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An exploratory study in South Africa: Big Data and auditing

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An exploratory study in South Africa: Big Data and auditing

A research report submitted by

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Date Submitted: 31 March 2021

Ethics Clearance Number: **SOA-2020-11-32**

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In partial fulfilment of the requirements of the degree of

Master of Commerce

University of the Witwatersrand

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Declaration of own work

I, Dimitri Petermann (student number 1302500), declare that the work contained in this thesis is my own and can, therefore, be submitted in my name in partial fulfilment of the degree of Masters of Commerce in Accounting for the School of Accountancy. It has not been submitted to be awarded another degree or for examination purposes at any other university.

In addition, I declare the following, in accordance with the Senate Plagiarism Policy:

- I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong.
- I confirm that all the work submitted for assessment for the partial fulfilment of the degree of Masters of Commerce in Accounting is my own work except where I have explicitly indicated otherwise.
- I have followed the required conventions in referencing the thoughts and ideas of others.
- I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own work or that I have failed to acknowledge the source of the ideas or words in my writing.

/Signed Dimitri Petermann (1302500)

Acknowledgements

I thank my supervisor, Samantha Gomez, for valuable feedback and support in making it possible to submit this research. I also thank the other faculty members in the School of Accountancy for their kind words and encouragement. Thank you to the Assistant Dean for granting the appeal to return in 2020.

Thank you to the participants in this study for taking the time to participate and provide in-depth answers for this research. Your answers make it possible to advance research in auditing, and the practice of auditing.

I thank my family, especially my mom and sisters, who have supported me over the years and believed in me. I am grateful to my wife Yolisa who had to endure the research process with me and was there when it mattered most.

Abstract

This study explores the latest development in audit technology: the adoption of Big Data in a South African context. It addresses three themes: whether there is a responsibility to incorporate Big Data when auditing financial statements under current auditing standards and if so, in what ways should Big Data be incorporated to evidence compliance with these standards. If not, under what circumstances such a responsibility may exist. Individual semi-structured interviews were conducted with 20 participants. The individuals interviewed, among them external auditors, audit academics, and employees of audit regulators and professional bodies, have practical experience and demonstrable knowledge of the current auditing standards. A conventional content analysis was used to identify core themes in the interview and recommend areas for further research. Participants unanimously agree that there is an implied responsibility to enhance their digital acumen to meet the ethical requirements of an audit. Most of the participants suggest that risk assessment procedures should include data analytics, auditors should verify the reliability of client data and that the inclusion of Big Data in an audit depends on clients' specific circumstances. This study is one of the first empirical accounts to provide a South African perspective on Big Data in auditing and to consider Big Data within the context of current auditing standards.

Keywords: Big Data, auditors, auditing, auditing standards, digital acumen, professional responsibility

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Abbreviations

Abbreviation	Title
APA	Auditing Profession Act, 2005
BDA	Big Data analytics
Big 4	Refers to the four largest auditing firms in South Africa namely: PWC, Deloitte, EY and KPMG
CPC	Code of Professional Conduct
CPD	Continuing Professional Development
IAASB	International Auditing and Assurance Standards Board
IESBA	International Ethics Standards Board for Accountants
IFAC	International Federation of Accountants
IFIAR	International Forum of Independent Audit Regulators
IRBA	The Independent Regulatory Board for Auditors
ISAs	International Standards on Auditing
ISA 200	International Standard on Auditing 200: Overall Objectives of The Independent Auditor and the Conduct of an Audit in accordance with International Standards on Auditing
ISA 230	International Standard on Auditing 230: Audit Documentation
ISA 240	International Standard on Auditing 240: The Auditor's Responsibilities Relating to Fraud in An Audit of Financial Statements
ISA 300	International Standard on Auditing 300: Planning an Audit of Financial Statements
ISA 315	International Standard on Auditing 315: Identifying and Assessing the Risks of Material Misstatement (Revised 2019)

Abbreviation	Title
ISA 500	International Standard on Auditing 500: Audit Evidence
ISA 620	International Standard on Auditing 620: Using the work of an auditor's expert
ISQC 1	International Standard on Quality Control (ISQC) 1: Quality Control for Firms that Perform Audits and Reviews of Financial Statements, and Other Assurance and Related Services Engagements
Mid-tier firms	Refers to the other large auditing firms in South Africa namely: BDO, SNG Grant Thornton, Baker Tilly Greenwoods, Crowe, Moore, PKF, Mazars and RSM.
POPI	Protection of Personal Information Act, 2013 (effective 1 July 2020)
SAICA	The South African Institute of Chartered Accountants

1 Introduction

1.1 Background of the study

The Fourth Industrial Revolution also commonly known as Industry 4.0, is touted to disrupt labour markets with some researchers asserting that there is a 94% probability that the jobs of auditors will be redundant in the near future (Frey & Osborne, 2017). Big data is considered one of the nine pillars which possess the potential to transform isolated cells and optimise process value chains in an autonomous manner. Many regard Big Data as the foundation of future disruptive technology (Vaidya, Ambad, & Bhosle, 2018). Despite being a threat, Big Data is also an opportunity for auditors to remain relevant (Borthick & Pennington, 2017; Wong, Stratopoulos, Stapleton, & Richins, 2017).

While the meaning of Big Data varies among researchers, there are certain attributes that remain intact (Tuttle, Kogan, & Vasarhelyi, 2015). According to Elgendy and Elragal (2014), three main features characterise Big Data: volume, variety and velocity, also known as the three V's. Volume is the primary attribute which indicates that Big Data is immense: this means that, because of the data size, traditional software is incapable of analysing it (Byrnes, Moffitt, & Warren, 2015). Velocity indicates the speed at which data can be recalled or accessed. It is due to the quality of acquiring near real-time information which makes a company more agile than its competitors (McAfee, Brynjolfsson, Davenport, Patil, & Barton, 2012; Stewart, Chychyla, & Cao, 2015). Variety explains the diversity in the type of data (Arnaboldi, Busco, & Cuganesan, 2017). Apart from the primary characteristics mentioned, Big Data is also verified by its veracity, which relates to data integrity (Alles & Gray, 2016; Zhang, Hoogduin, & Yoon, 2015).

Due to its volume and velocity, Big Data can necessitate a paradigm shift from traditional audits to continuous audits and continuous monitoring (Appelbaum, Yang, & Zhang, 2015; Lombardi, Bloch, & Vasarhelyi, 2014). In effect, a continuous assurance approach entails the supply of near real-time assurance which matches real-time decision-making (Appelbaum et al., 2015). However, Alles and Gray (2016) were less optimistic about a continuous audit prospect. They asserted that, even though the conception of a continuous audit was laid a quarter-century ago, its practical implementation is yet to materialise.

Other than a potential change in the audit approach, Appelbaum (2016) proposed two reasons to inspire auditors' interest in Big Data. Firstly, clients may use Big Data to inform accounting judgement and decision-making, and this may result in a material impact on financial statements. Secondly, auditors should be interested in Big Data as it can enhance risk analysis through a more comprehensive understanding of the environment in which the client operations can lead to better decision-making. For example, an early study by McAfee et al. (2012) suggested that companies which make the most use of their data was 5% more productive, and 6% more profitable than their competitors. It is only natural to state that auditors can also benefit from Big Data applications as they are required to obtain a detailed understanding of their client (IAASB, 2019: ISA 315; Tuttle et al., 2015).

Other possibilities for Big Data are that it can complement and enhance traditional financial information through processing audio, video, and textual (Zhang et al., 2015). For example, accounting systems can include video data onto a fixed asset register to provide additional information about the condition, features and characteristics of the asset (Byrnes et al., 2015, p. 402). Big Data can also assist management in supporting their fair value accounting by leveraging many different sources of market data to enhance the market value of an asset or providing support for crucial assumptions included in the calculation (Appelbaum, 2016; Byrnes et al., 2015).

The new tools and methods used for processing Big Data information for better decision-making are called Big Data Analytics ("BDA") (Kend & Nguyen, 2020; Salijeni, Samsonova-Taddei, & Turley, 2018). Despite BDA being a costly technology, audit firms have made significant investments in recent years either to develop or acquire this technology (Salijeni et al., 2018). The possible benefits for auditors include the ability to identify fraudulent transactions which can assist in addressing the expectation gap with users of financial (Gepp, Linnenluecke, O'Neill, & Smith, 2018). Big Data can also provide more persuasive evidence to assess the appropriateness of assumption or critical accounting estimates (Alles & Gray, 2016; Appelbaum, 2016; Byrnes et al., 2015).

However, despite these advantages, Alles and Gray (2016) identify several inhibitors or obstacles associated with incorporating Big Data in an audit environment. Firstly, there may be difficulty in obtaining direct access to the client's Big Data as this may insinuate a legal risk and an adverse impact on the client's IT systems. Secondly, a

shift to Big Data may make it possible to test 100% of a transaction population. This will mean that auditors will no longer be able to place reliance on sampling as an inherent limitation to defend against litigation. Thirdly, it may be difficult for auditors to conclude that Big Data is reliable due to a possible lack of veracity (i.e. the integrity of the data). Appelbaum (2016) explains that a lack of control options implemented by management will lead auditors to conclude that Big Data is not a reliable source of information. Lastly, for the effective use of Big Data, there is an inevitable need to train the auditors in new skill sets. A recent study by Salijeni et al. (2018) identifies that auditors address their lack of data expertise through specialist involvement.

In summary, there are risks and rewards in incorporating Big Data in an audit environment; most studies advocate the benefits of incorporating Big Data in an audit. However, only a handful of studies argue the need for changes to current auditing standards to include Big Data (Appelbaum, 2016; Kend & Nguyen, 2020; Salijeni et al., 2018; Titera & Krahel, 2015). Although identifying the changes needed in current auditing standards is helpful, it can take many years before these changes come into effect (Salijeni et al., 2018). A lack of guidance can also mean that auditors need to resort to their professional judgement to address the challenges arising from Big Data in their audits. Prior studies (Bengtsson & Zago, 2019; Kend & Nguyen, 2020; Maldonado, Claudio, & Pinho, 2020; Salijeni et al., 2018) have not considered how auditors view their responsibility under current auditing standards in South Africa.

1.2 Purpose and relevance of the study

The purpose of this research report is to increase understanding of an auditor's responsibility for Big Data under current auditing standards. It explores the potential existence of such a responsibility and considers how it should be addressed.

The research undertaken makes three significant contributions. Firstly, this study is among the first few to contribute empirical evidence through exploratory research: this is critical as previous research was mostly conceptual (Salijeni et al., 2018). Secondly, the findings are relevant and significant to several stakeholders. For standard setters and regulators, it can assist in deciding if there should be changes in the auditing guidelines (Wong et al., 2017). This research may also assist auditors and professional bodies to understand their responsibilities under current auditing standards (Appelbaum et al., 2015; Salijeni et al., 2018). For academics, the study can identify future areas for research and contribute to accounting education (Alles &

Gray, 2016). For example, by using this research to identify best practices related to Big Data in auditing, academics can incorporate these practices into their educational material when teaching the next generation of auditors (Stumke & Swart, 2020). Third, as identified by Gepp et al. (2018) and Salijeni et al. (2018), qualitative research assists in the alignment of theory and practice with empirical evidence. In exploring how Big Data can be incorporated into the current audit environment while also considering the auditing standards, this research report explores the views of auditors, regulators, and academics alike.

