging structures and evaluative criteria, and include the researchers’ subjective reflexivity and bias.

Similarly, Pajo (2018: 11) agrees with Creswell (2014) that qualitative research aims at gathering insights and depth into topics a researcher wants to know about. As a result, due to the literature yielding little information about the phenomenon of this study within the small and medium-sized audit practices in Durban, there was a need to learn more from participants through exploration. Little information is available in the literature that discusses the 'Use of data analysis techniques by small and medium-sized audit practices'.

A qualitative research study was appropriate to explore this phenomenon, especially from the perspective of internal auditors in the Durban based internal audit practices, since Durban was the primary focal point. Furthermore, the focus was on those practices that are practising internal auditing separately. This study intended to investigate the use of data analysis techniques in the internal audit practices that are small and medium-sized as these techniques were still new and were being explored.

According to Flick (2018), a qualitative research interview was appropriate in this study as it seeks to understand the world from the subject's point of view to unfold the meaning of people's experience and discover their lived world before scientific explanation. Brinkmann and Kvale (2018: 72) agree with Flick (2018) by specifying that qualitative interviews are commonly semi-structured with themes to be covered and include some prepared questions.

3.2.2 Questionnaire Validity

Ricci et al. (2019) illustrate that questionnaires are common in research, and using qualitative research design enriches the quality of questionnaire items. The questionnaire should fully reflect the perspective of the members of the population of interest, and the items should be acceptable, comprehensive, and relevant to their condition. In general, questionnaires are used to collect data in both quantitative and qualitative approaches (McGuirk and O'Neill 2016: 22).

In this study, the use of a qualitative questionnaire was appropriate. This was due to the need to collect investigative information that assisted in proving the hypothesis; that the small and medium-sized audit practices are challenged in

crossing over to audit data analytics. Also, COVID-19 compelled the researcher to prepare the questionnaire to make the participants feel comfortable to respond in their own space. Indeed, qualitative questionnaires are relevant in collecting exploratory information to prove a hypothesis (QuestionPro 2021: 10). Correspondingly, McGuirk and O'Neill (2016) agree that questionnaires containing qualitative data have many strengths. These strengths include the provision of insights on attitudes, interpretations, social trends, processes and values. In addition, questionnaires containing qualitative data are considered a more practical research tool because of their cost-effectiveness and extensive research coverage that is extremely flexible (McGuirk and O'Neill 2016). These questionnaires can be combined effectively with interviews and focus groups for a more in-depth viewpoint on context. This is because such questionnaires contain open questions. Hence, the questions in this study did not limit the responses of a respondent, unlike a structured quantitative questionnaire designed to validate or test accumulated data on a previously generated hypothesis. For example, open questions invite respondents to offer their understandings, experiences, and opinions in their own style as answers to the questionnaire (McGuirk and O'Neill 2016).

Validity is the creation of evidence that cannot be doubted in an attempt to prove that the theory of the study accurately matches its proposed idea. Validity is the degree to which all of the proof points to the anticipated interpretation of test scores for the proposed purpose (Creswell 2014: 159). Correspondingly, Pajo (2018: 125) agrees with Creswell (2014) and illustrates that validity is the capability of the data collection tool to capture and measure the hypothesis (i.e. viewpoint or belief) that is the measure of interest. Although there are many types of validity such as construct, criterion-related, face validity, concurrent validity, predictive validity and content validity, this study only selected one and applied it through this study.

Construct validity determines whether the research study tests the concept that should be measured from an instrument (Creswell 2014: 619). Constructive validity is the extent to which the measurements used (often questionnaires) with more than one possible related concept actually test the hypothesis or

theory they are measuring. It is verified by connecting the relationship of the test to other tests that measure similar qualities to check the correlation between the two measures (Dane 2018: 87).

The criterion-related validity refers to the extent a measure of a research study agrees with a set standard or criterion (Creswell 2014: 619). Face validity refers to the unanimous agreement that the questionnaire appears effective in terms of its identified aims. It relies on authoritative experts (Dane 2018: 87).

Concurrent validity relies on authoritative measurements to establish validity. This means comparing a new measurement (often a questionnaire) to a predominant one (valid measure). Therefore, the difference between concurrent and face validity is the fact that one relies on an existing valid measure (concurrent) while the other relies on experts (face validity). Predictive validity refers to the comparison of a measure with the future occurrence of another highly valid measure (Dane 2018: 87).

This study focused on the most appropriate version for this study, which is content validity. Content validity is a fundamental element of questionnaire validity (Ricci et al., 2019). Content validity is the extent to which items of a questionnaire are appropriate and representative of the targeted hypothesis for that particular assessment purpose (Ricci et al., 2019).

The qualitative research design was carried out in this study through the use of interviews and the support of questionnaires consisting of open-ended questions. With open-ended questions, a general type of question is asked to participants, and the participants shape the response possibilities, e.g., during an interview with a professional, a qualitative researcher might ask: What does professional development mean to you? (Creswell 2014:19). Thus, the use of open questions combined effectively with interviews, allowing for a more in-depth viewpoint on the study.

3.3 Target Population

The target population is defined as the total group of individuals or objects that are required in order to generalise the conclusions. It is all the possible units of

the total group of individuals or the total crowd of people that are the chosen target of the study (Dane 2018; Olsen 2012; Pajo 2018).

The target population of this study was the small and medium-sized audit practices within Durban. Using the search engine Google, 10 small and medium-sized audit practices specialising in internal audit around Durban were found. However, of these 10, only internal audit professionals were the focal point, i.e. those specialising in internal audit and registered with the Institute of Internal Auditors (IIA). In addition, the accessible population (i.e. the population with reasonable access) was 1 internal audit individual in each of the 10 practices identified.

The basis for selecting 10 internal audit practices was due to only having a few internal audit practices in Durban that are stand-alone (not subcontracted to big practices). Second, it was to align their data analytics maturity of implementation with the mandatory requirement of audit data analysis techniques enforced by the IIA Standard 1220.A2. Third, Durban was the core selection to base this study on.

3.4 Case Study

A case study was conducted in Durban particularly focusing on small and medium-sized internal audit practices. The case study assisted in the investigation of various factors related to data analytical software usage by these practices. Dawson (2016: 53) illustrates that a case study is one of the research tools used to gather and analyse data in order to illustrate a thesis or principle.

Dawson (2016: 53) notes that conducting a case study allows the researcher to achieve a comprehensive understanding of the specific case or set of cases. Depending on the detailed description and exploration in any given case, a case study provides an opportunity for the researcher to check out his or her findings against the ongoing data collection process (Hesse-Biber 2017: 231).

Hesse-Biber (2017: 222) explains that depending on the overall research question and methodological perspective driving the qualitative case study, the

source of evidence for a case study can be as follows, which has its own strengths and weaknesses:

Table 3. 1: Case Study Evidence

Source of Evidence	Strengths	Weaknesses
Documentation	<p>Stable: can be viewed repeatedly</p> <p>Unobtrusive: not created as a result of the case study</p> <p>Broad coverage: long span of time, many events and settings.</p>	<p>Retrievability: can be difficult to find</p> <p>Biased selectivity if collection is incomplete</p> <p>Reporting bias: reflects (unknown) bias of author</p> <p>Access: may be deliberately withheld.</p>
Archival Records	<p>Same as those for documentation.</p>	<p>Same as those for documentation</p> <p>Accessibility due to privacy reasons.</p>
Interviews	<p>Targeted: focuses directly on case study topics</p> <p>Insightful: provides perceived causal inferences and explanations.</p>	<p>Bias due to poorly articulated questions</p> <p>Response bias</p> <p>Inaccuracies due to poor recall</p> <p>Reflexivity: interviewee gives what interviewer wants to hear.</p>
Direct Observation	<p>Reality: covers events in real-time</p> <p>Contextual: covers context of case.</p>	<p>Time-consuming</p> <p>Selectivity: broad coverage difficult without a team of observers</p> <p>Reflexivity: events may proceed differently because they are being observed</p> <p>Cost: hours needed by human observers.</p>

Source of Evidence	Strengths	Weaknesses
Participant Observation	<p>Same as for direct observation</p> <p>Insightful into interpersonal behaviour and motives.</p>	<p>Same as for direct observation</p> <p>Bias due to participant observer's manipulation of events.</p>
Physical Artefacts	<p>Insightful into cultural features</p> <p>Insightful into technical operations.</p>	<p>Selectivity</p> <p>Availability.</p>

Source: Hesse-Biber (2017: 223)

This study relied on the use of interviews to accomplish the research objectives. The interviews of participants assisted the researcher to explain, better understand, and explore the research subject's experience of data analytics in their audit function. Indeed, the interview questions were open-ended, enabling the use of in-depth information to be collected. Drawing on interviews as the source of evidence revealed their strengths, as highlighted by Hesse-Biber (2017). The questions were focused directly on the research while offering insightful understandings and explanations about the study topic. Nevertheless, this source of evidence (interviews) may have been impacted by the weaknesses highlighted by Hesse-Biber (2017) in Table 3.1.

3.5 Measuring Instrument

Dawson (2016: 123) illustrates that questionnaires are the most common data collection method used by researchers. Pajo (2018: 161) explains that a questionnaire is the instrument that consists of questions. They can be researcher-administered or self-administered. Dawson (2016: 123) demonstrates that researcher-administered means the researcher ask the questions and writes in the answers, whereas self-administered means the respondent reads the questions and writes the answers. Indeed, the researcher-administered questionnaires were applied, as the researcher was

writing the answers as the respondent answered each question. Furthermore, all questions that were not clear were clarified immediately by the researcher.

Creswell (2014: 306) agrees with Dawson (2016) by explaining that the measuring instruments are used to collect data on a variety of variables, such as physical functioning to psychosocial wellbeing.

The questionnaire was used for interviews, and this was the measuring instrument in this study. Furthermore, the literature review which was presented in chapter two was used as the basis to formulate questions. The questions contained in the questionnaire were designed with the aim of meeting the research objectives. The order and flow of the questions were logically presented to the interviewee. Questions were designed to extract the respondents' opinions and their ideas of the phenomenon under review.

3.6 Interview Administration

The process of administering the interviews started with an appointment with the manager, requesting an interview with an internal auditor (participant). The meetings were face to face since questions had to be asked from the semi-structured questionnaire. The interviews were conducted at the participant(s) place of work during their agreed time and date, which did not interfere with their daily deliverables at work. The reader should note that the interviews were planned to start on the 1st February 2020. As per schedule, five interviews were conducted. Unfortunately, this planned process was interrupted because of the national lockdown that then occurred.

On the 23rd March 2020, the President of South Africa announced the closing of the country for 21 days as a result of the COVID-19 pandemic, which engulfed the entire world. This national lockdown was extended till the end of April 2020. Like any other business, the small and medium-sized internal audit practices were severely impacted. Therefore, some of the planned interviews were affected and to ensure a continuation of these interviews, the software application called Microsoft Teams was used, enabling five interviews to be

completed through a webcam. The same questions were administered to the remaining participants, with the researcher writing the responses.

Therefore, the internal auditors (participants) were requested for their voluntary co-operation and participation in the interview process. The study's target population was the small and medium-sized audit practices within Durban (Umhlanga and CBD area). The interviews took about 20 to 30 minutes per participant on a once-off basis. The researcher ensured that participants' daily tasks were not compromised during the interview through the scheduling process. The interviews comprised semi-structured questions under relevant themes as well as some more structured questions. The participants were given an opportunity to ask the researcher questions during the interview process for any clarity.

3.7 Pilot Testing

There is always a possibility of error in the data collection instrument (e.g., questionnaire) no matter how cautiously the research is designed. In order to identify potential problem areas and deficiencies contained in the research instrument before it is implemented in the entire study, pilot testing is an important stage in a research project. According to Creswell (2014: 390), pilot testing is the preparation of a larger study which involves a smaller study being conducted first to test research protocols, data collection instruments, and other research techniques. An external pilot test proved to be a vital test conducted before the conclusion of the questionnaire, and the outcome information was not included in this research study. In the pilot test, the researcher selected two internal auditors (participants) to complete the instrument (questionnaires) to be administered by the researcher. The two participants involved in the pilot testing were independent of the target population identified for this research study. They were from large internal audit practices in Durban, who previously practised in Durban based small and medium-sized audit practices. The participants were briefed on the study's purpose, aim and objectives; asked to identify any problems on the questionnaire, for instance, poorly worded questions, if it takes too much time to complete. Furthermore, gaps were

identified when they answered the questions, and it was picked up if answers were not directed to achieving the study's objectives. Based on their feedback, the instrument was revised before the data was collected.

3.8 Process Performed Before Analysing the Data

The researcher identified 10 internal audit professionals from various small and medium-sized internal audit practices in Durban to be participants in this study. Data was thereafter collected from these identified internal audit professionals.

In Section 4.2 (The Analysis of Results According to the Study Objectives), the presentation of the 13 research questions for investigation was made to understand better the views of each of the internal auditor participants regarding the use of data analysis techniques by small and medium-sized audit practices. In this section, a presentation of the findings for each of these research questions is made.

The participants were asked to focus and base their responses on their current internal audit practice at the time of the interview. The study questions addressed the use of data analysis techniques, the factors of IIA's requirements of technology-based audit and other data analysis techniques by the small and medium-sized audit practices. Section 4.2 present the analysis of results according to the study objectives.

Thereafter, the process that was performed is explained below during transcription, memoing, coding, analysing qualitative data, hand analysis of qualitative data, themes, qualitative data analysis computer program and NVivo.

Transcription:

During this process, the researcher wrote down everything that the individual participants said without any exceptions. Pajo (2018: 282) states that transcribing is writing down on paper every utterance from the interviewer.

Memoing:

Pajo (2018:282) indicates that in qualitative analysis, reading the transcribed interviews is the first step. The taking of notes as you are reading the transcribed interviews is called memoing and facilitates the analysis as it brings the researcher closer to the written material (Creswell 2014: 243). In order to become actively involved with the written material and before beginning with the analysis the researcher had to read the transcribed interviews more than once and think about them at length.

Coding:

With coding, the intention is to bring order to the written information by using a word or few words to capture common meaning or categorisation (Pajo, 2018: 282). Creswell (2014: 243) agrees with Pajo (2018) by indicating that grouping the text or visual data into small categories of information represents the process of coding. The intention is for the researcher is to seek evidence and assign a coding label for the code used to categorise the information from different databases used in the study. Therefore, the software program NVivo was installed on a Windows PC. It was able to assist the researcher by combining non-numerical, unstructured data, indexing, searching, and theorising. It enabled the researcher to make sense of complex data. Creswell (2014: 243) illustrates that NVivo offers a complete toolkit that enables rapid coding, thorough exploration, and rigorous management and analysis. The software's program can create text data matrixes for comparisons and also provides for visual mapping categories (Creswell 2014: 243).