1.3 Research questions

- Do auditors have a responsibility under current auditing standards to incorporate Big Data into the audit of financial statements?
- If yes, how should auditors consider Big Data in the audit of financial statements to ensure compliance with the requirements of current auditing standards?
- If no, under what circumstances will there be a responsibility under current auditing standards to incorporate Big Data in the audit of financial statements?

1.4 Assumptions, limitations and delimitations

i. Assumptions

Coetsee (2011) outlines three types of research frameworks used in accounting research: positivistic, interpretative, and critical. This study used an interpretative framework to explore the latest development in audit technology: the adoption of Big Data in South Africa. Interpretative research considers social actors' views as they construct their social reality, in this instance, individuals in the audit profession. Among them are external auditors, audit academics, and employees of audit regulators and professional bodies. This study is premised on the fact that auditing is a social construct of individuals in the audit profession.

Suchman's (1995) theory of legitimacy and Gidden's (1990) theory of modernity form part of the theoretical framework for this study. Auditing is assumed to change when such changes are considered legitimate and support the view in society that audits are effective and that auditors possess the necessary expertise. However, because of this study's interpretative framework, it does not attempt to investigate any of the motivators for change in auditing (Coetsee, 2011). Future research can adopt a

critical research framework to promote change and deliver social criticism (Ryan, Scapens, & Theobald, 2002).

ii. Limitations and delimitations

Participants in this research fall into three categories – external auditors, audit regulators and professional bodies, and audit academics – and as the study is qualitative, the sample size is relatively small. As a part of future research, the researcher recommends a similar study which includes a larger sample size or a quantitative method which can result in more general findings.

The participants in the study were limited to individuals in two major cities in South Africa: Johannesburg and Cape Town. Their geographies may have impacted the responses. It may mean that the findings are not applicable or directly transferrable to auditors in other geographies and institutional domains (such as other cities in South Africa or other countries in the world), even though similarities exist. This study has not considered public-sector audits in South Africa. Future research can pursue a similar study but with auditors at the Auditor-General of South Africa.

Another limitation of this study is that it considers only large audit firms[1] which are considerably different from smaller audit firms[2]. The study did not include participants from smaller audit firms, based on current literature. For example, Salijeni et al. (2018) suggest that these firms have not yet made the required investments in new audit technologies to enable Big Data.

1.5 Report structure

The remainder of this research report is structured as follows. Section 2 presents a review of existing literature and theoretical expectations of auditors about Big Data, including the general requirements of auditing standards. Section 3 explains the research method applied and the validity and reliability of the research findings. Section 4 details the research findings and discussion. Section 5 summarises the conclusions and recommendations for future research.

[1] Large audit firms comprise each of the Big-4 firms and mid-tier firms.
[2] For avoidance of doubt, smaller audit firms are those firms that are not large audit firms.

2 Literature Review

Section 2.1 comprises two parts. Firstly, it intends to explain this study in the context of prior advancements in audit technologies. Secondly, it provides an overview of the current themes in research about Big Data in auditing. Section 2.2 presents previous research views on current auditing standards and their link to Big Data. Section 2.3 discusses the connection between legitimacy theory and the audit profession as a theoretical framework for this research.

2.1 Big Data in the current audit literature

The purpose of section 2.1.1 is to place Big Data within the context of prior advances in audit technologies and to understand the rationale for such developments. The literature shows that introduction of new audit technologies arises from regulatory pressures and commercial incentives of auditors.

2.1.1 Prior developments in audit technologies

According to Salijeni (2019), auditing literature contains considerable evidence of how the audit profession has used technological advancement to maintain confidence in the audit process. Salijeni (2019) identifies two rationales for technological change in audits. Firstly, auditors introduce new technologies to address regulatory concerns about the standard of their work. For example, the audit profession introduced electronic working papers to structure audit processes which can prevail in consistent auditor judgements. Secondly, there is a commercial interest, i.e. profitability motive for auditors because changes in audit technologies have enabled their practices to become scalable, in this way, generating more revenues and profits and making it possible to operate on a global scale.

It was during the Industrial Revolution that the audit profession, as known today, was founded (Teck-Heang & Ali, 2008). At that time, there was a need for detailed testing of all transactions to detect fraud and ensure financial accountability of financial reports (Byrnes et al., 2015). Companies continued to experience significant growth in the 20th century and a larger volume of transactions meant it was no longer practical to verify all transactions (Ajao, Jayeoba, & Ajibade, 2016). The audit profession introduced materiality, sampling, analytical procedures and the audit risk model to enable effective and efficient audits in the 19th century (Salijeni, 2019; Teck-Heang & Ali, 2008).

Companies started to introduce computer systems to process, monitor and control their transactions in the late 1900s (Ajao et al., 2016). It was in this transient period that the first IT Audit Tools being Computer Aided Audit Tools (CAAT) software and Microsoft Excel was introduced (Dai & Vasarhelyi, 2016). In effect there was a shift in approach by the auditors from “verification of transactions” to “reliance on systems” (Teck-Heang & Ali, 2008).

Advances in audit technologies have historically been hindered by a lack of knowledge and the highly regulated and litigious environment in which auditors operate (M. G. Alles, 2015). Alles and Gray (2016) suggest that there are several inhibitors which prevent Big Data from being formally introduced and implemented in the current audit environment. For example, Appelbaum et al. (2015) expect that Big Data will enable auditors to test entire populations of transactions and enable continuous audits. On the other hand, Alles and Gray (2016) argue that this will be problematic for the audit profession as auditors rely on audit sampling as a legal defence in litigation.

Lombardi, Issa, and Brown-Liburd (2015) expect auditors to find it challenging to adopt Big Data because of a lack of knowledge and skills which can lead to information overload and significant audit inefficiencies. However, the lack of audit expertise does not mean that the present adoption of Big Data is impractical; auditors can initially use data specialists to supplement their lack of expertise (Salijeni et al., 2018). Another option identified by Dai and Vasarhelyi (2016) is that audit firms can partner with large tech firms to facilitate the introduction of data analytics. Maldonado et al. (2020) argue that audit firms need to have multidisciplinary audit teams to overcome the weaknesses in audit expertise.

In summary, since the industrial revolution, the aim of an audit changed from identifying fraud to enhancing the credibility of financial accounts (Teck-Heang & Ali, 2008). Like the introduction of the first IT audit tools, Big Data is predicted to be the next significant advancement in audit technologies (Dai & Vasarhelyi, 2016). Salijeni (2019) argued that regulatory concerns and commercial interest will drive developments in audit technologies.

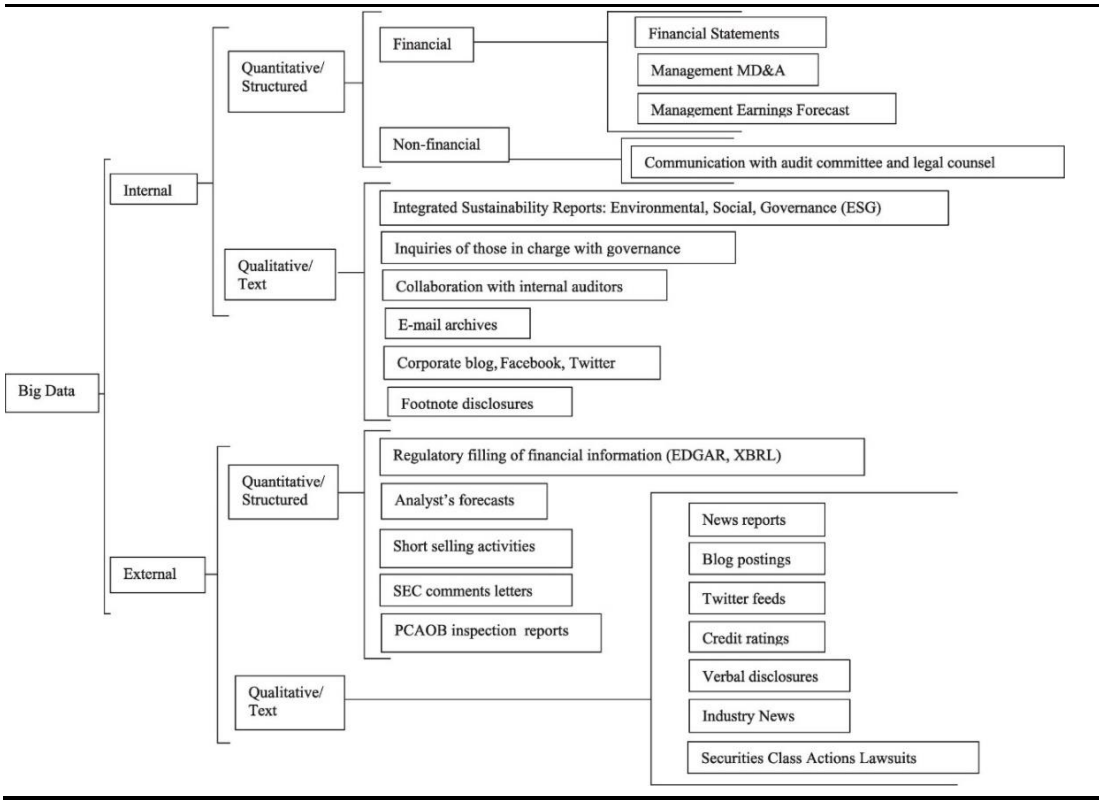
2.1.2 Big Data in auditing

Section 1.1 introduced the concept of Big Data. This section elaborates on core themes emerging in the literature as identified by Wright and Griffin (2015). The core themes are identified in subsections (i) to (v) below.

i. Big Data changes the meaning of information.

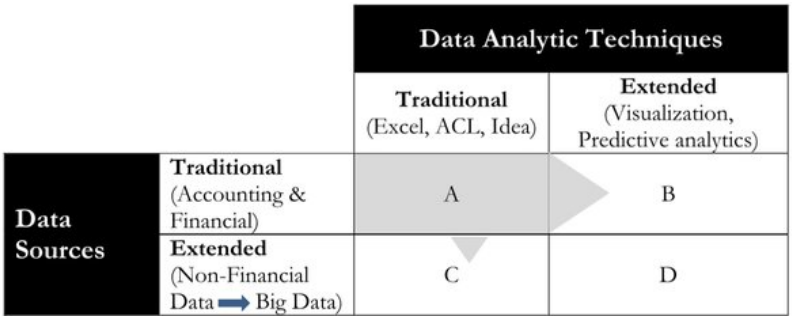
Byrnes et al. (2015) suggest that Big Data will enable auditors to incorporate non-traditional sources of information and complement traditional financial information. Rezaee et al. (2017) support this view and identify an initial overview of the different types of Big Data and its sources (refer to Figure 1).

Figure 1: Big Data and its sources by Rezaee et al. (2017)



Alles and Gray (2016) identify a conceptual framework for understanding Big Data in an audit by referring to data sources and data analytic techniques (refer to Figure 2). They expand that audit firms continue to operate in a traditional audit environment where data sources comprise accounting and financial information and auditors continue to use traditional tools like Excel to analyse data. For this research, this is defined as a "traditional audit".

Figure 2: Alles and Gray (2016)'s conceptual framework



Alles and Gray (2016) explain that as auditors incorporate more visualisation tools, such as data graphs, it will eventually lead auditors to broaden their data sources to include non-financial information too. It is only when auditors incorporate non-traditional data sources and data analytic techniques in their audit that there is a shift to Audit 3.0 (refer to Table 1). Audit 2.0 is the state of the audit profession in South Africa, and audit firms will need substantial investment in training their staff to address a lack of IT prowess (Stumke & Swart, 2020). Appelbaum (2016) explain that changes in management control processes are needed before there can be a change in the current audit approach to ensure that underlying data sources are reliable.

Table 1: Dai and Vasarhelyi (2016)'s generations of auditing

Audit 1.0	Audit 2.0	Audit 3.0	Audit 4.0
Manual audit Tolls pencils, calculators	IT audit tools, Excel, CAAT software	Inclusion of Big Data in audit analytics Tools, analytical apps	Semi and progressive automation of audit tools

ii. Big Data changes the design and operation of management control processes.

Big Data is considered a valuable asset for companies as it informs data-driven decision-making which is considered more effective (Byrnes et al., 2015). McAfee et al. (2012) support this view and argue that companies like Google and Amazon can attribute their prominence and growth to the effective use of Big Data. Appelbaum (2016) suggests that auditors, should be interested in how their clients are using Big Data and the related controls especially if used for accounting judgements that materially impact financial statements. Examples include fair value assessments for intangible assets and the determination of going concern assumption (Appelbaum,

2016). Byrnes et al. (2015) predict that audio, textual and video information will become more prominent than traditional financial information[3] has been.

iii. Big Data changes how information is viewed.

The purpose of audits has been to provide credibility to financial reporting at a time when very little information beyond financial statements were made available to investors (Lombardi et al., 2014). However, technology has since advanced to a point where information on companies is available on a near real-time basis to investors (Tuttle et al., 2015).

Table 2: Titera and Krahel (2015)'s information needs of investors

User type	Needs	Ideal Dataset	Frequency
Casual investor	Low	Key ratios; aggregated balances	Quarterly or annually
Experienced investor	Moderate	Full financial statements; abbreviated notes	Daily or weekly
Professional analyst/day trader	High	Deeper, near-transaction-level data; external data on broader market trends	Daily or Hourly

Many researchers are attributing the need to gain appropriate information to be critical. For example, Titera and Krahel (2015) argue that financial reporting and assurance standards should change to focus on data, instead of on financial statements. Wong et al. (2017) argue that if auditors are not able to fulfil the needs of investors that non-audit firms like Google can take undue advantage of the situation and enter the market for audit services. Consequently, investors need real-time assurance which will only be possible through a continuous audit approach (Appelbaum et al., 2015).

iv. Big Data changes the current audit approach.

The methods or techniques used to analyse Big Data are Big Data Analytics (BDA) and this may lead to a paramount shift if implemented in auditing (Gandomi & Haider, 2015). Alles and Gray (2016) identify the key differences between BDA and traditional

[3] Byrnes et al. (2015, p.397) consider traditional financial information as 'records of financial transactions, or of events expressed in monetary terms, made for the purposes of accounting'.

analytical procedures are that it will be able to make a more accurate prediction and incorporate rich data sources to identify potentially fraudulent transactions. Stewart et al. (2015) predict that BDA will probably signal the transition from audit sampling to complete population analysis. Wong et al. (2017) further indicate that auditors can seek to increase the scope of their service offering by expressing an opinion on the integrity of Big Data.

v. Big Data changes the quality of the auditor's judgement.

Lombardi et al. (2014) conducted a panel discussion in which participants agreed that technology and auditor judgement will be an essential part of the audit process. Rose, Rose, Sanderson, and Thibodeau (2017) experimented on 127 senior auditors to determine the impact of Big Data visualisations on auditor judgement. Their findings indicated that auditors who had viewed Big Data visualisations with patterns which contradicted management's assertions felt that there was increased risk and planned a greater audit effort. However, on the other hand, there is a limited understanding of how Big Data impacts auditor judgements, in particular, to addressing information processing biases and information overload which arise from Big Data (Lombardi et al., 2015).

2.2 Auditing standards

Alles (2015) explain that the ISAs neither prevent auditors nor encourage auditors to use Big Data. Moreover, Kend and Nguyen (2020) argue that standard setters have adopted a laissez-faire approach to regulation so as not to hinder technological advancement and that auditing standards do not necessarily need to change. This is supported by a study by Salijeni et al. (2018) which suggest that the standards have an adequate scope with which auditors can experiment. However, Salijeni et al. (2018) also argues that unless standard setters eliminate uncertainty around Big Data in audits, auditors will refrain from fully engaging with data analytics.

2.2.1 Commitment to ethical behaviour

ISA 200 requires auditors to comply with the IESBA code of conduct and all national conduct rules. In South Africa, the IRBA and SAICA establish the national conduct rules for auditors and both have adopted the IESBA code of conduct. South African auditors recognise the need to conform to the ethical requirements of the profession and commit to ethical behaviour (Mbanjwa, 2019).

IRBA (2021) have stated the following in respect of ethical behaviour in audits: “Auditors do not only require technical competence to perform a high-quality audit – they also require appropriate ethical and behavioural competence, and this is something that the IRBA has repeatedly highlighted in recent years.” ISA 200 requires auditors to comply with the following fundamentals of ethical behaviour (IAASB, 2018c: ISA 200). The main principles of concern are confidentiality, professional competence, and independence in relation to this study (refer to i to iii below).

i. Confidentiality

Sivarajah, Kamal, Irani, and Weerakkody (2017) assert that before Big Data can be accepted by society, the data security problems must be addressed by credible IT control systems. For Big Data to be considered a reliable source of information for an audit, clients must have controls in place (Vasarhelyi & Brown-Liburd, 2015). Auditors need to assess whether their clients’ controls over data is credible (Appelbaum, 2016). Auditors need also to implement policies and procedures to protect their client data (Alles & Gray, 2016).

ii. Professional competence

Salijeni et al. (2018) suggest that auditors involve data specialists to counteract a lack of professional expertise. Stumke and Swart (2020) assert that South African universities do not train auditors in fundamental IT skills. Given that Big Data stems from a complex IT environment, the findings from Stumke and Swart (2020) are quite troubling, as this lack of IT knowledge can inhibit the inclusion of Big Data in auditing (Alles & Gray, 2016; Maldonado et al., 2020). Janvrin and Weidenmier Watson (2017) suggest a possible solution for audit academics and identify several resources for incorporating Big Data into accounting education.

While university-level IT training is inadequate, audit firms are still responsible for ensuring that their staff are adequately trained (IAASB, 2018f: ISQC 1). Salijeni et al. (2018) assert that audit firms invest in auditor training but audit firms must ensure that their auditors possess the professional expertise necessary for the modern Big Data environment. Gupta and George (2016) support this view and argue that investments in Big Data initiatives alone are insufficient for audit firms and there is a need to create audit staff competencies that competing firms cannot match.

iii. Independence

The commercialisation of the audit profession contradicts the traditional view that auditors are acting in society's interest (Ernstberger, Koch, Schreiber, & Trompeter, 2020). The potential economic benefits (e.g. improved productivity and higher profitability) for companies which use Big Data may mean that auditors will have an opportunity to offer additional services to their clients (Salijeni et al., 2018). The provision of such services may represent a threat to auditor independence which is a pre-condition for effective auditor judgement and audit quality (Ernstberger et al., 2020; Trotman, Tan, & Ang, 2011). Auditors and audit firms need to recognise their possible ethical dilemma and implement safeguards to mitigate any threats to independence (Salijeni et al., 2018)

2.2.2 Risk-based audit approach

The ISAs adopt a risk-based audit approach which require auditors to identify risks of misstatements and to ensure that the risks have been addressed (Yudowati & Alamsyah, 2018). The aim of the planning phase is to determine the initial audit strategy and audit plan (IAASB, 2018d: ISA 300). The determination of an audit strategy and audit plan is a "continual and iterative process" (Kritzinger, 2015). Kritzinger (2015) identifies the following considerations under ISA 300 to set an overall audit strategy for an engagement:

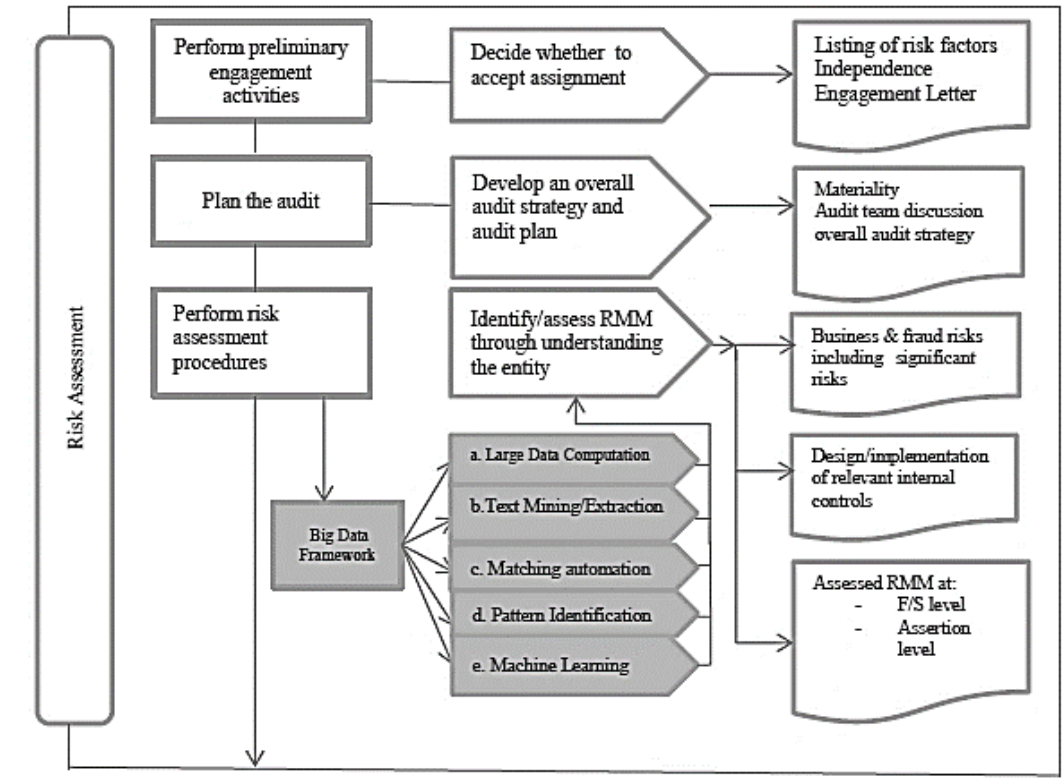
- Scope and reporting objectives
- Focus of the audit team's efforts
- Outcome of the pre-engagement activities
- Resources including involvement of specialists

Given the considerations identified, it is possible that auditors will decide whether to incorporate Big Data in their audit when setting the overall strategy for an audit. Salijeni (2019) support this view and assert that audit firms need to incentivise audit teams to use BDA and encourage its adoption. Salijeni (2019) suggest that auditors will consider enhanced risk assessment procedures to be a significant incentive to adopting BDA as part of their overall audit strategy.