Tabular Data Presentation:

Tabular data is presented using rows and columns containing information about the study's findings and also presents the findings in an attractive, easy to read and organised manner. The data collection process used was interviews, meaning findings are non-numeric values, and in order to present the results, a more practical form had to be used. The researcher used this

tabular data presentation to help the readers easily read the large set of study findings and interpret grouped data for clarity.

The Hand Analysis of Qualitative Data:

After the collection of data and the memoing process, the researcher divided the data into parts by marking it by hand using Microsoft Office (Word). The intention was to determine how these patterns and themes help answer the research questions. According to Creswell (2014: 239), the hand analysis of qualitative data is the traditional way of analysing text data. It involves the use of colour coding to mark parts of the text or cutting and pasting.

Themes:

These are the keywords and similar codes joined together, which the researcher has identified, forming the major idea within the collected database (Creswell 2014: 245). The research identified similar codes and summed them up together to form the major idea in the database.

Qualitative Data Analysis Computer Program:

The research also relied on a data analysis computer program to facilitate data analysis, as these programs provide several convenient features that facilitate data analysis for a research study. Creswell (2014: 241) points out that these programs store data, organise data, enabling a researcher to assign labels or codes to data, and facilitate searching through data and locating specific text or words. It was necessary to closely inspect every word and sentence to capture specific quotes or meaning of passages, hence the use of the computer program such as NVivo.

The researcher followed all these above-mentioned steps in order to make meaning of the data.

3.9 Data Analysis

This process of analysing qualitative data was an internal focal point since it happened inside the researcher's mind, involving the thinking process. The

researcher had to choose whether to analyse the data manually or use a computer program. The text database was gathered through conducting interviews with participants. The data analysis of texts consisted of dividing them into groups of sentences, referred to as text segments, and thereafter determining the meaning of each group of sentences. In describing the central phenomenon under study, the researcher analysed words. The result was the description of the 'use of data analysis techniques by small and medium-sized audit practices.

Pajo (2018: 293) explains that the process of qualitative data analysis is a thinking process that requires the researcher's mindset in order to make sense of the data. In addition, Creswell (2014: 243) confirms that data analysis is the process of making sense of the data findings collected through the application of using various techniques that are systematic and logical in order to ensure data integrity. Creswell (2014: 243) further clarifies that data analysis involves checking the response rate and bias to analyse the research hypothesis or questions. In the same way, Hesse-Biber (2017: 307) agrees with Creswell by illustrating that data analysis is a reflection of one's biases, values, and assumptions and actively writing them into the research. This may also comprise identifying how you collaborated with participants during phases of the project and discussing personal experiences (Creswell 2014: 243). Figure 3.1 by Creswell (2014: 237) illustrates a typical diagram of the process for qualitative data analysis:

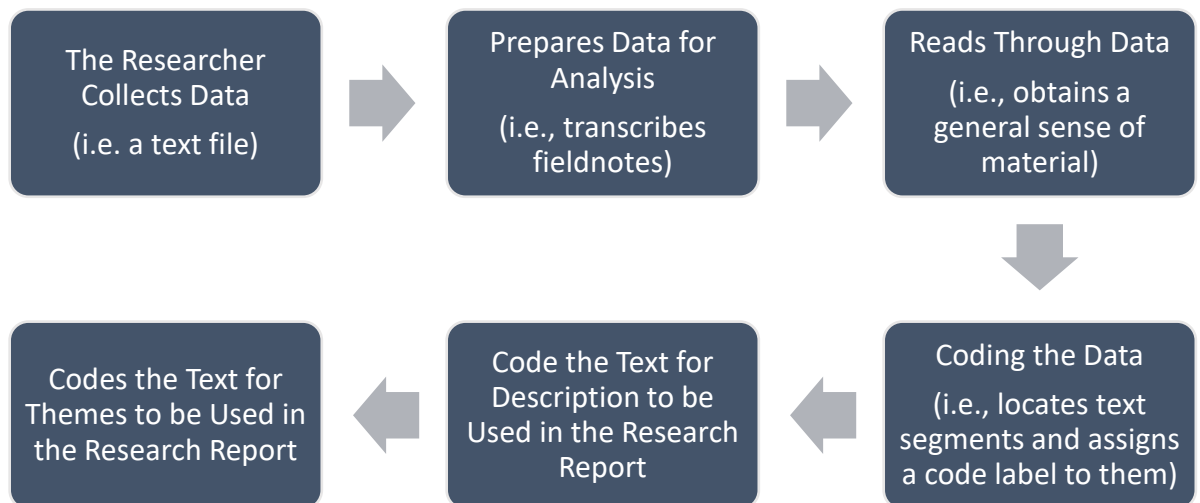


Figure 3 1: Data analysis Process

Source: Creswell (2014: 237)

The data from the first interview was analysed in the spreadsheet by extracting the key themes. Although new insights emerged, this created more themes/variables that were related to the study, and as more interviews were conducted, the same procedure was followed. From then on, preliminary codes were assigned to describe the content. Thereafter a search for patterns or themes, or connections in the codes across the different interviews was performed. These patterns or themes, or connections were reviewed and defined using the software called NVivo, which is described in detail in the following paragraph. The result from the collected data described participant's experiences and identified themes that represented the study findings. The researcher used the themes to interpret the meaning of the data by reflecting on how the findings relate to existing research as per the literature review. The researcher also made a personal reflection about the lessons learned during the study. A report detailing the findings from the researcher-administered questionnaire was produced. This was in response to the problem presented (as defined by the research questions) and also presented the 'solution' or 'answer' to those questions.

Software called NVivo was used to analyse the data collected from participants. NVivo software is intended to assist users organise and analyse unstructured or non-numeric data such as those derived from an interview. It arranges information; study relationships in the data; and combine analysis with linking, shaping, searching and modelling (Powerful research simplified 2020).

3.9.1 Coding

Hesse-Biber (2017: 315) illustrates that coding is assigning meaning to a large text which can be a word, several words, or full paragraphs. Equally, Pajo (2018: 289) agrees with Hesse-Biber (2017) by indicating that coding is the capturing of common meaning or categorisation through the use of a word or group of words. This goes to show that codes are used specifically to refer to the research question. An inductive coding process was used by the researcher resulting in the narrowing of data into a few themes using NVivo software.

3.9.2 Inductive Coding

This coding method formed the data collection technique that was used by the researcher and assisted in interpreting raw textual data to come up with concepts and themes. Hesse-Biber (2017: 318) notes that inductive coding is a data analysis process involving the researcher reading and interpreting raw textual data to develop concepts and themes. This is also a grounded theory approach involving a line-by-line coding of words into more useful data in order to narrow the scope of the study by analysing and developing theories after the collection of data (Hesse-Biber 2017: 318).

3.10 Reliability

Dane (2018: 86) states that reliability is an essential condition for quality measurement. Similarly, Pajo (2018: 121) agrees with Dane by stating that reliability is the degree to which research methods produce stable and consistent results. The data collection instrument is considered reliable when it produces the same outcomes even if used with different populations and with different subjects and or different settings. Likewise, Dane (2018: 83) agrees with Pajo (2018) by illustrating that reliability is the extent when continuous

conclusions of similar results are produced on all occasions of tests or procedures performed. The extent to which two things are associated can be measured through correlation is a statistical procedure. This statistical procedure (correlation) estimates the extent of changes in one variable and the association of those changes in another variable (Dane 2018: 83).

Creswell (2014: 159) indicates that reliability means that responses from a questionnaire selected to report individual responses are stable and consistent. These responses should be closely the same when researchers administer the questionnaires several times at different times (Creswell, 2014: 159). The researcher administered identical questionnaires to ensure overall consistency, resulting in participants answering specific questions one way. The objective was that the participant responds according to how they understood the question. During the interview, the researcher was always available, administering the open-ended questionnaire and assisting with questions that the respondent did not understand. All participants had internal audit experience and certification. Similarly, they knew the subject matter pertaining to the study's objectives (i.e. IIA Standards, internal audit data analysis techniques and consequences of non-compliance), which demonstrated their reliability for this study and their capabilities of being trusted.

3.11 Validity

Dane (2018: 86) refers to validity as the degree to which a variable measures the hypothesis theory it is supposed to measure. On the contrary, Creswell (2014: 159) states that validity is the development of evidence to prove that the test interpretation of the viewpoint or belief matches its proposed purpose. It is important to have the know-how in terms of measuring the specific hypothesis and make sure that the measurement works.

There are different techniques for assessing validity, as highlighted under Section 3.2.2. In this study, content validity was applied. The objectives of this study were highlighted under Section 1.2.2 and were performed using qualitative research to support the content validity of the use of data analysis techniques by small and medium-sized audit practices. Indeed, internal

auditors (participants) were selected for this qualitative study, who are working at a small and medium-sized internal audit practice in Durban, that is, a stand-alone (not subcontracted with any big practices). Subsequently, interviews were carried out to assess the current maturity in the use of data analysis techniques within the practices from the participant's perspective as a content measure. Participant's responses remained closely the same when administering the questionnaires, resulting in the development of and supporting the content validity of the use of data analysis techniques by small and medium-sized audit practices. Similarly, a pilot study was carried with two experienced internal auditors (participants) to complete the instrument (research-administered questionnaires).

3.12 Ethical Considerations

In this study, the researcher was aware that conducting research involves human participants and the duty to keep participants' information confidential. The researcher implemented the following ethical safeguards strategy to protect participants throughout all the stages of the research:

- Physical safeguarding was used to secure the location of private and sensitive information, preventing the information from unauthorised personnel. This included using secured interview rooms, storing information away from the public and easily accessible areas.
- Administrative safeguards were also used by limiting the number of individuals that have access to private and confidential information. This ensured the strengthening of the protection of privacy and confidentiality of participants' information.
- The researcher used technical safeguards, which are technological measures in nature, as another protective tool. The researcher also used computer passwords measures to protect data from an unauthorised individual, loss, theft and or modification.

The researcher demonstrated reasonable safeguards and protection, and these were clearly stated in the consent form. The use of the letter of

information assisted with the distribution of questionnaires, and each internal auditor in the small and medium-size internal audit practice was presented with a letter of information and consent prior to the collection of data (see Appendix B). Participants were given information on the aims of the research, procedures to be followed, and the credibility of the researcher and how the results were going to be used. The gatekeeper's permission letter was attached with the questionnaires provided by the Faculty Research Committee at its meeting on 25th July 2019, allowing preliminary permission to conduct the research and sustaining relief to participants about the legitimacy of the study (see Appendix A). Participants were given an opportunity to either participate in the study or withdraw from it if they wished to do so.

Hesse-Biber (2017: 67) reveals that the word ethics comes from the Greek word *ethos*, meaning 'character'. Researchers should not do anything that may cause harm to participants. According to Flick (2018: 84), a number of cases have occurred, raising awareness of research done with people not knowing that they were being researched and, at times suffering from the research. Such cases of exploitation and the attraction of public attention it caused led to the formulation of codes of ethics (Flick, 2018: 84). Similarly, Pajo (2018: 18) agrees with Flick (2018) that ethics are a group of morals and values governing our behaviours and decisions. Likewise, Hesse-Biber (2017: 67) agrees with Flick's (2018) views and indicates that the moral integrity of the researcher is very important because it ensures that the research process and the research findings are trustworthy and valid. Using this general understanding, the rights of people who participate in research studies are protected by using a set of rules and regulations. These rules are called research ethics (Pajo, 2018: 18).

Listed below are some of the basic principles of ethically sound research (Flick 2018: 85):

- Informed consent – participants should not partake in the research without first knowing about the research objectives and having the chance to refuse to take part.

- Deception of research participants – participants should not be given false information about the research objectives.
- Privacy – respect and confidentiality should be guaranteed and maintained for all participants.
- Data accuracy – the interpretation of accurate data should be the leading principle. This means data collection or analysis should be free from omission or fraud in the research principle.
- Respect for participants – respect for participants is essential.
- Beneficence –this means to consider the wellbeing of participants.
- Justice – refers to impartiality and equality. It means treating all participants equally and give them their due portion of services.

3.12.1 Information and Consent Letters

Hesse-Biber (2017: 73) indicates that these letters inform the respondents about the research project and what role they will play in it. One should include information about the potential risks associated with the project, and it is important to explain how the respondents will contribute to the project goals (Hesse-Biber 2017: 73). Similarly, Brinkmann and Kvale (2018: 32) agree with Hesse-Biber by explaining that the objective of the information and consent letters is to inform the research subjects about the purpose, design, risks, responsibilities, and benefits of participating in the research project.

In compliance with the Durban University of Technology's Research Committees Research Ethics Policy and Guidelines, all participants or respondents who took part in the research study, including the pilot study, were required to sign a consent letter (see Appendix C). The consent letter is an agreement to participate in the research project, which also underlines the purpose, design, risks, responsibilities and benefits for participating (Understanding Confidentiality and Anonymity 2021: 1). It also sets out the

responsibilities of the researcher. The questionnaire was administered to the participants only when consent was obtained from the participants.

3.12.2 Anonymity

Flick (2018: 85) notes that one of the major issues concerning data analysis is the maintenance of anonymity of the research participants. Anonymity means that the participants or respondents in the study cannot be personally identified, except in this case by the researcher. The use of real information about the participants and site should be anonymised from the beginning of the study (Flick 2018: 85). Dane (2018: 203) corresponds with Flick by stating that anonymity exists when no one knows the identity of the participant who provided the information. However, Brinkmann and Kvale (2018: 33) argue that anonymity serves to protect the researcher and denies the participants or respondents a voice in the research project. This is because researchers use anonymity as an excuse to retain the privilege of controlling and distributing the information about the study (Brinkmann and Kvale 2018: 33).

Prior to conducting the interview using the method of the researcher-administered questionnaire, all participants were made aware of the Consent Letter requirements. The participants were informed not to reveal their personal identities or make references to their colleagues. They were also informed to only participate out of their own free will, which is the ability to act at one's own discretion. Assurance was also provided to all participants that research information collected through their responses was to be treated in confidence and anonymity without the use of their identity in order to maintain anonymity.