An audit plan details the risk assessment procedures and further audit procedures to test transactions and balances at an assertion level (Kritzinger, 2015). Risk assessment procedures are designed to understand the client and the environment

in which it operates including its system of internal control (IAASB, 2019: ISA 315). Kritzinger (2015) explains that the nature, timing and extent of further audit procedures is based on the results of risk assessment procedures. Bengtsson and Zago (2019) focused on the fact that auditors consider BDA to be an important tool to assist to identify initial risks for an audit. This notion is supported by Rose et al. (2017) and Alawadhi (2015) who identify the benefits that data visualisation techniques have for setting the audit strategy and audit plan for auditors.

Figure 3: Yudowati and Alamsyah (2018) 's Big Data Framework



Yudowati and Alamsyah (2018) illustrate the application of Big Data to a risk-based audit approach in Figure 2 and place it firmly in the risk assessment i.e. planning stages of an audit. Yudowati and Alamsyah (2018) explain that the approach for sourcing Big Data should be like the process followed by auditors under ISA's except that there is more information which will enable auditors to identify more risks and gain a detailed understanding of their clients (Yudowati & Alamsyah, 2018).

2.2.3 Evidence collection and analytical procedures

The ISAs require that auditors must “obtain sufficient and appropriate audit evidence which forms the basis of their audit opinion” (IAASB, 2018a, p. 403: ISA 500 par. 4). In theory, there should always be sufficient audit evidence available to auditors, especially in a Big Data environment (Vasarhelyi & Brown-Liburd, 2015). However, the reality is that technology, resource constraints, and interactions with clients impact the nature and extent of information requested (Zhang et al., 2015).

Big Data can enhance the reliability of more traditional types of audit evidence like shipping documents by including, for instance, GPS data which is more difficult to alter (Zhang et al., 2015). On the other hand, not all Big Data may be reliable, for example, posts by some customers on social media sites can be biased and not be representative of the entire population (Zhang et al., 2015). As mentioned in section 1, determining the “veracity” i.e. the integrity of data will be problematic for auditors. Appelbaum (2016) argues that companies are responsible for the reliability of their data and proposes a conceptual framework to encourage Big Data provenance. The distinguishing feature of this framework is the use of digital signatures and should provide comfort to auditors that the Big Data is reliable (Appelbaum, 2016). As mentioned in section 1, BDA will enable auditors to test entire populations of structured data and use non-traditional unstructured data to develop more precise expectations for amounts in financial statements (Stewart et al., 2015). Stewart et al. (2015) identified that auditors will be able to use analytical procedures to identify and assess risks in each stage of the audit.

2.3 Theoretical framework

This study is grounded in legitimacy and modernity theory. This section comprises two parts. The first part introduces legitimacy and its dimensions. The second part explains institutional and modernity theory in the context of Big Data and auditing.

2.3.1 Legitimacy and its dimensions

There is extensive research on legitimacy in the field of auditing (Salijeni, 2019). Like Salijeni (2019) this study uses the definition of legitimacy as defined by Suchman (1995, p. 574), who defined it as "a generalised perception or assumption that the actions of an entity are desirable, proper or appropriate within some socially constructed systems of norms, values, beliefs and definitions."

This holistic view of legitimacy identifies the ability of organisations to gather cultural support in a social space which, in turn, ensures that the activities of the institution are understandable to the core audience (Salijeni, 2019; Suchman, 1995). In the context of auditing, Pentland (1993) argues that the systematic nature of audits provides cognitive comfort to stakeholders about financial statements.

Legitimacy can be strategic i.e. an economic resource or institutional i.e. a driver of conformity to avoid regulatory scrutiny (Suchman, 1995). In this context, Big Data is either an act by the audit profession to make more economic gains (strategic view) or a response to the increased use of data taking place in the business environment (institutional view) (Salijeni, 2019).

Suchman (1995) identified pragmatic, moral, and cognitive legitimacy as three distinct but related concepts of legitimacy. Pragmatic legitimacy comprises three ideas: the perceived value of the practice, the interests of stakeholders, and persuading others that they will benefit from the practice (Bengtsson & Zago, 2019; O'Dwyer, Owen, & Unerman, 2011). Moral legitimacy constitutes a normative view of the practice and that the action is right if it contributes to society. It can be assessed on criteria such as what it intends to accomplish, whether it is embraced as being socially acceptable and desirable, or whether it concerns the reputation of that organisation. Cognitive legitimacy suggest that a practice has value when it conforms to cultural norms (Bengtsson & Zago, 2019; O'Dwyer et al., 2011).

Suchman (1995) identified three means by which legitimacy can be increased. Firstly, to demonstrate how new technologies meet instrumental demands. Secondly, explaining how it will have a positive effect on stakeholders. Thirdly, is to enhance the reputation of the organisation's own previous legitimacy to make the new practice appear credible.

Salijeni (2019, p. 65) state that, "studies on legitimacy in auditing can be divided into two distinct but related streams." The first stream is those which investigate the audit profession and how it maintains its legitimacy through the promotion of ideas and programmes of auditing (Salijeni, 2019). Holm and Zaman (2012) explain how auditors sought legitimacy from regulators by introducing the concept of audit quality to address concerns of significant audit failures. The second is the studies which focus on audit technologies and how auditors need to secure legitimacy for technological advancements or how technologies may benefit auditors (Salijeni, 2019). Robson, Humphrey, Khalifa, and Jones (2007) explain how audit firms, through pragmatic legitimacy, were able to introduce business risk audits to stakeholders as a means of addressing both regulatory and business needs.

Overall, Salijeni (2019, p. 71) argues that, "the literature provides empirical support showing that the process of gaining legitimacy is precarious and requires a strategic approach." In this respect, the audit profession needs to be able to explain how to seek permission from stakeholders to incorporate Big Data in audit practices.

2.3.2 Institutional and modernity theory

Institutional theory attempts to understand the changes in social structure by considering how the practices become established as authoritative guidelines for socially acceptable and desirable behaviour (Scott, 2005). DiMaggio and Powell (1983) argue that the premise of institutional theory is that organisations must conform to authoritative guidelines to survive.

In auditing research, studies which have used institutional theory to interpret changes in technology consider such change to be institutional change (Robson et al., 2007; Salijeni, 2019). Institutional change represents in changes in both the audit profession and technology and how they effect changes in the audit practices. For example, Robson et al. (2007) applied institutional theory to discuss how the audit profession promoted the business risk audit to stakeholders and how this technology shaped the

identity of auditors. These studies demonstrate how technology has influenced institutional change and contributed to our collective understanding of how relationships between the various stakeholders of the audit profession (e.g., clients, regulators, and standard setters) shape, or are shaped by, the audit profession.

Giddens (1990) explain that people need to trust experts to understand and ensure that processes function. Experts like auditors and their specialists are important to supplement the technical knowledge of people when they are unable to understand all the factors which affect them in the world (Griffith, 2020). To ensure that they have not misplaced their trust, people monitor the effectiveness of experts (Reed, 2001). Moreover, Griffith (2020) demonstrated how, in response to changes in accounting standards, auditors used experts to provide confidence to stakeholders that an audit was effective.

With institutional theory, it is paramount that the audit profession conforms to authoritative guidelines such as those from the IRBA, the IAASB, IFAC and SAICA to survive. With the theory of modernity, it is imperative that the audit profession involve experts to maintain trust and confidence. In addition, the audit profession must actively engage in activities which are socially acceptable and desirable as developments in audit technologies like Big Data can be viewed as an attempt by the audit profession to maintain its legitimacy and trust (Salijeni, 2019). If there is a responsibility (perceived or real) to consider Big Data under current auditing standards, then audit firms must ensure that they adhere. However, if this is not the case, then before auditors can incorporate Big Data in their audits, they must convince the stakeholders that it is socially acceptable and desirable and that it will ensure that they are trusted.

3 Research Methodology

Section 3.1 explains the research paradigm and the approach adopted in this study. Section 3.2 identifies the population and sample size. Section 3.3 elaborates on the data collection process and the interview agenda set. Section 3.4 explains how the collected data i.e. interview transcripts were analysed. Section 3.5 discusses the validity of the study and the reliability of the data collection and interview process. Section 3.6 consider the ethics of the study.

3.1 Research approach

Saunders, Lewis, and Thornhill (2019) have emphasised the importance of identifying the research paradigm as it influences the research design and direction of reasoning. A qualitative research approach was selected to examine how individuals make sense of their worlds (Creswell & Creswell, 2017). Since this topic is a relatively new area of research, an exploratory design was used (Cribb, 2021). This research approach is appropriate given that this research aims to identify whether there is a responsibility for Big Data under current auditing standards with semi-structured interviews.

An abductive approach, which combines inductive and deductive processes, was utilised to allow data to be used both for the generation of new theory and the testing of existing theory (Alrajeh, Fearfull, & Monk, 2012; Saunders et al., 2019). The approach supports the identification of patterns and themes on a practical level, consistent (in method) with prior qualitative exploratory studies (e.g. Bengtsson & Zago, 2019; Kend & Nguyen, 2020; Maldonado et al., 2020; Salijeni et al., 2018).

Qualitative content analysis has been described as “a research method for subjective interpretation of text data through the systematic classification process of coding and identifying themes or patterns” (Hsieh & Shannon, 2005, p. 1278). This method for data analysis was selected to support the exploratory nature of this study given the absence of directly related prior research (Cohen, Manion, & Morrison, 2017; Cribb, 2021). This research does not aim at general findings but seeks to explore and develop insights through an in-depth iterative analysis of the data collected (Leedy & Ormrod, 2010).

3.2 Data sample

The participants in this study were regulators, audit academics, and external auditors (refer to Table 3). Participants were identified using purposive sampling based on their knowledge of information relevant to the interview questions (Rowley, 2012; Saunders et al., 2019). Purposive sampling ensured focus on the research questions and that data was collected from knowledgeable participants (Creswell & Creswell, 2017).