3.12.3 Confidentiality

According to Dane (2018: 203), confidentiality exists when only the researcher knows the participant's identity and by making a promise to not reveal those identities to others.

All participants were reassured verbally about the confidentiality of the research project's information provided. Through the use of research-administered

questionnaires, in one-on-one meetings in a private closed office space at the participant's workplace, or through Microsoft Teams in the same environment, the researcher ensured that correct steps towards confidentiality were taken.

3.12.4 Data Storage

The researcher drew on the DUT guidelines for research data storage which determined how the data would be stored.

3.13 Limitations

There were some limitations in conducting this study. As a result, it was critically important to minimise the impact of these limitations throughout the research. The limitations were 1) The research aims and objectives were narrowed, thereby increasing the level of focus, 2) Although the researcher has selected a sample, a wider sample size selection could have generated more accurate results, 3) The unavailability of participants since they were working, 4) Problems with technology as interviews had to be conducted through Microsoft Teams due to the COVID-19 pandemic, 5) Time and financial resources was a major limitation since interviewees did not have time within their schedule and the researcher did not have the resources to make it in time to the interviewee's place of work, and 6) Not many studies have been conducted on internal auditing because it is an emerging discipline.

This study highlights where small and medium-sized internal audit practices in Durban stand in their implementation of audit data analysis. Also, this study highlights what these practices in Durban need to do in the beginning to conform to the IIA Standard under Section 1220.A2 from the perspective of non-managerial internal auditors. Therefore, for this study to have applied to the entire small and medium-sized internal audit practices, the participants had to be internal auditors in the managerial/executive positions such as CAE's, HIA's and Audit Committee members. The inclusion of internal auditors in managerial/executive positions may have offered a different point of view (if not similar) during the semi-structured interviews.

3.14 Conclusion

This chapter was a broad overview that reveals the goals of the study and the research design that was applied in this study. Part of this overview highlighted the general reasons for choosing this research design.

This chapter also addressed the fundamental issues that take place during the conduct of the qualitative research design. It also revealed the key data instrument methods used for studying the small and medium internal audit practices in Durban (i.e. target population) using a combination of open-ended interviews and researcher-administered questionnaires with participants. The interview data instrument method was critical in investigating the factors of IIA's requirements of technology-based audit and other data analysis techniques by the small and medium-sized audit practices.

The consent letters acknowledging the participants' willingness to participate in the study was given to them prior to the commencement of the interview. The letter also informed the participants about the purpose, design, risks, responsibilities and benefits of participating in the research project.

The NVivo software was used by the researcher to analyse and interpret the responses. Before the questionnaire was finalised, a pilot study was carried out to ensure reliability and validity. The basic principles for ethical sound regulations and the pilot study process were explained. In the next chapter, the empirical results are unpacked, interpreted and discussed.

CHAPTER 4: PRESENTATION AND DISCUSSION OF THE RESULTS

4.1 Introduction

In the previous chapter, the researcher presented the research design, target population, and ethical considerations for this study. Chapter three also explained the data collection process and the data analysis instrument to be used in this study.

The purpose of this chapter is to discuss the fundamental findings of this study resulting from the methods applied in gathering and analysing information. The findings are presented in a logical sequence with no bias or interpretation from the researcher. One of the major purposes of this chapter is to show the significance of the research question(s) by breaking down the data into sentences. It answers the basic question of “What did the researcher find in the study?” The analysis is built on the interview responses relating to the views of 10 internal auditors who perform internal audits for small and medium-sized audit practices in the Durban area. These views relate to the use of data analysis techniques by small and medium-sized audit practices. Indeed, the research questions, research findings, and interviewee’s responses were shaped by the research objectives because they were the reason the data was collected.

The researcher approached this study from a different viewpoint using thematic analysis to consider the impact of the use of data analysis techniques by small and medium-sized audit practices when performing their internal audit services. Thematic analysis is a method of evaluating qualitative data such as interview transcripts. The researcher scrutinised the data with the intention to identify common themes, topics, ideas and patterns of meaning that comes up frequently. Creswell (2014: 274) states that a thematic analysis consists of extensive discussion of the major ideas, together with recurring, repetitive and forcefulness of information in the study as a result of analysing a qualitative database. The researcher has since established that these ideas in the study are interconnected due to identifying themes or patterns in the data as a result of using thematic analysis.

4.2 The Analysis of Results According to the Study Objectives

After having specified the research objectives in Section 1.2.2, listed below is the outline of how the set objectives were achieved in this study through the data collected.

Furthermore, based on the discussions in chapter 2 (literature review), research questions were developed for the present study. These research questions follow the order of the set objectives that were presented to the participants chosen in this study

4.2.1 Objective 1: To determine the extent of use of data analytical software by small and medium-sized audit practices

This objective was meant to determine the magnitude of the usage of data analytical software in the internal audit activity and in achieving its full potential given the growth of Big Data within the small and medium-sized audit practices. The applicable research questions for this objective are also contained in Appendix D. Tables 4.1 to 4.8 represent the answers the participants gave for the questions pertaining to objective 1. Table 4.1 represents the number of years of experience of the participants in the field of internal auditing:

Table 4 1: How Long Have You Been in Practice as an Internal Auditor?

How long have you been in practice as an internal auditor?	
Participant A	4 years
Participant B	9 years
Participant C	9 years
Participant D	5 years
Participant E	9 years
Participant F	8 years

Participant G	8 Years and 6 months
Participant H	1 year 4 months
Participant I	8 years
Participant J	6 years

Every participant interviewed in this study had several years of experience in the internal auditing practice. This made it easier for the researcher to rely on their responses since they were appropriate participants. They were all asked the same questions as indicated in Table 4.1 in order to gain their data analysis technique experiences in the internal audit practice, which provided valuable measures for the study.

The researcher also noticed that the higher the years of experience associated with the individual participants, the greater the strong views in relation to the research study. Indeed, the higher the years of experience revealed a good understanding by the participants of the data analytics techniques that are available in the market. Hence these participants selected could best inform the study questions and increase understanding of the phenomenon under study.

The empirical findings agree with the literature, which revealed that qualitative research interviews are about understanding the world from the subject's point of view, to unfold the meaning of people's experience and discover their lived world before scientific explanation (Flick 2018: 23). Indeed, the higher the number of years' experience a participant had within the profession gave the researcher access to their extensive knowledge, contributing to the research topic and objectives. Therefore, experienced participants understood the trend of change and demands in the internal auditing profession, leading to responses that resonated with the audience and the research topic. Table 4.2 represents the specification of the IIA Standards that are applicable to the practice:

Table 4 2: Applicable IIA Standards

There are IIA Standards that are to be followed; which ones are applicable to your practice?	
Participant A	It depends on the type of the audit engagement.
Participant B	All IIA Standards are applicable to our practice.
Participant C	Standards that are applicable to my practice are as follows: 1. Attribute Standards 2. Performance Standards; and 3. Implementation Standards.
Participant D	All of them.
Participant E	All IA Standards are applicable; coming from a consulting firm, our methodology is built around the IA Standards. By following the methodology, you are applying the standards.
Participant F	Yes, I don't remember them.
Participant G	All IIA Standards are applicable to me as an auditor as well as to the organisation that I work under.
Participant H	Attribute and Performance Standards.
Participant I	All of them.
Participant J	The organisation is compliant with the IIA, therefore, all the standards are applicable and followed. All the IIA Standards are applicable.

Table 4.2 represents the responses of participants to the research question, which enquired about the specification of the IIA Standards that apply to the practice. As depicted in Table 4.2, the majority, i.e., 90% of participants, deemed that all the IIA Standards are applicable to their practice. The participants indicated that all internal auditors are accountable for being compliant with the standards. This also included IIA Standards related to individual objectivity, proficiency, and due professional care and those relevant

to the performance of their job responsibilities. The remaining 10% of the participants explained that the applicable IIA Standards depend on the type of audit engagement. The participants further stated that it is the Chief Audit Executive's (CAEs) responsibility to ensure that the internal audit activity conforms to the IIA Standards.

In addition, it was mentioned that the applicable IIA Standards to their practice consist of two main categories, which are, Attribute, Performance and Implementation Standards. It was said that the Attribute Standards explain the characteristics needed to perform internal auditing for organisations and at the individual level. The Performance Standards discuss the nature of internal auditing and offer quality conditions to measure the performance of these services. The participants also mentioned that Attribute and Performance Standards apply to all types of internal audit services. The participants revealed the Implementation Standards as providing the requirements associated with assurance or consulting services of both Attribute and Performance Standards. These empirical findings are supported by the literature, which states that the Institute of Internal Auditors is the creator and custodian of the International Standards for the Professional Practice of Internal Auditors, to which all members must adhere (The Institute of Internal Auditors 2018). Table 4.3 represents the impact of the Computer Age era and Fourth Industrial Revolution at both the individual level and the internal audit function level:

Table 4 3: Effect of Computer Age Era and Fourth Industrial Revolution in the Practice

Are you aware of the Computer Age era and Fourth Industrial Revolution; are they affecting you in any way?	
Participant A	N/A
Participant B	No – I am not aware of the Fourth Revolution No – It has not affected our practice.

Participant C	Through utilisation of complex computer electronic systems they makes our lives even easier when auditing. For example, the use of Skype for business meetings and the use of internal auditing software such as TeamMate. These systems allow us to be more efficient and generate reports instantly.
Participant D	Yes, I'm aware of the Fourth Industrial Revolution, but they don't affect me; thus since I'm in a government sector and government are not quick to adapt to changes more especially technology, however, the Computer Age era evolution shouldn't be a problem in the internal auditing because already we've computerised auditing tools, e.g. CAAT.
Participant E	As an individual, they are, as companies are now looking for auditors who can audit systems as well and whom can utilise data analytics systems and write scripts.
Participant F	Yes, not yet.
Participant G	Yes, I am aware of the Computer Age era and the Fourth Industrial Revolution, and it affects Internal Audit Practice as everything is now moving towards automation; as such internal audit is also evolving and moving away from performing audits in a traditional way.
Participant H	Yes, I am aware. They are affecting us in cases of clients that are keeping the information as paper copies. It is always a hustle to receive the information instantly. We are still operating traditionally where if a client has an information in their system, we have to rely on IT auditors to audit that portion as we are not trained on such systems.
Participant I	Yes, I am aware. Yes, they have affected me in the sense that I need to upskill myself in the cyber security and cloud computing space.
Participant J	Yes, I am; I am an auditor who is quite intrigued by how our lives have been changing by the emerging technologies and how computers have changed our ways of living and working. They have had a positive impact in how I perform my work and how I had to also ensure we keep up with the times.

Table 4.3 represents the responses of participants to the research question, which enquired about the impact of the Computer Age era and the Fourth Industrial Revolution at both the individual level and at the internal audit function level.

Based on comments from the selected participants, these findings in Table 4.3 reflect that the majority (80%) of the participants are aware of the Computer Age era and Fourth Industrial Revolution, while a few are not aware (20%). The majority who are aware are also intrigued by how their lives have been changed by emerging technologies and how computers have changed ways of living and working. They further indicate that technology has had a positive impact on how they perform their work and had to ensure they keep up with the times. Especially as everything is now moving towards automation, as such internal audit is also evolving and moving away from performing audits in a traditional way.

Furthermore, the participants are of the opinion that through the utilisation of complex computer-aided systems, the Computer Age and Fourth Industrial Revolution does affect them. It is further noted that these electronic systems make their lives even easier when auditing, for example, Skype for business meetings and the use of internal auditing software such as TeamMate. These systems are said to be allowing them to be more efficient and generate reports instantly.

Another participant concluded that the Computer Age and Fourth Industrial Revolution are affecting them; in cases of clients keeping the information as paper copies, it is always a hustle to receive the information instantly. However, they are still operating traditionally where a client has information in their system, and they have to rely on IT auditors to audit that portion as they are not trained on such systems.

It was also indicated that companies are now looking for auditors who can audit systems and utilise data analytics systems and write scripts. Furthermore, some participants stated that they now need to upskill themselves in the cyber security and cloud computing space.

The empirical findings agree with the literature review, which indicates that data analytics is changing the internal audit profession, giving rise to abilities for the user to gain competitive advantage, manage operations and plan strategically in the Computer Age era and the Fourth Industrial Revolution (Data analytics to become a game changer for internal audit 2018). Table 4.4 represents the impact of internal controls changing to automation and the effect this has on individual participants:

Table 4 4: Effect of the Change of Internal Controls to Automaton

With most internal controls changing to automation, increasing the creation of electronic data, does it affect you, if so in what way?	
Participant A	No, I am not affected.
Participant B	No, it has not affected our practice.
Participant C	Yes, it does affect me in a positive manner. However, the use of electronic systems allows internal auditors to be more efficient and effective in assisting the organisations achieve its intended purpose and objectives.
Participant D	Yes, I'm aware of the Fourth Industrial Revolution, but they don't affect me thus, since I'm in a government sector and government are not quick to adapt to changes more especially technology, however the Computer Age era evolution shouldn't be a problem in the internal auditing because already we've had computerised auditing tools, e.g. CAAT.
Participant E	As an individual, they are, as companies are now looking for auditors who can audit systems as well and whom can utilise data analytics systems and write scripts.
Participant F	Yes, in a good way, it's much simpler than printing.
Participant G	Yes, It does affect me in that as an Internal Auditor I am now required to move with times and change the way to I use to perform audit and now start to understanding Information Systems, and start adapting to using IT/data analytical software tool when performing audit.

With most internal controls changing to automation, increasing the creation of electronic data, does it affect you, if so in what way?

Participant H This affects me in a way that I have been trained. It poses a challenge that requires my knowledge to be uplifted. It opens an opportunity for internal audit to merge with IT audit so that one of the auditor can perform both audits.

Participant I Yes, it does affect me in knowing and understanding the technology that bring the automation. There is now the need to further understand the technology that enables automation from a governance, risk and compliance perspective.

Participant J Yes, they do in a positive way because it has assisted me in working more efficiently and being able to also perform continuous audits using automation and also performing analysis of the data much easier and efficiently.

Table 4.4 represents the responses of participants to the research question, which enquired about the impact of internal controls changing to automation and the effect this has on individual participants. The response to this question revealed that 70% of the participants are affected by the change of internal controls to automation. Many participants indicated that these changes affect them positively because it has assisted them in working more efficiently and being able also to perform continuous audits using automation and also performing analysis of the data much easily and efficiently. It was also revealed that they must now know and understand the technology that brings automation. There is now the need to understand further the technology that enables automation from a governance, risk and compliance perspective.

However, the other 10% of participants highlighted that they have been trained as much as this affects them. It also poses a challenge that requires their knowledge to be upgraded. It opens an opportunity for internal audit to merge with IT audit so that one of the internal auditors can perform both audits. While another participant emphasised that in their capacity as an Internal Auditor, they are now required to move with the times and change the way they perform audits and now start to understand Information systems and start adapting using IT/data analytical software tools when performing audit. However, these

changes now pose a risk for most internal auditors with industrial knowledge since companies are now looking to employ auditors who can perform systems audits as well as utilise data analytics systems and write scripts.

The remaining 30% of participants did not agree that the automation of internal control affects them since their clients are from the government sectors, and as much as they are aware of the Fourth Industrial Revolution, they felt it would not affect them. This is because they believe that the government sectors are not quick to adapt to changes, especially technology.

These empirical findings agree with the literature, which states that internal audit practices should be using technology-based audit techniques to embrace the change brought by the Information Age (Coderre 2017). This is because the Digital Age comes with new challenges and opportunities for the internal auditor (Data analytics to become a game changer for internal audit 2018). This is the same reason the IIA Standards illustrates the importance of using technology-based audits or data analytics especially if the responsibilities of internal auditors are to be met (The Institute of Internal Auditors 2017). Table 4.5 represents the description of the data analysis implementation in the practices:

Table 4 5: Data Analytics Implementation Maturity in the Practice

Chief Audit Executives (CAEs) have repeatedly stated that data analysis expertise is a much-needed skill in internal audit, and the Institute of Internal Auditors (IIA) have rated data analysis, and analytical software as critical tools for effective internal audit organisations. How will you describe the data analytics implementation in the practice?	
Participant A	It's the use of large data, usually, the whole population is used for audit testing purpose.
Participant B	In the practice that I am in (Retail) data analysis is not a critical requirement, as there is limited data to work on.

Chief Audit Executives (CAEs) have repeatedly stated that data analysis expertise is a much-needed skill in internal audit, and the Institute of Internal Auditors (IIA) have rated data analysis, and analytical software as critical tools for effective internal audit organisations. How will you describe the data analytics implementation in the practice?

Participant C Basically, data analysis is when the internal auditor investigate variances picked up during the analysis of data when comparing the results of prior year to current. This assist in determining whether the organisation/auditee is aware of the gaps identified and resolve accordingly.

Participant D There are so many data analyst tools such as CAAT even Excel can be used to analyse data, but anyway, for the sake of your research, it has been good thus far.

Participant E Well, in my company, we have a separate data analytics department that handles all data analytics requirements.

Participant F Intermediate.

Participant G Our organisation has a unit within IT Auditors that specialise in IT Audits, therefore, it has not started in allowing traditional Internal Auditors to getting exposure in IT Audits and start acquiring data analytical skills.

Participant H I would suggest that it be made compulsory that the firms have data analytics software for their auditors and all other tools that will assist in auditing the systems and electronic data without having to print the documents.

Participant I It is challenging in the sense of budget and expectation. Business processes need to be understood above anything else, and most of the time, this is not documented and accounted for when deploying data analytics. Furthermore, legacy systems have certain data that will need to be cleaned before it can be used and comes with its own challenge. These two points are not usually taken into account, and they are the ones that make most of the difference.

Participant J We have extensively applied the use of data analysis to an extent that there's a team of auditors that specialise in data analytics. These auditors assists the other auditors with performing all the analysis of data to ensure that they perform their audits efficiently and effectively.

Table 4.5 represents the responses of participants to the research question, which enquired about the description of the data analysis implementation in their practices. Fifty per cent of the participants indicated that their practices are extensively using data analysis since there are internal auditors specialising in data analytics. These internal auditors assist the other internal auditors with performing all the analysis of data to ensure that they perform their audits efficiently and effectively. It was also revealed that the practices use the traditional internal audit to provide the other internal auditors without IT skills the opportunity to slowly acquire the skills from the experienced data analytical internal auditors.

Furthermore, approximately 30% of participants stated that data analysis is not a critical requirement in their internal audit practice since there is limited data to work on. One of the participants elaborated that their implementation maturity is limited and does not affect them since their clients are the government sector, and this sector is not quick to adapt to changes, especially in technology. However, it was also stated that this should not be a problem in the internal auditing because already there are computerised auditing tools such as CAAT available to assist when needed.

Ten per cent of the participants in this study indicated that they do not have a data analysis software in their practice. This participant added that it should be made compulsory that the practices have data analytics software for their internal auditors and all other tools that will assist in auditing the systems and electronic data without having to print documents.

Finally, 10% of the participants highlighted that it is challenging in their practice to implement data analytics because of budget and expectation issues. It was also revealed that business processes need to be understood, and most of the time, this is not documented and accounted for when deploying data analytics. Furthermore, legacy systems have certain data that will need to be cleaned before it can be used and comes with its own challenge. It was also mentioned that these two points listed above are not considered, and they are the ones that make most of the difference.

These empirical findings support the literature, which states that current maturity in data analytics within many audit practices is rated low because of the lack of innovative technology (Data analytics to become a game changer for internal audit 2018). Also, Lowe et al. (2018) state that the small and medium-sized internal audit practices continue to fall behind on IT use and the perceived importance for audit testing, audit report writing, and client administrative management applications. Table 4.6 represents the data analysis software in use.

Table 4 6: Data Analytics Software in Use, Comfortability, Reason for Not Using Other Software

In terms of data analytics which software do you use? Are you comfortable with that software? Why have you not moved to another software package?	
Participant A	SQL and Excel
Participant B	Data analysis is not utilised in the practice that I am working in.
Participant C	Currently, I utilise Teammate and Caseware. Yes, I am comfortable with the mentioned software, due to the advanced training that was provided when these systems were introduced. We have not moved to any of the newly introduced software packages due to financial constraints. This is a challenge faced by all government departments.
Participant D	There are so many data analyst tools such as CAAT even Excel can be used to analyse data, but anyway, for the sake of your research, it has been good thus far.
Participant E	I personally am not using any software as the company caters for that for all the teams. The only data analytics I use is Excel.
Participant F	SQL, yes, the company would be required to change the database structure, which will be unnecessary with the current tool meeting its purpose and unnecessary cost.

In terms of data analytics which software do you use? Are you comfortable with that software? Why have you not moved to another software package?

Participant G	Currently I do not perform an audits that require data analytics audit; therefore, I do not use any data analytic software. However, IT Auditors within our Department use CAATS.
Participant H	None, we rely on IT auditors for data analytics.
Participant I	SQL and ACL. Yes. These are cost implications that comes with moving to a new software.
Participant J	ACL package, I am one of the ACL specialists in my organisation. The software package is one of the highly recommended packages, it meets our analytics objectives, and it is quite easy to use.

Table 4.6 represents participants' responses to the research question, which enquired about the data analysis software in use. As indicated in Table 4.6, there were mixed views from participants in terms of the data analysis software in use. Nevertheless, 20% of the participants in this study identified SQL and Microsoft Excel as the data analysis software in use and said that they met their purpose. However, the Microsoft Excel application reflects the traditional response of every internal auditor, although this application provides basic analytics not as advanced as other software in the market. While this is the case, 40% of the participants reveal they are not using any audit data analytical software.

It was also identified that 40% of the participants are comfortable using the following software when performing data analysis, i.e., ACL, CAAT, Teammate and Caseware. In addition, the interviews revealed that ACL continues to be the software that meets the analytics objective for most practices. It was revealed that ACL helps with the task of automation and auditing. It also includes the extraction and analysis of the data, fraud detection, fraud prevention, and risk management. ACL is said to read through large data sets

and find irregularities or patterns in transactions that may possibly point out control weaknesses or fraud.

The empirical findings support the literature that states that irrespective of the software package, internal auditors should be using data analysis. Options include ACL, Tableau, SaS, TeamMate Analytics, and many others (Coderre 2017). Table 4.7 represents the experiences of participants in using the data analytical software in the audits function and how it is different from the traditional internal audit approach.

Table 4 7: Experience of Data Analytical Software and Differences from Traditional Internal Audit

What is your experience associated with the use of data analytical software and how different is it from the traditional internal audit?	
Participant A	Data analytics software make things easier than the traditional method, and with the software you can look at the total population
Participant B	Data analysis is a very useful tool in scrutinising data for validity and accuracy produced by the business system
Participant C	It works much faster and more efficient
Participant D	The above widely tools have been in existed for some time and which some organisations currently still use them and I haven't seen any different
Participant E	I personally am not using any software as the company caters for that for all the teams. The only data analytics in use is Excel
Participant F	It adds more value to the client by interrogating the data directly
Participant G	No experience
Participant H	None. I have not been exposed to the use of data analytics

What is your experience associated with the use of data analytical software and how different is it from the traditional internal audit?

Participant I	No experience
Participant J	It has increased my efficiency and effectiveness; it actually reduces the room for human error unlike traditional effectiveness internal audit ways

Table 4.7 represents the responses of participants to the research question, which enquired about the experiences of participants in using the data analytical software in the audits function and how it is different from the traditional internal audit. Forty per cent of participants have agreed that the software has increased their efficiency and effectiveness. They believe data analytics performed through internal auditing at their practice has reduced room for human error, unlike the traditional internal audit.

Ten per cent of participants had different opinions, such as data analysis is useful in scrutinising data for validity and accuracy. In contrast, another 10% disagreed about this software being different by indicating that these tools have existed for some time and some organisations currently still use them (referring to CAATs).

Another 10% of participants have experienced data analytics as software that makes things easier than the traditional method and believe that the software can perform an internal audit of the total population rather than a sample. Furthermore, the participant believed it adds more value to the client by interrogating the data directly.

As much as some participants have been exposed to the different forms of software in their performance of internal audit, some have not been exposed. Thirty per cent of the participants stated they had personally not used any sophisticated data analysis software. The only data analysis used is Microsoft Excel which is a basic tool.

These empirical findings support and contradict the literature. It supports the literature by stating that data analysis proved increased functionality especially with its capacity to efficiently process larger amounts of data (The Institute of Internal Auditors and Global Technology Audit Guide 2017: 1). The audit data analytics tool also includes the ability to gain competitive advantage, manage operations and plan strategically in this Computer Age era (Data analytics to become a game changer for internal audit 2018.). Nevertheless, the empirical findings contradict the literature because compared to CAAT tools, the Audit Data Analytics tools involve more specialised knowledge and skills such as advanced statistical techniques or data mining, which is a rare skill for internal auditors, causing a challenge (Li et al., 2018). Table 4.8 represents the benefits and disadvantages associated with using Data Analytical Software:

Table 4 8: Advantages and Disadvantages Associated with Using Data Analytical Software

What are the benefits and disadvantages associated with using Data Analytical Software?	
Participant A	Benefits: Data analytics software make things easier than the traditional method and with the software you can look at the total population.
	Disadvantages: Not sure.
Participant B	Benefits: Easily identify issues with the business system.
	Disadvantages: Data analysis is only limited to information which is captured onto the system.
Participant C	Benefits: The benefits would be the fact that they are more efficient and produces results instantly.
	Disadvantages: The disadvantages would be that the training required is very extensive and costly.

What are the benefits and disadvantages associated with using Data Analytical Software?

Participant D	Benefits: Data can easily and meaningfully but the purchase cost price are too high for a simple small audit firm.
	Disadvantages: Data can easily and meaningfully but the purchase cost price are too high for a simple small audit firm.
Participant E	Benefits: I personally am not using any software as the company caters for that for all the teams. The only data analytics in use is Excel.
Participant F	Benefits: client value-add.
	Disadvantages: if wrong data was inputted into the system, audit may conclude with incorrect information.
Participant G	Benefits: using data analytical software speeds up time and improve efficiency. It also allows Internal Auditor to be able to test the entire data sets/large quantity of data and extra data from any source.
Participant H	Benefits: the benefits are that the data is readily available to audit. The audit gets completed in less time. We can have a greater sample size and easily manipulate data for desired results.
	Disadvantages: the disadvantages are that the access may result in the misuse of the data.
Participant I	Benefits: greater assurance coverage.
	Disadvantages: a lot of time is put in conducting and performing data analytics leading to blowing up the budget.
Participant J	Benefits: increased efficiency through the use of computer programmes to perform very fast processing of large volume of data and provide analysis to auditors on which to base their conclusion, saving time within the audit and allowing better focus on judgemental and risk areas.

What are the benefits and disadvantages associated with using Data Analytical Software?

Disadvantages: lack of data privacy and confidentiality.

Table 4.8 represents the responses of participants to the research question, which enquired about the benefits and disadvantages associated with using Data Analytical Software. Ninety per cent of the participants in the study identified advantages associated with the use of data analytical software in the internal audit function as indicated in Table 4.8. Ten per cent did not. The majority who identified the advantages of data analytical software listed them as the following:

- Increased efficiency by using computer programs to perform high-speed processing of large volumes of data and provide analysis to auditors on which to base their conclusion, saving time within the audit and allowing better focus on judgemental and risk areas;
- Easily identify issues with the business system;
- Data can be easily and meaningfully read;
- Data analytics software makes things easier than the traditional method, and with the software, you can look at the total population;
- They are more efficient and produce results instantly;
- Data is readily available to audit. The audit gets completed in less time;
- Client value-add;
- Greater assurance coverage.

In addition, the interviews also provided interesting results that were not anticipated about the data analysis software disadvantages as follows:

The lack of data privacy and confidentiality;

- Data analysis is only limited to information that is captured onto the system;
- The purchase cost price is too high for a simple small audit practice;
- The training required is very extensive and costly;
- The access may result in the misuse of the data;
- Much time is spent conducting and performing data analytics, which leads to blowing up the budgeted time.

The empirical findings support the literature, which also revealed that businesses could benefit from Big Data in various ways, which includes but not limited to competitive advantage, increased revenue, innovation and faster product development, market demands predictions, and well-informed business decisions (The Institute of Internal Auditors and Global Technology Audit Guide 2017: 5). In addition, it was noted that data analytics means new challenges to the internal auditor. For example, the testing of large populations generates a number of exceptions. Getting hold of data consumes significant “time for the audit team. The information delivered by the client should be in a format that can be used by the auditor, and this is not always obvious” (De Bonhome et al., 2017: 3).

4.2.2 Objective 2: To examine the impact or consequences of non-compliance of the use of data analytic software by the small and medium-sized audit practices.