Table 3: Background of South African participants

Participant	Description	Experience	Stakeholder Group	Length
R1	External auditor	1-3 years	Big 4 Firm	22 minutes
R2	Audit academic	10-15 years	Academic	32 minutes
R3	External auditor	5-10 years	Big 4 Firm	17 minutes
R4	External auditor	5-10 years	Big 4 Firm	52 minutes
R5	External auditor	1-3 years	Big 4 Firm	52 minutes
R6	External auditor	10-15 years	Big 4 Firm	52 minutes
R7	External auditor	5-10 years	Big 4 Firm	50 minutes
R8	Audit academic	5-10 years	Academic	45 minutes
R9	External auditor	5-10 years	Mid-tier Firm	39 minutes
R10	External auditor	5-10 years	Mid-tier Firm	15 minutes
R11	External auditor	5-10 years	Big 4 Firm	29 minutes
R12	IRBA employee	5-10 years	Audit Regulator	52 minutes
R13	Audit academic	10-15 years	Academic	24 minutes
R14	External auditor	1-3 years	Mid-tier Firm	38 minutes
R15	External auditor	5-10 years	Mid-tier Firm	29 minutes
R16	External auditor	1-3 years	Big 4 Firm	18 minutes
R17	External auditor	5-10 years	Mid-tier Firm	18 minutes
R18	External auditor	1-3 years	Big 4 Firm	30 minutes
R19	SAICA employee	10-15 years	Professional Body	56 minutes
R20	IRBA employee	10-15 years	Audit Regulator	48 minutes

The description of 'External auditor' in Table 3 refers to trainees, managers and audit partners employed at one of the audit firms in South Africa. Creswell and Creswell (2017) emphasise the importance of selecting individuals who have experienced the phenomenon. Accordingly, it was essential to interview participants with different levels of experience and who met the following criteria:

- Participants had to be chartered accountants trained, or training, in South Africa,
- Participants had to be working, or have worked, in South Africa, for an audit firm, tertiary institution, audit regulator, or professional body, and
- Participants had to have experience in auditing or alternatively,
- Participants had to have experience in teaching auditing, in the case of academics at tertiary institutions.

Qualitative research which uses interviews for data collection and content analysis for data analysis tends to be characterised by relatively small sample sizes (Creswell & Creswell, 2017). For semi-structured interviews, a sample of 5–25 has been recommended (Creswell & Poth, 2016). The sample size for this study was 20 participants, comparable to previous studies of this nature.

Table 4: South African participants by stakeholder group and location

	Johannesburg	Cape Town	South Africa
Big 4 Audit Firm	6	3	9
Mid-tier Firm	3	2	5
Regulator and Professional Body	3	-	3
Academics	2	1	3
Total	14	6	20

Diversity among participants was essential to ensure the data's contextual validity and to avoid participation bias (Creswell & Creswell, 2017). The sample was drawn from the two major cities in South Africa, came from both Big Four and mid-tier firms, and included audit regulators, professional bodies, and academics. The sample demographics are important to help identify future areas of research (Cribb, 2021). The use of purposive sampling represents a limitation and delimitation of this study (discussed in detail in section 1.4).

3.3 Data collection process

Data was collected from the participants by remote video call interview. The interviews were semi-structured to ensure in-depth data while maintaining focus on the research questions (Rowley, 2012). The list of pre-written interview questions encouraged lateral thinking through non-leading, open-ended questions (Dumay & Qu, 2011). Open-ended questions allowed participants to provide detailed knowledge, insights, and opinions (Dumay & Qu, 2011; Turner III, 2010).

Before the interviews took place, the researcher contacted the selected participants before each meeting to ensure availability and provide any necessary clarification. Participants received information on the nature and purpose of the study and assurance of their confidentiality (Appendix A). All interviews were conducted over six weeks from 6 December 2020 to 18 January 2021. The researcher ensured confidentiality by excluding any identifying information from the data by employing strict data access control and assigning a pseudonym to each participant in the study.

The researcher adopted the interview agenda formulated by Salijeni (2019) to assist in drafting the interview questions in this study (refer to Table 5). All participants received the list of interview questions (refer to Appendix B) before their appointments to allow considered responses (O'Dwyer et al., 2011). While this approach can create rehearsed responses (Gill, Stewart, Treasure, & Chadwick, 2008), the questions relate to auditors' responsibilities, so such responses are appropriate. Semi-structured interviewing also allowed the researcher to probe the responses further and made it possible to collect sufficient reliable contextual data (Cohen et al., 2017; Cribb, 2021).

A pilot interview was conducted with two members of the interview group (one external auditor and one academic) to evaluate the drafted questions' quality and limitations. The pilot ensured that necessary changes were made to the interview questions before they were employed in the study (Rowley, 2012). The pilot interviews' outcomes were confirmed internally before proceeding to ensure that the interview agenda did not undermine the data collection process. For example, the researcher adapted question two of the interview agenda for audit academics, and employees of audit regulators and professional bodies to refer to an "audit organisation" instead of an "organisation".

Table 5: List of interview questions and rationale for inclusion

Interview questions	Rationale for inclusion
1. What is your understanding of Big Data?	The participants' understanding of Big Data may be different from that reflected in current literature so it provides useful context to their responses.
2. In what context is Big Data related to your organisation?	The participants need to demonstrate how Big Data may be related to their organisation and it provides useful context to their responses.
3. How is Big Data related to auditing?	The participants need to demonstrate how Big Data may be related to auditing and it provides useful context to their responses.
4. What is an auditor's responsibility for Big Data under current auditing standards?	The participants demonstrate whether they believe there to be a responsibility or not: this aims to obtain findings for the first research question identified.
4.1 If (4) indicates that there is responsibility then: how should an auditor ensure that they meet their responsibility under current auditing standards?	The participants demonstrate how an auditor should fulfil their responsibilities under current auditing standards. It aims to answer the second research question.
4.2 If (4) indicates that there is no responsibility then: under what circumstances will an auditor have a responsibility under current auditing standards?	Further clarification on question 4 to identify under what circumstances there may be a responsibility to consider Big Data in auditing. It seeks to answer the third research question.

3.4 Data analysis

After the interview process, the researcher transcribed the recordings using the transcription protocol recommended by McLellan, MacQueen, and Neidig (2003). Then a qualitative content analysis was implemented. Erlingsson and Brysiewicz (2017) have identified a five-step process for interview data analysis:

- Reading the transcripts;
- Dividing the transcripts into meaningful groups;
- Condensing the transcripts;
- Labelling or coding the data; and
- Grouping the codes to identify themes.

The aim of the reading step is for the researcher to be familiar with the data (Cribb, 2021). Familiarity with the data is an integral part analysis (Braun & Clarke, 2006). The researcher ensured this familiarity by repeatedly listening to the audio recordings and re-reading the transcripts throughout the transcription and coding processes.

Dividing the data allows researchers to adopt a pragmatic data analysis approach (Cribb, 2021; Rowley, 2012). The participants' responses were divided by each interview question (refer to Table 5). Creswell and Poth (2016) support this phase, explaining that it should be considered a form of initial coding during which a researcher identifies the major categories of information.

The purpose of condensing the data (i.e. eliminating unnecessary wording) is to assist the researcher's focus on the participants' key messages (Cribb, 2021).The researcher edited verbatim transcripts to intelligent verbatim transcripts to eliminate expressions such as "um", repetitive words, and inarticulate phrases. McLellan et al. (2003) 's transcription protocol support keeping relevant data foremost.

The transcripts were systematically coded using ATLAS.TI. Friese (2019) supports the use of ATLAS.TI for content analysis in qualitative exploratory studies. The use of coding software enhances the reliability of data analysis (Saldaña, 2015).

After coding all the transcripts, the researcher grouped the codes to identify themes in the interview data. The researcher minimised the risk of incorrect analysis by having the themes reviewed internally by the research supervisor (Leedy & Ormrod, 2010).

3.5 Validity and reliability

External validity was not the primary concern of this study seeks as its focus is to identify areas for future research (Creswell & Creswell, 2017). The researcher conducted interviews until data saturation was reached and interviewed a diverse sample of participants to maximise external validity (O'Dwyer et al., 2011). The researcher reached data saturation after 15 interviews and this was confirmed by the subsequent five interviews. Internal validity was addressed by subjecting the interview agenda to peer-review and pilot testing (Leedy & Ormrod, 2010).

Interview data

The researcher ensured data reliability by examining the interview transcripts in detail to verify their accuracy. Otter.ai transcription software was used to machine generate an initial transcription. Using this software freed time to review the transcripts in detail and to avoid erroneous transcriptions of responses (Creswell & Creswell, 2017). The transcription proceeded through three iterations, each subject to review: a machine-generated transcript, a draft transcript, and a final transcript.

All the interviews transcripts were subject to 'member-checking' to enhance the quality of the research (Saunders et al., 2019). Member-checking allowed participants to check for accuracy and to clarification of their responses if necessary (Birt, Scott, Cavers, Campbell, & Walter, 2016).

Interview process

The reliability of data gathered through semi-structured interviews can be affected by participation bias, interviewer bias and participant bias (Saunders et al., 2019). Participation bias arises from the nature of people who agree to be interviewed (Saunders et al., 2019). In this study, participation bias was mitigated by ensuring diversity in the participant geography and organisation (refer to Table 4).

Interviewer bias occurs when the interviewer's tone or non-verbal behaviour biases how the participant responds to the questions (Saunders et al., 2019). Interview bias was mitigated by employing a pilot-tested interview agenda with open-ended questions. The researcher adopted an un-biased approach and reacted neutrally to the answers given by participants. Non-verbal behaviour was minimised by disabling the researchers video camera and muting audio when participants responded.

Participant bias or response bias can be caused by how participants view the interviewer and whether they trust the interviewer with their responses (Saunders et al., 2019). The following actions were taken by the researcher to mitigate participation bias and to ensure the credibility of the study:

- Participants were contacted using an official university e-mail account, including information about the research supervisor;
- Participants were provided with an information sheet with an official university letterhead, including contact details for the researcher and supervisor;
- The interviews were opened appropriately by thanking the participant for taking part in this study and re-affirming their confidentiality;
- During the interview, active listening principles were exercised when asking further exploratory questions to establish trust and mitigate response bias.

The researcher's perceived credibility can contribute to participant bias and must be considered a possible influence on the data collected (Creswell & Creswell, 2017; Saunders et al., 2019). An inherent characteristic of interview-based research is that the researcher is an instrument for data collection (Wa-Mbaleka, 2019). It is vital to understand the researcher's background to be able to replicate the research in the future. The researcher is a qualified chartered accountant with audit experience; knowing this provided participants with an assurance of research credibility.

3.6 Ethical considerations

Ethical issues are to be expected in research with human subjects (Saunders et al., 2019). For the avoidance of doubt, this statement assures the reader that due care was taken to maintain ethical conduct throughout this research. This study's findings were in no way falsified, fabricated, nor suppressed to achieve a specific outcome. The analysis and interpretation of the collected data was consistent with accepted qualitative research procedures.

From the outset, all participants were informed that this research was for academic purposes only. The interview agenda was subject to a pilot test. The University's Ethics Committee approved ethical clearance before commencement of any interviews (refer to Appendix D & Appendix E). Participants permitted their interviews to be recorded by signing participation consent forms. The researcher handled the data responsibly by using reputable software (refer to Appendix F).

4 Research findings and discussion

This section discusses the findings from interviews and is set out as follows. Section 4.1 presents the views of participants on whether there is a responsibility under current auditing standards. Section 4.2 discusses how auditors should ensure that they meet their implied responsibility under current auditing standards. Section 4.3 identifies the circumstances under which an auditor may be responsible for using Big Data in an audit.

4.1 Auditor responsibility under current auditing standards

Do auditors have a responsibility under current auditing standards to incorporate Big Data in the audit of financial statements?

In this study, 50% of participants identified Big Data as large structured financial datasets which traditional audit tools (e.g. Excel) cannot process. Alles and Gray (2016) and Dai and Vasarhelyi (2016) identify the shift from traditional audit tools (e.g. Excel) to non-traditional audit tools as a precursor of the next generation of auditing: Audit 3.0. Power BI[4] and internal data analytic tools are examples of non-traditional audit tools used to analyse large data sets for journal entries testing (R1, R3, R5, R6, R7, R14).

> We always get the journal entries done from the client, which may be an instance of Big Data, and we always use that to test our journal entries. We go through it and look at it and say, 'okay, what are the funny journal entries that stick out which we need to look at and from there, we do the testing.' (R7, External Auditor)

More than 70% of participants felt that external auditors do not need to consider whether to incorporate non-traditional data in their audit. They argued that an auditor's focus is on the financial statements and that it is probable that non-traditional data is not relevant (R2, R9, R12, R20). However, 84% of participants agreed that when non-traditional data supported the financial statements auditors need to involve a specialist to supplement their professional expertise.

Participants unanimously agreed that there is an implied responsibility to incorporate Big Data in an audit but not an expressed responsibility under current auditing

[4] Power BI is a business analytics service by Microsoft: refer to powerbi.microsoft.com.

standards (refer to Figure 4). Participants mainly attributed this to the fact that auditing standards have not kept pace with the developments of audit technologies (R6, R8, R15, R17, R19). All participants agreed that there is a responsibility to professional competence and due care to develop skills about Big Data and consider its impact on audit risk assessments:

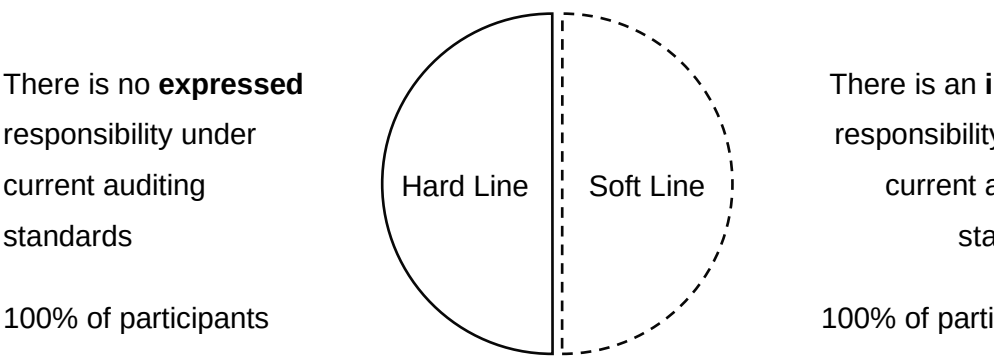
> I think the biggest thing for auditors to do currently is to upskill themselves and to learn more about Big Data… to understand how it impacts us and understand who the stakeholders are who are impacted by this Big Data and who is affected if something goes wrong. [R6, External Auditor]

Even with the advent of Big Data, the auditors' responsibilities under current auditing standards remain largely unaltered (R2, R3, R5, R6, R8, R19, R20). Auditors can perform an audit without incorporating Big Data in their approach but regulators may challenge this approach if it is not supported by adequate documentation (R8, R20).

Ninety per cent of participants felt that Big Data was a client-driven phenomenon. This is unsurprising given that Big Data is considered a driver of business profits (McAfee et al., 2012). Shareholders may expect auditors to understand how data is used in the business and expect them to ensure that it is used responsibly and ethically (R3, R14).

> We are here as an emissary of the shareholders. We want to ensure that the business is operating and not losing money. In some way that it is a good corporate citizen. (R14, External Auditor)

Figure 4: Participants' views on an auditor's responsibility for Big Data



In summary, the interview evidence suggests that there is a responsibility to incorporate Big Data in an audit, even if that responsibility is not in the form of an

expressed statement. Giddens (1990) and Suchman (1995) theorised that external auditors seek to legitimise their existence by purporting to society that they have expert knowledge to conduct audits effectively. The identification of an implied responsibility can be how individuals involved in auditing (e.g., external auditors, audit academics, professional bodies and audit regulators) seek to create the impression that external auditors still have the necessary expertise to conduct audits effectively.

4.2 Compliance with the requirements of current auditing standards

How should auditors consider Big Data in the audit of financial statements to ensure compliance with the requirements of current auditing standards?

Participants support the notion that auditing standards do not need to change (R2, R3, R6, R19, R20). R2, an audit academic, argues that an introduction of new technologies like Big Data has not changed the fundamentals of auditing, aside from the fact that there is a risk which requires a response which incorporates digitisation and automation. R3, an external auditor, also supports this view, “The words we use are different, the processes undertaken is slightly different, but it is the same audit responsibilities as they always were (R3).”

Auditors are reluctant to incorporate Big Data in an audit unless it is an expressed requirement in the standards (R4, R8, R9, R12, R17). R8 explains that external auditors probably want to avoid litigation risks from archiving Big Data on their audit file. Alles and Gray (2016) identify the litigation risk as one of the inhibitors preventing auditors from incorporating Big Data in their audit. External auditors are reluctant to use BDA because they are concerned that it may not survive an audit’s regulatory scrutiny even though it may be a source of quality evidence (R4, R12, R17, R19). R19, an employee of a professional body, explains that it is important for audit firms to have regulatory buy-in before adopting new audit technologies to avoid relaying the wrong message about audit quality in the market.

The conventional content analysis and abductive approach adopted in this study facilitate the identification of some of the most likely or “implied” responsibilities under current auditing standards. The responsibilities identified in this study are detailed in Table 6 below and have been reviewed as a component of the research findings and cross-referenced to current auditing standards’ requirements.

Table 6: Summary of the key implied responsibilities identified by participants

Implied responsibilities	Requirements of the current auditing standards	Applicable ISA
Gain digital acumen to commit to the ethical requirements of an audit	"The auditor shall comply with relevant ethical requirements, including those pertaining to independence, relating to financial statement audit engagements." (IAASB, 2018c, p. 83: ISA 200 par. 14) "The firm shall establish policies and procedures designed to provide it with reasonable assurance that the firm and its personnel comply with relevant ethical requirements." (IAASB, 2018f, p. 48: ISQC 1 par. 20)	ISA 200 ISQC 1 IRBA and SAICA CPC's
Use data analytics on Big Data to identify risks of error and fraud in an audit	"The auditor shall identify the risks of material misstatement and determine whether they exist at: (a) the financial statement level; or (b) the assertion level for classes of transactions, account balances and disclosures." (IAASB, 2019, p. 15: ISA 315 par. 28) "In accordance with ISA 315 (Revised 2019), the auditor shall identify and assess the risks of material misstatement due to fraud at the financial statement level and at the assertion level for classes of transactions, account balances and disclosures." (IAASB, 2018b, p. 132: ISA 240 par. 25)	ISA 315 ISA 240

Implied responsibilities	Requirements of the current auditing standards	Applicable ISA
Verify that the Big Data is reliable for the audit of financial statements	"When designing and performing audit procedures, the auditor shall consider the relevance and reliability of the information to be used as audit evidence." (IAASB, 2018a, p. 404: ISA 500 par. 7) "The auditor shall evaluate whether the auditor's expert has the necessary competence, capabilities and objectivity for the auditor's purposes. In the case of an auditor's external expert, the evaluation of objectivity shall include inquiry regarding interests and relationships that may create a threat to that expert's objectivity." (IAASB, 2018g, p. 686: ISA 620 par. 9) "The auditor shall obtain a sufficient understanding of the field of expertise of the auditor's expert to enable the auditor to: (a) Determine the nature, scope and objectives of that expert's work for the auditor's purposes; and b) Evaluate the adequacy of that work for the auditor's purposes." (IAASB, 2018g, p. 686: ISA 620 par. 10)	ISA 500 ISA 620

4.2.1 Gain digital acumen to commit to the ethical requirements of an audit

In this study, 80% of participants identified the need for further training to maintain their professional competence under the code of conduct requirements. External auditors need to learn more about their legal obligations for data security and how to enhance their digital acumen to identify risks in their audits (R1, R5, R8, R9, R11, R19, R20). R19, an employee of a professional body, asserts that there may be a requirement under the revised CPD policies to understand advanced technologies if their use is an essential part of day-to-day activities. If an auditor has improperly accepted an audit that they cannot perform competently it may lead to regulatory sanctions and poor audit quality (R12, R19, R20).

> There is no excuse for doing an audit that you cannot competently perform. If we perform a review and find that the auditor is not competent to perform that audit, then the consequences could be even worse for the auditor [than the costs associated with not accepting the engagement]. (R20, Audit Regulator)

Moreover, 75% of participants emphasise that there is a professional responsibility to protect client data and ensure that it remains confidential. The importance of protecting data is, in part, attributed to legislative changes regarding the protection of data, such as the POPI Act (R1, R6, R7). Auditors must also recognise that, although this may not be stated explicitly in the current auditing standards, there is an expectation that they comply with the regulations to protect client data:

> If we lose information from the client or the wrong people access that information, then that is on us. We cannot say that the auditing standards did not tell us what to do because we know what the other laws and regulations are saying about the protection of personal information. (R6, External Auditor)

The responsibility of protecting client data also extends beyond the completion of an audit. As one external auditor notes, “we have to ensure that the data used after the audit is purged i.e. that you have to delete all the information that you have received from the client after the audit retention period (R7).” External auditors can ensure that data is confidential by limiting access to the data and handling this with care internally (R5, R6). An auditor’s commitment to keeping client data confidential may mean that they are reluctant to request data that is not relevant for their audit (R1, R3, R5). This

finding supports Alles and Gray (2016) who identify the potential risk of auditors collecting more data than they need and their need to ensure that there are no breaches of confidentiality or privacy.

Nearly 90% of respondents state that audit firms are responsible for emphasising the importance of training and the need for auditors to become more data-savvy. ISQC 1 details the responsibilities of audit firms for quality management and providing training to personnel on relevant ethical requirements (IAASB, 2018f: ISQC 1). Moreover, ISQC 1 recognise that audit firms need to provide external auditors with additional training on how to use IT applications appropriately or recognise that specialised skills are needed (IAASB, 2018f: ISQC 1). Audit firms are responding to new audit technologies with internal training and involve data science specialists to supplement knowledge and skills in the firm (R1, R5, R6, R11, R14). However, audit firms have not yet mandated that audit teams use data analytics tools possibly because of cost implications and the need to have client consent (R8, R11).

> I would think it [data analytics tools] will come to a stage where it is compulsory to say this amount of your budget is spent on our new digitalization tools. However, it has not been mandated yet and when things are not mandated, we tend to just carry on doing what we have always been doing. (R11, External Auditor)

ISA 200 refers auditors to the IESBA Code of Ethics for Professional Accountants when outlining the relevant ethical requirements relating to financial statement audits (IAASB, 2018c :ISA 200). In South Africa, the IRBA has stated that auditors need to demonstrate their ethical competence to be able to perform a high-quality audit (IRBA, 2021). Salijeni et al. (2018) and Kend and Nguyen (2020) suggest that there should be research into how auditors' expertise has been altered in Big Data environments. In this study, participants recognise that external auditors need to be able to analyse client data with data analytics and ensure that client data is protected and kept confidential (R1, R6).