This objective was intended to demonstrate penalties for failing to conform to the IIA Standards, especially the imposed ‘must’ use of technology-based audits and other data analytic techniques, as stated under Section 1220.A2.

The applicable research questions for this objective are also contained in Appendix D. Tables 4.9 to 4.10 represent the answers from participants pertaining to objective 2 research questions. Table 4.9 represents the support

offered by the CAE and Audit Committee towards the adoption of analytics and the adoption of IIA Standard changes:

Table 4 9: Support of the CAE and Audit Committee to Adopt Data Analytics and IIA Standards

How supportive is the CAE and Audit Committee towards the adoption of analytics and the adoption of IIA Standard changes?	
Participant A	Very supportive.
Participant B	The CAE and the AC are very supportive when it comes to the adoption of analytics and the IIA Standards.
Participant C	They are very supportive. However, it's always a problem to implement due to financial constraints.
Participant D	Yes, much supportive.
Participant E	They are very supportive as the client usually requests that data analytics be used.
Participant F	Very supportive.
Participant G	CAE and Audit Committee in our organisation are currently not doing anything to move from traditional internal audit into using data analytics.
Participant H	Somewhat supportive. I can say 100% supportive upon seeing the plan for the changes
Participant I	Very supportive, as business processes are being geared towards digitisation.
Participant J	Very supportive as they have seen the benefits of using data analytics during their audit, the fact that time is saved, that they have increased the Audit team's efficiency and effectiveness.

Table 4.9 represents participants' responses to the research question, which enquired about the support offered by the CAE and Audit Committee towards

the adoption of analytics and the adoption of IIA Standard changes. Based on participants' these findings reflect that the adoption of data analytics and IIA Standards is supported by CAE and the Audit Committee. Eighty per cent of the participants acknowledged that the CAE and Audit Committee is very supportive as they have seen the benefits of using data analytics during their audit, such that that time is saved, and that they have increased the audit team's efficiency and effectiveness. The other reason emphasised was that the audit client usually requests that data analytics be used since business processes are being geared towards digitalisation.

In contrast, 20% of the participants had a different viewpoint from the majority. It was noted that the CAE and Audit Committee in one participant's practice is currently not doing anything to move from traditional internal audit into using data analytics. It was highlighted that the reason for this lack of support was that the practice already had a team of IT auditors meaning one team of internal auditors focus on traditional auditing while the other focus on IT audits.

The empirical findings support the literature by revealing the support the CAEs and the HIAs have contributed to adopting analytics. The literature pointed out that around one-third of HIAs utilises the audit data analytics tools at an intermediary or advanced level. The remaining two-thirds utilise simple, ad hoc analytics (such as spreadsheets) or no analytics at all (Peters 2017). In addition, the empirical findings agree with the literature by indicating that CAEs who struggle to incorporate a successful analytics program are factors such as "1) difficulty in accessing data, 2) lack of data analytics skills, and 3) the high costs to implement" (Davis and Cernautan 2017: para 2). Table 4.10 represents the impact or consequences of non-conformance with the IIA Standards:

Table 4 10: Consequences of Non-Conformance with IIA Standards in the Practice

Briefly state the impact or consequences of non-conformance with the IIA Standards your practice has enforced through conducting Quality Assurance and Improvement Program (QAIP)?

Participant A	A consequence management policy is in place, which states the process to be taken for non-adherence to Quality Assurance standards.
Participant B	There is a standard and consistent method which is followed for every audit.
Participant C	Consequence management is always enforced if there is non-compliance with the IIA standards. In addition, to this, normally, the audit on quality assurance is performed by the independent body or external audit firm. This is done once in five years, and in case there is non-compliance, the organisation obtain the qualified audit opinion.
Participant D	Obviously, non-compliance with IIA Standards would render internal audit activity useless and redundant.
Participant E	Our company conforms to all QAIP requirements, and this is also enforced by the internal QAR department that ensures all quality requirements are met.
Participant F	Critical
Participant G	None
Participant H	We have not received the communication regarding this.
Participant I	None
Participant J	Fine, and also disciplinary.

Table 4.10 represents participants' responses to the research question, which enquired about the impact or consequences of non-conformance with the IIA Standards. It was noted through participant's responses that 30% have no consequences of non-conformance imposed on them for non-conformance with the IIA Standards. While 70% agree that they encounter consequences of non-conformance with the IIA Standards in their individual practices if they are

breached. These empirical findings revealed that every internal audit practice has to develop a QAIP designed to identify non-conformance in the internal audit activity. Non-conformance is an indication of the failure of the internal audit activity to conform to the Definition of Internal Auditing and the Standards and the application of the Code of Ethics (The Institute of Internal Auditors 2018). This non-conformance has consequences that each practice deals with according to their specific management policy since such non-conformance could threaten the organisation’s ability to achieve goals.

4.2.3 Objective 3: To determine factors and reasons for any non-compliance

This objective was expected to highlight root causes for being non-compliant with IIA Standards, especially the imposed ‘must’ use of technology-based audits and other data analytic techniques, as stated under Section 1220.A2.

The applicable research questions for this objective are also contained in Appendix D. Tables 4.11 to 4.12 represent the answers from participants pertaining to objective 3 research questions. Table 4.11 represents the action taken by the practices to ensure they have individuals with data analytics capabilities.

Table 4 11: Efforts Shown by the Practice in Promoting Data Analytics Capabilities

What has the practice done to ensure they have individuals with data analytics capabilities? Has the practice supported the internal auditors with trainings and software, and given sufficient time to develop the skills?	
Participant A	Nothing as yet, but there is a dedicated data analytics team which IA can consult should they need training or any assistance.
Participant B	Currently there is no staff member with data analytics capabilities.

What has the practice done to ensure they have individuals with data analytics capabilities? Has the practice supported the internal auditors with trainings and software, and given sufficient time to develop the skills?

Participant C	This has not been implemented due to financial constraints, only a group of individuals do attend trainings and the transfer of skills to others is always a problem.
Participant D	Yes, trainings are done.
Participant E	Well in my company, we have a separate data analytics department that handles all data analytics requirements. If an internal auditor wishes to have data analytics capabilities, they may train should the training be available
Participant F	Not enough.
Participant G	Our organisation has IT Auditors who specialise in IT Audit. However, the organisation has not done anything to support Internal Auditors in developing and acquiring data analytics skills.
Participant H	No, no support has been given to international auditors to develop skills for data analytics.
Participant I	The audit function has made data analytics as part of its strategy. Yes, training is provided.
Participant J	Identified individuals that were interested in also becoming ACL specialists, took them for training those That were not yet attended any training. The selected auditors then provided internal training to the other team members.

Table 4.11 represents the responses of participants to the research question, which enquired about the action taken by their practice to ensure they have individuals with data analytics capabilities. The responses from 30% of the participants noted that in their internal audit practice, management identified interested internal auditors who want to become ACL specialists, and upskilled them through training. The selected internal auditors thereafter provide internal training to other team members. While 70% of the participants representing the

majority has indicated that currently their practices has not done anything to support Internal Auditors to develop and acquire data analytics skills. However, it was also revealed that there is a dedicated data analytics team which internal audit can consult should they need training or any assistance. Other causes to the lack of effort shown by their practice is the financial constraints associated with these data analytics software tools.

These empirical findings may contradict the literature slightly. This is because the literature points out that auditors from small and medium-sized internal audit practices do not see IT applications as important to their businesses and clients (Lowe et al., 2018). However, the empirical findings agree with the fact that the small and medium-sized internal audit practices do not know-how to go about in improving audit quality through data analytics (Soileau and Soileau 2016).

Table 4.12 represents the challenges associated with the development and maintenance of an effective data analysis capability in the small and medium-sized internal audit practices:

Table 4 12: Development and maintenance challenges of an effective data analytics capability

What are the challenges associated with developing and maintaining an effective data analysis capability in your practice?	
Participant A	Not sure.
Participant B	There is no data analysis in the company.
Participant C	Budget constraints.
Participant D	Purchase cost price are too high for a simple small audit firm.
Participant E	Availability of training.
Participant F	Continuous updates and relationships with IT department.

What are the challenges associated with developing and maintaining an effective data analysis capability in your practice?

Participant G	Lack of knowledge and lack of understanding the importance of developing such skills for internal auditors.
Participant H	This has not been communicated. I am not sure whether it is the cost associated with developing and maintain data analysis capability or whether the firm is comfortable with having to rely on IT auditors for that.
Participant I	Remuneration packages. Data analytics is a specialised skill which makes it scarce, and retaining individuals with such a skill set becomes costly.
Participant J	There is less people that are interested in being data analyst; this has resulted in the analyst team being overworked.

Table 4.12 represents the responses of the participants to the research question, which enquired about the challenges associated with the development and maintenance of an effective data analysis capability in the small and medium-sized internal audit practices. Regardless of data analytics capabilities, it was noted during the interviews that 90% of the participants agree that with the reality of Big Data, comes the challenge of analysing the data in a way that brings value to clients. Hence why data analytics was regarded as a specialised skill that is scarce and retaining individuals with such a skill set can become costly. It becomes more challenging when internal auditors in the practice show less interest in being data analysts, as it results in the analyst team being overworked.

In addition, other participants noted that there is no data analysis in their company due to the purchase cost price being too high for simple small internal audit practices. However, it was also indicated that small and medium-sized internal audit practices are also comfortable relying on outsourcing IT assurance services, such as data analytics capabilities. This also results in the challenge of maintaining continuous updates and relationships with the IT

department, contributing to the lack of knowledge and understanding of the importance of developing such skills for internal auditors.

These empirical findings support the literature which states that over the past 20 years, CAEs struggled to incorporate a successful analytics program due to the three factors: 1) difficulty in accessing data; 2) lack of data analytics skills; and 3) the high costs to implement (Davis and Cernautan 2017: para 2).

4.2.4 Objective 4: To recommend the steps to be considered in the implementation of data analytics by small and medium-sized audit practices.

This objective was meant for the selected participants in the study to identify recommendations for the effective implementation of data analytics by small and medium-sized audit practices.

The applicable research questions for this objective are also contained in Appendix D. Table 4.13 represents the answers from participants pertaining to objective 4 research questions. Table 4.13 represents the implementation strategy taken by the practice in phasing in data analytics in the internal audit function.

Table 4 13: Strategy Used to Phase in Data Analytics in the Internal Audit Function

What implementation strategy did the practice use in phasing in data analytics in the internal audit function?	
Participant A	Not sure.
Participant B	There is no implementation strategy in the company.
Participant C	The internal audit methodology clearly outlines the importance of phasing in the data analysis in our practice. However, it is not followed accordingly.
Participant D	Trainings are done.

What implementation strategy did the practice use in phasing in data analytics in the internal audit function?

Participant E	A separate department was created within the firm.
Participant F	None.
Participant G	Currently, there are no implementation strategies.
Participant H	None.
Participant I	Hiring a specialist and a dedicated resource.
Participant J	Identified individuals that already had analytics capabilities and those that were interested, sent those that did not have formal training for training, started including the team members in all the planning for all audits to identify areas that might require data analytics.

Table 4.13 represents participants’ responses to the research question, which enquired about the implementation strategy taken by the practice in phasing in data analytics in the internal audit function. About 50% of the participants indicated that they are not sure about their practice’s strategy used to phase in data analysis and that their practice does not have an implementation strategy. The remaining 50% of the participants stated that their practice provided training, and the internal audit methodology was updated to outline the importance of phasing in the data analysis. In addition, other participants stated a separate department was created within the practice purely for data analysis as well as hiring a specialist and a dedicated resource.

These empirical findings contradict the literature, which states that audit data analytics requires big planning, discrete action, and specific management approaches (Peters 2017). It also requires the five-point methodology for successful implementation of analytics based on the maturity standing of an organisation (LaValle et al., 2010).

4.3 Discussion of the Findings

The following are the discussion of the study based on the above findings:

4.3.1 IIA Standard and its Applicability

The study revealed a difference in points of view in the applicability of the IIA Standards for internal auditors and the internal audit function. These different perspectives brought uncertainty in the enforcement of the required use of data analysis techniques by the internal audit participants. It should be noted that this enforcement of the use of data analysis techniques is, however, a mandatory requirement contained in the IIA Standards under Section 1220.A2.

It should be further noted that the IIA Standards are principle-focused and offers a framework for promoting and performing internal auditing. They are mandatory requirements consisting of basic requirements statements for the professional practice of internal auditing and for evaluating the effectiveness of its performance.

Therefore, since these are mandatory requirements, adherence to the IIA Standards is of utmost important and non-conformance should be prevented. According to the Institute of Internal Auditors (2017: 9), Section 1322 of the IIA Standard specifies that when non-conformance with the IIA Standards impacts the overall scope or operation of the internal audit activity, the CAE must disclose the non-conformance and the impact to senior management and the board.

The study revealed that the IIA Standard compliance is best assessed by performing a QAIP. The program helps to assess the efficiency and effectiveness of the internal audit activity. The program includes evaluating the conformance with the IIA Standards, especially as the Computer Age era and Fourth Industrial Revolution changes organisational internal control processes; hence quality processes of internal audit practices must evolve to keep pace.

4.3.2 Effect of Computer Age Era and Fourth Industrial Revolution in the Practice

It emerged in this study that the introduction of new technology through the Computer Age era and the developing Fourth Industrial Revolution is the cause

of change of internal controls in organisations. Many of the internal audit participants have recognised that the internal auditing process between the Industrial Age era and the Computer Age era has changed. The much anticipated Fourth Industrial Revolution also raises concerns in terms of how it will drive the changes in the performance of the internal audit activity and how these changes will affect professional competency and due care.

The Computer Age (also known as the Information Age) is a historical period characterised by the change from the traditional Industrial Revolution to an economy primarily created from information technology. This is when information became a commodity that is quickly and widely distributed and easily available through computer technology.

The Fourth Industrial Revolution is about more than just technology-driven. The Fourth Industrial Revolution has moved into a new era of “economic disruption with uncertain socio-economic consequences for Africa” (Signé cited in Ndung’u and Signé 2020: 1). It also has a profound impact on small and medium internal audit practices. As Ndung’u and Signé (2020: 1) state, the Fourth Industrial Revolution is characterised by the combination of the biological, digital, physical worlds and the utilisation of new technologies (i.e. artificial intelligence, cloud computing, robotics, 3D printing, the Internet of Things, and advanced wireless technologies, etc.)