4.2.2 Use data analytics to identify risks of error and fraud in an audit

In this study, 95% of participants feel that data is an integral part of an audit and that it must be considered in developing the audit approach. In this respect, one external auditor says, "I think the importance of data has grown so much to the point where I would say you cannot do an audit without it (R3)." Of the participants, 85% considered

it important to include data analytics as a risk assessment procedure in an audit, while 64% of participants feel that using data analytics may lead to an element of unpredictability in the audit approach needed as an overall response to fraud risk.

Yudowati and Alamsyah (2018) suggest that new audit technologies will probably form part of an auditor's risk assessment procedures in their Big Data framework (refer to Figure 2). Participants in this study agree that data and data analytics are important for identifying risks (R2, R4, R7, R8, R9, R12, R17). The IAASB revised ISA 315 to include reference to automated analytical procedures referred to as data analytics to encourage auditors to use them to identify risks (IAASB, 2019: ISA 315). Due to the increased volume of data, it has become necessary to use data analytics to identify risks (R8, R17).

> Previously it might have been easy to identify where your risks might be with a planning analytic, but now it is not because the data is excessive, and we cannot just use one Excel spreadsheet. (R17, External Auditor)

Alles and Gray (2016) and Gepp et al. (2018) suggested that auditors can use BDA to detect fraud in financial statements. A further study by Salijeni et al. (2018) identified that journal testing was the most common area in which auditors use data analytics. Salijeni et al. (2018) suggested that auditors should use data analytics to address regulator concerns that journals testing is inadequate to ensure compliance with ISA 240. In this study, 45% of participants have discussed how they have used data analytics to test entire populations of journal entries. Of the participants, 60% feel that using data analytics can lead to an element of unpredictability in their audit approach. ISA 240 requires auditors to incorporate an element of unpredictability in their audit approach as an overall response to fraud risk (IAASB, 2018b: ISA 240).

> We are trying to identify fraud in unpredictable ways at the client, by looking at the information i.e. who has produced the journal entries, when they have produced the journal entries, did they have permission to produce the journal, why they have processed the journals and are these journals unexpected. (R7, External Auditor)

Auditors need to recognise the need to use data analytics to identify possible misstatements due to fraud or error in financial statements (Appelbaum, Kogan, & Vasarhelyi, 2017). Although data analytics can assist auditors with detecting fraud risk factors, the assessment of fraud risk requires professional judgement with in-

depth knowledge of the audit client (Lombardi et al., 2014; Wong et al., 2017). Of the participants, 60% supported the notion that auditors need to exercise professional judgement when interpreting the results of data analytics for risk assessment.

Gepp et al. (2018) identified that leading audit firms had started to incorporate Big Data into their audit approach. A further study by Kend and Nguyen (2020) stated that audit firms were establishing the use of data analytics to innovate their audit approach. Kend and Nguyen (2020) recommended that audit plans consider the impact of advanced technologies (e.g. automation and machine-learning) which will potentially involve more controls testing. Salijeni et al. (2018) pointed out that the term "data scientist" is gaining prominence and auditors need to involve specialists to supplement their expertise because of their limited knowledge of data processing and analysis. Additionally, Salijeni et al. (2018) noted that audit technologies should enable auditors to test full populations instead of relying on audit sampling. Alles and Gray (2016) suggested that auditors will be reluctant not to rely on sampling as it exposes them to litigation risk.

4.2.3 Verify that the Big Data is reliable for the audit of financial statements

In this study, 90% of the participants feel that an auditor is responsible for ensuring that data is reliable if it supports the audit opinion. Audit evidence is appropriate when it is relevant and provides reliable support for the audit opinion (IAASB, 2018a: ISA 500). Of the participants, 85% feel that auditors should ensure that data is reliable by verifying that all is complete and accurate. The accuracy of data relates to whether the information has been accurately captured and calculated correctly on an individual line-item basis (R1, R17). Auditors can verify that data is complete if it agrees to the accounting records (R1, R5, R14, R15, R17).

> Our first indicator of completeness issues if this population that we have received from the client does not agree to the trial balance (R5, External Auditor)

Except for two-thirds of the audit academics, none of the participants identified unstructured data sets when explaining their understanding of Big Data (refer to Table 5 for the list of interview questions). This finding may be attributed to the fact that it will be difficult for auditors to verify that Big Data is relevant and reliable (Appelbaum, 2016). Zhang et al. (2015) suggest that auditors are less familiar with the variety of Big Data sources and the sophisticated techniques and professional judgement

needed to analyse the data. Of the participants, 70% feel that data is only useful when analysed and 65% feel that data analysis is judgemental. Lombardi et al. (2015) argued that analysing Big Data will be difficult for auditors as doing so may lead to an information overload. Salijeni et al. (2018) suggested that as a possible solution, auditors can supplement their knowledge by involving specialists in their audits.

In this study, 85% of participants feel that it is important to involve a specialist in an audit. The involvement of IT experts is required when the client IT environment is complex to ensure the integrity of client data and IT systems (R3, R7, R8, R15). Moreover, when the client environment demands an IT audit, it will be difficult to justify an audit approach which does not include the use of a specialist (R7, R12, R15, R20).

ISA 620 defines an auditor's responsibility for specialists "in a field of expertise other than accounting or auditing" when that specialist's work supports the audit opinion (IAASB, 2018g, p. 684: ISA 620 par. 1). In addition, ISA 620 requires that auditors evaluate their specialists and understand their specialists' work (IAASB, 2018g: ISA 620). When evaluating specialists' work, auditors must understand how it has met the audit's objective (R4, R6, R7, R13, R18, R19). Auditors must consider the specialists' qualification and credentials in evaluating specialists' competence and capabilities (R7, R12, R15, R18, R19). However, 50% of all the participants in this study feel that auditors do not necessarily have the expertise to evaluate their specialists' competence.

> I may not know the method or the methodology [of the specialist] because I might not have had schooling in that area, but you need to at least understand enough to be able to look at their report to understand it and so that you can bring it back to an audit perspective. (R15, External Auditor)

A recent study by Griffith (2020) suggested that auditors should use specialists to provide comfort about matters in which they do not have sufficient expertise. Moreover, Griffith (2020) suggest that auditors have no option but to accept the work of their specialists as correct, given limited professional expertise. This approach is not ideal being that an auditor is ultimately responsible for the audit opinion even if they used specialists in their audit (R7, R12, R13, R15, R19).

4.3 Circumstances under which there is a responsibility to audit Big Data

Under what circumstances will there be a responsibility under current auditing standards to incorporate Big Data in the audit of financial statements?

In section 4.1, it is noted that all participants in this study did not consider there to be an expressed responsibility to incorporate Big Data when auditing financial statements. This can be because 90% of participants feel that Big Data is a client-driven phenomenon and that the use of Big Data depends on the client-specific circumstances.

> There is no point in doing excessive amounts of analytics, or research or data manipulation if the clients relatively do everything themselves... If a company is not very data-driven, they might not care about [data analytics] (R7, External Auditor).

In this study, 90% of participants feel that there is a responsibility to have a thorough understanding of the client. ISA 315 requires auditors have a robust understanding of their client for effective risk assessment (IAASB, 2019: ISA 315). ISA 220 and ISQC 1 requires that auditors have an understanding of their client before they accept the engagement (IAASB, 2018e: ISA 220; 2018f: ISQC 1). Before accepting an audit, auditors need to consider their own competence and capabilities, the availability of IT specialists' resources, terms of the audit, and the adequacy of the audit fee (R8, R9, R12, R19, R20).

It is important for clients to consent to auditors' use of data analytics because of potential cost implications for them in the audit fee (R11, R14). As one external auditor notes, "If they can get it as part of their audit fee, then they will definitely be open and interested in it. It is when you try and bring in an extra cost element that they start becoming apprehensive (R11)." Of the participants, 45% agree that auditors need to consider whether incorporating Big Data in their audit approach adds value to the audit through audit efficiencies or better insight into audit findings.

McAfee et al. (2012) suggested that companies that use Big Data effectively can achieve more significant commercial benefits than their peers. There may be an expectation that clients will want access to auditor's technologies to realise the benefits associated with data-driven analytics (Salijeni et al., 2018). Audit firms can seek to provide additional non-audit services to their clients, but it is important to

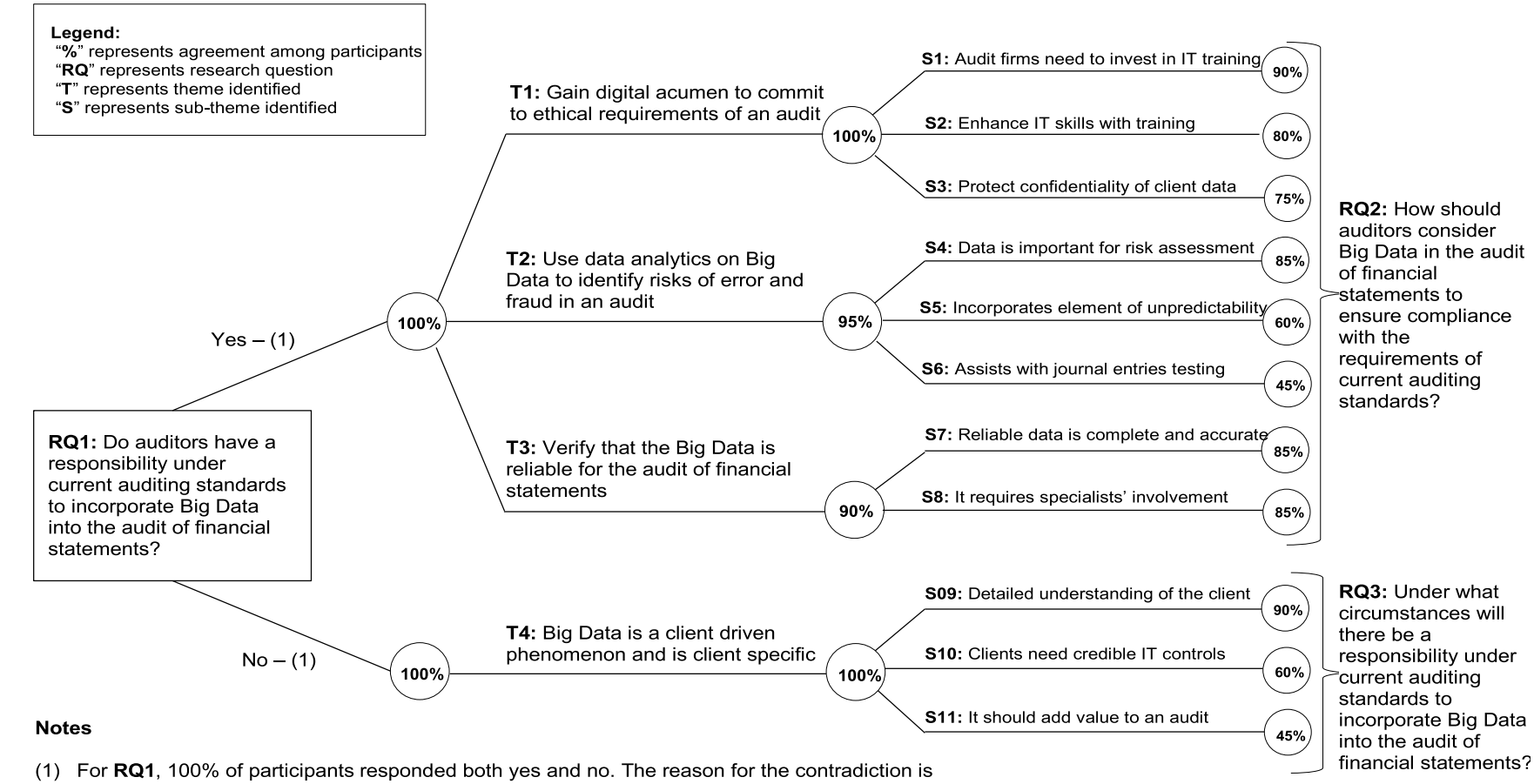
manage client expectations and consider strict independence requirements (R6, R7, R8). As one external auditor explains, “It might be valuable for you to produce a report based on the information and the client might like it but you must always be aware of where the independence lines are drawn (R7).”