Failure to recognise and take advantage of the Computer Age era and Fourth Industrial Revolution opportunities will impose risks on the value-add and the improvement of organisational processes by the internal audit activity. Any lack of effort to develop existing internal auditing data analysis models by small and medium-sized practices imposes risk on them falling further behind, lowering their competitiveness.

4.3.3 Data Analytics Implementation Maturity in the Practice

The maturity model characterises the stage from the least matured state to the most matured state of traditional auditing through to continuous assurance of enterprise risk management using technology-based audits techniques. This

means the progressive shift in internal audit practices by using the maximum degree of audit automation.

The study revealed that the small and medium-sized internal audit practices are either data analytics naive or aware. This comes after the study revealed that there is either no analytics skills and/or the internal audit practice has some data analytics skills through having a team of auditors specialising in data analytics. While this is the case, it points out that the data analytics maturity journey linked to business requirements, internal auditor skills, experience, assurance and available funding is still in the early stage.

The study has shown that the small and medium-sized internal audit practices focus on technical skills and tools when it comes to the adoption of data analytics into the internal audit function. However, this adoption requires a planning transformation, including transforming the execution, reporting audits and relationships with stakeholders. Such an adoption supplementary need internal audit practices to pay attention to their audit methodology and/or approach, not only their technical capabilities.

4.4 Conclusion

The transformation of the internal audit activity by the small and medium-sized internal audit practices requires much more development than the technical capabilities in order to be at the most matured state of usage of data analytics. These practices have not considered the advantages of constructing integrated data analytics and continuing auditing all the way through an internal audit methodology.

Nonetheless, this chapter presented an investigation and interpretation of data collected from conducting interviews with 10 internal auditors. The findings and discussions were connected to the literature review section, and the next section contains recommendations, indicating the strategic approach to be followed.

CHAPTER 5: SUMMARY AND CONCLUSIONS

5.1 Introduction

In Chapter 4, data were presented and analysed, and the fundamental findings of this study were discussed. The study sought to investigate the factors or reasons that make small and medium-sized internal audit practices successful and/or unsuccessful in implementing data analytical software. The findings of the study showed that the transformation of the internal audit activity by the mentioned practices requires more intervention in order to be at the most matured state of usage of data analytics. Findings also revealed that these practices had not considered the advantages of constructing an integrated data analytics and continuous auditing all the way through an internal audit methodology.

5.2 Summary of the Study Overview

The purpose of Chapter 5 is to highlight in detail the summary of the study and points out how the objectives of the study have been accomplished. This chapter also discloses the conclusions of the research findings, and the researcher suggests recommendations for the findings. The study is supported by research studies that highlight the effect of data analytical software in small and medium-sized internal audit practices. The study contributed to the determination of innovative approaches within the internal audit function in rendering internal audit services, as opposed to remaining with traditional approaches.

Chapter 2 provided an overview of the importance of attaining the obligatory knowledge, i.e., technology-based audit and other data analysis. Information obtained after reviewing the literature enabled a discussion on the characteristics of data analysis techniques required to maintain an internal audit function that is effective. The data analytics implementation in the internal audit function was discussed, which is a fundamental tool for conformance with the IIA's International Standards for small and medium-sized internal audit practices. The implementation process requires individuals with expertise in

data analytics, and the appropriate hardware and software resources. This implementation process also relied on the relationship between the maturity path of data analytics and the skillsets of an internal audit team. This meant that internal audit practices considering adopting analytics, and with already existing team members who have both the skillset and knowledge of audit data analytics, can advance at a further level of the maturity path of implementation. The limitations around data analytics were also outlined as being important and required to be closed in order to improve data analytics effectiveness and efficiency in the internal audit function.

Chapter 3 provided the explanations for the choice made in selecting the qualitative research design. The qualitative design was suited to establish an understanding and answers where the cases are variable and the need to explore the research problems are mysterious. Therefore, the use of audit data analysis techniques in the internal audit practices that are small and medium-sized was still new and was being explored. In addition, qualitative research interviews were appropriate as it searches for an understanding of the point of view from internal auditors in practice before scientific explanation. This study focused on content validity which is a fundamental element of questionnaire validity. Indeed, the measuring instrument was the questionnaires which consisted of open-ended questions. The gatekeeper's permission letter was attached with the questionnaires, allowing preliminary permission to conduct the research. The use of the letter of information assisted with distributing questionnaires to participants and was presented with the consent letter prior to the collection of data. Reasonable safeguards and protection were also clearly stated in the consent form. A software called NVivo was used to analyse the data collected from participants.

Chapter 4 presented results of the use of data analysis techniques by small and medium-sized audit practices, and the findings showed discussions pertaining to 10 internal auditors. Table 4.2 revealed that all the IIA Standards are considered applicable to internal audit practice, and most of the participants agreed. The participants added that all internal auditors are accountable for being compliant with the standards while being in practice. However, Table 4.10

indicates that any non-conformance indicates the failure of the internal audit activity to conform to the IIA Standards. This non-conformance has consequences dealt with in accordance with each practice specific management policy. A QAIP needs to be developed within each practice to identify non-conformance in the internal audit activity.

Table 4.6 indicates the findings of the data analytics implementation maturity in the participant's practices. It revealed that most small and medium-sized internal audit practices have not started allowing traditional internal auditors exposed to technology-based audit and other data analysis skills. This is due to data analysis not being perceived as a critical requirement in these small and medium-sized internal audit practices since data usage is considered limited. However, despite the data usage being considered limited, as depicted in Table 4.4, most participants revealed that they are affected by the change of internal controls to automation, especially since it poses challenges, including the requirement of improving knowledge because of redundant old control processes. This indicates that business process tools used are changing whilst the business process objectives remain the same (Kiyosaki and Lechter 2012: 219).

5.3 Discussion on Achievement of Research Objectives

Following the specified research objectives in Chapter 1 under Section B (3), the discussion below highlights how the research objectives were achieved in this study.

5.3.1 Objective 1

To determine the extent of use of data analytical software by small and medium-sized audit practices.

The literature review in Chapter 2 indicates data analytics can be used within many phases of the internal audit process. This includes the risk assessment process, micro-level audit planning and macro-level audit planning, which were explained in more detail in the literature review. The literature review explained that the implementation of data analytics requires some work effort. This is due

to the implementation process requiring individuals with expertise in data analytics and the appropriate hardware and software resources. It was also pointed out that the level of maturity by which these data analytical resources are being used within the internal audit activity differ, with the rate of usage either at a basic level or complex level. Nevertheless, despite the increasing data analytic technique usage, the aggregation of people having the skills to manipulate data and interpret results is also increasing. This limitation, however, does not block that the value of an internal audit is seen to be enhanced significantly by the usage of data analytics.

Chapter 2 revealed that internal controls have changed to automation, and internal auditors at the small and medium-sized internal audit practices are affected by this change. This change determines the extent of usage and understanding of the technology that brings the automation from a governance, risk and compliance perspective. It also confirms that internal auditors must learn from the lessons of being slow to change and adapt to a changing world. Should the adaptation fail or be slowly implemented, internal audit practices will be left behind since they are held in the old ways of thinking and doing things, especially during the effect of the worldwide pandemic of COVID-19 in 2020 and 2021. The effect of the pandemic is also a fast reaction to organisations worldwide relying on automation which promotes more Big Data creation.

Chapter 4 disclosed that the Head of Internal Auditors (HIAs) should implement the introduction of data analytics after evaluating the specifics of the organisation, the organisational size, the industry, and the board/audit committee's commitment. The strategic needs for the usage of data analytics must be defined by the HIA.

During the assessment of the research findings, there were mixed views from participants in terms of the data analysis software in use. Some small and medium-sized internal audit practices have data analytical technique in use, while other have none. Six of the practices chosen did not have an implementation strategy, as highlighted in Chapter 4. The other results of two participants showed that their practice provided training, and the internal audit

methodology was updated to outline the importance of phasing in the data analysis in their practice. In addition, two other participants revealed that a separate department was created within the practice purely for data analysis and also for hiring a specialist and a dedicated resource where required.

Three participants in this study identified SQL and Microsoft Excel as the data analysis software in use and that it meets their purpose. Other participants highlighted that data analytical software internal auditors in the selected practices were comfortable with ACL, CAAT, Teammate and Caseware. However, the Microsoft Excel application was discovered to be the traditional response of every internal auditor, and it was revealed that it provides basic analytics tools not as advanced as other software in the market. At the same time, ACL continues to be one of the recognised software and meets the analytics objective for most practices. Therefore, this objective has been achieved.

5.3.2 Objective 2

To examine the impact or consequences of non-compliance of the use of data analytic software by the small and medium-sized audit practices.

In the literature review, it was pointed out that one of the uses of data analytics by the internal audit function is identifying key drivers of non-compliance risks. This use is one of the value-add for implementing data analytical tools in the internal audit function. Hence, the IIA now regards an effective internal audit organisation as that which applies data analysis, data extraction and analytical software tools.

Chapter 2 revealed the purpose of the IIA under 2.2.5 as the leading professional body representing worldwide the interests of internal auditors. The IIA is the creator and custodian of the IIA Standards to which all members must adhere (The Institute of Internal Auditors 2018). The IIA Standards demonstrates the importance of using innovating technology through using the word 'must' to stipulate an unconditional requirement if the responsibilities of internal auditors are to be met (The Institute of Internal Auditors 2017).

Chapter 4 revealed that a QAIP must be developed by internal audit practice designed to identify non-conformance in the internal audit activity. Non-conformance was explained as an indication of the failure of the internal audit activity to conform to the Definition of Internal Auditing and the IIA Standards and the application of the Code of Ethics. The non-conformance was further explained as having consequences which each practice deals within accordance to their specific management police since such non-conformance could threaten a client's ability to achieve goals. Therefore, this objective has been achieved.

5.3.3 Objective 3

This objective was to determine the reasons for any non-compliance. This was meant to gain an understanding of the factors causing the small and medium-sized internal audit practices to be non-compliant with the use of data analytical tools in the internal audit function. The results of the qualitative study showed that irrespective of data analytics capabilities, the challenge is analysing the data in a way that brings value to clients. Therefore, data analytics is regarded as a scarce specialised skill, and retaining individuals with such a skill set is indicated as costly. The challenges increase when internal auditors in the practice show less interest in being data analysts, resulting in the analyst team being overworked.

Other participants indicated that the purchase cost of effective data analytical tools is too high for simple small internal audit practices. However, it was also indicated that small and medium-sized internal audit practices are also comfortable relying on outsourcing IT assurance services, such as data analytics capabilities. This also results in the challenge of maintaining continuous updates and relationships with the IT department, contributing to the lack of knowledge and understanding the importance of developing such skills for internal auditors. These finding results are associated with that of Davis and Cernautan (2017), who demonstrates that over the past 20 years, CAEs who struggle to incorporate a successful analytics program all mentioned

three factors: 1) difficulty in accessing data; 2) lack of data analytics skills; and 3) the high costs to implement (Davis and Cernautan 2017: para 2).

However, as indicated in Chapter 2, challenges to implement analytics were dominant in the past. Data is now easier to access, the data analytic tools “are powerful, flexible, and easy to use, and the cost of not implementing vastly outweighs the cost to implement” (Davis and Cernautan 2017: para 2). Big Data is increasing the risk velocity making it almost impossible to fulfil the internal audit mandates using outdated manual audit processes that focus solely on post-detection techniques. Therefore, this objective has been achieved.

5.3.4 Objective 4

This objective was to recommend the steps to be considered in the implementation of data analytics by small and medium-sized audit practices.

First, the internal audit practice size is not a limitation factor in determining the implementation of data analytics program. The literature highlights that the implementation focuses on improving the already existing methodology since traditional internal audit methodologies have significantly achieved their designed purpose for the past few years (Adding insight to audit transforming internal audit through data analytics n.d.). Nevertheless, the progressive complexity and fast-paced business landscape of businesses are moving in the direction that calls for implementing advanced business analytic techniques. The purpose of implementing these data analytical techniques is to enhance the attention on risk and acquire more insight into the organisation (Adding insight to audit transforming internal audit through data analytics n.d.).

Chapter 2 revealed that the integration of data analytics into the audit methodology calls for a formal development and implementation plan. The plan must address the obligation to recruit resources at the suitable level and number, technology and the appropriate software, including processes and the data around those processes.

This integration of data analytics will require a project manager with clear objectives, milestones, and a reporting requirement in order to be held accountable for the delivery of the plan. The reporting should go to the CAE and the audit committee if the audit committee fully supports the adoption of analytics (Coderre 2017). When procuring, an internal audit needs to invest in modern technologies that are easy to accustom and implement. CAEs must “make the use of analytics required rather than optional” (Davis and Cernautan 2017: para 1).

In addition, clearly defined performance and goals must be the measure of data analytic initiative. Internal auditors need to assess critical questions “to ask to ensure they understand how the business objectives and operating cycle will impact t the underlying data to be analyzed” (Soileau and Soileau 2016: 36). This is the reason why the HIA needs to determine the applicable audit population areas in which analytics can be applied before implementing it in the audit plan.

The literature also reveals that internal audit practices will need to either hire new analytically trained professionals or more likely use the services of third-party solutions providers for Big Data analytics. Many businesses outsource their Big Data applications to solutions providers that offer specialist services. The reliance on third-party solutions providers also promotes a privacy concern.

Internal auditors will need to be supported by training and software and be given adequate time to develop skills and implement the analytics functionality. Internal auditors will need to be dedicated to analytics and nothing else. The training indicated was established to go beyond the scope of the academic and professional level of an auditor.

It was also revealed that small and medium-sized internal audit practices could use tools already in existence to implement analytics within their audit functions, decreasing the need for expensive up-front investments. This includes the hiring and retaining of skilled internal auditors, defining and implementing repeatable processes, and installing suitable technologies. In

addition, use analytics to automate the more routine activities of the internal audit process, which will allow the internal audit team to have more time for strategic and complex issues (Peters 2017). Therefore, this objective has been achieved.

5.4 Limitations of the Study

The literature review supported the research and was, therefore, a crucial part of this study. It also assisted in the identification of the scope of work performed in this study. However, there were limited prior research studies on this research topic, especially within Durban, due to the research problem being narrow.

The study concentrated only on 10 internal auditors from different small and medium-sized internal audit practices in Durban, but the findings can be broadly applied. Also, there is a possibility that a wider sample size could have generated more accurate results.

Some deadlines for submission were not achieved in time due to a combination of factors. Interview appointments with the participants had to be rescheduled due to their demanding work schedule and the researcher having insufficient resources to make it in time to the participant's place of work to conduct interviews. The unavailability of participants became the stumbling block during the lockdown because of COVID-19. This meant closing operations of non-essential industries to prevent the spread of the virus at the workplace. Correspondingly the small and medium-sized internal audit practices in Durban were severely impacted. Therefore, some of the planned interviews were impacted by being postponed. Alternative means were used to ensure the interview process continued, such as software applications called Microsoft Teams. These software applications enabled some interviews to occur using a webcam, which also presented challenges. Time was another constraint that affected the research deadline negatively, especially due to the COVID-19 pandemic.

5.5 Summary of the Theoretical Study

Internal auditors are undeniably affected by the change of internal controls to automation. These changes are viewed as affecting them positively because it has assisted them in working more efficiently and being able to perform continuous audits using automation and also perform analysis of the data much easily and efficiently. The empirical findings indicated the importance of IIA standards to be adhered to for the effective implementation of data analytics. Due to Big Data that needs to be analysed effectively, the individuals with expertise will have to be utilised in the maturity journey. Indeed, the small and medium-sized practices maturity journey to using audit data analysis is low, especially as most have not started to allow traditional internal auditors to get exposure in IT audits especially acquiring data analytical skills.

Therefore, from the first theoretical framework point of view, this problem was reflected as a fuzzy data analysis problem. The task was to analyse data from the Durban based small and medium-sized audit practices to classify the use of data analysis. The fuzzy sets framework application in this study enabled a rational decision-making process by allowing an objective treatment of information. However, the framework did not reject subjectivity, uncertainty, or ambiguity in this study. Through addressing the study's objectives, the fuzzy set framework afforded an opportunity to improve the study's phenomenon through exploring and articulating concerns and possibilities for improvement.

In addition, from the second theoretical framework point of view, the utilisation of grounded theory in this study made certain that the audit data analysis technique tools have a significant likelihood of progressing. The grounded theory framework provided the theoretical understanding of emerging and immature areas in using data analysis techniques by small and medium-sized audit practices.

5.6 Conclusions of the Findings

The enforcement of the use of data analysis techniques is, however, a mandatory requirement contained in the IIA Standards under Section 1220.A2. Therefore, since these are mandatory requirements, adherence to the IIA

Standards is of utmost importance and non-conformance should be prevented. According to the Institute of Internal Auditors (2017 9). The study revealed that the IIA Standard compliance is best assessed by performing a QAIP. The program helps to assess the efficiency and effectiveness of the internal audit activity. Furthermore, the program includes the evaluation of the conformance with the IIA Standards, especially as the Computer Age era and Fourth Industrial Revolution change the organisational internal control processes. Hence quality processes of internal audit practices must evolve to withstand this change.

It emerged in this study that the introduction of new technology through the Computer Age era and the developing Fourth Industrial Revolution is the cause of change of internal controls in organisations. The much anticipated Fourth Industrial Revolution also raises concerns about how it will drive the changes in the performance of the internal audit activity and how these changes will affect professional competency and due care. Failure to recognise and take advantage of the Computer Age era and Fourth Industrial Revolution opportunities will impose risks on the value-add and the improvement of organisational processes by the internal audit activity. Any lack of effort to develop existing internal auditing data analysis models by small and medium-sized practices imposes risk on them falling further behind, lowering their competitiveness.

The maturity model characterises the stage from the least matured state to the most matured state of traditional auditing through to continuous assurance of enterprise risk management using technology-based audits techniques. This means the progressive shift in internal audit practices by using the maximum degree of audit automation.

The study revealed that the small and medium-sized internal audit practices are either data analytics naive or aware. This comes after the study revealed that there is either no analytics skills and/or the internal audit practice has some skills of data analytics through having a team of auditors specialising in data analytics. While this is the case, it points out that the data analytics maturity

journey that demonstrates the level of required groundwork for these practices looking to implement data analytics is still in the early stage.

The study has shown that the small and medium-sized internal audit practices focus on technical skills and tools when it comes to adopting data analytics into the internal audit function. However, this adoption requires a planning transformation, including transforming the execution, reporting audits and relationships with stakeholders. Such an adoption supplementary needs internal audit practices to pay attention to their audit methodology and/or approach and not only to their technical capabilities.

5.7 Recommendation for Small and Medium-Sized Audit Practices

This study recommends that each practice employ or train at least one internal auditor who can use the audit data analytics. This should be a long-term investment to the internal audit practice compared to the cost of training and hiring. Also, utilise the partway to maturity journey as a measure of where each practice can begin to implement audit data analytics. They must also consider developing QAIP to identify non-conformance in the internal audit activity. Furthermore, this study recommends that the small and medium-sized internal audit practices struggling to implement the audit data analytics collaborate with other practices, especially those rated higher-up in the partway to maturity journey of implementing audit data analytics. This may mean linking up with larger internal audit practices especially where audit data analytical techniques will be used as a procedure in the internal audit function. This study focused on small and medium-size practices, which indicated that the transformation of their internal audit activity requires much more data analytical development. Future research could be conducted on large audit firms as opposed to the small and medium size enterprises (SMEs) as to how they have adopted the new technologies

REFERENCES

- ACL Analytics II. 2014. *Revolutionize your approach to data analysis with collaboration, investigation, and interpretation*. ACL Solution Sheet. Available: http://www.dataconsulting.co.uk/wp-content/uploads/2016/08/solution_sheet_ACL_analytics11_en.pdf (Accessed 25 July 2019).
- Appelbaum, D., Kogan, A. and Vasarhelyi, M. A. 2017. Big data and analytics in the modern audit engagement: *Research Needs*. *AUDITING: A Journal of Practice & Theory*, 36: 1-27.
- Babbie, E. R. 2011. *Introduction to social research*. 5th ed. Wadsworth: Cengage learning.
- Bahtiar., Pagalung, G., Habbe, A. H. and Harryanto. 2017. *The effects of audit experience, trust and information technology on the professional skepticism and ability in detecting fraud by internal bank auditors in Jakarta, Indonesia*. *Scientific Research Journal*, V(IX): Available: <http://www.scirj.org/papers-0917/scirj-P0917427.pdf> (Accessed 03 April 2021).
- Bănărescu, A. 2015. Detecting and preventing fraud with data analytics. *Procedia Economics and Finance*, 32: 1827-1836.
- Berisha, G. and Pula, J. S. 2015. Defining small and medium enterprises: a critical review. *Academic Journal of Business, Administration, Law and Social Sciences*, 1(1): 2410-3918.
- Booth, A., Sutton, A. and Papaioannou, D. 2016. *Systematic approaches to a successful literature review*. 2nd ed. London: Sage.
- Boshuizen, P. and Elder. B. 2016. *Driving business performance using data analytics*. KPMG. Available: <https://assets.kpmg.com/content/dam/kpmg/pdf/2016/02/driving-business-performance.pdf> (accessed 07 august 2018).

- Botez, D. 2018. Recent challenge for auditors: using data analytics in the audit of the financial statements. *Brain: Broad Research in Artificial Intelligence & Neuroscience*, 9(4): 61-71.
- Brinkmann, S. and Kvale, S. 2018. *Doing interviews (qualitative research kit)*. 2nd ed. Los Angeles SAGE.
- Cao, M., Chychyla, R. and Stewart, T., 2015. Big data analytics in financial statement audits. *Accounting Horizons*, 29(2): 423-429. <http://dx.doi.org/10.2308/acch-51068>
- Clark, B. 2021. *Exploring the theories of data analysis: EDA, CDA, and grounded theory*. Available: <https://www.idashboards.com/blog/2018/02/28/exploring-the-theories-of-data-analysis-eda-cda-and-grounded-theory/> (Accessed 16 March 2021).
- Coderre, D. 2017. *So, why are you still not using data analytics?* Available: <https://misti.com/internal-audit-insights/so-why-are-you-still-not-using-data-analytics> (Accessed 13 April 2018).
- Computer Science, Conference on Information Communications Technology and Society (ICTAS)*. <https://doi.org/10.1109/ICTAS.2019.8703610>
- Creswell, J. W. 2014. *Educational research*. 4th ed. Los Angeles: Sage.
- Data analytics to become a game changer for internal audit* . 2018. Consultancy.uk. Available: <https://www.consultancy.uk/news/16863/data-analytics-to-become-a-game-changer-for-internal-audit> (Accessed 29 June 2019).
- Dagilienė, L. and Klovienė, L. 2019. Motivation to use big data and big data analytics in external auditing. *Managerial Auditing Journal*. <https://doi.org/10.1108/MAJ-01-2018-1773>
- Dane, F. C. 2018. *Evaluating research: methodology for people who need to read research*. 2nd ed. Thousand Oaks, California: SAGE Publications, Inc.

- Davis, S. and Cernautan, S. 2017. *The data analytics strategy*. Available: <https://iaonline.theiia.org/2017/Pages/The-Data-Analytics-Strategy.aspx> (Accessed 16 April 2018).
- Dawson, C. 2016. *100 activities for teaching research methods*. Thousand Oaks, California: SAGE.
- De Bonhome, O., Gjymshana, E., Jans, M., Kroes, D., Marissen, M., Simpelaere, F., Trumpener, J. and Verachtert, S. 2017. *Data analytics: the future of audit*. Institut des Réviseurs d'Entreprises: Brussels. Available: https://www.ibr-ire.be/docs/default-source/fr/Documents/reglementation-et-publications/publications/brochures/generalites/IBR_DataAnalytics_18-0112_r04.pdf (Accessed 2017).
- DeKroon, N. and Karp, B. 2017. *An auditor's guide to data analytics*. https://chapters.theiia.org/raleigh-durham/Events/Training%20Presentations/2013_May_Raleigh%20IIA%20Presentation_Data%20Analysis.pdf (Accessed 2019).
- Deloitte. n.d. *Adding insight to audit transforming internal audit through data analytics*. Available: <https://www2.deloitte.com/content/dam/Deloitte/ca/Documents/audit/ca-en-audit-adding-insight-to-audit.pdf>
- Earley, C. E. 2015. Data analytics in auditing: opportunities and challenges. *Business Horizons*, 58(5): 493-500.
- eNCA. 2019, 14 March. *Standard bank to cut thousands of jobs*. Available: <https://www.enca.com/business/standard-bank-cut-thousands-jobs> (Accessed 29 August 2019).
- Flick, U. 2018. *Designing qualitative research*. Los Angeles: Sage.

- Francis, T. 2019. *Standards for the internal audit function*. Available: <https://www.wipfli.com/insights/articles/fi-standards-for-the-internal-audit-practice-bank> (Accessed 20 April 2019).
- Gleim, I. N. 2017. *CIA review part 1: internal audit basics*. Florida: Gleim Publication Inc.
- Global Technology Audit Guide (GTAG). 2012. *Information technology risk and controls* 2nd ed. The Institute of Internal Auditors. Available: https://chapters.theiia.org/montreal/ChapterDocuments/GTAG%201%20-%20Information%20technology%20controls_2nd%20ed.pdf (Accessed 02 April 2021).
- Grbich, C. 2013. *Qualitative data analysis*. London: SAGE.
- Hesse-Biber. S. N. 2017. *The practice of qualitative research: engaging students in the research process*. Los Angeles: SAGE.
- Hirth, R. 2009. *Guide to internal audit USA*: Protiviti Inc. Available: https://www.protiviti.com/sites/default/files/singapore/insights/guide_to_internal_audit.pdf (Accessed 20 April 2019).
- Hoelsing, M. 2010. *Applying data analytics to IS Audit*. Available: <http://professor.unisinos.br/llemes/Aula13/jpdf1004-risk-perception.pdf> (Accessed 03 April 2021).
- ICEAW. n.d. *Using data analytics in external audits*. Available: <https://www.icaew.com/technical/audit-and-assurance/audit/risk-assessment-internal-control-and-response/6-data-analytics-in-external-audit>
- Jackson, R. D. C. and Stent, W. J. 2016. *Auditing notes for South African students*. 10th ed. Durban: LexisNexis.
- Kambatla, K., Kollias, G., Kumar, V. and Grama, A. 2014. *Trends in big data analytics*. Elsevier Inc. Available:

<https://experts.umn.edu/en/publications/trends-in-big-data-analytics>

(Accessed 7 September 2020)

Kaya, I., Akbulut, D. H. and Ozoner, K. (2018). Big data analytics in internal audit. *PressAcademia Procedia (PAP)* 7: 260-262.

<http://doi.org/10.17261/Pressacademia.2018.893>

Kiyosaki, R. T. 2012. *Retire young retire rich: How to get rich and stay rich forever!* Plata Publishing: LLC.

Kiyosaki, R. T. and Lechter, S. L. 2012. *Rich dad's prophecy*. New York: Warner Books

Kruse, R., Held, P. and Moewes, C. 2013. *On fuzzy data analysis Germany*. Springer-verlag. Available:

https://www.researchgate.net/publication/224850362_On_Fuzzy_Data_Analysis (Accessed 27 May 2020)

LaValle, S., Lesser, E., Shockley, R., Hopkins, M.S. and Kruschwitz, N. 2010, Dec 21. Big data, analytics and the path from insights to value. *MIT Sloan Management Review, Magazine Winter*. Available:

<https://sloanreview.mit.edu/article/big-data-analytics-and-the-path-from-insights-to-value/>

Li, H. Dai, J., Gershberg, T. and Vasarhelyi, M.A. 2018. Understanding usage and value of audit analytics for internal auditors: *an organisational approach*. *International Journal of Accounting Information Systems*, 28: 59-76.

<https://doi.org/10.1016/j.accinf.2017.12.005>

Lowe, D. J., Bierstaker, J. L., Janvrin, D. J. and Jenkins, G. 2018. Information technology in an audit context: *have the big 4 lost their advantage?* *Journal of Information Systems*, 32(1): 87-107. <https://doi.org/10.2308/isys-51794>

Maxwell, J. 2012. *A realist approach for qualitative research*. Thousand Oaks: SAGE. Thousand Oaks, United States.