In this study, 60% of participants feel that Big Data is related to their client control and IT processes. While the use of IT auditors can provide comfort to auditors, there is still a need to challenge management’s assertion that the data is reliable and to exercise professional scepticism and professional judgement (R5, R8, R12, R14, R15, R19). One participant emphasised the fallibility of such systems:

> You might have credible systems and credible models that are in place but at the end of the day, the corporate failures that we are seeing are not taking place at companies that do not have systems in place, but they are taking place at companies with the "Rolls Royce" systems. (R19, Professional Body)

In summary, the incorporation of Big Data depends on an auditor’s understanding of client circumstances. It is essential for auditors to demonstrate how they have considered their client’s specific circumstances in deciding whether to incorporate Big Data in their audit approach. It is important for auditors to have a detailed understanding of their client in order to achieve a quality audit (IRBA, 2021).

Figure 5: Summary of responses of all 20 participants



Notes

(1) For **RQ1**, 100% of participants responded both yes and no. The reason for the contradiction is that participants agreed that there is an implied responsibility to incorporate Big Data in an audit, but not an expressed responsibility, under current auditing standards.

5 Conclusion

This final section is organised as follows. Section 5.1 provides recommendations for several stakeholders who will possibly find this study relevant. Section 5.2 outlines areas for future research. Section 5.3 discusses the study's key findings concluding remarks.

5.1 Recommendations for stakeholders

Regulators must continue to encourage further developments in auditing. One such area can focus on further guidance on auditor's responsibility for non-traditional sources of information (refer to Figure 1) and for clearly communicating regulator expectations concerning non-traditional analytical tools. The IT guidance developed from the IRBA's collaboration with IFIAR will greatly influence the future of audits (IRBA, 2021).

External auditors must develop digital acumen, not only to increase effectiveness and efficiency but also to prevent compromising client data. Audit firms must also support external auditors and foster an environment which encourages ongoing learning.

Professional bodies must enforce their CPD policies and challenge their members to acquire the advanced IT skills which the Fourth Industrial Revolution requires. SAICA deserves to be commended for its CA 2025 initiative, a demonstration of its ambition and potential. A successful implementation will raise the bar for auditors not only in South Africa but also around the world.

Audit academics must expand the minds of future auditors by introducing their students to Audit 4.0 concepts — no simple feat, given the significant inequalities in IT literacy in South Africa (Stumke & Swart, 2020). It will require an innovative approach which includes academics engaging actively with the wider profession. Audit education remains the driving force for change in the profession.

5.2 Recommendations for future research

Future research can detail the adoption of training to enhance digital acumen. In addition, researchers may investigate the existence of an expectation gap, among auditors and stakeholders, concerning Big Data. Significant trust is placed in the work of 'data specialists', and researchers can analyse how external auditors evaluate and perceive them. In an initial study, the list of their responsibilities will not be exhaustive;

further research can certainly expand such a list. Finally, this study is not without limitations, and each offers an opportunity for further research (see Section 1.4).

5.3 Concluding remarks

This study set out to explore the latest development in audit technology, the adoption of Big Data in South Africa. It addresses three themes: whether there is a responsibility to incorporate Big Data when auditing financial statements under current auditing standards; if so, in what ways should Big Data be incorporated to evidence compliance with these standards and if not, under what circumstances such a responsibility may exist.

In this study, all the participants agreed on an implied responsibility to meet the ethical requirements of an audit by enhancing their digital acumen. Ninety per cent of the participants suggested that risk-assessment procedures should include data analytics and that auditors should verify the reliability of client data. The same percentage of respondents felt that the inclusion of Big Data in an audit depends on the client's specific circumstances.

This study supports Lombardi et al. (2014) who state that "the auditing field is at a critical junction". The data revolution means that in its current form, the auditing profession may become an anachronism within the next decade (Dai & Vasarhelyi, 2016; Frey & Osborne, 2017). The COVID-19 pandemic has fast-tracked the digitisation of the South African economy (IRBA, 2021) and with it the expected disruption of the Fourth Industrial Revolution. The audit profession faces a categorical imperative for survival, namely, to learn more about Big Data and other technologies. As a member of the World Economic Forum put the matter[5], "Every Industrial Revolution brings along a learning revolution."

[5] A statement by Alexander De Croo, Prime Minister of Belgium and a member of the World Economic Forum.

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Appendix A: Information sheet

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

University of the Witwatersrand,
School of Accountancy
1 Jorissen Street
011 717 6138

1 December 2020

Good day

Re: Participant Information **SOA-2020-11-32**

I am studying for a Master of Commerce in Accountancy in the School of Accountancy at the University of the Witwatersrand.

As part of my studies, I must undertake a research project, and I am conducting a research project titled: "An exploratory study in South Africa: Big Data and auditing" under the supervision of Samantha Gomez.

As part of this research project, I would like to invite you to take part in an interview. This activity will involve answering a set of interview questions and will take around 30 to 60 minutes. With your permission, I would also like to record the interview using a digital device.

There will be no personal costs to you if you participate in this project. You will not receive any direct benefits from participation and there are no disadvantages or penalties if you do not choose to participate or if you withdraw from the study. You may withdraw at any time or not answer any question. If you experience any distress or discomfort at any point, we will stop the interview or resume another time.

The interview will be completely confidential and anonymous as I will not be asking for your name or any identifying information, and the information you give to me will be held securely and not disclosed to anyone else. I will be using a pseudonym (false name) to represent your participation in my final research report.

If you have any questions during or afterwards about this research, feel free to contact me on the details listed below. This study will be written up as a research report which will be available online through the university library website. If you wish to receive a summary of this report, I will be happy to send it to you.

The data collected from this research project will be stored in the university depository and will be kept for seven years. With your permission the data collected from this research project may be used by other researchers subject to their own ethics clearance being obtained.

If you have any concerns or complaints regarding the ethical procedures of this study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), 011 717 1408, email hrec-medical.researchoffice@wits.ac.za

Yours sincerely,

Dimitri Petermann
07842 668223
1302500@students.wits.ac.za

Samantha Gomez
011 717 8228
samantha.gomez@wits.ac.za

Appendix B: Interview agenda

INTERVIEW AGENDA

1. What is your understanding of Big Data?

2. In what context is Big Data related to your organisation?

3. How is Big Data related to auditing?

4. What is an auditor's responsibility for Big Data under current auditing standards?

4.1 If (4) indicate that there is responsibility then: how should an auditor ensure that they meet their responsibility under current auditing standards?

4.2 If (4) indicate that there is not a responsibility then: under what circumstances will an auditor have a responsibility under current auditing standards?

Appendix C: Participation consent form

PARTICIPATION CONSENT FORM

I, ..., agree to participate in the research project titled "An exploratory study in South Africa: Big Data and auditing" with ethics clearance number SOA-2020-11-32. I understand that the research report is undertaken as part of the fulfilment of the requirements of the researcher's Master of Commerce degree at the University of the Witwatersrand. The research has been explained to me and I understand what my participation will involve.

I agree to the following:

(Please circle the relevant options below).

I agree that my participation will remain anonymous

YES NO

I agree that the researcher may use anonymous quotes in his research report on an anonymous basis

YES NO

I agree that the interview may be audio recorded provided the recording is stored securely and not distributed for any purpose other than for the fulfilment of the research explained above.

YES NO

I agree that the information I provide may be used anonymously after this project has ended, for academic purposes by other researchers, subject to their own ethics clearance being obtained and in accordance with above regarding anonymity

YES NO

I can decide at any time during the interview that I no longer wish to participate in this project and can withdraw from it immediately without giving any reason. I understand that I will be able to withdraw my data up to the point of submission of my responses.

YES NO

I understand that the information I have submitted will be published in a thesis and an academic journal and that I can request a copy of the final article.

YES NO

I understand that my personal information will not be collected.

YES NO

..... (signature)

..... (name of participant)

..... (date)

..... (signature)

..... (Dimitri Petermann / Student No.1302500)

..... (date)

Appendix D: Approval of title

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Private Bag 3 Wits, 2050
Fax:
Tel:

Reference: Mr Tshepo Mohlakoane
E-mail: Tshepo Mohlakoane@wits.ac.za

01 March 2021
Person No: 1302500
PAG

Mr D Petermann
[redacted]

Dear Mr Dimitri Petermann

Master of Commerce: Approval of Title

We have pleasure in advising that your proposal entitled *An exploratory study in South Africa: Big Data and auditing* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mrs Marike Bosman
Faculty Registrar
Faculty of Commerce, Law and Management

Appendix E: Ethics clearance certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

SCHOOL OF ACCOUNTANCY ETHICS COMMITTEE
CONSTITUTED UNDER THE UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: SOA-2020-11-32**
PROJECT TITLE	**An exploratory study in South Africa: Big Data and auditing**
INVESTIGATOR	**Dimitri Petermann (1302500)**
SCHOOL/DEPARTMENT OF INVESTIGATOR	School of Accountancy
DATE CONSIDERED	16 November 2020
DECISION OF THE COMMITTEE	Approved unconditionally
RISK LEVEL	**MINIMAL RISK**
EXPIRY DATE	31 March 2021 (if extension is granted) at the latest must meet n + 2 rule (2023) as outlined by the CLM Faculty.
ISSUE DATE OF CERTIFICATE	2 December 2020
MEMBER OF THE ETHICS COMMITTEE:	[redacted]

cc: Supervisor: **Samantha Gomez**

DECLARATION OF INVESTIGATOR

To be completed in duplicate and **ONE COPY** returned to the Chairperson of the School/Department ethics committee.

I fully understand the conditions under which I am are authorized to carry out the abovementioned research and I guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee.

_____ _____/_____/_____
Signature **Date**

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

Appendix F: List of reputable software

Name	Purpose
Otter.ai	Machine-generate initial drafts of each transcript.
Google Meets	Record interviews with participants.
Google Drive	Store interview recordings and transcripts.
MS One Drive	Store drafts of research reports.
MS Word	Draft research report.
Atlas.TI	Coding of interview transcripts.
Gmail	Official university email address.
Grammarly	Check spelling and grammar in MS Word.
Endnote	Referencing software