- McGuirk, P. M. and O'Neill, P., 2016. *Using questionnaires in qualitative human geography*. Available: <https://ro.uow.edu.au/cgi/viewcontent.cgi?article=3519&context=sspapers> (Accessed 22 August 2020).
- Mokhitli, M. and Kyobe, M. 2019. *Examining factors that impede internal auditors from leveraging information technology for continuous auditing* [Conference paper]. Conference on Information Communications Technology and Society (ICTAS) 1-6. <http://dx.doi.org/10.1109/ICTAS.2019.8703610>
- Ndung'u, N. and L. Signé. 2020. The fourth industrial revolution and digitization will transform Africa into a global powerhouse. *In: Foresight Africa: 2020 Report*. Available: <https://www.brookings.edu/research/the-fourth-industrial-revolution-and-digitization-will-transform-africa-into-a-global-powerhouse/>
- Olley, J. 2021. 5 Benefits of adopting data analytics in internal audit. *Caseware IDEA*. Available: <https://idea.caseware.com/blog/5-benefits-data-analytics-internal-audit> (Accessed 24 April 2020).
- Olsen, W. 2012. *Data collection - key debates and methods in social research*. London: SAGE. <https://dx.doi.org/10.4135/9781473914230>
- Pajo, B. 2018. *Introduction to research methods: a hands-on approach*, Thousand Oaks, California: SAGE Publications, Inc.
- Pan, G. and Seow, P-S. 2016. Preparing accounting graduates for digital revolution: a critical review of information technology competencies and skills development. *Journal of Education for Business*, 91(3): 1-10. <http://dx.doi.org/10.1080/08832323.2016.1145622>
- Peters, I. 2017. *Data analytics – is it time to take the first step?* Chartered Institute of Internal Auditors. Available: <https://www.iiia.org.uk/media/1689102/0906-iiia-data-analytics-5-4-17-v4.pdf> (Accessed 26 April 2018).

Pett, J., Kristall, M. and Mack, D. (2017) 'Opportunity from disruption: adopting six traits can enable internal audit functions to become more agile in the face of change', *Internal Auditor*, 74(3), 57+. Available: <http://dspace.kottakkalfarookcollege.edu.in:8001/jspui/bitstream/123456789/1050/1/ContentServer%20%2815%29.pdflink.gale.com/apps/doc/A497672681/AONE?u=anon~79f88e43&sid=googleScholar&xid=cb7bb221> (Accessed 05 April 2021).

Powerful research, simplified. 2020. NVivo. Available: <https://www.qsrinternational.com/nvivo-qualitative-data-analysis-software/about/nvivo> (Accessed 14 April 2020).

Pricewaterhouse Coopers (PWC). 2015. *Data analytics - transforming your Internal Audit function.* Available: <https://www.pwc.co.uk/services/audit-assurance/risk-assurance/services/internal-audit/insights/data-analytics---transforming-your-internal-audit-function.html> (Accessed 16 April 2018).

QuestionPro. 2021. The ultimate guide to great questionnaires. Available: <https://www.questionpro.com/blog/what-is-a-questionnaire/> (Accessed 16 March 2021).

Ricci, L., Lanfranchi, J-B., Lemetayer, F., Rotonda, C., Guillemin, F., Coste, J., Gullemin, F., Coste, J. and Spitz, E. 2019. Qualitative methods used to generate questionnaire items: a systematic review. *Qualitative Health Research*, 29(1): 149-156. <https://doi.org/10.1177/1049732318783186>

Russom, P. 2011. *Big data analytics. TDWI best practices report.* The Data Warehousing Institute (TDWI) Research.

Smit, Y. and Watkins, J. A. 2012. A literature review of small and medium enterprises (SME) risk management practices in South Africa. *African Journal of Business Management*, 6(21): 6324-6330.

Soileau, J. and Soileau, L. 2016. Analytics and the small audit department. *Internal Auditor (IA)*, 73: 35-39. Available:

<https://jabatanfungsionalauditor.files.wordpress.com/2016/06/majalan-ia-juni-2016.pdf>

Soileau, J., Soileau, L. and Summers, G. 2015. The evolution of analytics and internal audit. *EDPACS*, 51(2): 10-17.

<https://doi.org/10.1080/07366981.2015.1012441>

South Africa. 2004. *National Small Business Amendment Act 29 of 2004*.

Government Gazette number 27101. Available:

https://www.gov.za/sites/default/files/gcis_document/201409/a29-04.pdf

The Institute of Internal Auditors North America. 2019. *The IPPF: the framework for internal audit effectiveness. Standards & guidance — International Professional Practices Framework (IPPF)*. Available:

<https://na.theiia.org/standards-guidance/pages/standards-and-guidance-ippf.aspx> (Accessed 09 April 2019).

The Institute of Internal Auditors North America. 2018. *Definition of internal auditing*.

Available: <https://na.theiia.org/standards-guidance/mandatory-guidance/Pages/Definition-of-Internal-Auditing.aspx>

(Accessed 19 May 2018).

The Institute of Internal Auditors South Africa. 2018. *Global certification overview*.

Available: https://www.iiasa.org.za/page/Global_Certification (Accessed 25 May 2018).

The Institute of Internal Auditors North America. 2017. *Global Technology Audit Guide (GTAG): understanding and auditing big data*.

<https://na.theiia.org/standards-guidance/recommended-guidance/practice-guides/Pages/GTAG-Understanding-and-Auditing-Big-Data.aspx>

(Accessed 15 December 2020).

The Institute of Internal Auditors [IIA]. 2017. International standards for the professional practice of internal auditing (standards).

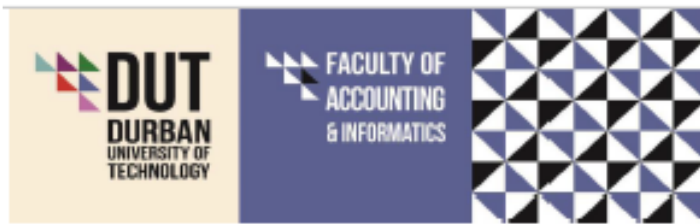
<https://na.theiia.org/standards-guidance/public%20documents/ippf-standards-2017.pdf> (Accessed 31 May 2018).

Tsai, C. W., Lai, C. F., Chao, H. C. and Vasilakos, A. V. 2015. *Big data analytics: a survey*. United Kingdom: *Journal of Big Data*. <https://doi.org/10.1186/s40537-015-0030-3> (Accessed 17 January 2018).

Understanding confidentiality and anonymity. 2021. Evergreen, Olympia: Washington. Evergreen Institutional Review Board (IRB). Available: <http://www.evergreen.edu/humansubjectsreview/confidentiality> (Accessed 22 April 2018).

APPENDICES

Appendix A: Gatekeeper's Permission



Faculty Research Office
Durban University of Technology

1 October 2019

Mr. B. G. Mhlongo

Student Number: 20700585

Degree: Master of Accounting: Internal Auditing

Dear Mr. Mhlongo

ETHICAL APPROVAL: LEVEL 2

Your email correspondence in respect of the above refers.

I am pleased to inform you that the Faculty Research Committee (FRC) at its meeting on 25 July 2019, has granted preliminary permission for you to conduct your research **"USE OF DATA ANALYSIS TECHNIQUES BY SMALL AND MEDIUM SIZED AUDIT PRACTICES"**.

You are required to present this letter to sites of data collection to obtain permission to collect data. Please also note that at each of your interviews you must present a letter of information and a letter of consent for each participant, as per your research proposal.

A summary of your key research findings may be submitted to the FRC on completion of your studies.

Kindest regards.

Yours sincerely

Dr Delene Heukelman
Faculty Research Coordinator (Acting)

Appendix B: Letter of Information



Title of the Research Study: USE OF DATA ANALYSIS TECHNIQUES BY SMALL AND MEDIUM-SIZED AUDIT PRACTICES.

Principal Investigator/s/researcher: Bonginkosi Goodwill Mhlongo

Co-Investigator/s/supervisor/s: Dr LM Lakhanya (Co-supervisor), Dr L. F Jali (Supervisor)

Brief Introduction and Purpose of the Study: The purpose of this study is to demonstrate that small and medium-sized audit practices are challenged in crossing over from a traditional internal audit technique to that which incorporates data analytics. To highlight how data analytics software (tools) can offer many opportunities that can improve the internal audit quality. To also find out the reasons why small and medium-sized audit practices fail to successfully use data analytics when the Institute of Internal Auditors (IIA) rate data analytics as a critical tool for effective internal audit organisation.

Outline of the Procedures :The researcher's primary data would be from interviews using interview transcripts and observation .The participants will be nominated from the researcher's former employer in La Lucia especially since they are having some challenges in successfully incorporating data analytic software in their internal audit function, whilst other individual internal auditors will be selected non-randomly within Durban (Mhlanga/ La Lucia area and CBD) and based on their knowledge as well as years of experience within the field of internal auditing.

Risks or Discomforts to the Participant: Participants will be encouraged to disclose information in the manner in which they are most comfortable with; also, the use of artificial names will be encouraged.

Benefits: The participants will gain an understanding of the critical importance of having data analytical software as an added tool within their internal audit function. Also, how data analytic skill can improve the efficiency of the internal audit function and provide in-depth insight in detecting and preventing high-risk areas within the organisational processes.

Reason/s why the Participant May Be Withdrawn from the Study: Participation will be voluntary and participants can withdraw at any time without any adverse penalties for the participant.

Remuneration: Nil

Costs of the Study: The study will be undertaken in the participant's workplace through the request of booking of an empty board room for about 20-30 minute.

Confidentiality: All information received will be confidential and used only for the research purposes; no individual will be identified in the dissertation.

Research-related Injury: None expected

Persons to Contact in the Event of Any Problems or Queries:

Please contact the Researcher (Tel no.:XXX), my supervisor (Tel no.:031 373 6712.) or the Institutional Research Ethics administrator on 031 373 2900. Complaints can be reported to the DVC:TIP, Prof F. Otieno on 031 373 2382.

General:

The primary spoken language of the research population is English

Appendix C: Letter of Consent



LETTER OF CONSENT

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the Researcher, Bonginkosi Goodwill Mhlongo about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number:
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during this research which may relate to my participation will be made available to me.

Full Name of Participant

Date

Time

Signature / Right Thumbprint

I, Bonginkosi Goodwill Mhlongo herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

Bonginkosi Goodwill Mhlongo

Full Name of Researcher

Date

Signature

Full Name of Witness (If applicable)

Date

Signature

Full Name of Legal Guardian (If applicable)

Date

Signature

Appendix D: Research Questions



TITLE OF THE RESEARCH STUDY:	USE OF DATA ANALYSIS TECHNIQUES BY SMALL AND MEDIUM-SIZED AUDIT PRACTICES
PURPOSE OF DOCUMENT:	RESEARCH QUESTIONS

RESEARCH OBJECTIVE 1	
<ul style="list-style-type: none"> • How long have you been in practice for as an internal auditor? 	<hr/> <hr/>
<ul style="list-style-type: none"> • There are IIA Standards that are to be followed, which ones are applicable to your practice? 	<hr/> <hr/>
<ul style="list-style-type: none"> • Are you aware of the <u>Computer Age era and Fourth Industrial Revolution</u>, are they affecting you in any way? 	<hr/> <hr/>
<ul style="list-style-type: none"> • With most internal controls changing to automation, increasing the creation of electronic data, does it affect you, if so in what way? 	<hr/> <hr/>

- Chief Audit Executives (CAEs) have repeatedly stated that data analysis expertise is a much-needed skill in internal audit, and the Institute of Internal Auditors (IIA) have rated data analysis, and analytical software as critical tools for effective internal audit organisations. How will you describe the data analytics implementation in the practice?

- In terms of data analytics which software do you use? Are you comfortable with that software? Why have you not moved to another software package?

- What is your experience associated with the use of data analytical software and how different is it from the traditional internal audit?

- What are the benefits and disadvantages associated with using Data Analytical Software?

RESEARCH OBJECTIVE 2

- How supportive is the CAE and Audit Committee towards the adoption of analytics and the adoption of IIA Standard changes?

- Briefly state the impact or consequences of non-conformance with the IIA Standards your practice has enforced through conducting Quality Assurance and Improvement Program?

RESEARCH OBJECTIVE 3

- What has the practice done to ensure they have individuals with data analytics capabilities? Has the practice supported the internal auditors with trainings and software, and given sufficient time to develop the skills?

- What are the challenges associated with developing and maintaining an effective data analysis capability in your practice?

RESEARCH OBJECTIVE 4

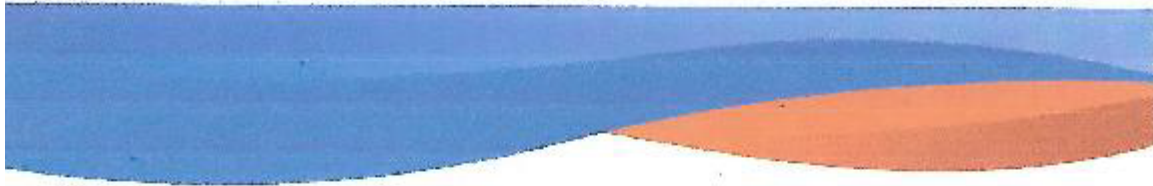
- What implementation strategy did the practice use in phasing in data analytics in the internal audit function?

All information provided will be treated with utmost confidentiality.

This research is in fulfilment of the requirement for the award of Master of Accounting Degree (Internal Auditing)

NAME OF RESEARCHER: BONGINKOSI GOODWILL MHLONGO

Appendix E: Editing Certificate



27 August 2021

Declaration of editing

I declare that I have edited the thesis of Mr Bonginkosi Goodwill Mhlongo titled, 'Use of Data Analysis Techniques by Small and Medium-Sized Audit Practices'. My involvement was restricted to language usage and spelling, completeness and consistency, referencing style of the references in the thesis and reference list, formatting of headings, table captions, automated page numbering and automated table of contents. I did no structural re-writing of the content. After my language editing, the author has the option to accept or reject suggestions/changes prior to submission.

This thesis was duly edited by me using track changes. I make no claim as to the accuracy of the research content. It is not the responsibility of the editor to check for plagiarism. I am not accountable for any changes made to this document by the author or any other party subsequent to my edit.

Signed _____ at Durban this 27 day of
AUGUST 2021



Vanessa Lynn Neophytou
Associate Member
KwaZulu-Natal Branch: Branch Coordinator
Membership number: NE0001
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www.editors.org.za

Appendix F: Turnitin Report

**USE OF DATA ANALYSIS
TECHNIQUES BY SMALL AND
MEDIUM-SIZED AUDIT
PRACTICES**

by Bonginkosi Mhlongo

Submission date: 14-Sep-2021 10:54AM (UTC+0200)

Submission ID: 1648151043

File name: Bonginkosi_Mhlongo_-_Masters_Dissertation_SUBMISSION.docx (562.23K)

Word count: 39559

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